

Port of **Mackay**

► Appendix G

Sediment Characterisation Assessment



Maintenance Dredging Sediment Characterisation Report

Port of Mackay

13/12/18

Level 31, 12 Creek St
Brisbane QLD 4000
Australia

301001-02095-00-EN-RPT-0001

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Project No: 301001-02095-00-EN-RPT-0001 – Maintenance Dredging Sediment Characterisation Report: Port of Mackay

Rev	Description	Author	Review	Advisian Approval	Date
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Executive summary

Sedimentation of navigational infrastructure at the Port of Mackay occurs naturally and is caused by the transportation of sediment from ocean currents, swell and tides, and cyclonic activity. These sediments require periodic removal to maintain safe and efficient operational depths. Prior to dredging, sediment characterisation in accordance with the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009) is required to assess concentrations of potential contaminants and the acceptability of the material to be dredged for unconfined ocean placement.

The sediments characterised in this report are located within the Port of Mackay Channel, Swing Basin, Berth Pockets 1, 3, 4 and 5 and Tug Berths. The characterisation was implemented based on the rationale and methodology for sampling and analysis outlined in the *Port of Mackay Sampling and Analysis Plan (SAP)* prepared by Advisian in September 2018. Field sampling was undertaken in a single mobilisation from 24 to 28 September 2018.

As summarised in the table below, the sediment characterisation indicates that the concentrations and / or 95% Upper Confidence Limit (UCL) of the mean of all chemical contaminants analysed are below the respective NAGD screening criteria.

As per the NAGD assessment framework, it is considered that the sediments to be dredged from the Port of Mackay Channel, Swing Basin, Berth Pockets 1, 3, 4 and 5 and Tug Berths are suitable for unconfined ocean placement in the Dredge Material Placement Area (DMPA).

In accordance with Section 4.2.1 of the NAGD, the typical validity period for Phase II and Phase III results is five years. This means that, depending on other activities at the port, the results from this assessment may be valid until 24 September 2023.

Maintenance Dredging Sediment Characterisation Report

Port of Mackay

Sample Location	Units	H-3	95%UCL				
			SB	BP	TB	REF	SG
Misc							
% Moisture	%	52.3					
Total Organic Carbon	%	0.77					
Metals and Metalloids							
Arsenic, As	mg/kg	7.3	9.0	8.5	8.0	21.0	9.6
Cadmium, Cd	mg/kg	<0.1					
Chromium, Cr	mg/kg	16	21.1	26.1	25.7	4.4	4.5
Copper, Cu	mg/kg	140	15.0	24.6	24.5	4.3	1.8
Lead, Pb	mg/kg	27.7	13.1	15.2	15.5	14.1	2.9
Mercury, Hg	mg/kg	0.03	0.02	0.025	0.03		
Nickel, Ni	mg/kg	8.4	12.0	14.9	15.1	3.7	2.2
Zinc, Zn	mg/kg	165	40.4	68.4	56.9	7.9	7.4
Organotins							
Monobutyltin - Phase II	µg Sn/kg	18					
<i>Normalised to % TOC</i>	µg Sn/kg	23.38					
Dibutyltin - Phase II	µg Sn/kg	50					
<i>Normalised to % TOC</i>	µg Sn/kg	64.94			1.4		
Tributyltin - Phase II	µg Sn/kg	177					
<i>Normalised to % TOC</i>	µg Sn/kg	229.87		1.6	3.6		
TPH							
TPH C6-C9	mg/kg						
TPH C10-14	mg/kg			7.0	6.0		
TPH C15-28	mg/kg			24.8	32.2	10.9	8.8
TPH C29-36	mg/kg			20.6	29.2	8.4	8.4
Total TPH	mg/kg			50.3	67.1	19.5	17.7
TRH							
C6 - C10 Fraction	mg/kg						
C6 - C10 Fraction - BTEX	mg/kg						
>C10 - C16 Fraction	mg/kg			7.0	6.3		
>C16 - C34 Fraction	mg/kg			36.1	47.9	15.1	14.1
>C34 - C40 Fraction	mg/kg			14.6	22.0	7.1	
>C10 - C40 Fraction (sum)	mg/kg			57.5	75.9	22.5	14.1
>C10 - C16 Fraction- Naphthalene	mg/kg			7.0	6.3		

Sample Location	Units	H-3	95%UCL				
			SB	BP	TB	REF	SG
BTEXN							
Benzene	mg/kg						
Toluene	mg/kg						
Ethylbenzene	mg/kg						
meta- & para-Xylene	mg/kg						
ortho-Xylene	mg/kg						
Total Xylenes	mg/kg						
Sum of BTEX	mg/kg						
Naphthalene	mg/kg						
PAH							
Naphthalene	µg/kg						
Normalised to % TOC	µg/kg			17.7	15.4		
2-Methylnaphthalene	µg/kg						
Normalised to % TOC	µg/kg				8.1		
Acenaphthylene	µg/kg						
Normalised to % TOC	µg/kg			4.6	25.1		
Acenaphthene	µg/kg						
Normalised to % TOC	µg/kg			16.9	9.9		
Fluorene	µg/kg						
Normalised to % TOC	µg/kg			9.5	23.9		
Phenanthrene	µg/kg						
Normalised to % TOC	µg/kg			71.9	367.5		
Anthracene	µg/kg						
Normalised to % TOC	µg/kg			10.6	75.2		
Fluoranthene	µg/kg						
Normalised to % TOC	µg/kg			151.0	1029.0		
Pyrene	µg/kg						
Normalised to % TOC	µg/kg			115.2	700.2		
Benz(a)anthracene	µg/kg						
Normalised to % TOC	µg/kg			60.9	345.0		
Chrysene	µg/kg						
Normalised to % TOC	µg/kg			50.4	284.2		
Benzo(b+j)fluoranthene	µg/kg						

Sample ID	Units	H-3	95%UCL				
			SB	BP	TB	REF	SG
PAH							
Normalised to % TOC	µg/kg			45.2	186.4		
Benzo(k)fluoranthene	µg/kg						
Normalised to % TOC	µg/kg			25.3	91.3		
Benzo(e)pyrene	µg/kg						
Normalised to % TOC	µg/kg			25.1	279.3		
Benzo(a)pyrene	µg/kg						
Normalised to % TOC	µg/kg			35.8	135.8		
Perylene	µg/kg						
Normalised to % TOC	µg/kg			21.9	121.6		
Benzo(g,h,i)perylene	µg/kg						
Normalised to % TOC	µg/kg			21.2	60.4		
Dibenz(a,h)anthracene	µg/kg						
Normalised to % TOC	µg/kg			6.8	15.7		
Indeno(1.2.3.cd)pyrene	µg/kg						
Normalised to % TOC	µg/kg			19.7	58.8		
Coronene	µg/kg						
Normalised to % TOC	µg/kg			5.3	16.1		
Sum of PAHs	µg/kg						
Normalised to % TOC	µg/kg			697.3	3486.0		
Organochlorine Pesticides							
Aldrin	µg/kg						
alpha-BHC	µg/kg						
beta-BHC	µg/kg						
delta-BHC	µg/kg						
4.4'-DDD	µg/kg						
4.4'-DDE	µg/kg						
4.4'-DDT	µg/kg						
Sum of DDD + DDE + DDT	µg/kg						
Dieldrin	µg/kg						
alpha-Endosulfan	µg/kg						
beta-Endosulfan	µg/kg						
Endosulfan sulfate	µg/kg						

Sample ID	Units	H-3	95%UCL				
			SB	BP	TB	REF	S
Organochlorine Pesticides							
Endosulfan (sum)	µg/kg						
Endrin	µg/kg						
Endrin aldehyde	µg/kg						
Endrin ketone	µg/kg						
Heptachlor	µg/kg						
Heptachlor epoxide	µg/kg						
Hexachlorobenzene (HCB)	µg/kg						
gamma-BHC	µg/kg						
Methoxychlor	µg/kg						
cis-Chlordane	µg/kg						
trans-Chlordane	µg/kg						
Total Chlordane (sum)	µg/kg						
Oxychlordane	µg/kg						
Sum of Aldrin + Dieldrin	µg/kg						
Radionuclides							
Gross alpha	Bq/kg DW				916.9		
Gross beta	Bq/kg DW				575.4		
Sum of radionuclides	Bq/kg DW				1418.0		

Notes

SB: Swing Basin
 BP: Berth Pockets
 TB: Tug Berth
 Ref: Reference sites
 SG: Spoil Ground (as known as Dredge Material Placement Area (DMPA))
 H-3: Historical sampling location adjacent to slipway
 Value exceeds NAGD or agreed local screening level

1 Introduction

The Port of Mackay (the Port) is operated by North Queensland Bulk Ports Corporation (NQBP) and is situated approximately four kilometres north of the Pioneer River mouth at North Mackay, on the central Queensland coast (Figure 1-1). 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 (GBRWHA) but falls outside of the Great Barrier Reef Marine Park (GBRMP). Multiple commodities pass through the Port facilities, including fuels, refined and bulk sugar, bulk molasses, liquid chemicals, bulk fertilisers, bulk grain, general cargo and iron concentrates.

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.

NQBP has existing approvals in place for maintenance dredging within the Port, including a ten-year Sea Dumping Permit (2012-2022) and an associated and approved Long-Term Dredge Management Plan (LTDMP). The approval requires that a sediment characterisation assessment, consistent with previous assessments, be completed every five years to ensure sediments remain suitable for on-going ocean disposal at the approved Dredge Material Placement Area (DMPA).

As set out in the LTDMP (WorleyParsons, 2010), there are potentially four major dredge programs within the 10-year 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 DMPA approximately 3km north-east of the port entrance per the conditions set out in the port's 10-year Sea Dumping Permit.

Advisian were commissioned by NQBP to undertake a sediment characterisation assessment within the Port. The assessment is required prior to the proposed dredging campaign to support placement of maintenance dredge material at sea under NQBP's existing approval and LTDMP.

A Sampling and Analysis Plan (SAP) outlining the process by which the sediments are to be characterised was prepared by Advisian in 2018 in accordance with the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009). A full copy of the SAP is provided in Appendix A. This report details the results of the sediment characterisation assessment undertaken in accordance with the SAP.

Sediment characterisation was undertaken in all navigational areas of the Port (Channel, Swing Basin, Berth Pockets 1, 3, 4 and 5, Tug Berths), the DMPA and associated offshore Reference sites. All sampling was undertaken in accordance with the requirements outlined within the NAGD (Commonwealth of Australia, 2009) and aligned with the most recent survey completed in 2013 (Golder Associates, 2013) and the LTDMP (WorleyParsons, 2010).



Additional sampling was carried out at location H-3 adjacent to the slipway to continue monitoring historical contamination detected at this site.

1.1 Objectives

The objectives of the sediment characterisation assessment are to:

- Undertake the sediment characterisation in accordance with the SAP
- Ensure sampling is undertaken consistent with industry best practice and the NAGD (Commonwealth of Australia, 2009)
- Understand the quality and contamination status of sediments to be dredged from the Port
- Achieve high quality laboratory analysis results incorporating appropriate Quality Assurance (QA) / Quality Control (QC) through use of recognised and National Association of Testing Authorities, Australia (NATA) accredited analytical laboratories with expertise in marine sediment quality assessment applicable to dredge material management
- Ensure data from sampling is accurately reported, summarised, analysed and stored safely to provide confidence in the efficacy of the sediment sampling, handling, testing, analysis and reporting sufficient to determine the suitability of the dredge material for placement in accordance with the Sea Dumping Permit and LTDMP.

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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

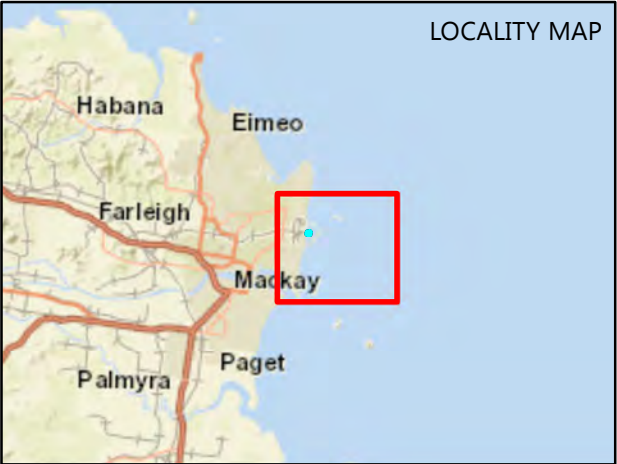
Source Information:
Port facility layout and dredge area
Provided by NQBP - Sept 2018
Imagery - Web Service
Dept of Natural Resources and Energy

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0 800
Metres



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2 Previous sediment investigations

The most recent and relevant studies which characterise the sediments found in the Channel, Swing Basin Area, Berth Pockets and Tug Berth Areas within the Port include:

- WorleyParsons, 2007. Mackay Port Authority: Port of Mackay Harbour – Sediment Quality Assessment.
- WorleyParsons, 2010. NQBP Mackay Harbour and Spoil Ground 2009 Sediment Characterisation Report, document number 301001-00797-00-EN-REP-0001.
- Golder Associates (2013). 2013 Maintenance Dredging – Sediment Characterisation Report. Report prepared for NQBP.

The main findings from each study are detailed in the SAP (Appendix A) and a summary of the historical contamination status is provided below.

The surrounding marine habitats and associated environmental values along with the management objectives for the port, dredge areas and the DMPA are summarised in the LTDMP.

2.1 Historical contamination status

A summary of the historical sediment suitability for ocean placement for each of the dredge areas is provided in Table 2-1. All previous investigations found that the sediment from all dredge management areas was suitable for ocean placement.

Table 2-1 Historical contamination status of dredge sediments from each dredge area

Management Area	Location	Suitability for Ocean Placement
Channel and Swing Basin	Channel and Swing Basin	Suitable
Berth Pockets	Berth Pockets	Suitable
Tug Berth	Tug Berth	Suitable

3 Method

Sediments for Phase II (sampling and analysis) were collected from 24 to 28 September 2018.

3.1 Sampling locations and intensity

The number of sampling locations was based on the anticipated dredge volumes for each dredge area in accordance with Appendix A of the NAGD, 2009. These are provided in Table 3-1. This is generally consistent with in the most recent previous sediment characterisation assessment (Golder Associates, 2013).

Sampling was undertaken at each maintenance dredge area within the Port: Channel and Swing Basin, Berth Pockets 1, 3, 4 and 5 and Tug Berths. Sampling was also undertaken at reference sites (REF) and within the DMPA. The fixed sample location H3 is located adjacent to the slipway and was included for consistency with previous sediment characterisation programs. The sampling locations in each dredge area are presented in Figure 3-1 to Figure 3-4.

3.2 Variations to the SAP

Variations to the approved SAP that occurred in execution of the works are set out below:

- No field triplicate was taken at DMPA-1 due to the dense sandy seabed and depth of water at this site. The dense seabed restricted the grab sampling device from penetrating effectively. After 30 attempts, only material of a volume sufficient for the primary sample analysis was obtained. The above changes resulted in obtaining two fewer samples than indicated in the SAP (39 instead of 41).
- Particle size distribution (PSD) analysis could not be completed on sample REF03 due to sample volume.
- Ten additional PSD analyses were scheduled to provide more complete information regarding sediment textures.



Table 3-1 Description of the areas to be dredged and site requirements as per NAGD (2009)

Dredge Area	Estimated Maximum Dredge Volume ²	Sampling locations required as per NADG (2009)	Number of grid squares	Sampling locations with currency from previous work	Revised number of sampling locations required	Number of sites sampled
Channel and Swing Basin	80,000	16	80	No	8 ¹	8
Berth Pockets	27,000	9	45	No	6 ¹	6
Tug Berths	10,000	6	30	No	6	6
DMPA	-	-	-	-	3	3
Reference	-	-	-	-	3	3
Slipway ³	-	-	-	-	1	1
Total	117,000				27	27
<p>Notes:</p> <p>¹ where indicated the number of sample sites was reduced due to previous information and a classification of 'probably clean'. This methodology is acceptable under the NAGD</p> <p>² Dredge volumes and depths are based on reported figures Golder Associates, 2013</p> <p>³ Sample location H3</p>						

Port of Mackay
Sediment Investigation

Figure 3-1:
Channel and Swing Basin
Sampling Locations



Port of Mackay
Sediment Investigation

Figure 3-2:
Berth Pockets Stratified
Sampling Locations



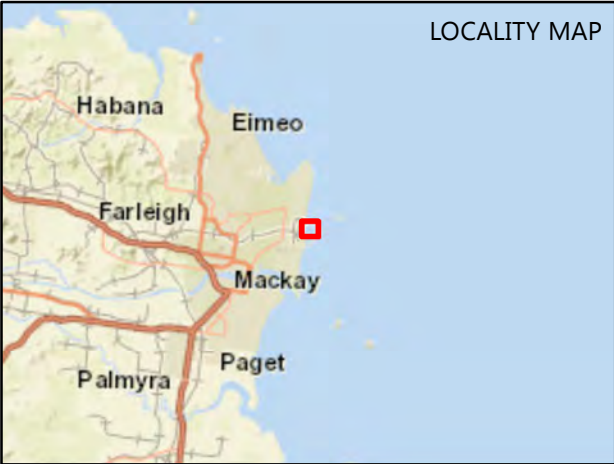
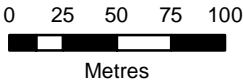
- LEGEND**
- Sampling location
 - Sampling grid
 - Berths and operational areas
 - Berth pocket dredge area

Source Information:
Port facility layout
 Provided by NQBP - Sept 2018
Imagery - Aug 2017
 Provided by NQBP - Sept 2018

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Port of Mackay
Sediment Investigation

Figure 3-3:
Tug Berth
Sampling Locations

- LEGEND**
- 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
 Provided by NQBP - Sept 2018

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20 0 20 40

Metres



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Port of Mackay Sediment Investigation

Figure 3-4:
DMPA and Reference Sites
Sampling Locations

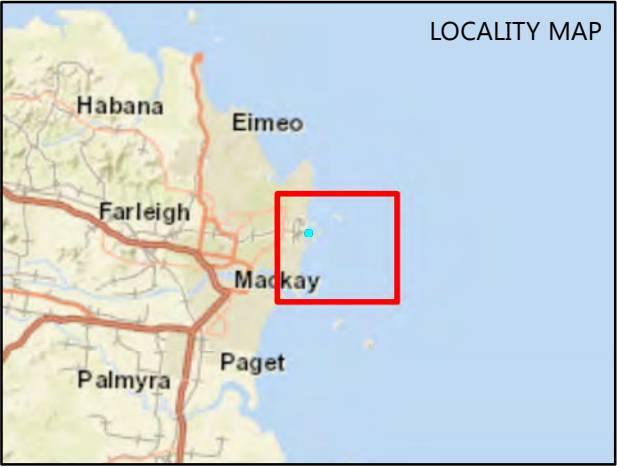
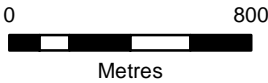
- LEGEND**
- Sampling location
 - Existing Dredge Material Placement Area
 - Great Barrier Reef Marine Park boundary

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

Field sampling procedures, conforming to *Appendix F Field and laboratory quality assurance and quality control* of the NAGD (2009) and Advisian's QA/QC protocols, were carried out to minimise the potential for cross contamination and preserve the sample integrity. Table 3-2 provides a summary of the sediment sampling activities undertaken.

Table 3-2 Sampling 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	Grab Sampling: Samples were collected using a boat deployed van Veen grab sampler. The grab sampler is constructed of stainless steel and has an approximate grab payload of 5kg. Using a pulley system, the grab sampler is 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 is then lifted back to the surface where it is opened and sediments placed directly into stainless steel mixing bowls for processing.
Location log	<p>The following information was recorded at each sampling location and presented in Appendix B:</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 ▪ 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 B) 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

Activity	Details
	<ul style="list-style-type: none"> Consistency Plasticity 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	Samples were homogenized in stainless-steel mixing bowls using powderless nitrile gloved hands. Homogenised sediment material was then placed into laboratory supplied 250ml and 125ml glass jars leaving zero head space and into zip lock bags. Label information was completed on each sample container and the containers were stored on ice in eskies.
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	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.
Dispatch	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 ALS to SGS.

3.4 Laboratory analysis

Samples were analysed for the following list of primary physical characteristics and chemicals of concern, as indicated in the SAP (Advisian, 2018). These included:

- Moisture content (%)
- Particle size distribution (PSD) and settling rate
- Total organic carbon (%TOC)
- Metals and metalloids including: arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni) and zinc (Zn)
- Organotin compounds, tributyltin (TBT), dibutyltin (DBT) and monobutyltin (MBT)
- Polycyclic Aromatic Hydrocarbons (PAH) excluding the Channel and Swing Basin

- Total Petroleum Hydrocarbons (TPH) and Total Recoverable Hydrocarbons (TRH) excluding the Channel and Swing Basin
- Organochlorine Pesticides (OCP) at the Tug Berth only.

Phase III laboratory analysis included:

- PAHs in elutriate.

Table 3-3 provides a summary of the chemical analyses undertaken on sediments collected at specific sampling locations for Phase II and Phase III samples. Primary analysis was undertaken by Australian Laboratory Services (ALS), while and Société Générale de Surveillance (SGS) was commissioned to provide the secondary laboratory analyses on blind duplicate samples. Both laboratories are NATA accredited for the analyses undertaken.

All samples were submitted to ALS under a single work order EB1823470. The blind duplicate samples were forwarded to SGS by ALS where they were analysed as work order SE184684.

As part of the QA/QC process (refer to Section 3.5), the laboratory reported results to the Lowest Practical Quantitation Limit (PQL) or the limit of reporting (LOR) at the time of analysis. The PQLs are those necessary to accurately determine contaminant concentrations at, or near, natural levels, or to reliably detect organic substances that may have impacts at very low environmental concentrations. The LORs achieved for each of the respective analyses are reported in conjunction with the results in Section 4 of this report. These LORs comply with minimum PQLs required under the NAGD Appendix A, Table 1.

The laboratory methods are designed to minimise matrix interferences and to meet or exceed the NAGD PQLs. However, if moisture content exceeds 50%, PQLs may need to be raised to meet quality assurance protocols. Laboratory and Quality Assurance procedures comply with those specified in Appendix F of NAGD.

Table 3-3: Summary of Phase II and III analysis undertaken

Phase	Grid ID / Sample Location ID		Sample type	Analysis						Elutriate
				TOC & Moisture	Metals & Organotins	TPH, TRH & PAH	OCP	Radio-nuclides	PSD & settling rate	
2	SB_02	T1, T2, T3	G	3	3				3	
2	SB_16	SB_16	G	1	1				1	
2	SB_40	SB_40	G	1	1					
2	SB_45	SB_45	G	1	1				1	
2	SB_50	SB_50	G	1	1					
2	SB_52	SB_52	G	1	1				1	
2	SB_58	SB_58	G	1	1					
2	SB_79	SB_79, D1, D2	G	3	3				3	
2	B1_02	T1, T2, T3	G	3	3	3			3	
2	B1_07	B1_07	G	1	1	1				
2	B3_14	B3_14	G	1	1	1			1	
2	B4_01	B4_01	G	1	1	1			1	
2	B5_08	B5_08	G	1	1	1				
2	B5_10	B5_10, D3, D4	G	3	3	3			3	
2	TB_02	TB-1	G	1	1	1	1	1	1	
2	TB_05	T1, T2, T3	G	3	3	3	3	3		
2	TB_12	TB_12	G	1	1	1	1	1		
2	TB_18	TB_18	G	1	1	1	1	1	1	
2	TB_26	TB_26	G	1	1	1	1	1		
2	TB_29	TB_29, D5, D6	G	3	3	3	3	3	3	
2	REF_01	REF-1	G	1	1	1			1	
2	REF_02	REF-2	G	1	1	1			1	
2	REF_03	REF-3	G	1	1	1			1	
2	SG_01	DMPA-1 T1	G	1	1	1			1	
		DMPA-1 T2		Could not collect						
		DMPA-1 T3								
2	SG_02	DMPA-2	G	1	1	1			1	
2	SG_03	DMPA-3	G	1	1	1			1	
2	H-3	H-3	G	1	1					
3	TB_02	TB-1	G							1
Notes										
	Blind triplicate sample									
	Triplicate sample									
G	Grab sample									

3.5 Quality Assurance / Quality Control

Appropriate QA/QC is an essential element of the sampling program and was included in all aspects of the field sampling and processing of the samples. This section details the methods employed in field sampling and laboratory QA/QC to ensure validity of the analytical results.

3.5.1 QA/QC – Field sampling

Consistent with NAGD requirements, the following QA/QC measures were implemented:

- Collection of field replicate triplicate samples (i.e. three separate samples taken at the same location) at 10% of locations (refer to Table 3-3) to determine the variability of sediment chemical and physical characteristics.
- Collection of field split triplicates samples (one sample split into three separate containers) at 5% of locations to assess variation in results between laboratory analysis methods and processes. Split triplicates are created by thoroughly mixing sediment from a single location, then splitting the sediment into three different containers. One of the three (triplicate) samples is sent to a second (reference) laboratory (i.e. SGS) for analysis. All field split triplicate samples (refer to Table 3-3) were 'blind' labelled in the field with QC field numbers, which do not relate to sampling location names (e.g. D1, D2, etc.)
- Comparison of results of field quality control split replicate and field triplicate samples against NAGD Screening Levels.

QA/QC during field work was ensured by:

- Using suitably qualified environmental staff and support personnel experienced in grab sampling, field supervision and sediment logging.
- Sample homogenisation was performed by hand using powderless nitrile gloves within large stainless-steel mixing bowls, with one bowl dedicated to a single horizon.
- Samples for chemical analysis were contained with zero headspace in appropriately cleaned, pre-treated and labelled glass jars with Teflon lined lids that were provided by the analytical laboratory.
- Samples for physical analysis were contained in resealable (i.e. zip lock) plastic bags provided by the analytical laboratory.
- Keeping samples cool with ice in eskies during sampling and following collection. At the completion of each sampling trip, samples were kept cool (4°C) by refrigeration prior to laboratory dispatch. During transport samples were stored in eskies with ice packs until received by the laboratory and refrigerated until analysed.
- Transportation of samples under chain of custody documentation.
- All sampling equipment, including core tray and mixing bowls were decontaminated between sampling locations via a decontamination procedure involving a wash with ambient sea water and a laboratory grade detergent (Decon 90), and successive rinsing with deionised water.



3.5.2 QA/QC – Laboratory Analysis

A validation of the analytical data was undertaken in accordance with the NAGD Appendix A confirm that the data quality was suitable for undertaking an assessment to characterise material proposed for dredging and disposal. This validation included a consideration of results for laboratory blanks, standards, spikes, duplicate samples and surrogate recovery. A summary of the outlier results are presented in Section 4.5, while the laboratory QA/QC certificates are provided in Appendix C.

The laboratories used for sediment sample analyses are NATA accredited for the methods used and are experienced in the analysis of marine sediments. Laboratory QA/QC procedures were carried out in accordance with the requirements of the NAGD Appendix F including:

- laboratory blanks
- laboratory control sample
- matrix spikes
- laboratory duplicates
- surrogate recovery.

Laboratory blanks are samples submitted by the laboratory during sample analysis to assist in identifying any cross contamination of samples during laboratory preparation, extraction or analysis. Analysis of laboratory blank samples should result in a concentration not exceeding the LOR for a particular contaminant.

Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes to monitor method precision and accuracy independent of sample matrix. Recovery limits are based on statistical evaluation of processed LCS.

Matrix spikes are undertaken by the laboratory to identify the amount of interference from the sediment matrix on contaminant recovery. Samples collected from the field are split from the base sample and spiked with a known contaminant concentration. The percent recovery of the contaminant is then calculated. The purpose of this is to monitor potential matrix effects on analyte recoveries.

Laboratory duplicates determine the precision of analysis performed by the laboratory by the calculation of the RPD. The RPD is calculated based on a comparison of an intra-laboratory split of the sample material with results representing the relative percent difference (%RPD) between the two sample concentrations for a specific contaminant.

Surrogate recovery is undertaken by “spiking” a sample with a chemical similar to the contaminant and assessing its recovery after analysis. If a high percentage of the surrogate is recovered (75%-125% under NAGD guidelines), it indicates that the laboratory analytical methods can accurately measure the contaminant of concern.



3.6 Data analysis

3.6.1 Phase II – Sediment analysis for total contaminant concentrations

Chemical concentration levels for sediments were compared against the screening levels listed in Appendix A – Table 2 of the NAGD, to assess whether the sediment is suitable for placement at sea or if further testing is required (e.g. elutriate, bioavailability and/or direct toxicity assessment).

The assessment against NAGD criteria involved the comparison of concentrations at the 95% Upper Confidence Limit (UCL) of the mean to the NAGD screening levels. Detections for organic parameters were normalised to % TOC where the recorded TOC value was within the range of 0.2 – 10%. If TOC values were outside this range, then the highest or lowest of the 0.2 – 10% range will be adopted as appropriate. For the purposes of calculation of normalised values and of 95% UCLs, values below detection limit were set to one-half of the laboratory LOR in accordance with NAGD recommendations. For organic concentrations below detection, the half detection levels were not normalised to % TOC. Means, standard deviations and 95% UCLs were calculated for each of the dredge areas. Means and 95% UCLs were not calculated for contaminant groups that were found to have concentrations below detection levels at all sampling locations.

The methods used to calculate the 95% UCLs were based on the methods required in Appendix A of the NAGD (P38, Comparison of Data to Screening Levels) as described below.

Normality of datasets were determined using Shapiro-Wilks test and quantile-quantile plots in ProUCL Version 5 developed by the United States Environmental Protection Agency (USEPA 2016). Datasets were determined as being either normal or log-normal, or neither in their distributions. Normal datasets were analysed using the 1-tailed student's t UCL. Log-normal datasets were analysed using non-parametric jackknife analysis as recommended in the NAGD. Datasets that were neither normal nor log-normally distributed were also analysed using non-parametric jackknife analysis.

The NAGD (2009) states that if the 95%UCL values for all substances are below relevant screening levels, it is unlikely that contaminant substance concentrations in the sediment will have an adverse effect on organisms living in or on that sediment. Sediments are therefore considered non-toxic and there are no chemical obstacles to unconfined ocean placement.

3.6.2 Phase III – Elutriate analysis

Phase III elutriate analysis is undertaken using sediments prepared in a 1:4 suspension of laboratory prepared seawater standard. Elutriate analysis is required when primary concentrations of contaminants exceed the NAGD screening criteria during the Phase II assessment. The elutriate concentrations (or concentrations at the 95th percentile for the relevant dredge area) are then compared against the relevant toxicant trigger level in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000) and / or the Great Barrier Reef Marine Water Quality Guidelines (GBRWQG, 2010).

This sediment characterisation study includes Phase III elutriate analysis, the results of which are provided in Section 4.2.2.5.



3.6.3 Phase III – Bioavailability analysis

This analysis was not required.

3.6.4 Phase IV – Toxicity testing

This analysis was not required.



4 Results

This section presents the findings from the field investigation undertaken, including the sediment textures encountered (i.e. physical characteristics) and a summary of laboratory data. Sediment logs and photographs are presented in Appendix B, while all chemical summaries of results are presented in tabulated form below. The laboratory reports and QA/QC certificates as well as CoC documentation are provided in Appendix C.

Note the area surrounding sampling site H-3 will not be dredged and the results from this site are used to monitor historical contamination at the location. Results from this site are presented where applicable but excluded from all statistical analysis. This is an approach that is consistent with previous investigations.

4.1 Channel and Swing Basin

4.1.1 Physical characteristics

4.1.1.1 Particle Size Distribution

Sediments within the Channel and Swing Basin are a mixture of textures ranging from silty sand to sandy clays. Sand is located near the Port entrance (SB45), adjacent to the Berth 4 (SB50) and adjacent to Berth 1 (SB02). Samples SB45 and SB02 also contained gravel. A comparison of the mean PSD values suggests that most sediments contain sand (42%), followed by silt (31%) then clay (23%). A summary of PSD results for the Channel and Swing Basin are presented in Table 4-1 and Figure 4-1.

The PSD results from the triplicate site (SB02 T1, T2 and T3) indicates spatial variation in the percentage of gravel, sand and clay between T1, T2 and T3 samples.

4.1.1.2 Settling rate

Settling rates are provided in Table 4-1. This indicates that SB45 (silty sand) had the fastest settling rate and SB79 (i.e. sandy silty clay) had the slowest.

Table 4-1 Particle size distribution of sediments across the Channel and Swing Basin

Sample ID	Date Sampled	Texture					Soil Particle Density (Clay/Silt/Sand)	10% Setteability					20% Setteability				
		Clay	Silt	Sand	Gravel	Cobbles		Underflow Density	Underflow Solids	Settling Rate @ 50% of Settlement	Settling Rate @ 90% of Settlement	Clarity	Underflow Density	Underflow Solids	Settling Rate @ 50% of Settlement	Settling Rate @ 90% of Settlement	Clarity
Units		%	%	%	%	%	g/cm3	g/cm3	%	mm/min	mm/min		g/cm3	%	mm/min	mm/min	
PQL		1	1	1	1	1	0.01	0.01	0.1	0.001	0.001		0.01	0.1	0.001	0.001	
Size (mm)		<0.02	0.02-0.6	0.6-2	2-60	>60	-										
SB_02 (T1)	24/09/2018	16	13	52	19	<1	2.54	1.52	67.2	18	18	Clear	1.53	65.5	9.2	0.6	Clear
SB_02 (T2)	24/09/2018	13	30	42	15	<1	2.49	1.34	59.8	18.8	10.6	Clear	1.51	55	6.6	0.4	Clear
SB_02 (T3)	24/09/2018	31	26	37	6	<1	2.48	1.21	55.3	14.4	8.8	Clear	1.36	52.5	7	6.4	Clear
SB_16	24/09/2018	17	75	8	<1	<1		1.11	53	15.4	8	Clear	1.13	49.1	2.2	0.067	Clear
SB_45	24/09/2018	5	6	86	3	<1	2.59	1.5	66.6	26	19.6	Clear	1.69	59.2	15.4	6	Clear
SB_52	24/09/2018	34	42	24	<1	<1		1.04	37	4.6	0.058	Clear	1.14	19.8	0.05	0.008	Clear
SB_79	24/09/2018	36	41	23	<1	<1	2.5	1.18	23.4	2.4	0.108	Clear	1.16	23	0.05	0.006	Clear
SB_40	24/09/2018	40	43	16	1	<1	2.65	1.12	19.8	0.267	0.03	Clear	1.13	23.2	0.017	0.01	Clear
SB_50	24/09/2018	4	1	95	<1	<1	2.63	1.54	59.1	24.4	1.8	Clear	1.49	58.4	14.4	0.2	Clear
SB_58	24/09/2018	36	30	34	<1	<1	2.61	1.21	25.8	2.2	0.067	Clear	1.18	24.1	0.016	0.016	Clear
Mean		23	31	42	9	<1	2.56	1	47	13	7		1	43	5	1	
H-3	25/09/2018	26	14	60	<1	<1	2.52	1.21	30.6	1.8	0.083	Clear	1.32	36.1	1	0.025	Clear

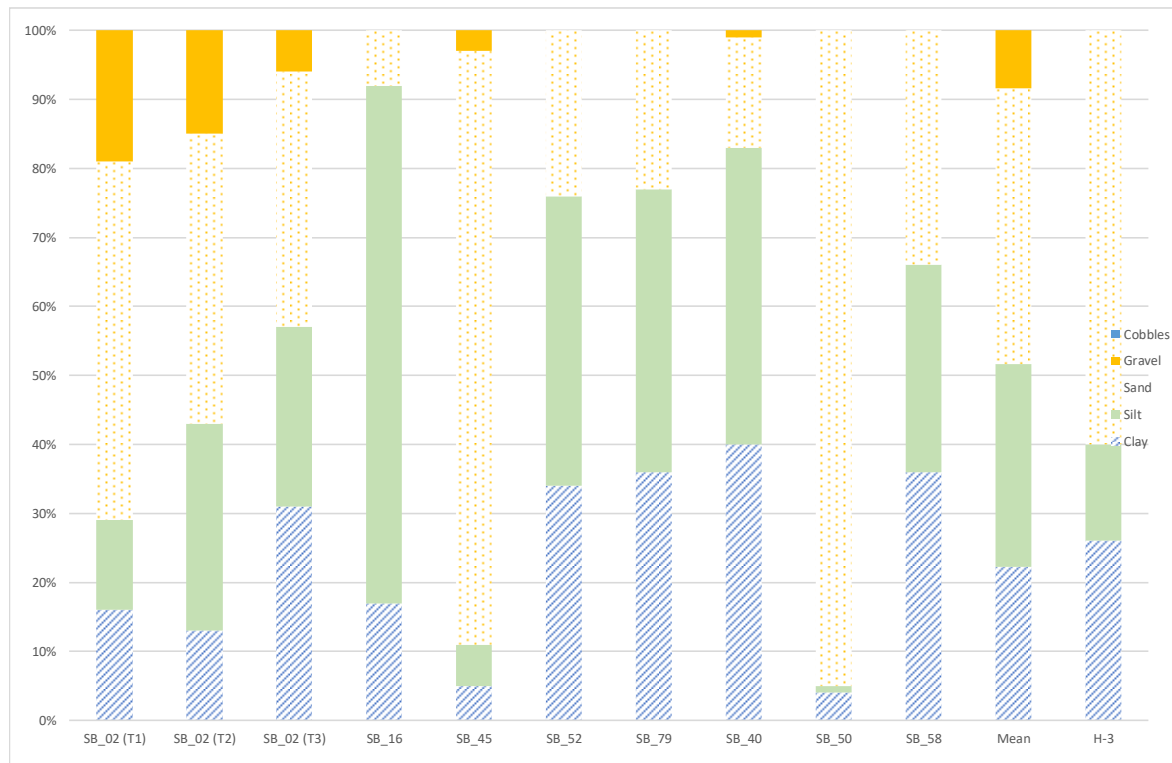


Figure 4-1 Particle size distribution of sediments in Channel and Swing Basin

4.1.2 Chemical characteristics

The results of chemical analyses (dry weight) for sediments in Channel and Swing Basin are summarised below. This summary includes a comparison against NAGD screening levels in Table 2 of Appendix A. A tabulated summary of the chemical analysis is provided in Table 4-2. Primary laboratory reports are provided in Appendix C.

4.1.2.1 Metals and Metalloids

Metals and metalloid concentrations were below the respective NAGD Screening Levels in all SB samples. This was similarly the case for sample H-3.

4.1.2.2 Organotins

There are no NAGD screening criteria for MBT or DBT. Concentrations of these organotin compounds were below the LOR. Concentrations of TBT were also below the laboratory LOR and therefore below the NAGD screening level of 9µgSn/kg.

A normalised concentration of TBT (229.87µgSn/kg) was detected in sample H-3. This is greater than the NAGD screening level of 9µgSn/kg. As the area surrounding H-3 will not be dredged it has been excluded from the statistical analysis.

Table 4-2 Summary of chemical analysis results for Channel and Swing Basin

Sample ID	Units	PQL	NAGD PQL	NAGD Screening Level	H-3	SB_02 (T1)	SB_16	SB_40	SB_45	SB_50	SB_52	SB_58	SB_79	Mean/ Geomean	Standard Deviation	95% UCL	Normal (N) Log-normal (L) Neither (X)
Date Sampled					25/09/18	24/09/18	24/09/18	24/09/18	24/09/18	24/09/18	24/09/18	24/09/18	24/09/18				
Misc																	
% Moisture	%	1	0.1	-	52.3	34.2	67.2	64.4	35.3	21	63.1	58.5	59.7	50.4	17.5		
Total Organic Carbon	%	0.02	0.1	-	0.77	0.54	1.57	1.23	1.4	0.22	1.11	1.22	1.08	1.0	0.4		
Metals and Metalloids																	
Arsenic, As	mg/kg	1	1	20	7.3	13.6	8.05	6.86	5.12	3.93	6.7	5.72	6.39	7.0	2.9	9.0	N
Cadmium, Cd	mg/kg	0.1	0.1	1.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				
Chromium, Cr	mg/kg	1	1	80	16	8.4	25.2	21.6	7.9	3.9	21.9	16.9	21	15.9	8.0	21.1	N
Copper, Cu	mg/kg	1	1	65	140	9	16.5	14.6	5.4	2.7	16.2	12.2	15.1	11.5	5.2	15.0	N
Lead, Pb	mg/kg	1	1	50	27.7	6.6	15.3	14.2	5.8	3.2	13.8	11	11.2	10.1	4.4	13.1	N
Mercury, Hg	mg/kg	0.01	0.01	0.15	0.03	<0.01	0.04	0.02	<0.01	<0.01	0.02	0.02	0.02	0.02	0.01	0.02	N
Nickel, Ni	mg/kg	1	1	21	8.4	8	14.4	11.8	4.5	2.9	11.9	9.4	11.8	9.3	4.0	12.0	N
Zinc, Zn	mg/kg	1	1	200	165	18.6	46.1	39.9	17	12.7	43.1	33.6	40.8	31.5	13.3	40.4	N
Organotins																	
Monobutyltin - Phase II	µg Sn/kg	1	1	-	18	<1	<1	<1	<1	<1	<1	<1	<1				
Normalised to % TOC	µg Sn/kg		-	-	23.38												
Dibutyltin - Phase II	µg Sn/kg	1	1	-	50	<1	<1	<1	<1	<1	<1	<1	<1				
Normalised to % TOC	µg Sn/kg		-	-	64.94												
Tributyltin - Phase II	µg Sn/kg	0.5	1	-	177	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				
Normalised to % TOC	µg Sn/kg		-	9	229.87												
Notes																	
Note	When calculating averages and 95%UCLs, values below detection for individual sample results were set to half the detection levels (consistent with the NAGD).																
PQL	Practical Quantitation Limit																
Sample ID	Sample location numbers																
ND	Insufficient data																
-	No guidelines levels (i.e. Screening or Maximum Levels) set in NAGD for given parameter, or no analysis undertaken for a given sample																
	Value exceeds NAGD or agreed local screening level																
Normalised to % TOC	Normalised to % TOC, over the range of TOC from 0.2 to 10%																
	Not tested																
#	Average of four field replicate samples																



4.2 Tug Berth

4.2.1 Physical characteristics

4.2.1.1 Particle Size Distribution

Sediment textures within the Tug Berth are generally evenly distributed within the samples with the majority comprised of silt (45%) and clay (39%). However, there is a higher portion of sand in sample TB02 (29%) and TB05 (24%). A summary of PSD results for the Tug Berth is presented in Table 4-3 and Figure 4-2.

4.2.1.2 Settling rate

Settling rates are provided in Table 4-3. This indicates that settling rates are similar, however, the fastest settling rate was recorded for sample TB05 and the slowest for TB29, TB12, TB26. This is indicative of the proportion of sand that contributes to faster settling rates.

Table 4-3 Particle size distribution of sediments across the Tug Berth

Sample ID	Date Sampled	Texture					Soil Particle Density (Clay/Silt/Sand)	10% Settleability					20% Settleability				
		Clay	Silt	Sand	Gravel	Cobbles		Underflow Density	Underflow Solids	Settling Rate @ 50% of Settlement	Settling Rate @ 90% of Settlement	Clarity	Underflow Density	Underflow Solids	Settling Rate @ 50% of Settlement	Settling Rate @ 90% of Settlement	Clarity
		%	%	%	%	%		g/cm3	%	mm/min	mm/min		g/cm3	%	mm/min	mm/min	
Units		%	%	%	%	%	g/cm3	g/cm3	%	mm/min	mm/min		g/cm3	%	mm/min	mm/min	
PQL		1	1	1	1	1	0.01	0.01	0.1	0.001	0.001		0.01	0.1	0.001	0.001	
Size (mm)		<0.02	0.02-0.6	0.6-2	2-60	>60	-										
TB_02	25/09/2018	34	36	29	1	<1		1.06	33.7	2	0.05	Clear	1.14	21.5	0.05	0.003	Clear
TB_18	25/09/2018	34	53	13	<1	<1	2.55	1.07	35.4	0.8	0.15	Clear	1.15	21.3	0.017	0.006	Clear
TB_29	25/09/2018	36	53	11	<1	<1		1.07	32.8	0.267	0.075	Clear	1.11	19.6	0.01	0.01	Clear
TB_05 (T1)	25/09/2018	40	34	24	2	<1	2.55	1.16	26.1	2.8	0.075	Clear	1.15	24.1	0.017	0.002	Clear
TB_12	25/09/2018	46	42	12	<1	<1	2.55	1.06	20	0.267	0.036	Clear	1.11	22.9	0.009	0.009	Clear
TB_26	25/09/2018	44	52	4	<1	<1	2.41	1.05	20.2	0.267	0.032	Clear	1.14	21.5	0.017	0.004	Clear
Mean		39	45	16	2	<1	2.52	1.08	28.0	1.1	0.070		1.13	21.8	0.02	0.006	

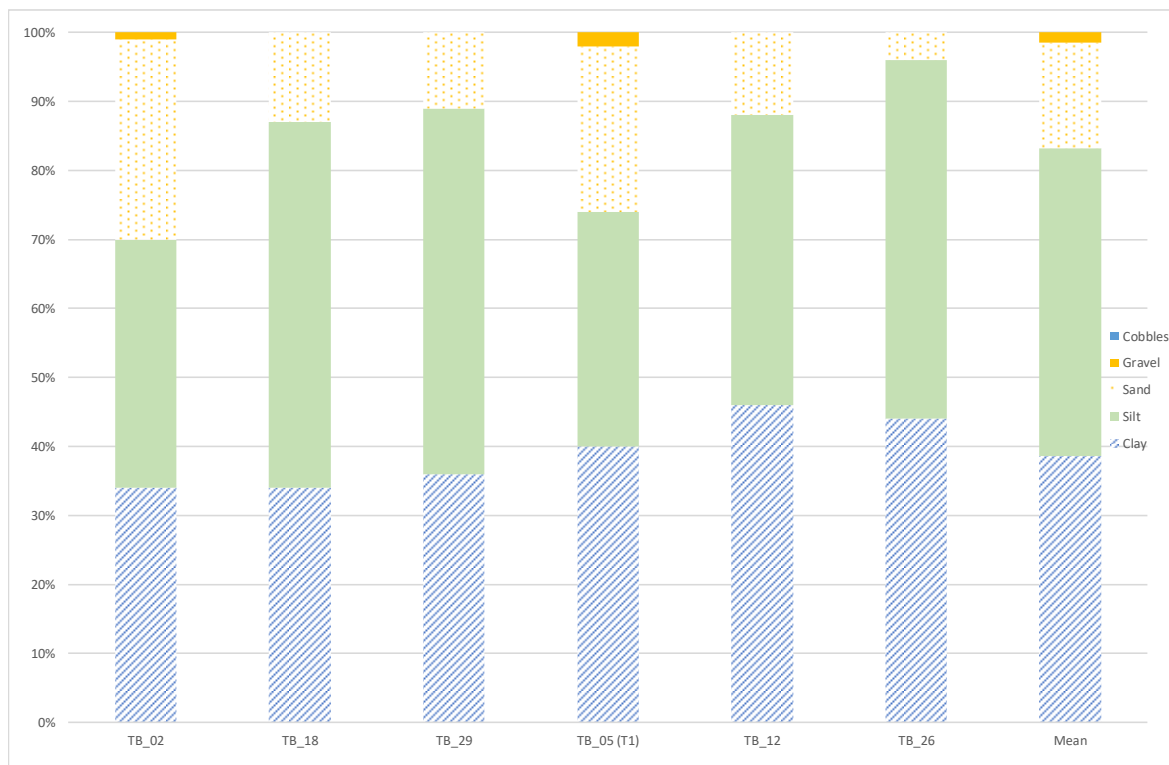


Figure 4-2 Particle size distribution of sediments in the Tug Berth

4.2.2 Chemical characteristics

The results of chemical analyses for sediments in the Tug Berth are summarised below. This summary includes a comparison against NAGD screening levels in Table 2 of Appendix A. A tabulated summary of the chemical analysis is provided in Table 4-2. Primary laboratory reports are provided in Appendix C.

4.2.2.1 Metals and Metalloids

Metals and metalloid concentrations were below the respective NAGD Screening Level for all Tug Berth samples.

4.2.2.2 Organotins

Concentrations of MBT were below the laboratory LOR. There are no NAGD Screening Levels for comparison.

Low level concentrations of DBT were detected in three samples (TB02, TB05, TB18), however there are no NAGD Screening Levels for comparison. The remaining samples had DBT concentrations below the laboratory LOR.

Concentrations of TBT were detected in all Tug Berth samples. When normalised these TBT concentrations were below the NAGD screening level of 9 µg Sn/kg. The 95% UCL of the mean for the normalised dataset was also below the NAGD screening criteria of 9µgSn/kg.

4.2.2.3 TPH, TRH and BTEX

Concentrations of TPH and TRH were detected in all Tug Berth samples. However, only total TPH can be compared to a NAGD screening level of 500mg/kg. Concentrations of total TPH in all samples collected were below the NAGD screening level.

Concentrations of BTEX in all samples analysed were below the LOR.

4.2.2.4 PAH

Concentrations of PAHs were detected in all samples. However, once normalized to %TOC and outlier concentrations identified (refer to Section 5.3) and rectified, PAH concentrations in all samples were below NAGD Screening Level for total PAH (10,000µg/kg). The 95%UCL of the mean (3,486µg/kg) was also below the NAGD Screening Level.

4.2.2.5 PAH Phase III sampling

A decision to undertake Phase III elutriate analysis on sample TB_02 was made based on a PAH concentration identified through preliminary laboratory analysis; however subsequent analysis showed this result to be an outlier (refer to Section 5.3) which did not require elutriate analysis. Due to timing constraints the elutriate analysis was undertaken in parallel with triplicate analysis, with the triplicate analysis results indicating that elutriate analysis was not required. Nonetheless



the elutriate results are summarized in Table 4-4 and indicate concentrations of PAHs in elutriates were below the respective LORs. Due to the results of triplicate analysis (refer to Section 5.3), Phase III results are not considered further.

4.2.2.6 Organochloride pesticides

Concentrations of OCPs in all samples analysed were below the LOR and therefore below the NAGD screening levels for the various OCP compounds.

4.2.2.7 Radionuclides

Concentrations of the gross alpha radionuclides ranged from less than the laboratory of 500 Bq/kg DW in TB12 and TB18 to 1100 Bq/kg DW in TB29. These concentrations are below the NAGD Screening Level of 35,000 Bq/kg DW (i.e. 35 Bq/g DW). The 95% UCL of the mean (916.6Bq/kg DW) was also below the NAGD Screening Level.

Concentrations of gross beta radionuclides ranged from less than the laboratory of 500 Bq/kg DW in TB05 and TB18 to 560 Bq/kg DW in TB26. These concentrations are below the NAGD Screening Level of 35,000 Bq/kg DW (i.e. 35 Bq/g DW). The 95% UCL of the mean (575.4Bq/kg DW) was also below the NAGD Screening Level.

The sum of radionuclides ranged from less than the laboratory of 500 Bq/kg DW in TB18 to 1630 Bq/kg DW in TB29. These concentrations are below the NAGD Screening Level of 35,000 Bq/kg DW (i.e. 35 Bq/g DW). The 95% UCL of the mean (1418Bq/kg DW) was also below the NAGD Screening Level.

Table 4-4 Summary of chemical analysis results for Tug Berth

Sample ID	Units	PQL	NAGD PQL	NAGD Screening Level	ANZG, 2018 95% Protection	TB_02 Elutriate 25/09/18	TB_02 25/09/18	TB_05 (T1) 25/09/18	TB_12 25/09/18	TB_18 25/09/18	TB_26 25/09/18	TB_29 25/09/18	Mean/ Geomean	Standard Deviation	95% UCL	Normal (N) Log-normal (L) Neither (X)
Date Sampled																
Misc																
% Moisture	%	1	0.1	-	-		63.7	62	67.3	62.4	65.7	65.8	64.5	2.1		
Total Organic Carbon	%	0	0.1	-	-		0.8	1.18	0.99	1.15	1.05	0.92	1.0	0.1		
Metals and Metalloids																
Arsenic, As	mg/kg	1	1	20	-		7.48	7	8.27	7.24	7.83	8.01	7.6	0.5	8.0	N
Cadmium, Cd	mg/kg	0.1	0.1	1.5	-		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				
Chromium, Cr	mg/kg	1	1	80	-		26.1	19.5	24.6	22.6	23.2	25.9	23.7	2.5	25.7	N
Copper, Cu	mg/kg	1	1	65	-		26.2	20.3	22.3	23.4	19.5	23.4	22.5	2.4	24.5	N
Lead, Pb	mg/kg	1	1	50	-		15.3	12.6	15.3	14.4	14	15.6	14.5	1.1	15.5	N
Mercury, Hg	mg/kg	0	0.01	0.15	-		0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.004	0.03	X
Nickel, Ni	mg/kg	1	1	21	-		15.6	11.1	14.4	13.2	13.6	14.7	13.8	1.6	15.1	N
Zinc, Zn	mg/kg	1	1	200	-		60.2	48.9	55.3	51.9	49.9	54.5	53.5	4.1	56.9	N
Organotins																
Monobutyltin - Phase II	µg Sn/kg	1	1	-	-		<1	<1	<1	<1	<1	<1				
Normalised to % TOC	µg Sn/kg		-	-	-											
Dibutyltin - Phase II	µg Sn/kg	1	1	-	-		1	1	<1	1	<1	<1				
Normalised to % TOC	µg Sn/kg		-	-	-		1.25	0.85		0.87			1.0	0.2	1.4	N
Tributyltin - Phase II	µg Sn/kg	0.5	1	-	-		2.5	5.3	0.8	3.3	1.1	2.3				
Normalised to % TOC	µg Sn/kg		-	9	-		3.13	4.49	0.81	2.87	1.05	2.50	2.5	1.4	3.6	N
TPH																
TPH C6-C9	mg/kg	3	10	-	-		<3	<3	<3	<3	<3	<3				
TPH C10-14	mg/kg	3	10	-	-		5	6	4	4	6	6	5.2	1.0	6.0	N
TPH C15-28	mg/kg	3	50	-	-		19	42	14	18	28	23	24.0	10.0	32.2	N
TPH C29-36	mg/kg	5	50	-	-		12	41	12	14	23	18	20.0	11.1	29.2	N
Total TPH	mg/kg	3		550	-		36	89	30	36	57	47	49.2	21.8	67.1	N
TRH																
C6 - C10 Fraction	mg/kg	3	-	-	-		<3	<3	<3	<3	<3	<3				
C6 - C10 Fraction - BTEX	mg/kg	3	-	-	-		<3.0	<3.0	<3.0	<3.0	<3.0	<3.0				
>C10 - C16 Fraction	mg/kg	3	-	-	-		5	7	4	4	6	6	5.3	1.2	6.3	N
>C16 - C34 Fraction	mg/kg	3	-	-	-		25	64	22	26	40	33	35.0	15.6	47.9	N
>C34 - C40 Fraction	mg/kg	5	-	-	-		9	30	12	12	17	15	15.8	7.5	22.0	N
>C10 - C40 Fraction (sum)	mg/kg	3	-	-	-		39	101	38	42	63	54	56.2	24.0	75.9	N
>C10 - C16 Fraction- Naphthalene	mg/kg	3	-	-	-		5	7	4	4	6	6	5.3	1.2	6.3	N
BTEXN																
Benzene	mg/kg	0.2	-	-	-		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
Toluene	mg/kg	0.2	-	-	-		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
Ethylbenzene	mg/kg	0.2	-	-	-		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
meta- & para-Xylene	mg/kg	0.2	-	-	-		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4				
ortho-Xylene	mg/kg	0.2	-	-	-		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
Total Xylenes	mg/kg	0.5	-	-	-		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				
Sum of BTEX	mg/kg	0.2	200	-	-		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
Naphthalene	mg/kg	0.2	-	-	-		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
PAH																
Naphthalene	µg/kg	5	5	-	70*	<1	4.125	20	14	13	13	12				
Normalised to % TOC	µg/kg			-			5.16	16.95	14.14	11.30	12.38	13.04	12.2	3.9	15.4	N
2-Methylnaphthalene	µg/kg	5	5	-			7	<5	<5	<5	<5	<5				
Normalised to % TOC	µg/kg			-			8.75	2.50	2.50	2.50	2.50	2.50	3.5	2.6	8.1	X
Acenaphthylene	µg/kg	4	5	-		<1	20.375	45	<5	<5	<5	<5				
Normalised to % TOC	µg/kg			-			25.47	38.14	2.50	2.50	2.50	2.50	12.3	15.7	25.1	X
Acenaphthene	µg/kg	4	5	-		<1	13.625	4	<5	<5	<5	<5				
Normalised to % TOC	µg/kg			-			17.03	3.39	2.50	2.50	2.50	2.50	5.1	5.9	9.9	X
Fluorene	µg/kg	4	5	-		<1	32.375	20	<5	<5	<5	<5				
Normalised to % TOC	µg/kg			-			40.47	16.95	2.50	2.50	2.50	2.50	11.2	15.4	23.9	X
Phenanthrene	µg/kg	4	5	-	0.6*	<1	537.875	213	8	20	10	9				
Normalised to % TOC	µg/kg			-			672.34	180.51	8.08	17.39	9.52	9.78	149.6	264.9	367.5	N
Anthracene	µg/kg	4	5	-	0.1*	<1	95.375	85	<5	6	<5	<5				
Normalised to % TOC	µg/kg			-			119.22	72.03	2.50	5.22	2.50	2.50	34.0	50.0	75.2	L
Fluoranthene	µg/kg	4	5	-	1*	<1	1542.875	456	15	60	17	15				
Normalised to % TOC	µg/kg			-			1928.59	386.44	15.15	52.17	16.19	16.30	402.5	761.6	1029.0	N
Pyrene	µg/kg	4	5	-		<1	1035.375	362	13	52	14	13				
Normalised to % TOC	µg/kg			-			1294.22	306.78	13.13	45.22	13.33	14.13	281.1	509.4	700.2	N
Benz(a)anthracene	µg/kg	4	5	-		<1	492.875	240	7	30	8	8				
Normalised to % TOC	µg/kg			-			616.09	203.39	7.07	26.09	7.62	8.70	144.8	243.3	345.0	N

Sample ID	Units	PQL	NAGD PQL	NAGD Screening Level	ANZG, 2018 95% Protection	TB_02 Elutriate 25/09/18	TB_02 25/09/18	TB_05 (T1) 25/09/18	TB_12 25/09/18	TB_18 25/09/18	TB_26 25/09/18	TB_29 25/09/18	Mean/ Geomean	Standard Deviation	95% UCL	Normal (N) Log-normal (L) Neither (X)
Date Sampled																
Chrysene	µg/kg	4	5	-		<1	407.875	189	8	25	8	8				
<i>Normalised to % TOC</i>	µg/kg			-			509.84	160.17	8.08	21.74	7.62	8.70	119.4	200.4	284.2	N
Benzo(b+j)fluoranthene	µg/kg	4	5	-		<1	237.875	200	10	33	9	10				
<i>Normalised to % TOC</i>	µg/kg			-			297.34	169.49	10.10	28.70	8.57	10.87	87.5	120.3	186.4	N
Benzo(k)fluoranthene	µg/kg	4	5	-		<1	117.125	99	<5	13	<5	<5				
<i>Normalised to % TOC</i>	µg/kg			-			146.41	83.90	2.50	11.30	2.50	2.50	41.5	60.5	91.3	N
Benzo(e)pyrene	µg/kg	4	5	-			421	109	6	19	5	6				
<i>Normalised to % TOC</i>	µg/kg			-			526.25	92.37	6.06	16.52	4.76	6.52	108.7	207.3	279.3	L
Benzo(a)pyrene	µg/kg	4	5	-	0.1*	<0.5	132.125	218	7	28	7	7				
<i>Normalised to % TOC</i>	µg/kg			-			165.16	184.75	7.07	24.35	6.67	7.61	65.9	84.9	135.8	N
Perylene	µg/kg	4	5	-			168	88	12	21	12	12				
<i>Normalised to % TOC</i>	µg/kg			-			210.00	74.58	12.12	18.26	11.43	13.04	56.6	79.0	121.6	N
Benzo(g,h,i)perylene	µg/kg	4	5	-		<1	37.125	115	7	22	7	7				
<i>Normalised to % TOC</i>	µg/kg			-			46.41	97.46	7.07	19.13	6.67	7.61	30.7	36.1	60.4	N
Dibenz(a,h)anthracene	µg/kg	4	5	-		<1	13.375	26	<5	6	<5	<5				
<i>Normalised to % TOC</i>	µg/kg			-			16.72	22.03	2.50	5.22	2.50	2.50	8.6	8.6	15.7	N
Indeno(1,2,3-cd)pyrene	µg/kg	4	5	-		<1	43.375	107	6	19	6	6				
<i>Normalised to % TOC</i>	µg/kg			-			54.22	90.68	6.06	16.52	5.71	6.52	30.0	35.1	58.8	N
Coronene	µg/kg	5	5	-			13	27	<5	8	<5	<5				
<i>Normalised to % TOC</i>	µg/kg			-			16.25	22.88	2.50	6.96	2.50	2.50	8.9	8.7	16.1	N
Sum of PAHs	µg/kg	4	100	10000		<0.5	4900.375	2620	113	375	116	113				
<i>Normalised to % TOC</i>	µg/kg			10000			6125.47	2220.34	114.14	326.09	110.48	122.83	1503.2	2410.0	3486.0	N

Organochlorine Pesticides

Aldrin	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
alpha-BHC	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
beta-BHC	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
delta-BHC	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
4,4'-DDD	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
4,4'-DDE	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
4,4'-DDT	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Sum of DDD + DDE + DDT	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Dieldrin	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
alpha-Endosulfan	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
beta-Endosulfan	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Endosulfan sulfate	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Endosulfan (sum)	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Endrin	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Endrin aldehyde	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Endrin ketone	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Heptachlor	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Heptachlor epoxide	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Hexachlorobenzene (HCB)	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
gamma-BHC	µg/kg	0.3	-	-	-		<0.25	<0.25	<0.25	<0.25	<0.25	<0.25				
Methoxychlor	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
cis-Chlordane	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
trans-Chlordane	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Total Chlordane (sum)	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Oxychlordane	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Sum of Aldrin + Dieldrin	µg/kg	0.5	-	-	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				

Radionuclides

Gross alpha	Bq/kg DW	500	-	35000	-		640	640	<500	<500	920	1100	825.0	225.9	916.9	N
Gross beta	Bq/kg DW	500	-		-		570	<500	530	<500	560	530	547.5	20.6	575.4	N
Sum of radionuclides	Bq/kg DW	500	-		-		1210	640	530	<500	1480	1630	1098.0	493.4	1418.0	N

Notes

Note	When calculating averages and 95%UCLs, values below detection for individual sample results were set to half the detection levels (consistent with the NAGD).
PQL	Practical Quantitation Limit
Sample ID	Sample location numbers
ND	Insufficient data
-	No guidelines levels (i.e. Screening or Maximum Levels) set in NAGD for given parameter, or no analysis undertaken for a given sample
	Value exceeds NAGD or agreed local screening level
<i>Normalised to % TOC</i>	Normalised to % TOC, over the range of TOC from 0.2 to 10%
	Not tested
#	Average of four field replacate samples
*	Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments (ANZG, 2018) 95% Species Protection (µg/L)

PAH concentrations for TB_02 are the average of triplicate analysis. Concentrations were detected original, however, all triplicate samples returned results below the laboratory LOR

PAH elutriates results for TB02 are reported in µg/L



4.3 Berth Pockets

4.3.1 Physical characteristics

4.3.1.1 Particle Size Distribution

Sediment textures within the Berth Pockets are primarily comprised of silt and clay with a combined fine content of 79%. However, each sample contained portions of sand greater than 10%. Samples with sand portions greater than 25% include B1_02 T1, B5_10, B5_08 and B1_07. A summary of PSD results for the Berth Pockets is presented in Table 4-5 and Figure 4-3.

The triplicate samples indicate there is some variability in sediment textures, with the T1 sample showing the most variability with the highest portion of sand.

4.3.1.2 Settling rate

Settling rates are provided in Table 4-5. This indicates that settling rates are similarly slow in all samples except for B1_02 T2 and T3. These samples have the least percentage sand and have even slower settling rates.

Table 4-5 Particle size distribution of sediments across the Berth Pockets

Sample ID	Date Sampled	Texture					Soil Particle Density (Clay/Silt/Sand)	10% Setteability					20% Setteability				
		Clay	Silt	Sand	Gravel	Cobbles		Underflow Density	Underflow Solids	Settling Rate @ 50% of Settlement	Settling Rate @ 90% of Settlement	Clarity	Underflow Density	Underflow Solids	Settling Rate @ 50% of Settlement	Settling Rate @ 90% of Settlement	Clarity
Units	%	%	%	%	%	g/cm3	g/cm3	%	mm/min	mm/min		g/cm3	%	mm/min	mm/min		
PQL	1	1	1	1	1	0.01	0.01	0.1	0.001	0.001		0.01	0.1	0.001	0.001		
Size (mm)		<0.02	0.02-0.6	0.6-2	2-60	>60	-										
B1_02 (T1)	26/09/2018	28	35	36	1	<1		1.04	40.8	2.6	0.217	Clear	1.15	30.6	0.05	0.015	Clear
B1_02 (T2)	26/09/2018	23	66	11	<1	<1		1.05	30.8	0.333	0.027	Clear	1.11	24.9	0.033	0.009	Clear
B1_02 (T3)	26/09/2018	22	67	11	<1	<1		1.04	30.1	0.333	0.02	Clear	1.11	20.8	0.009	0.009	Clear
B3_14	26/09/2018	40	43	17	<1	<1		1.07	35.8	3.2	0.133	Clear	1.12	25	0.67	0.024	Clear
B4_01	26/09/2018	37	52	11	<1	<1		1.05	29.8	2.6	0.092	Clear	1.09	26.1	0.05	0.016	Clear
B5_10	26/09/2018	42	32	26	<1	<1		1.06	32.7	2.6	0.133	Clear	1.11	31.1	0.05	0.015	Clear
B5_08	26/09/2018	43	29	27	1	<1	2.62	1.19	25.5	2.8	0.058	Clear	1.15	24.9	0.016	0.016	Clear
B1_07	26/09/2018	46	24	27	3	<1	2.58	1.15	22.9	2	0.021	Clear	1.18	24.1	0.033	0.01	Clear
Mean		35	44	21	2	<1	2.60	1.08	31.1	2.1	0.088		1.13	25.9	0.11	0.014	

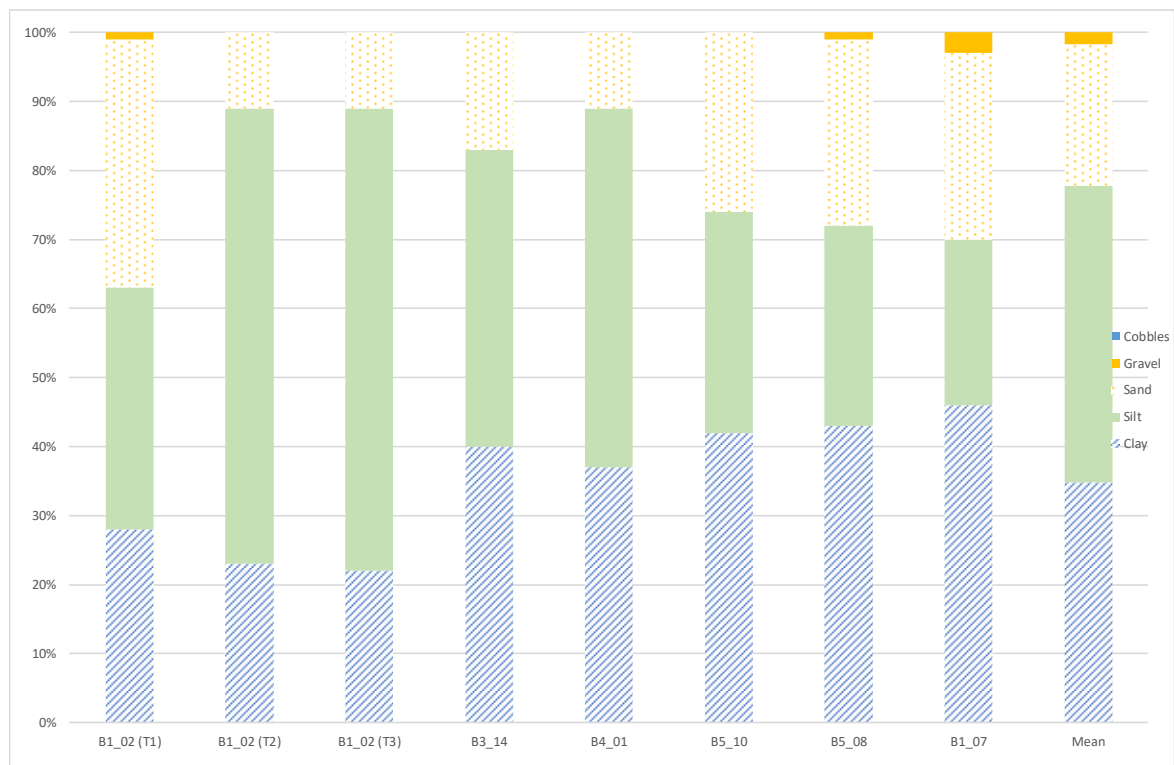


Figure 4-3 Particle size distribution of sediments in the Berth Pockets

4.3.2 Chemical characteristics

The results of chemical analyses for sediments in the Berth Pockets are summarised below. This summary includes a comparison against NAGD screening levels in Table 2 of Appendix A. A tabulated summary of the chemical analysis is provided in Table 4-6. Primary laboratory reports are provided in Appendix C.

4.3.2.1 Metals and Metalloids

Metals and metalloid concentrations were below the respective NAGD Screening Level for all Berth Pocket samples.

4.3.2.2 Organotins

There are no NAGD screening criteria for MBT or DBT. Concentrations of these organotin compounds were below the LOR.

Concentrations of TBT were below the LOR for all Berth Pocket samples except for B5_08 (1.4µgSn/kg, normalised 1.71µgSn/kg). These concentrations are below the NAGD screening level of 9µg Sn/kg. The 95% UCL of the mean was calculated, however, it is inaccurate as only one concentration above the LOR was detected. Nonetheless the 95%UCL of the mean (1.6µgSn/kg) is below the NAGD Screening Level.

4.3.2.3 TPH, TRH and BTEX

Concentrations of TPH and TRH were detected in most samples. However, only total TPH can be compared to a NAGD screening level of 500mg/kg. Concentrations of TPH in all samples collected were below the NAGD screening level.

Concentrations of BTEX in all samples analysed were below the LOR.

4.3.2.4 PAH

Concentrations of PAHs were detected in all samples, however, when normalised, summed and the 95%UCL calculated are below the NAGD screening criteria of 10,000µg/kg for total PAH.

Table 4-6: Summary of chemical analysis results for Berth Pockets

Sample ID	Units	PQL	NAGD PQL	NAGD Screening Level	B1_02 (T1) 26/09/18	B1_07 26/09/18	B3_14 26/09/18	B4_01 26/09/18	B5_08 26/09/18	B5_10 26/09/18	Mean/ Geomean	Standard Deviation	95% UCL	Normal (N) Log-normal (L) Neither (X)
Misc														
% Moisture	%	1	0.1	-	59.7	61.8	65	69.4	58.2	67.3	63.6	4.4		
Total Organic Carbon	%	0	0.1	-	0.75	0.73	0.98	1.2	0.82	0.88	0.9	0.2		
Metals and Metalloids														
Arsenic, As	mg/kg	1	1	20	7.94	6.8	8.42	8.96	6.98	8.05	7.9	0.8	8.5	N
Cadmium, Cd	mg/kg	0.1	0.1	1.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				
Chromium, Cr	mg/kg	1	1	80	22	22.3	24.7	28.5	20.4	24.4	23.7	2.8	26.1	N
Copper, Cu	mg/kg	1	1	65	30.1	21.9	16	19.8	16.1	17.6	20.3	5.3	24.6	N
Lead, Pb	mg/kg	1	1	50	10.9	16	13	15.4	11.9	14.2	13.6	2.0	15.2	N
Mercury, Hg	mg/kg	0	0.01	0.15	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.004	0.025	X
Nickel, Ni	mg/kg	1	1	21	12.2	13.1	13.6	16.1	12.2	14.5	13.6	1.5	14.9	N
Zinc, Zn	mg/kg	1	1	200	83	57.9	48.3	58.3	41.8	50	56.6	14.4	68.4	N
Organotins														
Monobutyltin - Phase II	µg Sn/kg	1	1	-	<1	<1	<1	<1	<1	<1				
<i>Normalised to % TOC</i>	µg Sn/kg		-	-										
Dibutyltin - Phase II	µg Sn/kg	1	1	-	<1	<1	<1	<1	<1	<1				
<i>Normalised to % TOC</i>	µg Sn/kg		-	-										
Tributyltin - Phase II	µg Sn/kg	0.5	1	-	<0.5	<0.5	<0.5	<0.5	1.4	<0.5				
<i>Normalised to % TOC</i>	µg Sn/kg		-	9	0.25	0.25	0.25	0.25	1.71	0.25	0.5	0.6	1.6	X
TPH														
TPH C6-C9	mg/kg	3	10	-	<3	<3	<3	<3	<3	<3				
TPH C10-14	mg/kg	3	10	-	6	6	8	6	4	6	6.0	1.3	7.0	N
TPH C15-28	mg/kg	3	50	-	22	21	29	17	12	20	20.2	5.6	24.8	N
TPH C29-36	mg/kg	5	50	-	16	16	27	10	10	14	15.5	6.3	20.6	N
Total TPH	mg/kg	3		550	44	43	64	33	26	40	41.7	12.9	50.3	N
TRH														
C6 - C10 Fraction	mg/kg	3	-	-	<3	<3	<3	<3	<3	<3				
C6 - C10 Fraction - BTEX	mg/kg	3	-	-	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0				
>C10 - C16 Fraction	mg/kg	3	-	-	6	6	8	6	4	6	6.0	1.3	7.0	N
>C16 - C34 Fraction	mg/kg	3	-	-	31	30	44	22	17	27	28.5	9.2	36.1	N
>C34 - C40 Fraction	mg/kg	5	-	-	10	12	19	8	8	10	11.2	4.1	14.6	N
>C10 - C40 Fraction (sum)	mg/kg	3	-	-	47	48	71	36	29	43	45.7	14.3	57.5	N
>C10 - C16 Fraction- Naphthalene	mg/kg	3	-	-	6	6	8	6	4	6	6.0	1.3	7.0	N
BTEXN														
Benzene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
Toluene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
Ethylbenzene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
meta- & para-Xylene	mg/kg	0.2	-	-	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4				
ortho-Xylene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
Total Xylenes	mg/kg	0.5	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				
Sum of BTEX	mg/kg	0.2	200	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
Naphthalene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
PAH														
Naphthalene	µg/kg	5	5	-	16	12	11	15	10	12				
<i>Normalised to % TOC</i>	µg/kg			-	21.33	16.44	11.22	12.50	12.20	13.64	14.6	3.8	17.7	N
2-Methylnaphthalene	µg/kg	5	5	-	<5	<5	<5	<5	<5	<5				
<i>Normalised to % TOC</i>	µg/kg			-										
Acenaphthylene	µg/kg	4	5	-	5	<5	<5	<5	<5	<5				
<i>Normalised to % TOC</i>	µg/kg			-	6.67	2.50	2.50	2.50	2.50	2.50	3.2	1.7	4.6	X
Acenaphthene	µg/kg	4	5	-	14	<5	<5	<5	<5	<5				
<i>Normalised to % TOC</i>	µg/kg			-	18.67	2.50	2.50	2.50	2.50	2.50	5.2	6.6	16.9	X
Fluorene	µg/kg	4	5	-	12	<5	<5	5	<5	<5				
<i>Normalised to % TOC</i>	µg/kg			-	16.00	2.50	2.50	4.17	2.50	2.50	5.0	5.4	9.5	X
Phenanthrene	µg/kg	4	5	-	99	10	7	10	13	9				
<i>Normalised to % TOC</i>	µg/kg			-	132.00	13.70	7.14	8.33	15.85	10.23	31.2	49.5	71.9	L

Sample ID	Units	PQL	NAGD PQL	NAGD Screening Level	B1_02 (T1) 26/09/18	B1_07 26/09/18	B3_14 26/09/18	B4_01 26/09/18	B5_08 26/09/18	B5_10 26/09/18	Mean/ Geomean	Standard Deviation	95% UCL	Normal (N) Log-normal (L) Neither (X)
Date Sampled														
Anthracene	µg/kg	4	5	-	12	7	<5	<5	<5	<5				
<i>Normalised to % TOC</i>	µg/kg			-	16.00	9.59	2.50	2.50	2.50	2.50	5.9	5.7	10.6	X
Fluoranthene	µg/kg	4	5	-	210	18	10	19	28	14				
<i>Normalised to % TOC</i>	µg/kg			-	280.00	24.66	10.20	15.83	34.15	15.91	63.5	106.4	151.0	L
Pyrene	µg/kg	4	5	-	159	15	8	17	24	11				
<i>Normalised to % TOC</i>	µg/kg			-	212.00	20.55	8.16	14.17	29.27	12.50	49.4	80.0	115.2	L
Benz(a)anthracene	µg/kg	4	5	-	82	11	<5	10	18	6				
<i>Normalised to % TOC</i>	µg/kg			-	109.33	15.07	2.50	8.33	21.95	6.82	27.3	40.7	60.9	L
Chrysene	µg/kg	4	5	-	66	13	5	10	15	8				
<i>Normalised to % TOC</i>	µg/kg			-	88.00	17.81	5.10	8.33	18.29	9.09	24.4	31.6	50.4	L
Benzo(b+j)fluoranthene	µg/kg	4	5	-	58	9	6	11	18	8				
<i>Normalised to % TOC</i>	µg/kg			-	77.33	12.33	6.12	9.17	21.95	9.09	22.7	27.3	45.2	N
Benzo(k)fluoranthene	µg/kg	4	5	-	33	6	<5	6	9	<5				
<i>Normalised to % TOC</i>	µg/kg			-	44.00	8.22	2.50	5.00	10.98	2.50	12.2	15.9	25.3	L
Benzo(e)pyrene	µg/kg	4	5	-	32	6	<5	7	11	<5				
<i>Normalised to % TOC</i>	µg/kg			-	42.67	8.22	2.50	5.83	13.41	2.50	12.5	15.3	25.1	N
Benzo(a)pyrene	µg/kg	4	5	-	46	8	<5	9	15	5				
<i>Normalised to % TOC</i>	µg/kg			-	61.33	10.96	2.50	7.50	18.29	5.68	17.7	22.0	35.8	N
Perylene	µg/kg	4	5	-	21	12	11	16	15	13				
<i>Normalised to % TOC</i>	µg/kg			-	28.00	16.44	11.22	13.33	18.29	14.77	17.0	5.9	21.9	N
Benzo(g,h,i)perylene	µg/kg	4	5	-	26	6	<5	7	11	<5				
<i>Normalised to % TOC</i>	µg/kg			-	34.67	8.22	2.50	5.83	13.41	2.50	11.2	12.2	21.2	N
Dibenz(a,h)anthracene	µg/kg	4	5	-	7	5	<5	<5	<5	<5				
<i>Normalised to % TOC</i>	µg/kg			-	9.33	6.85	2.50	2.50	2.50	2.50	4.4	3.0	6.8	X
Indeno(1.2.3.cd)pyrene	µg/kg	4	5	-	24	6	<5	7	10	<5				
<i>Normalised to % TOC</i>	µg/kg			-	32.00	8.22	2.50	5.83	12.20	2.50	10.5	11.1	19.7	N
Coronene	µg/kg	5	5	-	6	<5	<5	<5	<5	<5				
<i>Normalised to % TOC</i>	µg/kg			-	8.00	2.50	2.50	2.50	2.50	2.50	3.4	2.2	5.3	X
Sum of PAHs	µg/kg	4	100	10000	928	144	58	149	197	86				
<i>Normalised to % TOC</i>	µg/kg			10000	1237.33	197.26	59.18	124.17	240.24	97.73	326.0	451.3	697.3	L

Notes

Note	When calculating averages and 95%UCLs, values below detection for individual sample results were set to half the detection levels (consistent with the NAGD).
PQL	Practical Quantitation Limit
Sample ID	Sample location numbers
ND	Insufficient data
-	No guidelines levels (i.e. Screening or Maximum Levels) set in NAGD for given parameter, or no analysis undertaken for a given sample
	Value exceeds NAGD or agreed local screening level
<i>Normalised to % TOC</i>	Normalised to % TOC, over the range of TOC from 0.2 to 10%
	Not tested
#	Average of four field replicates samples



4.4 Dredge Material Placement Area

4.4.1 Physical characteristics

4.4.1.1 Particle Size Distribution

Sediment textures within the DMPA are comprised of sand and gravel with only 2% or less of silt and clays. A summary of PSD results for the DMPA is presented in Table 4-7 and Figure 4-4.

4.4.1.2 Settling rate

Settling rates are provided in Table 4-7. This indicates that settling rates are similarly fast due to high sand and gravel content.

Table 4-7 Particle size distribution of sediments across the DMPA

Sample ID	Date Sampled	Texture					Soil Particle Density (Clay/Silt/Sand)	10% Settleability					20% Settleability				
		Clay	Silt	Sand	Gravel	Cobbles		Underflow Density	Underflow Solids	Settling Rate @ 50% of Settlement	Settling Rate @ 90% of Settlement	Clarity	Underflow Density	Underflow Solids	Settling Rate @ 50% of Settlement	Settling Rate @ 90% of Settlement	Clarity
Units		%	%	%	%	%	g/cm3	g/cm3	%	mm/min	mm/min		g/cm3	%	mm/min	mm/min	
PQL		1	1	1	1	1	0.01	0.01	0.1	0.001	0.001		0.01	0.1	0.001	0.001	
Size (mm)		<0.02	0.02-0.6	0.6-2	2-60	>60	-										
SG_01	27/09/2018	1	2	30	67	<1		1.83	68.3	55.6	55.6	Clear	2.1	68.1	24.6	24.6	Clear
SG_02	27/09/2018	<1	1	63	36	<1	2.49	1.74	71.8	57	57	Clear	2.06	69.5	24.2	24.2	Clear
SG_03	27/09/2018	<1	1	66	33	<1	2.41	1.79	69.9	58	58	Clear	1.78	70.3	24.6	24.6	Clear
Mean		1	1	53	45	<1	2.45	1.79	70.0	56.9	56.9		1.98	69.3	24.47	24.5	

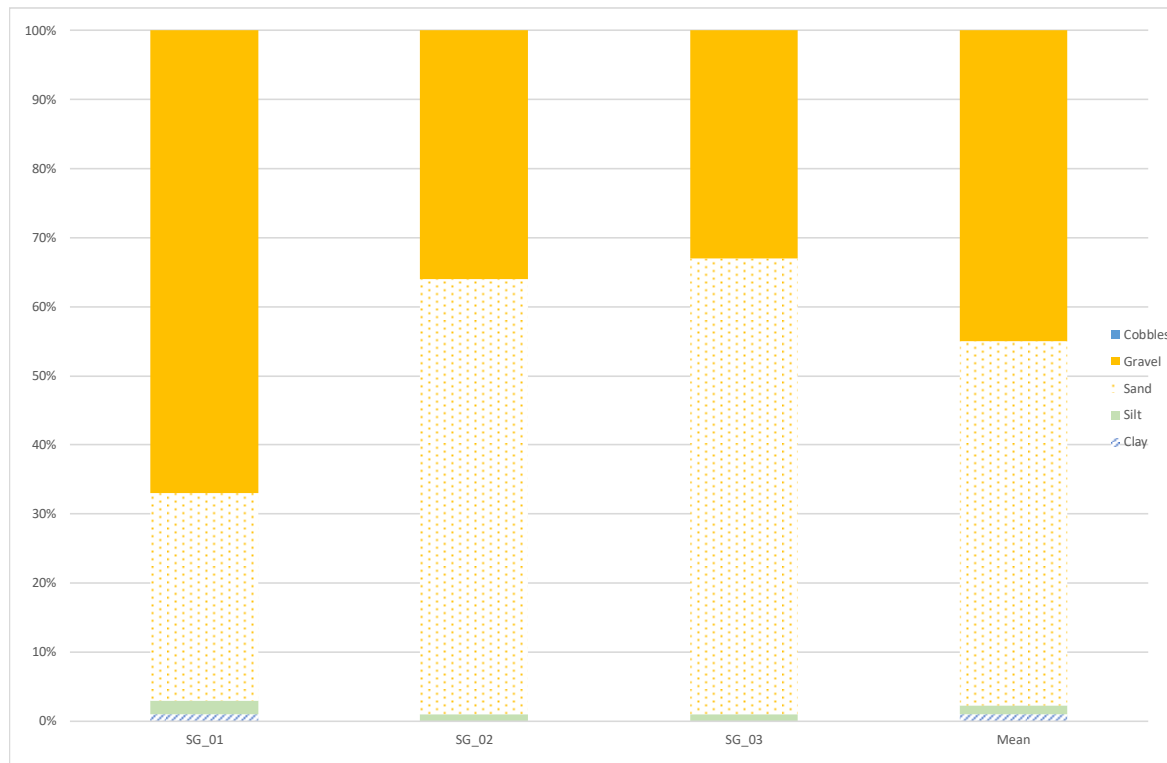


Figure 4-4 Particle size distribution of sediments in the DMPA

4.4.2 Chemical characteristics

The results of chemical analyses for sediments in the DMPA are summarised below. This summary includes a comparison against NAGD screening levels in Table 2 of Appendix A. A tabulated summary of the chemical analysis is provided in Table 4-8. Primary laboratory reports are provided in Appendix C.

Note that 95%UCLs of the mean values were not calculated as the sample size (i.e. three values) is too small to generate accurate results.

4.4.2.1 Metals and Metalloids

Metals and metalloid concentrations were below the respective NAGD Screening Level for all DMPA (SG) samples.

4.4.2.2 Organotins

All organotin compounds were less than the laboratory LORs, therefore concentrations of TBT are below the NAGD screening level of 9µgSn/kg.



4.4.2.3 TPH, TRH and BTEX

Concentrations of TPH and TRH were detected in most samples. However, only total TPH can be compared to a NAGD screening level of 500mg/kg. Concentrations of TPH in all samples collected were below the NAGD screening level.

Concentrations of BTEX in all samples analysed were below the LOR.

4.4.2.4 PAH

Concentrations of PAHs were below the LOR in all reference samples collected, therefore the 95%UCL of the mean could not be calculated. Nonetheless, these concentrations were below NAGD screening criteria of 10,000µg/kg for total PAH.

Table 4-8: Summary of chemical analysis results for DMPA sites

Sample ID	Units	PQL	NAGD PQL	NAGD Screening Level	SG_01 27/09/18	SG_02 27/09/18	SG_03 27/09/18	Mean/ Geomean	Standard Deviation	95% UCL	Normal (N) Log-normal (L) Neither (X)
Date Sampled											
Misc											
% Moisture	%	1	0.1	-	22	19.3	16.2	19.2	2.9		
Total Organic Carbon	%	0	0.1	-	0.24	0.2	0.19	0.2	0.03		
Metals and Metalloids											
Arsenic, As	mg/kg	1	1	20	5.62	6.69	8.64	7.0	1.5		
Cadmium, Cd	mg/kg	0.1	0.1	1.5	<0.1	<0.1	<0.1				
Chromium, Cr	mg/kg	1	1	80	4	2.2	2.6	2.9	0.9		
Copper, Cu	mg/kg	1	1	65	1.6	1.2	1.5	1.4	0.2		
Lead, Pb	mg/kg	1	1	50	2.7	2.2	2.4	2.4	0.3		
Mercury, Hg	mg/kg	0	0.01	0.15	<0.01	<0.01	<0.01				
Nickel, Ni	mg/kg	1	1	21	2	1.4	1.7	1.7	0.3		
Zinc, Zn	mg/kg	1	1	200	5.3	3.4	6.2	5.0	1.4		
Organotins											
Monobutyltin - Phase II	µg Sn/kg	1	1	-	<1	<1	<1				
<i>Normalised to % TOC</i>	µg Sn/kg		-	-							
Dibutyltin - Phase II	µg Sn/kg	1	1	-	<1	<1	<1				
<i>Normalised to % TOC</i>	µg Sn/kg		-	-							
Tributyltin - Phase II	µg Sn/kg	0.5	1	-	<0.5	<0.5	<0.5				
<i>Normalised to % TOC</i>	µg Sn/kg		-	9							
TPH											
TPH C6-C9	mg/kg	3	10	-	<3	<3	<3				
TPH C10-14	mg/kg	3	10	-	<3	<3	<3				
TPH C15-28	mg/kg	3	50	-	7	<3	4	5.5	2.1		
TPH C29-36	mg/kg	5	50	-	7	<5	<5	7.0			
Total TPH	mg/kg	3		550	14	<3	4	9.0	7.1		
TRH											
C6 - C10 Fraction	mg/kg	3	-	-	<3	<3	<3				
C6 - C10 Fraction - BTEX	mg/kg	3	-	-	<3.0	<3.0	<3.0				
>C10 - C16 Fraction	mg/kg	3	-	-	<3	<3	<3				
>C16 - C34 Fraction	mg/kg	3	-	-	12	5	6	7.7	3.8		
>C34 - C40 Fraction	mg/kg	5	-	-	<5	<5	<5				
>C10 - C40 Fraction (sum)	mg/kg	3	-	-	12	5	6	7.7	3.8		
>C10 - C16 Fraction- Naphthalene	mg/kg	3	-	-	<3	<3	<3				
BTEXN											
Benzene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2				
Toluene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2				
Ethylbenzene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2				
meta- & para-Xylene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2				
ortho-Xylene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2				
Total Xylenes	mg/kg	0.5	-	-	<0.5	<0.5	<0.5				
Sum of BTEX	mg/kg	0.2	200	-	<0.2	<0.2	<0.2				
Naphthalene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2				
PAH											
Naphthalene	µg/kg	5	5	-	<5	<5	<5				
<i>Normalised to % TOC</i>	µg/kg			-							
2-Methylnaphthalene	µg/kg	5	5	-	<5	<5	<5				
<i>Normalised to % TOC</i>	µg/kg			-							
Acenaphthylene	µg/kg	4	5	-	<4	<4	<4				
<i>Normalised to % TOC</i>	µg/kg			-							

Sample ID	Units	PQL	NAGD PQL	NAGD Screening Level	SG_01 27/09/18	SG_02 27/09/18	SG_03 27/09/18	Mean/ Geomean	Standard Deviation	95% UCL	Normal (N) Log-normal (L) Neither (X)
Date Sampled											
Acenaphthene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Fluorene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Phenanthrene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Anthracene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Fluoranthene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Pyrene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Benz(a)anthracene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Chrysene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Benzo(b+j)fluoranthene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Benzo(k)fluoranthene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Benzo(e)pyrene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Benzo(a)pyrene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Perylene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Benzo(g,h,i)perylene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Dibenz(a,h)anthracene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Indeno(1,2,3.cd)pyrene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Coronene	µg/kg	5	5	-	<5	<5	<5				
Normalised to % TOC	µg/kg			-							
Sum of PAHs	µg/kg	4	100	10000	<4	<4	<4				
Normalised to % TOC	µg/kg			10000							

Notes

Note	When calculating averages and 95%UCLs, values below detection for individual sample results were set to half the detection levels (consistent with the NAGD).
PQL	Practical Quantitation Limit
Sample ID	Sample location numbers
ND	Insufficient data
-	No guidelines levels (i.e. Screening or Maximum Levels) set in NAGD for given parameter, or no analysis undertaken for a given sample
	Value exceeds NAGD or agreed local screening level
Normalised to % TOC	Normalised to % TOC, over the range of TOC from 0.2 to 10%
	Not tested



4.5 Reference sites

4.5.1 Physical characteristics

4.5.1.1 Particle Size Distribution

Sediment textures within the reference sites are comprised of sand and gravel with only 1% or less of silt and clays. A summary of PSD results for the reference sites are presented in Table 4-9 and Figure 4-5.

4.5.1.2 Settling rate

Settling rates are provided in Table 4-9. This indicates that settling rates are similarly fast due to high sand and gravel content.

Table 4-9 Particle size distribution of sediments across the reference sites

Sample ID	Date Sampled	Texture					Soil Particle Density (Clay/Silt/Sand)	10% Setteability					20% Setteability				
		Clay	Silt	Sand	Gravel	Cobbles		Underflow Density	Underflow Solids	Settling Rate @ 50% of Settlement	Settling Rate @ 90% of Settlement	Clarity	Underflow Density	Underflow Solids	Settling Rate @ 50% of Settlement	Settling Rate @ 90% of Settlement	Clarity
Units		%	%	%	%	%	g/cm3	g/cm3	%	mm/min	mm/min	g/cm3	%	mm/min	mm/min		
PQL		1	1	1	1	1	0.01	0.01	0.1	0.001	0.001	0.01	0.1	0.001	0.001		
Size (mm)		<0.02	0.02-0.6	0.6-2	2-60	>60	-										
REF_01	27/09/2018	<1	1	68	31	<1	2.61	1.93	74	56.6	56.6	Clear	1.96	72.7	24.4	24.4	Clear
REF_02	27/09/2018	1	1	83	15	<1	3.08	1.99	71.7	58.4	58.4	Clear	1.99	71.7	24.8	24.8	Clear
REF_03	27/09/2018																
Mean		1	1	76	23	<1	2.85	1.96	72.9	57.5	57.500		1.98	72.2	24.60	24.600	

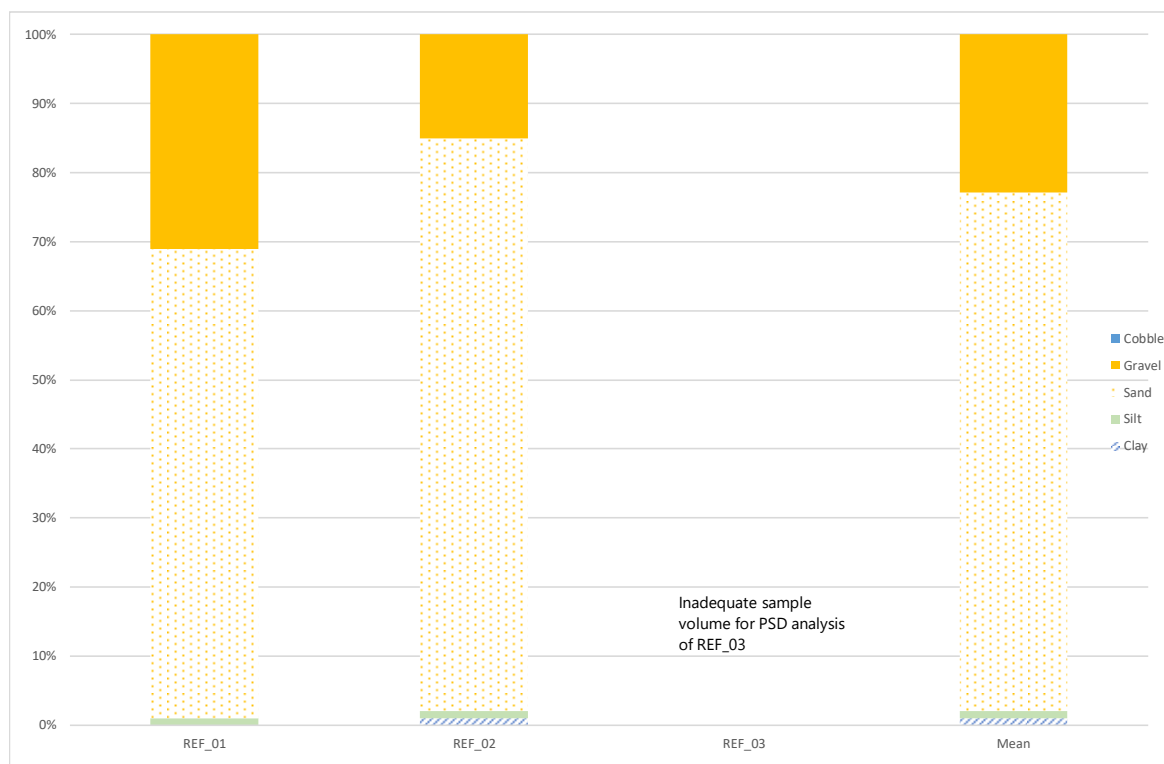


Figure 4-5 Particle size distribution of sediments in the reference sites

4.5.2 Chemical characteristics

The results of chemical analyses for sediments in the reference sites are summarised below. This summary includes a comparison against NAGD screening levels in Table 2 of Appendix A. A tabulated summary of the chemical analysis is provided in Table 4-10. Primary laboratory reports are provided in Appendix C.

Note that 95%UCLs of the mean values were not calculated as the sample size (i.e. three values) is too small to generate accurate results.

4.5.2.1 Metals and Metalloids

Metals and metalloid concentrations were below the respective NAGD Screening Level for all reference samples.

4.5.2.2 Organotins

All organotin compounds were less than the laboratory LORs, therefore concentrations of TBT are below the NAGD screening level of 9µgSn/kg.



4.5.2.3 TPH, TRH and BTEX

Concentrations of TPH and TRH were detected in most samples. However, only total TPH can be compared to a NAGD screening level of 500mg/kg. Concentrations of TPH in all samples collected were below the NAGD screening level.

Concentrations of BTEX in all samples analysed were below the LOR.

4.5.2.4 PAH

Concentrations of PAHs were below the LOR in all reference samples collected, therefore the 95%UCL of the mean could not be calculated. Nonetheless, these concentrations were below NAGD screening criteria of 10,000µg/kg for total PAH.

4.6 Comparison of Reference sites to DMPA

Contaminant concentrations in DMPA (SG) and Reference site samples are similarly below the NAGD Screening Levels for all chemicals of concern. Sediment textures in DMPA (SG) and Reference site samples are consistent and primarily sand and gravel with negligible clay and silt components. These results indicate that both DMPA (SG) and Reference site samples are comparable and support continued placement of maintenance dredge material.

Table 4-10: Summary of chemical analysis results for reference sites

Sample ID	Units	PQL	NAGD PQL	NAGD Screening Level	REF_01 27/09/18	REF_02 27/09/18	REF_03 27/09/18	Mean/ Geomean	Standard Deviation	95% UCL	Normal (N) Log-normal (L) Neither (X)
Date Sampled											
Misc											
% Moisture	%	1	0.1	-	17.7	17.8	17.2	17.6	0.3		
Total Organic Carbon	%	0	0.1	-	0.23	0.25	0.2	0.2	0.0		
Metals and Metalloids											
Arsenic, As	mg/kg	1	1	20	18.4	9.7	9.88	12.7	5.0		
Cadmium, Cd	mg/kg	0.1	0.1	1.5	<0.1	<0.1	<0.1				
Chromium, Cr	mg/kg	1	1	80	4	3.7	3.1	3.6	0.5		
Copper, Cu	mg/kg	1	1	65	3.6	1.2	1.2	2.0	1.4		
Lead, Pb	mg/kg	1	1	50	11.4	3.1	2.4	5.6	5.0		
Mercury, Hg	mg/kg	0	0.01	0.15	<0.01	<0.01	<0.01				
Nickel, Ni	mg/kg	1	1	21	3.2	1.7	1.5	2.1	0.9		
Zinc, Zn	mg/kg	1	1	200	7	4	4.3	5.1	1.7		
Organotins											
Monobutyltin - Phase II	µg Sn/kg	1	1	-	<1	<1	<1				
Normalised to % TOC	µg Sn/kg		-	-							
Dibutyltin - Phase II	µg Sn/kg	1	1	-	<1	<1	<1				
Normalised to % TOC	µg Sn/kg		-	-							
Tributyltin - Phase II	µg Sn/kg	0.5	1	-	<0.5	<0.5	<0.5				
Normalised to % TOC	µg Sn/kg		-	9							
TPH											
TPH C6-C9	mg/kg	3	10	-	<3	<3	<3				
TPH C10-14	mg/kg	3	10	-	<3	<3	<3				
TPH C15-28	mg/kg	3	50	-	7	9	4	6.7	2.5		
TPH C29-36	mg/kg	5	50	-	<5	7	<5	7.0			
Total TPH	mg/kg	3		550	7	16	4	9.0	6.2		
TRH											
C6 - C10 Fraction	mg/kg	3	-	-	<3	<3	<3				
C6 - C10 Fraction - BTEX	mg/kg	3	-	-	<3.0	<3.0	<3.0				
>C10 - C16 Fraction	mg/kg	3	-	-	<3	<3	<3				
>C16 - C34 Fraction	mg/kg	3	-	-	10	13	7	10.0	3.0		
>C34 - C40 Fraction	mg/kg	5	-	-	<5	6	<5	6.0			
>C10 - C40 Fraction (sum)	mg/kg	3	-	-	10	19	7	12.0	6.2		
>C10 - C16 Fraction- Naphthalene	mg/kg	3	-	-	<3	<3	<3				
BTEXN											
Benzene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2				
Toluene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2				
Ethylbenzene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2				
meta- & para-Xylene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2				
ortho-Xylene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2				
Total Xylenes	mg/kg	0.5	-	-	<0.5	<0.5	<0.5				
Sum of BTEX	mg/kg	0.2	200	-	<0.2	<0.2	<0.2				
Naphthalene	mg/kg	0.2	-	-	<0.2	<0.2	<0.2				
PAH											
Naphthalene	µg/kg	5	5	-	<5	<5	<5				
Normalised to % TOC	µg/kg			-							
2-Methylnaphthalene	µg/kg	5	5	-	<5	<5	<5				
Normalised to % TOC	µg/kg			-							
Acenaphthylene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							

Sample ID	Units	PQL	NAGD PQL	NAGD Screening Level	REF_01 27/09/18	REF_02 27/09/18	REF_03 27/09/18	Mean/ Geomean	Standard Deviation	95% UCL	Normal (N) Log-normal (L) Neither (X)
Date Sampled											
Acenaphthene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Fluorene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Phenanthrene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Anthracene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Fluoranthene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Pyrene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Benz(a)anthracene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Chrysene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Benzo(b+j)fluoranthene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Benzo(k)fluoranthene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Benzo(e)pyrene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Benzo(a)pyrene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Perylene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Benzo(g,h,i)perylene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Dibenz(a,h)anthracene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Indeno(1,2,3,cd)pyrene	µg/kg	4	5	-	<4	<4	<4				
Normalised to % TOC	µg/kg			-							
Coronene	µg/kg	5	5	-	<5	<5	<5				
Normalised to % TOC	µg/kg			-							
Sum of PAHs	µg/kg	4	100	10000	<4	<4	<4				
Normalised to % TOC	µg/kg			10000							

Notes

Note	When calculating averages and 95%UCLs, values below detection for individual sample results were set to half the detection levels (consistent with the NAGD).
PQL	Practical Quantitation Limit
Sample ID	Sample location numbers
ND	Insufficient data
-	No guidelines levels (i.e. Screening or Maximum Levels) set in NAGD for given parameter, or no analysis undertaken for a given sample
	Value exceeds NAGD or agreed local screening level
Normalised to % TOC	Normalised to % TOC, over the range of TOC from 0.2 to 10%
	Not tested



5 Data validation

This section examines the validity of the analytical data obtained in the study to provide confidence in the results presented.

5.1 Field sampling

Split duplicate samples are used to assess variation associated with sub-sample handling. Field replicate samples were collected to assess the extent of heterogeneity of sediments at sampling locations. As per the NAGD:

"...duplicates (that is, separately extracted splits of a single mixed sample, not aliquot splits after extraction) should be within an Relative Percent Difference (RPD) of ± 35 per cent."

"Field replicates (that is, two separate samples taken at the same location) should agree within an RPD (or for three samples at the one location, the relative standard deviation, RSD) of $\pm 50\%$, although they may not always do so where the sediments are very heterogenous or greatly differing in grain size."

The number of field QA/QC samples analysed are presented in Table 3-3, while the results of the RPD and RSD assessment are provided in Table 5-1.

5.1.1 Field replicates

Six RPD and 18 RSD exceedances were recorded for field replicate results samples. These comprise of one TBT, one DBT, one Hg, one TRH > C34 - C40 Fraction and 20 PAH compounds. The RSD result of TBT is not uncommon as concentrations of TBT are known to vary significantly within small spatial distributions, but also within the same sample despite homogenisation. This is often due to its presence as paint flecks within sediment resulting in heterogenic concentrations within split samples. The exceedances recorded for DBT and Hg are associated with minor concentrations detected close to the LOR. Primary results for TRHs and PAHs indicate variability exists throughout the Tug Berth and Berth Pocket sediments and therefore RSD exceedances are not surprising. Nonetheless, as the associated primary sample concentrations for the RSD/RPD exceedances are either below the respective NAGD screening criteria or below the laboratory LOR, they are not considered to impact data quality or the outcome of this assessment.

5.1.2 Field split triplicate

The field split triplicate results analysed by ALS/SGS indicate a total of 21 blind split triplicate samples exceeded the $\pm 35\%$ RPD for duplicate analysis stipulated in the NAGD. This comprises seven metals (Cr, Ni, Zn), two TOC, four TPH, four TRH, three PAH and one gross alpha radionuclide exceedance.

The seven metal RPD exceedances were recorded for samples analysed by SGS. For each metal, the SGS concentrations were less than those detected by ALS. This may be associated with more aggressive acid extraction methods at ALS. The two TOC values are associated with low concentrations close to the LOR.



Similarly to RSD results, TPH, TRH and PAHs are variable throughout sediments and likely to have contributed to the RPD exceedance.

An RPD exceedance was recorded for Gross Alpha in samples TB_29 and D5 analysed by ALS. On further investigation, the laboratory has indicated that results are within their measurement uncertainties and therefore considered acceptable.

Although several exceedances have been identified, the concentrations of the parameters are below the respective NAGD screening levels, therefore do not impact data quality.

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5.1.3 Field Blanks

Field rinsate blank samples were below LOR as indicated in Table 5-2.

Table 5-2: Rinsate blank sample results

Sample ID			Rinsate 1	Rinsate 2	Rinsate 3	Rinsate 4
Date	Units	PQL	24/09/18	25/09/18	26/09/18	27/09/18
Sampled						
Metals and Metalloids						
Arsenic	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.005	<0.005	<0.005	<0.005	<0.005

5.2 Laboratory analysis

The accuracy of the data provided by the laboratory is determined through analysis of spiked samples. The NAGD recommends that "Recovery Rates [for matrix spiked samples] should be within the limits specified for the analysis method (typically 75-125%)".

The precision of the data is assessed by the RPD for replicate/duplicate samples or the RSD for triplicate or more samples. The NAGD recommends that "Duplicate samples are to be spiked and the duplicates should agree within the specified relative percent differences (RPD) for the method (typically ± 30 -35%)".

ALS and SGS incorporated a range of QA/QC methods to ensure accuracy of laboratory data including:

- Duplicate analyses
- Method blanks
- Laboratory control samples
- Sample surrogate recoveries
- Matrix spikes.

The Quality Control Report provided by ALS and SGS are included with laboratory analysis reports in Appendix C, while a summary of the laboratory outliers is provided in Table 5-3.

Table 5-3 QA/QC laboratory outlier summary table

QA/QC Method	Laboratory Outliers	Comments
Laboratory control spikes	ALS (EB1823470): Outliers (recoveries greater than the upper control limit (36-128%)) were reported for QC sample 1996483-002 and 2002075-002 for MBT	These exceedances suggest a high bias in MBT, however, MBT concentrations in primary samples were all below the respective laboratory LOR (except sample H-3) therefore these outliers are not considered impact data quality.
	ALS (EB1828594): Recovery greater than the upper control limits for PAH compounds in QC sample QC-2055992-002	Primary PAH concentrations for the repeated analysis were below the LOR therefore this outlier result does not impact data quality.
	ALS (EB1828853): None	
Laboratory Duplicates	ALS (EB1823470): Several RPD values greater than the laboratory acceptable range (0-20%) and the NAGD's RPD acceptable range of $\pm 30-35$ per cent for duplicate samples reported by ALS. These exceedances included: <ul style="list-style-type: none"> PAH compounds for TB_05(T3) and B1_02(T1) >C10-C40 Fraction (sum) for B1_02(T1) As for SB_02(T1) Zn for B1_02(T1) 	As indicated in Section 5.1.1, PAH variations were detected. This is confirmed by ALS RPD exceedances. This suggests PAH concentrations are not homogeneous throughout sediments. However as there are no LCS, MB or MS exceedances for PAH compounds the laboratory duplicate exceedances do not impact data quality. Primary concentrations for >C10-C40, As and Zn were below the NAGD Screening Levels for all samples. This combined with LCS and MB results being within acceptable limits for metals indicates that these RPD exceedance do not impact data quality.
	ALS (EB1828594) and ALS (EB1828853): None	
Matrix Spikes (MS)	ALS (EB1823470): MS were within NAGD guidelines except for those analytes listed below: <ul style="list-style-type: none"> TPH, BTEX, and MBT outliers reported for B1_07 and B1_02(T3) 	MS recoveries less than the lower data quality objectives indicated there may be matrix interferences that may be attributed to sample heterogeneity. However, as MB and LCS were

QA/QC Method	Laboratory Outliers	Comments
	<ul style="list-style-type: none"> MBT for SB_02(T2), B1_07, B1_02(T3) 	within acceptable limits for TPH and BTEX and primary sample concentrations for MBT are less than the laboratory LOR these outliers are not considered to impact data quality.
	ALS (EB1828594) and ALS (EB1828853): None	
	<p>SGS (SE184684)</p> <p>MS outliers (below the acceptance criteria) were recorded for</p> <ul style="list-style-type: none"> Ni, Zn in SGS QC sample LB158396 Toluene, ethylbenzene, xylenes, TRH C6-9 in SGS QC sample LB158393 	As MB, LCS samples were within the acceptable range these MS outliers do not impact data quality.
Surrogate Spikes	<p>ALS (EB1823470):</p> <p>Surrogates outliers for TBT occurred for SG_03, SB_58 and REF_02. The outliers were greater than the laboratory criteria (35-130%).</p>	Surrogate recoveries greater than the acceptance criteria suggest concentrations of TBT are estimations with a high bias. However, as primary concentrations were below the laboratory LOR or below the NAGD Screening Level in all primary samples these outliers do not impact data quality.
	ALS (EB1828594) and ALS (EB1828853): None	
	<p>SGS (SE184684)</p> <p>BTEX surrogate outliers (below the acceptance criteria) were recorded for SGS QC sample LB158396</p>	Surrogate recoveries less than the acceptance criteria indicate a low bias, however as the primary sample concentrations (i.e. <LOR) were replicated by ALS and MB, LCS samples are within acceptable ranges this outlier does not impact data quality.
Holding times	<p>ALS (EB1823470):</p> <p>Exceedances occurred for moisture content, TRH, TPH, BTEXN, TOC, organotins, and PAHs for B1_02(T2), B1_02(T3).</p>	The samples with holding time exceedances are triplicate T2 and T3 samples and have been compared with sample B1_02(T1) (Section 5.1.1). These results indicate variability in sample concentrations, however, as the associated primary sample concentrations are either below the respective NAGD screening criteria or below the laboratory LOR, they are not considered to impact data quality or the outcome of this assessment.

QA/QC Method	Laboratory Outliers	Comments
Frequency of quality control samples	ALS (EB1828594): Exceedances occurred for PAH	As the laboratory refrigerate samples during storage it is unlikely that PAH concentrations were impacted due to extended holding times. Due to the refrigerated storage and as the result was replicated three times, this exceedance is considered not to impact data quality.
	ALS (EB1828853): None	
	ALS (EB1823470), ALS (EB1828594) and ALS (EB1828853): None	

5.3 Outliers

Outliers are identified when individual sample concentrations exceed two standard deviations (NAGD, 2009). Where they were detected above the Screening Levels, the stored portion of the sample was reanalysed (labelled R1, R2 and R3) in triplicate, and if the original result was not confirmed, it was discarded (TBT only) in favour of the mean of the triplicates. Where the parameter was something other than TBT (i.e. PAH), the original result was retained and included in the mean of the triplicate analysis. In some cases, concentrations exceeding the Screening Levels were also reanalysed in triplicate.

Outliers and concentrations identified above the Screening Levels and the associated initial concentration and concentrations of the reanalysis are provided in Table 5-4. The means calculated are used as the new PAH concentrations for sample TB_02 in Table 4-4.

Table 5-4: TB02 PAH outliers

Parameter	Initial Conc.	Mean	Initial SD	2 x SD	Initial concentration outlier?	R1	R2	R3	Mean
Naphthalene	15	14.5	2.9	5.8	Yes	0.5	0.5	0.5	7.7
2-Methylnaphthalene	7	ID	ID	ID	ID	NT	NT	NT	7.0
Acenaphthylene	80	62.5	ID	ID	ID	0.5	0.5	0.5	24.0
Acenaphthene	53	28.5	ID	ID	ID	0.5	0.5	0.5	13.8
Fluorene	128	74.0	ID	ID	ID	0.5	0.5	0.5	33.9
Phenanthrene	2150	401.7	860.3	1720.6	Yes	0.5	0.5	0.5	790.8
Anthracene	380	157.0	197.1	394.2	No	0.5	0.5	0.5	183.8
Fluoranthene	6170	1122.2	2478.9	4957.9	Yes	0.5	0.5	0.5	2264.7
Pyrene	4140	765.7	1658.7	3317.4	Yes	0.5	0.5	0.5	1521.3
Benz(a)anthracene	1970	377.2	785.6	1571.3	Yes	0.5	0.5	0.5	726.1
Chrysene	1630	311.3	649.9	1299.8	Yes	0.5	0.5	0.5	600.6
Benzo(b+j)fluoranthene	950	202.0	373.9	747.8	Yes	0.5	0.5	0.5	353.9
Benzo(k)fluoranthene	467	193.0	241.2	482.3	Yes	0.5	0.5	0.5	225.4
Benzo(e)pyrene	421	94.3	165.0	330.1	Yes	NT	NT	NT	276.2
Benzo(a)pyrene	527	132.3	210.3	420.6	Yes	0.5	0.5	0.5	203.4
Perylene	168	52.2	64.1	128.1	Yes	NT	NT	NT	116.1
Benzo(g,h,i)perylene	147	50.8	63.2	126.4	Yes	0.5	0.5	0.5	62.8
Dibenz(a,h)anthracene	52	28.0	23.1	46.1	Yes	0.5	0.5	0.5	25.5
Indeno(1.2.3.cd)pyrene	172	52.7	70.5	141.0	Yes	0.5	0.5	0.5	70.1
Coronene	13	16.0	9.8	19.7	No	NT	NT	NT	ID
Sum of PAHs	19600	3822.8	7791.3	15582.5	Yes	0.5	0.5	0.5	7231.6

Notes: ** Initial result retained; NT: Not Tested; ID: Indeterminable



6 Conclusion

The following conclusions are drawn from the sediment characterisation assessment described within this report:

- Concentrations and / or 95% UCL of the mean of all chemical contaminants are below the respective NAGD screening criteria
- The sediments in the DMPA are physically and chemically similar to the sediments in the reference area therefore support the continued placement of material at the DMPA.

As per the NAGD assessment framework, it is considered that the sediments to be dredged from the Port of Mackay Channel, Swing Basin, Berth Pockets 1, 3, 4 and 5 and Tug Berths are suitable for unconfined ocean placement in the DMPA.

In accordance with Section 4.2.1 of the NAGD, the typical validity period for Phase II and Phase III results is five years. This means that, depending on other activities at the port, the results from this assessment may be valid until 24 September 2023.

7 References

Advisian, 2018. Port of Mackay Maintenance Dredging Sampling and Analysis Plan, document number 301001-02095-EN-PLN-001. Advisian, Brisbane.

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USEPA (2016). ProUCL: Statistical Support Software for Site Investigation and Evaluation, developed by USEPA and available online at: https://www.epa.gov/sites/production/files/2015-03/documents/proucl_one_page_fact_sheet.final_.pdf.



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**Maintenance Dredging Sediment
Characterisation Report**
Port of Mackay



Appendix A Sampling and Analysis Plan



Maintenance Dredging Sampling and Analysis Plan

Port of Mackay

19/0918

Level 31, 12 Creek St
Brisbane QLD 4000
Australia

301001-02095-00-EN-PLN-0001

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Project No: 301001-02095-00-EN-PLN-0001 – Maintenance Dredging Sampling and Analysis Plan



Rev	Description	Author	Review	Advisian Approval	Date
0	Original	 N Bainton	 A Kochnieff	 B Boylson	19/09/18

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1 Introduction

Advisian has been commissioned by North Queensland Bulk Ports (NQBPs) to undertake a sediment sampling and characterisation assessment within the Port of Mackay (the Port) to inform and support future maintenance dredging at Mackay. A sediment characterisation assessment is required to support near-term placement of maintenance dredge material at sea under NQBPs's existing sea dumping permit in accordance with a ten-year Sea Dumping Approval (2012-2022) and an associated and approved Long Term Dredge Management Plan (LTDMP) prepared by WorleyParsons in 2010.

This document represents the Sampling and Analysis Plan (SAP) which describes the dredging proposal and outlines the proposed design and scope of the sediment characterisation assessment for the existing navigational areas within the Port. This SAP has been prepared in support of the sediment characterisation field program proposed to be conducted during September 2018. The SAP has been developed in accordance with the requirements outlined within the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009) and aligned with the most recent survey completed in 2013 (Golder Associates, 2013) and LTDMP (WorleyParsons, 2010). The SAP describes the sampling and analysis methods used to characterise the sediments, to ensure adequate data is collected pertaining to the physical and chemical properties of the proposed dredge sediments, prior to the next dredging as currently proposed for 2019. Adherence to the SAP will ensure that the data collected is valid and can be used to determine the suitability for placement of dredge material at the approved Dredge Material Placement Area (DMPA) (i.e. spoil ground) location.

The areas that this SAP applies to include the channel, swing basin, berth pockets 1, 3, 4 and 5, tug berths, DMPA and reference sites.

1.1 Objectives

This SAP is developed based on the requirements as set out in the NAGD (Commonwealth of Australia, 2009) with the objective to support Phase II, and if required Phase III, investigations in accordance with the NAGD, the ten-year Sea Dumping Approval (2012-2022) and the associated and approved LTDMP. The specific objectives of the SAP are to:

- Understand the quality and contamination status of sediments to be dredged from the Port
- Ensure sampling is undertaken consistent with industry best practice and the NAGD, 2009
- Achieve high quality laboratory analysis results incorporating appropriate Quality Assurance (QA) / Quality Control (QC) through use of recognised and NATA accredited analytical laboratories with expertise in marine sediment quality assessment applicable to dredge material management
- Ensure data from sampling is accurately reported, summarised, analysed and stored safely to provide confidence in the efficacy of the sediment sampling, handling, testing, analysis and reporting sufficient to determine the suitability of the dredge material for placement in accordance with the Sea Dumping Approval and LTDMP.



1.2 Scope

- Provide a description of the proposed dredging and placement footprint
- Understand the quality and contamination status of sediments to be dredged by describing existing and historical land uses which may influence the contamination potential of the sediment to be dredged
- Identify contaminants required for analysis based on potential contaminant sources and results of recent testing
- Determine the location and number of samples required to provide an adequate dataset for calculating the upper 95 percentile confidence limit (95% UCL) of the mean to compare to screening levels of contaminants
- Define the types of analysis required for sediments
- Identify and describe industry best practice field sampling protocols (i.e. collection and handling) to ensure sampling is undertaken to gain a representative understanding of the material
- Identify and describe appropriate QA/QC procedures for sample collection, handling and laboratory analysis in accordance with NAGD, 2009 to ensure high quality laboratory analysis results are achieved.
- Outline data assessment process and define the statistical techniques used to determine the status of potential contamination within the sediment to be dredged
- Present the reporting framework for the presentation of data, results and conclusions to address the needs of NQBP and the appropriate regulatory agency.

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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

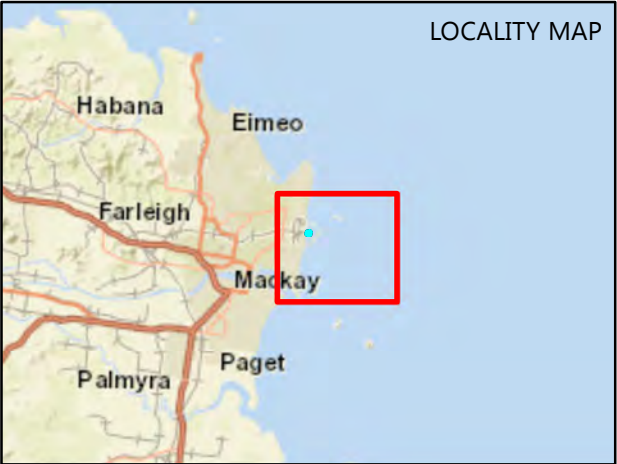
Source Information:
Port facility layout and dredge area
Provided by NQBP - Sept 2018
Imagery - Web Service
Dept of Natural Resources and Energy

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



2 Background

The Port 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 fuels, refined and bulk sugar, bulk molasses, liquid chemicals, bulk fertilisers, bulk grain, general cargo and iron concentrates.

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 LTDMP (WorleyParsons, 2010), there are four major dredge program for the 10 year 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 first major program was conducted in 2011 with the next major programs being completed in 2014 and 2017. The next major program is scheduled to be conducted in 2019. The dredge material is placed at the approved DMPA approximately 3km north-east of the Port entrance per the conditions set out in the 10 Year Sea Dumping Permit.

NQBP has existing approvals in place for maintenance dredging within the Port, including a ten-year Sea Dumping Approval (2012-2022) and an associated and approved LTDMP. The approval requires that a sediment characterisation assessment, consistent with previous assessments, be completed every five years to ensure sediments remain suitable for on-going ocean disposal at the approved DMPA.



3 Proposed Maintenance Dredging

The NAGD requires proponents to define the location and estimated volume of dredging and dredge sediment relocation, along with the proposed methods to be utilised. Proponents are also required to provide an indication of the timing/schedule of activities. The following sections address these requirements.

3.1 Previous maintenance dredging

Investigation completed by WBM in 2004 identified that regular undocumented dredging and subsequent disposal has occurred at the Port since the early 1960's. From 1994 dredge activities were undertaken daily, averaging 40,000 m³ per annum using the Grab Bucket Dredge "James Pearce". The Trailing Suction Hopper Dredge (TSHD) 'Brisbane' commenced maintenance dredging services at the Port in 2004. In 2004, 2007 and 2013 the TSHD 'Brisbane' dredged amounts of 118,000 m³, 106,000 m³ and 108,600 m³ (Golder Associates, 2013) respectively.

3.2 Dredge volumes and footprint

To ensure continued safe and efficient port operations, maintenance dredging, to be undertaken in 2020, is proposed for the Channel, Swing basin, Berth pockets 1, 3, 4 and 5, and the Tug berth. Based upon historical dredge requirements, it is estimated that a total of 580,000 m³ over a 10 year period (commencing 2010) would be a sufficient volume to achieve appropriate maintenance dredging within the Port. It was also determined that this would be undertaken as four 120,000m³ programs using the TSHD 'Brisbane' and the minor programs (approximately 10,000m³) would be undertaken by the 'James Pearce' dredge.

The estimated volume of sediment in each of the berths has been drawn from the LTDMP (Table 3-1). The estimated maximum dredge volume of sediment to be removed at each major dredging event is estimated as **120,000m³** (WorleyParsons, 2010).

The maintenance dredging footprint applicable to this SAP includes those areas shown in Figure 1-1. The proposed management areas for the SAP, along with the design depth and estimated volume of sediment to be dredged from each area are set out in Table 3-1.

Table 3-1 Dredge areas and volume of sediment to be dredged (Golder Associates, 2013)

Dredge Area	Design Depth (mLAT)	Dredge Area (m ²)	Estimated Maximum Dredge Volume (m ³)
Channel	-8.7m	43,500	80,000
Swing basin	-8.5m	352,500	
Berth 1	-10.8m	5,000	27,000
Berth 3	-13.0m	10,000	
Berth 4	-10.6m	2,000	
Berth 5	-12.5m	10,000	
Tug berths (TB)	-6.0m	14,920	1600
Total Volume			108,600

3.3 Type of sediments to be dredged

The Golder Associates (2013) study concluded that sediments, on average, were comprised of 34% clays, 27% silt, 37% sand and 1.4% gravel. The fine portion (silt and clay) is less than what was previously described in the LTDMP which noted that sediments were comprised of approximately 80-97% silt/clays (<75µm) with the remainder being predominately fine sands and minor gravel.

3.4 Dredging methods

It is proposed to utilise the 'Brisbane' or a similar TSHD as the primary dredging and dredge sediment relocation equipment for the Port maintenance dredging. The 'James Pearce' dredge supports via periodic dredging of the berth pockets and swing basin.

3.4.1 Trailing suction hopper dredge (TSHD)

Depending on the ongoing viability and availability of the 'Brisbane' other TSHDs may be used for dredging from time to time; however, for the purposes of this SAP, the specifications and operational characteristics of the 'Brisbane' will form the baseline for dredge specification and operational environmental management.

Sediment to be dredged is removed through two suction heads, which are lowered into position on either side of the vessel. As the vessel moves slowly at around 1 – 3 knots, large pumps draw water through the heads, which entrain the sediment and transport the water/sediment mixture aboard into a central collection hopper. Each extraction run takes approximately one hour to complete within about a one hour and 40 minute dredge cycle (depending upon the DMPA location).



The sediment/water ratio of sediment delivered to the central hopper of the 'Brisbane' is typically quite low. Whilst it varies depending on the type of sediment being dredged, the sediment concentration is generally in the order of 10 – 30 % solids. To maximise dredge sediment capacity, these large volumes of water are managed using a central column weir, which is incorporated into the hopper. This arrangement allows excess water to decant from the sediment and overflow to discharge. Overflow occurs only toward the very end of the dredging run as the hopper nears capacity (typically the last ten minutes of a one hour dredging run). The capacity of the hopper is dependent on the sediment type – with volumes (including both sediment and water) approximating 2,800 m³ for fine silts and 1,700 m³ for sands (of a maximum hopper capacity of 2,900m³). Considering that more water is held in the silt matrix than sands, the dry weight cubic metres of sand able to be practically collected in each load is therefore generally greater than that in silts.

Once the dredge has filled its hopper, the vessel will then relocate the sediment to the designated DMPA. Dredged sediment is discharged below keel level to minimise turbidity generation. Each dredged sediment placement is manually logged using both satellite navigation and standard bridge equipment, and is electronically fixed using a differentially corrected global positioning system (GPS). The electronic track plot marks the start of the placement process (hopper open), and the end of the process (hopper closed). This track usually shows an arc, which the dredge follows to ensure that all dredged sediment is placed within the designated DMPA boundary. The time taken to place sediment over the DMPA is typically about 15 minutes out of the approximately 1-hour 40 minute dredge cycle.

During the dredging works, electronic logs of each dredge sediment relocation event will be maintained. At the completion of each dredge program, these logs will be available to the relevant government agencies to demonstrate compliance with permit conditions.

The TSHD undertaking dredging works at the Port will include the following minimum specifications to minimise environmental impact from dredging and dredge sediment relocation:

- Central weir discharge system
- Below keel discharge point
- Low wash hull design
- Electronic positioning system.

An Environmental Management Plan (EMP) will be developed by the dredging contractor, and implemented for maintenance dredging programs. The dredge disposal procedures, any associated monitoring arrangements and corrective actions are incorporated into the EMP. Implementation of the EMP is audited by NQBP environmental staff.

3.5 Dredged sediment relocation

3.5.1 Dredge Material Placement Ground (DMPA)

The dredged sediment from the maintenance dredging is expected to be placed at the existing DMPA located approximately 3km north-east of the Port entrance, in water depths of -11m to -14m LAT.

The continued use of the DMPA mitigates impacts from smothering through preventing the need to place dredged sediment in an area that has not been disturbed previously. The seabed of the DMPA is relatively flat and featureless and consists of silty sands. The geomorphic features of the DMPA have been altered through its historical use. The DMPA is not an area of high productivity leading to significant ecological or biological processes.

The coral communities of Round Top Island are the closest natural habitat to the DMPA that provides some biological diversity. These communities may potentially be impacted by dredge plumes; however, previous studies have shown these impacts to be minimal and of short duration (WorleyParsons 2013a). Seagrass and macroalgal communities within the ground have been identified as highly dynamic and influenced by seasonal changes (WorleyParsons 2013b)

3.5.2 Uniform dredge sediment deposition

Impacts to the DMPA and adjacent areas will be minimised through relocation of the dredge sediment in such a manner as to uniformly spread it over the area. This is achieved through deposition patterns that vary with the prevailing current direction. When currents are minimal, deposition will occur relatively uniformly over the DMPA area in arc patterns (refer Figure 3-1 left). When currents are present, deposition will occur in arcs in the up-current portion of the DMPA to consider drift of sediment as it settles (refer Figure 3-1 right).

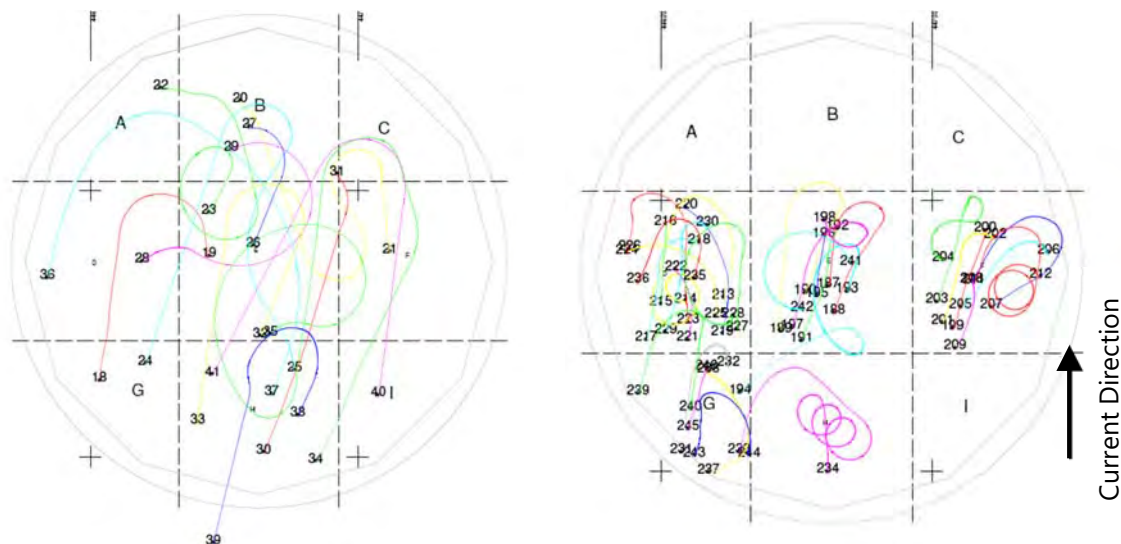


Figure 3-1 Example of dump plot showing deposition during periods of low current (left) and high current (right)

3.6 Timing

Maintenance dredging of the existing material is proposed to occur during 2019 and is dependent on ongoing bathymetric survey.

4 Existing Information

4.1 Site history and land use

The Port is located approximately 6km north-east of the city of Mackay within the Pioneer River Catchment. The Pioneer River Catchment is approximately 1,500km² and is comprised of approximately 50% forested areas. The remaining 40% is made up of agricultural land which includes sugar cane and vegetable production as well as cattle grazing for beef production.

The Port is an artificial harbour that is enclosed by northern and southern breakwaters. This provides for four berths and handling facilities. As described previously, the Port commenced operations during 1939. Prior to European settlement, the general area of the Port consisted of a complex mosaic of coastal dune vegetation, freshwater wetlands, estuarine plant communities and rainforest areas.

The localised catchment area of the Port is primarily comprised of industrial land uses. The majority of the catchment drains to the south, away from the Port and into the Pioneer River.

4.2 Previous sediment investigations

The most recent studies which characterise the sediments found in the Channel, Swing Basin Area, Berth Pockets and Tug Berth Areas within the Port and relevant to this SAP include:

- Worleyparsons, 2007. Mackay Port Authority: Port of Mackay Harbour – Sediment Quality Assessment
- WorleyParsons, 2010. NQBP Mackay Harbour and Spoil Ground 2009 Sediment Characterisation Report, document number 301001-00797-00-EN-REP-0001
- Golder Associates (2013). 2013 Maintenance Dredging – Sediment Characterisation Report. Report prepared for North Queensland Bulk Ports.

The main findings from each study are summarised in Table 4-1. Note that the surrounding marine habitats and associated environmental values and objectives for the port, dredge areas and the spoil dispersal sites have been summarised in the LTDMP. There are no significant alterations that would result in a change to these areas since the submission of the LTDMP and the identified controls in the LTDMP would continue to apply as identified.

4.2.1 Physical Characteristics

Golder Associates, 2013 indicate sediments in the Channel and Swing Basin areas were predominantly comprised of 38% sand, 32% clay, 29% silt and 1.4% gravel. Sediments in the Tug Berth were comprised 64% sand 23% clay, 12% silt and 1.1% gravel. Sediments in the berth pockets were comprised of 10% sand, 48% clay, 41% silt and 1.6% gravel. On average sediments within the Port were comprised of 34% clays, 27% silt, 37% sand and 1.4% gravel (Section 3.3).

4.2.2 Chemical Characteristics

Table 4-1 provides a summary of sediment characterisation studies completed at the Port.

Table 4-1 Historical sediment investigations of the Port of Mackay

Previous Studies	Findings	Suitability for Placement at Sea
WorleyParsons (2007)	<p>In 2007 sediment samples from 19 locations within the Channel and Swing Basin Dredge Area were analysed for metals, polycyclic aromatic hydrocarbons (PAHs) and organotins including tributyltin (TBT), dibutyltin (DBT) and Monobutyltin (MBT). This survey was completed under an existing SAP and in accordance with the National Ocean Disposal Guidelines for Dredged Material (Commonwealth of Australia, 2002; NODGDM). These guidelines have been superseded by the NAGD, 2009. For the purposes of comparing results, the summary of results from the 2007 sediment survey has been completed against the NAGD guidelines. The results for chemical testing for sediments within this dredge area are summarised as follows:</p> <ul style="list-style-type: none"> ▪ Metal concentrations were all below NAGD screening and maximum guideline levels within the dredge area ▪ One location (i.e. H3) adjacent to the slipway (outside the dredge area) exceeded NAGD screening levels for arsenic, lead, copper and zinc ▪ All detections of PAH compounds were below respective screening levels, except H3 where nine PAH compounds exceeded screening levels ▪ Except for locations H3 and H19, all sites reported organotin species at concentrations below laboratory levels of reporting. Location H3 reported TBT concentration well above the NAGD Sediment Quality Guidelines. <p>Based on the dataset for the dredging area only, i.e. excluding location H3, the 95% UCL of the mean for all contaminants (metals, PAHs and organotins) were below respective NAGD screening levels. The results from materials to be dredged concluded that sediments were suitable for unconfined ocean disposal.</p>	Yes
WorleyParsons (2010)	<p>In 2009 two sediment sampling programs were completed and covered two separate dredge areas, the Channel and Swing Basin Dredge Area and the Berth Pockets Dredge Area. 19 locations were sampled from the Channel and Swing Basin Dredge Area, in accordance with the SAP (WBM, 2004b) and previous sampling undertaken in 2007 (WorleyParsons, 2007). An additional 12 locations were sampled within the Berth Pockets for further information to assist in the application for a long-term Commonwealth Sea Dumping Permit (previously approved SAP did not sample within the berth pockets). The results for chemical testing within the two dredge areas are summarised as follows:</p> <p>Channel and Swing Basin:</p> <ul style="list-style-type: none"> ▪ All metal concentrations within the dredge area were below respective NAGD screening levels ▪ Location H3, which is outside the dredge area, exceeded the NAGD screening level for copper ▪ Total PAHs were below the NAGD screening levels across all locations ▪ Polychlorinated biphenols (PCBs), organochlorine pesticides (OCPs), organophosphorus pesticides (OPPs) and total petroleum hydrocarbons (TPHs) were below detection at all locations ▪ OCPs (i.e. DDD, DDE and DDT) were above NAGD screening levels at location H3, which is outside the dredge area. These compounds, and all other OCPs, were not detected at any location within the dredge area ▪ TBT was present below the NAGD screening level at all but one location. TBT was detected above the NAGD screening level at location H3, which is outside the dredge area ▪ Based on the dataset for the dredging area only (i.e. excluding location H3), the 95% UCL of the mean for all contaminants (metals, PAHs, PCBs, OPPs, OCPs, TPHs and organotins) were below respective NAGD screening levels. <p>Berth Pockets:</p> <ul style="list-style-type: none"> ▪ All metal concentrations were below respective NAGD screening levels ▪ TPHs, OCPs, OPPs and PCBs were below detection limits at all sites ▪ One location exceeded the NAGD screening levels for Total PAHs; ▪ TBT was detected at all berth sampling sites. Results of the screening level analysis (NAGD Phase 2) identified that TBT exceeded the screening level at the 95% UCL of the mean. As such, under the NAGD framework for contaminant assessment, further analysis was required for elutriate and bioavailability testing (NAGD Phase 3). Further sampling and analysis was completed for the three sites that exceeded the screening level for TBT normalised to 1%TOC (B4, B6 and B7). Fresh sediment material was collected using Van veen grab on 9 December 2009 and analysed for TOC, organotins, elutriate tributyltin and pore water TBT. Elutriate and pore water TBT analyses were completed to assess the potential release of TBT to the water column during dredging activities and potential TBT bioavailability to benthic organisms post spoil disposal. The results of this additional analysis indicated that TBT is below the ANZECC/ARMCANZ (2000) guidelines and there is low risk of TBT being bioavailable to benthic organisms following disposal. <p>In conclusion, sediments from the berth pocket dredge area were suitable for unconfined ocean placement at the approved DMPA.</p>	Yes

Previous Studies	Findings	Suitability for Placement at Sea
Golder Associates (2013)	<p>A total of 28 sites were sampled from the Channel, Swing Basin and Berth Pockets. The samples underwent analyses for total organic carbon (TOC), particle size distribution (PSD), heavy metals, organotins, PAHs, OCPs and radionuclides.</p> <ul style="list-style-type: none">▪ The 95% UCL concentrations of all contaminants in samples from the Channel and Swing Basin area and the Berth Pockets area are below the NAGD screening levels.▪ The 95% UCL concentrations of all contaminants in samples from the Tug Berth were less than the NAGD screening levels except for TBT which had a normalised TBT 95% UCL mean concentration of 17.8 µg Sn/kg. This is above the ISQG-Low value but less than the maximum acceptable screening limit of 80 µg Sn/kg used as the cut off point for unconfined ocean disposal.▪ Bioavailability testing (elutriate and porewater analyses) for TBT conducted as part of the 2009 Sediment characterisation Investigation (WorleyParsons, 2010) further supported the acceptance of material from the Tug Berth for unconfined ocean disposal.	Yes

4.3 Contamination status

The sources and history of contamination remains unchanged based upon a review of aerial imagery from 2007 onwards. Industrial land uses are the primary source of contamination for the Mackay Harbour.

Based upon the historical activities the following may be potential sources of contamination to maintenance material sediments:

- Sulphuric Acid Terminal
- Ethanol and Petroleum products tank farm
- Fuel loading wharf
- Gas Terminal
- Scrap metal storage
- Bulk sugar Terminal
- Molasses Terminal
- Tallow Terminal
- Grain Terminal
- Slipway.

4.3.1 Contaminants of concern

The following section identifies contaminants of concern for the Port and associated exemptions for other parameters based on historical data. The NAGD defines contaminants of potential concern (COPCs) and contaminants of concern (COCs) as follows:

- *COPCs are those contaminants that exceed the background concentrations and the Screening Level (or elevated concentrations of contaminants for which guidelines do not exist).*
- *COCs are those contaminants which exceed the background concentrations and the Screening Level and for which the bioavailability, bioaccumulation or toxicity assessments indicate that significant effects from the contaminants are likely.*

COPCs and their likely sources that have been identified as occurring in the Port region through site history, nearby land use and previous sediment characterisation data (Section 4.2) and are outlined in Table 4-2. However, based on the findings of sediment studies to date, none of the contaminants identified from the Port are defined as COCs.

Table 4-2 Contaminants of potential concern

Contaminants	Known or likely sources	Area of Concern
Heavy metals: Arsenic (As), Cadmium (Cd), Copper (Cu), chromium (Cr), Silver (Ag), Lead (Pb), Nickel (Ni) and Zinc (Zn)	<ul style="list-style-type: none"> Antifouling Paints from vessels and port structures Sand blasting Bauxite fines Metal fabrication Urban runoff/stormwater (minimal input) 	<ul style="list-style-type: none"> Channel Swing Basin Berth Pockets Tug Berths
Organotins (TBT, DBT, MBT)	<ul style="list-style-type: none"> Antifouling Paints from vessels 	<ul style="list-style-type: none"> Channel Swing Basin Berth Pockets Tug Berths
PAHs	<ul style="list-style-type: none"> Bunker Fuels Lubricants Partially combusted hydrocarbons 	<ul style="list-style-type: none"> Berth Pockets Tug Berths
Total Petroleum Hydrocarbons (TPH)	<ul style="list-style-type: none"> Fuel transfer 	<ul style="list-style-type: none"> Berth Pockets Tug Berths
Organochloride pesticides (OCP)	<ul style="list-style-type: none"> Agricultural activities Industrial activities 	<ul style="list-style-type: none"> Tug Berths
Radionuclides (Gross Alpha/Beta)	<ul style="list-style-type: none"> Sandblasting 	<ul style="list-style-type: none"> Tug Berths

Of the contaminants identified, organotins (TBT, DBT and MBT) are considered to have the greatest potential (despite its use being banned for the last decade) to be present in sediments in the Port and will be sampled from each dredge area and sampling locations. Metals will be adopted as an indicator analyte in this SAP and analysed from the same number of locations as organotins.

PAH and TPH analysis is only proposed for the tug berths and berth pockets, while radionuclides and OCP will be analysed for locations in the Tug berths.

Physical sediment characteristics including particle size distribution (PSD), settling velocity and bulk density will be analysed from all dredge location, but only a portion of locations (i.e. 50%) will be analysed. Note that TOC and moisture content will be analysed for all locations and samples.

The following list of contaminants together with the NAGD Screening level and sampling regime are summarised in Table 4-3.

Table 4-3 Proposed contaminants for laboratory analysis

Contaminants	NAGD Screening	Sampling regime
As	20 mg/kg	All dredge areas
Cd	1.5 mg/kg	All dredge areas
Cr	80 mg/kg	All dredge areas
Cu	65 mg/kg	All dredge areas
Pb	50 mg/kg	All dredge areas
Ni	21 mg/kg	All dredge areas
Zn	200 mg/kg	All dredge areas
Hg	0.15 mg/kg	All dredge areas
Organotins	9 µgSn/kg	All dredge areas
TPH	550 mg/kg	Berth Pockets & Tug berth only
Sum of PAH	10,000 µg/kg	Berth Pockets & Tug berth only
Radionuclides (Sum of gross alpha and gross beta)	35000 Bq/kg (dry wgt)	Tug berth only
OCP	2 µg/kg	Tug berth only
TOC	NA	All dredge areas
Moisture content	NA	All dredge areas
PSD Settling velocity	N/A	All dredge areas (50% of locations)

4.3.2 Exemption from testing

The NAGD 2009 states that exemptions from some or all sediment testing requirements are possible under certain circumstances, subject to approval by the determining authority. The following exemptions from testing for this SAP (in alignment with those previously requested and agreed) are requested because prior sediment characterisations, existing port operations and the absence of sources from the local catchments indicate that the current sediments are highly unlikely to be contaminated with these analytes. These exemptions have been approved previously by GBRMPA for all navigational areas of the Port.

Based upon historical non-detects and no known contaminant sources, the following contaminants are excluded in this SAP (in alignment with the 2010 SAP (WorleyParsons, 2010b) and the 2013 SAP (Golder Associates, 2013):

- **Silver:** Results of sampling from the channel, swing basin, approach and berth pockets have confirmed an absence of Silver at concentrations which may define these sediments as contaminated.
- **Polychlorinated biphenyls (PCBs):** No significant catchment based sources of PCBs exist within the vicinity of the Port. Results of sampling from the channel, swing basin, approach and berth pockets have confirmed an absence of PCBs at concentrations which may define these sediments as contaminated. Exemption of PCBs analysis is requested for all areas described in this SAP.
- **Organophosphorus pesticides (OPs):** The presence of OC/OPs is predominately associated with industrial or agricultural activities involving use or manufacture of herbicides and pesticides. Results of sampling from the channel, swing basin, approach and berth pockets have confirmed an absence of OPs at concentrations which may define these sediments as contaminated.

5 Sampling and Analysis of Sediments

5.1 Rationale

The sampling and analysis of sediments proposed complies with the requirements for maintenance dredging projects as outlined within Appendix D of the NAGD. The program is designed to conduct Phase II and Phase III sampling and analysis for the determination of dredge material characterisation for the purposes of unconfined ocean disposal (Figure 5-1).

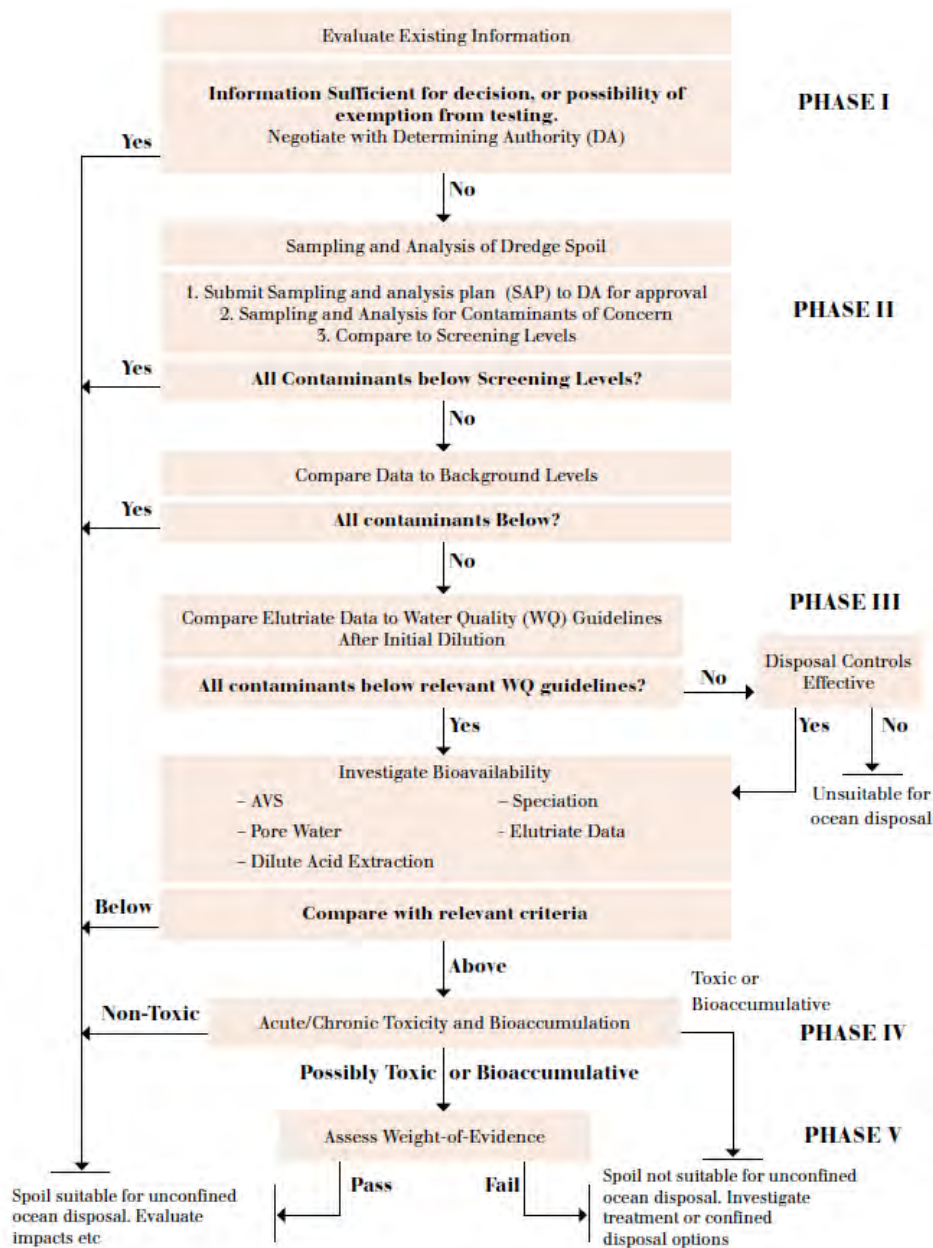


Figure 5-1 Process for the assessment of potential contaminants (NADG, Commonwealth of Australia 2009)

5.2 Sampling Locations and Horizons

The number of sampling locations is based on the anticipated dredge volumes for each dredge area in accordance with Appendix A of the NAGD, 2009. These are provided in Table 5-1. This is generally consistent with in the most recent previous sediment characterisation assessment completed by Golder Associates in 2013. This includes sampling at each maintenance dredge area within the Port: Channel and Swing Basin, Berth Pockets 1, 3, 4 & 5 and Tug Berths. Sampling will also be undertaken at reference sites (REF) and within the DMPA. The fixed sample location H3 located adjacent to the slipway will be included for consistency with previous sediment characterisation programs.

5.2.1 Channel and swing basin

The volume of maintenance dredge material estimated from the Channel and the Swing basin is 88,000m³ (Table 5-1). This equates to 16 sampling locations in accordance with the NAGD, 2009 guidelines; however, it is proposed to reduce the sampling locations by half to eight (Figure 5-2). This reduction of locations is justified as the NAGD stipulate *"where good quality data for the site are already available to support the classification, the number of sample locations in the 'probably contaminated' and 'probably clean' categories may be halved"*. Given the footprint of the Channel and Swing basin has been well studied from previous maintenance and capital dredging programs, and results have indicated no contamination, therefore the area is considered to be 'probably clean'. Although the most recent dataset is from January 2013 therefore slightly outside of the five year currency, the rationale for this reduction is supported as the contaminant input from the catchment (refer to Section 4) have not changed since the data was collected.

Note that fixed sample location H3 is located adjacent to the slipway and is outside of the maintenance dredge areas. Although it will be sampled and analysed, it will not form part of the sediment data analysis. Location H3 is identified in Figure 5-2.

5.2.2 Berth pockets

The volume of maintenance dredge material estimated from the Berth Pockets area is 27,000m³ (Table 5-1). This equates to nine sampling locations in accordance with the NAGD; however, it is proposed to reduce the sampling locations to six (Figure 5-3). This reduction of locations is based on sediments being classified as 'probably clean' as the results of previous sediment characterisations have indicated berth pocket sediments are not contaminated.

5.2.3 Tug berths

The volume of maintenance dredge material estimated from the Tug Berths is 1,600m³ (Table 5-1). This equates to six sampling locations in accordance with the NAGD for the dredge volume interval of 0 – 10,000m³ (Figure 5-4).

5.2.4 Reference sites

Samples will be obtained from three reference sampling locations. The seafloor sediment characteristics at the reference sites will provide background levels of contaminants in which to compare the results of the sediment characteristics in the Port navigational areas. Reference sites

are selected approximately 5.8km to the southeast of the Port which is approximately 4.5km to the south of the existing DMPA (Figure 5-5). The reference sites are chosen based on the results of the predictive modelling undertaken to examine the fate of sediment dumped at the DMPA to ensure these sites remain outside the dispersion patterns reported for the DMPA. The reference sites are located in an area of similar depth to the DMPA.

5.2.5 DMPA

Three sampling sites will be located within the DMPA, spread evenly across the rectangular DMPA. The data from these sites are used to examine the sediment characteristics of the area to characterise any existing contamination, prior to any future placement of sediment into this area (Figure 5-5).

A summary of the number of locations according to the NAGD, 2009, the total number of grid squares required (i.e. five times the number of locations required) used to randomly select sample location and the proposed number of sampling location within each dredge area are provided in Table 5-1. The number of samples, including QA/QC sampling is provided in Table 5-2. The sampling coordinates are provided in Appendix A.

Table 5-1 Description of the areas to be dredged and sampling requirements as per NAGD (2009)

Dredge Area	Estimated Maximum Dredge Volume ²	Sampling locations required as per NADG (2009)	Number of grid squares	Sampling locations with currency from previous work	Revised number of sampling locations required
Channel and Swing Basin	80,000	16	80	No	8
Berth Pockets	27,000	9	45	No	6
Tug berths	10,000	6	30	No	6
DMPA	-	-	-	-	3
Reference	-	-	-	-	3
Slipway ³	-	-	-	-	1
Total	117,000				27

Notes:

¹ where indicated the number of sample sites has been reduced due to previous information and a classification of 'probably clean'. This methodology is acceptable under the NAGD.

² Dredge volumes and depths are based on reported figures Golder Associates, 2013

³ Sample location H3

Table 5-2: Sampling intensity and QA/QC

Dredge area	Number of locations	Primary sample numbers	10% field triplicate samples	5% field split triplicate samples	Total samples
Channel and Swing basin	8	8 ¹	1 site (2 samples)	1 site (2 samples)	12
Berth pockets	6	6 ¹	1 site (2 samples)	1 site (2 samples)	10
Tug berths	6	6	1 site (2 samples)	1 site (2 samples)	10
DMPA	3	3	1 site (2 samples)	-	5
Reference	3	3	-	-	3
Slipway	1	1	-	-	1
Totals	27	27	8	6	41

Notes:

¹ where indicated the number of sample sites has been reduced due to previous information and a classification of 'probably clean'. This methodology is acceptable under the NAGD.

5.2.6 Sediment horizons

Sampling and analysis of maintenance sediment at the Port will target the surface horizon only, i.e. 0-0.5m. Samples will be collected using a Van-veen grab sampler deployed from the vessel. Operated from the surface, the grab sampler enables the collection of surface sediments to approximately 0.1-0.5m below the seabed. As the dredged depth is likely to be 0.5m or less for most areas, grab sampling is considered appropriate and a safe and cost-effective option for this study. This approach has been approved for previous sediment characterisation assessments.

Port of Mackay
Sediment Investigation

Figure 5-2:
Channel and Swing Basin
Randomly Assigned Sampling
Locations



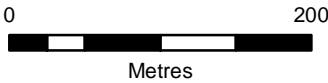
- LEGEND**
- Fixed sampling location
 - ▨ Sampling location
 - ▭ Sampling grid
 - ▭ Berths and operational areas
 - ▭ Swing basin
 - ▨ Swing basin and channel dredge area

Source Information:
Port facility layout
Provided by NQBP - Sept 2018
Imagery - Aug 2017
Provided by NQBP - Sept 2018

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Coordinate System: GDA 1994 MGA Zone 55
Scale at A3 - 1:5,000



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Port of Mackay
Sediment Investigation

Figure 5-3:
Berth Pockets Stratified
Randomly Assigned Sampling
Locations



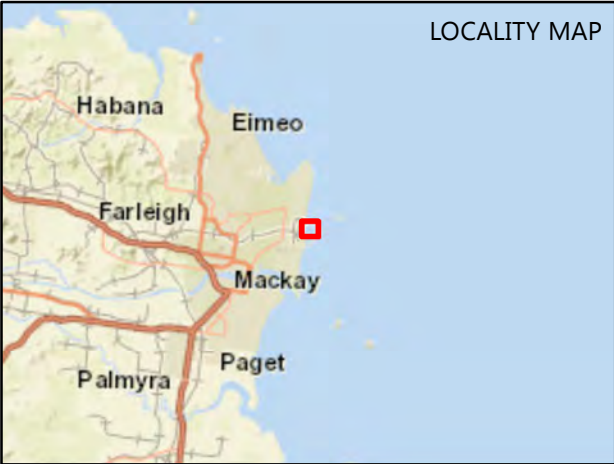
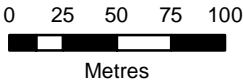
- LEGEND**
- Sampling location
 - Sampling grid
 - Berths and operational areas
 - Berth pocket dredge area

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

Figure 5-4:
Tug Berth
Randomly Assigned Sampling
Locations

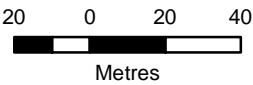
- LEGEND**
- Sampling location
 - Sampling grid
 - Berths and operational areas
 - Tug berth pocket dredge area

Source Information:
Port facility layout
 Provided by NQBP - Sept 2018
Imagery - Aug 2017
 Provided by NQBP - Sept 2018

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Port of Mackay Sediment Investigation

**Figure 5-5:
DMPA and Reference Sites
Randomly Assigned Sampling
Locations**

LEGEND

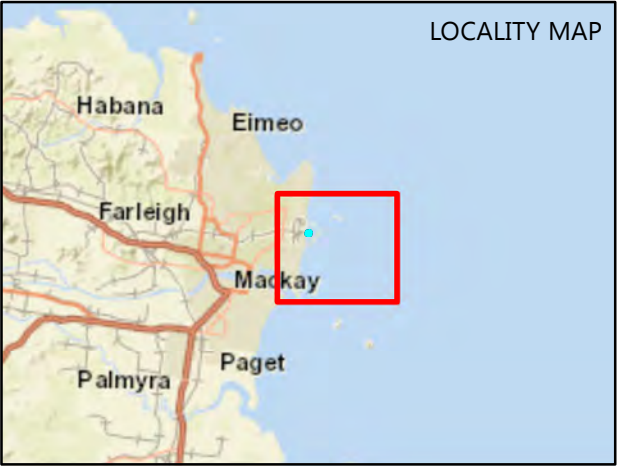
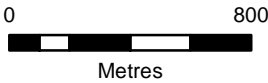
- Sampling location
- Existing Dredge Material Placement Area
- Great Barrier Reef Marine Park boundary

Source Information:
Port facility layout and dredge area
Provided by NQBP - Sept 2018
Imagery - Web Service
Dept of Natural Resources and Energy
Great Barrier Reef Marine Park Boundary
Great Barrier Reef Marine Park Authority

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5.3 Analytical Parameters

5.3.1 Phase II sediment analysis

Phase II sediment analysis will be consistent with the contaminants detailed in Section 4.3. This is outlined along with the Practical Quantitation Limits (PQLs) as detailed within the NAGD and laboratory limit of reporting (LOR) in Table 5-3. Detailed analytical summary and sampling numbers at each dredge area is provided in Table 5-4.

Table 5-3: Contaminant suites, NAGD PQLs and laboratory LORs

Contaminant suites	NAGD PQL	Laboratory LOR	Sampling location
Total metals and metalloids (As, Cd, Cr, Cu, Pb, Ni, Zn)	All 1 mg/kg Cd 0.1 mg/kg	All 1 mg/kg Cd 0.1 mg/kg	All dredge areas REF DMPA
Hg	0.01 mg/kg	0.01 mg/kg	
Organotins	1 µgSn/kg	0.5 µgSn/kg	All dredge areas REF DMPA
TPH	100 mg/kg	0.2-3 mg/kg	Berth Pockets Tug Berths REF DMPA
PAH (super ultra-trace 20 analytes)	100 µg/kg	4-5 µg/kg	Berth Pockets Tug Berths REF DMPA
Radionuclides (gross alpha and gross beta)	N/A	500 bq/kg	Tug berths
OCP (ultra-trace 21 analytes)	1 µg/kg	5 µg/kg	Tug berths
TOC	0.1%	0.1%	All dredge areas REF DMPA
Moisture content	0.1%	1%	All dredge areas REF DMPA
PSD	Size distribution (sieve and hydrometer)	1%	All dredge areas REF DMPA



Contaminant suites	NAGD PQL	Laboratory LOR	Sampling location
Settling velocity	Rates of settlement after 50% and 90% settlement	0.01 mm/min	All dredge areas REF DMPA

Table 5-4 Detailed analytical summary at each site and sample vessel requirements

Dredge Area	Site	Horizon	TOC and Moisture	Metals / Organotins	TPH/PAH	OCP	Radionuclides	PSD & settling rate	Triplicate	Split Duplicates	250ml Jars	Extra jars for potential Phase III	5 kg bag for potential porewater analysis	Zip lock Bags
Channel and Swing Basin	CSB-1	0.0-0.5	3	3				1	yes		6	1		4
	CSB-2	0.0-0.5	1	1				1			2	1		2
	CSB-3	0.0-0.5	1	1							2	1		
	CSB-4	0.0-0.5	1	1				1			2	1		2
	CSB-5	0.0-0.5	1	1							2	1		
	CSB-6	0.0-0.5	1	1				1			2	1		2
	CSB-7	0.0-0.5	1	1							2	1		
	CSB-8	0.0-0.5	3	3				3		yes	6	1		4
Berth Pockets (BP)	BP-1	0.0-0.5	3	3	3			1	yes		6	1		4
	BP-2	0.0-0.5	1	1	1						2	1		
	BP-3	0.0-0.5	1	1	1			1			2	1		2
	BP-4	0.0-0.5	1	1	1			1			2	1		2
	BP-5	0.0-0.5	1	1	1						2	1		2
	BP-6	0.0-0.5	3	3	3			3		Yes	6	1		4
Tug Berth (TB)	TB-1	0.0-0.5	1	1	1	1	1	1				2	1	2
	TB-2	0.0-0.5	3	3	3	3	3		yes		6	2	3	
	TB-3	0.0-0.5	1	1	1	1	1				2	2	1	
	TB-4	0.0-0.5	1	1	1	1	1	1			2	2	1	2
	TB-5	0.0-0.5	1	1	1	1	1				2	2	1	
	TB-6	0.0-0.5	3	3	3	3	3	1		yes	6	2	3	4
Reference (REF)	REF-1	0.0-0.5	1	1	1			1			2	1		2
	REF-2	0.0-0.5	1	1	1			1			2	1		2
	REF-3	0.0-0.5	1	1	1			1			2	1		2
DMPA	DMPA-1	0.0-0.5	3	3	3			1	yes		6	1		4
	DMPA-2	0.0-0.5	1	1	1			1			2	1		2
	DMPA-3	0.0-0.5	1	1	1			1			2	1		2
Slipway	H-3	0.0-0.5	1	1							2	2		
Totals			41	41	28	10	10	22	4	3	82	34	10	50

5.3.2 Phase III Elutriate and Bioavailability Analysis

Any exceedance of the 95% UCL of the mean for contaminant analytes will require progress to Phase III elutriate and bioavailability testing. It is proposed to collect additional sediment material during the initial program and hold these at the laboratory if further testing is required and the samples are within holding times. Analysis would include elutriate testing, dilute acid extraction (DAE) and porewater analysis. Phase III analysis hold samples include one additional 250ml jar at all locations except for the Tug berth where 5kg of sediment will be collected. In addition, 40 litres of seawater from the DMPA will be obtained in the event further testing is needed. If samples are outside of holding times additional sediment sampling may be required.

Samples provided for potential Phase III analysis will be noted for preservation to extend the 14-day holding time for TBT and PAHs. This is important as results require analysis before determination of progress to Phase III is required.

5.4 Methods and Equipment

Sediments will be collected with a Van-veen grab (0.25m³) deployed from the sampling vessel by hand (Figure 5-6). The grab sampler is constructed of stainless steel and has an approximate grab payload of 3kg. The grab is set with a release pin on-deck. Using a pulley system, the grab sampler is deployed from the boat and lowered to the sediments on the sea floor. As the grab reaches the sediment the pressure on the pin is released and the jaws close on the sediment upon retrieval. The grab sampler is then lifted back to the surface. Once recovered to the deck, the sediment is released to a large stainless-steel bowl. Where multiple samples are required, multiple bowls are used (i.e. triplicate samples). If insufficient sample is obtained at a site, the vessel will be relocated to within 10m of the original site and the grab will be lowered again. This will be repeated until sufficient sample volumes are obtained.

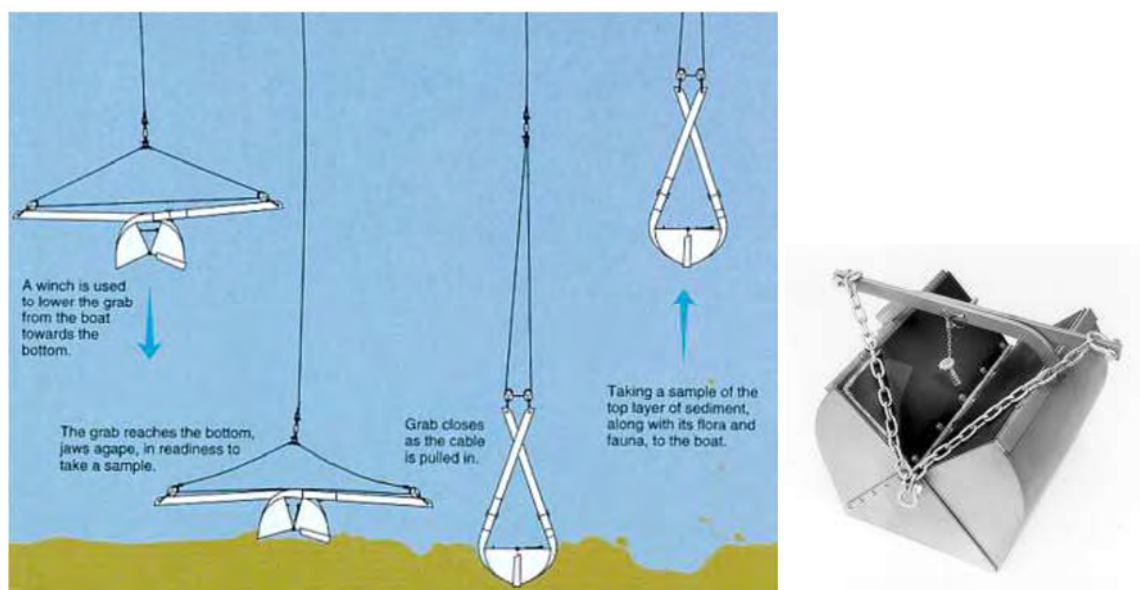


Figure 5-6 Deployment schematic and a Van-veen grab

5.4.1 Sampling Vessel

The vessel (the 'Brynda') proposed to be used for sampling is commercially registered and licensed for operation within the study area. The vessel is suitably sized for expected conditions to allow the progress of field works within a nominal sea state of 0.5m and winds to 15 knots. The vessel has a large powerful engine and an adequate shade cover. This vessel is suitable for any open water operations such as the collection of sediments from the DMPA.

5.4.2 Sampling Procedures

Field sampling procedures, conforming to *Appendix F Field and laboratory quality assurance and quality control* of NAGD, 2009 and Advisian's Quality Assurance / Quality Control (QA/QC) protocols, will be carried out to minimise the potential for cross contamination and preserve the sample integrity. Table 5-5 provides a summary of the sediment sampling activities to be undertaken.

Table 5-5 Sampling activities

Activity	Details
Sampling locations	The co-ordinates of the sampling locations will be uploaded onto a Garmin 76CSx Global Positioning System (GPS) unit with an accuracy of +/-5m. The Garmin will be used to navigate to the locations and if required, also re-position the locations due to site conditions.
Sediment sampling	Samples will be collected using a boat deployed grab sampler as described in Section 5.4.
Sediment logging	<p>The following information is recorded at each sampling location:</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 ▪ 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 <p>The sediment log for each grab is recorded on separate field data sheets, which describe each sample according to the following information:</p> <ul style="list-style-type: none"> ▪ Colour ▪ Field texture ▪ Observed sand grain size ▪ Plasticity ▪ Moisture content of sample (e.g. Wet, moist, dry) ▪ % stones ▪ Presence of shell/shell grit ▪ Odour (e.g. marine, sulphurous). <p>An example log sheet is provided in Appendix B.</p>
Sediment sampling & storage	<p>Once the sample is collected, placed into a stainless-steel mixing bowl and logged, the sample will be homogenized using powderless nitrile gloves.</p> <p>Homogenised sediment material is then placed into laboratory supplied 250 ml and 125 ml glass jars leaving zero head space and into zip lock bags. Label information is completed on each sample container and the containers will be stored on ice in eskies.</p>

Activity	Details
Labelling	<p>Sample bags and jars will be labelled with the date, the abbreviated project location (Port of Mackay), the location number / depth, sampler's initials and date of sampling. For instance, a grab sample collected at CSB-1 is labelled as follows:</p> <p>CSB-1 grab (sample I.D) NB (initials of sampler) 24/09/18 (date sampled)</p>
Decontamination	<p>Decontamination between samples included washing of all sampling equipment with ambient sea water and a laboratory grade detergent (Decon 90), and successive rinsing with deionised water.</p>
Dispatch	<p>All samples collected will be delivered to ALS Mackay daily. Here, samples will be logged into their system and stored in refrigerated storage until the sample is analysed. All testing will occur within recommended holding times. Triplicate split samples collected in the field will be dispatched by ALS to SGS in Brisbane so that inter-laboratory QC analysis can be assessed.</p>

5.4.3 Schedule

It is proposed that field sampling will be initiated once approval of the SAP is received and a calm weather window occurs. Approximately three days is required to sample all sites.

5.4.4 Contingency Plan

There are important considerations to consider when sediment sampling at the Port:

- Sea conditions – To minimise the potential of an aborted survey and the need for re-mobilisation, sea state forecasts will be closely considered prior to mobilising to the field. It should be noted that the Port area is sheltered therefore calm conditions are expected.
- Tidal conditions – The tides within the Port generate strong current flow and there can be very high tidal ranges (up to 6m during spring tides). Ideally Neap tidal period will be targeted to minimise difficulties associated with positioning the vessel and retrieving grab samples.
- Priority locations – Sampling within the Harbour will be undertaken as a priority while vessels are absent from the selected berth or during shutdown periods. Sampling in the Channel and Swing Basin, Reference Areas and DMPA will occur opportunistically when the weather is amenable to sampling.

5.5 Primary and Secondary Laboratories

Sediment analysis will be completed ALS and SGS laboratories. Both laboratories are National Association of Testing Authorities (NATA) accredited for the analyses of marine sediments. ALS is

the primary laboratory and SGS is the secondary laboratory. The secondary laboratory undertakes analysis of the split triplicate samples.

5.5.1 Laboratory Methods

Samples will be analysed for the physical characteristics and contaminant substances of concern as identified in Table 4-2. Detailed descriptions of these analyses by the primary laboratory (ALS) are provided in Appendix C.

5.6 QAQC

5.6.1 Quality Control – Field Sampling

The methods to be employed in field sampling quality assurance to ensure validity of the analyses results is ensured by:

- Using suitably qualified environmental staff and support personnel experienced in using a Van-veen Grab, field supervision and sediment logging
- Samples will be contained in appropriately cleaned, pre-treated and labelled sample containers that are provided by the analytical laboratory
- Samples will be kept cool (4°C) after sampling and during transport, stored in eskies with ice packs
- Transportation of samples under chain of custody documentation
- All sampling equipment, including mixing bowls etc. will be decontaminated between samples and sampling locations via a decontamination procedure involving a wash with ambient sea water and a laboratory grade detergent (Decon 90), and successive rinsing with deionised water.

5.6.2 Quality Control – Analysis

NAGD (Appendix F) specifies that field quality control samples should include (per batch of 20 or fewer):

- In cases where volatile substances such as some chlorinated organics are being determined, one container (trip) blank filled with inert material, for example chromatographic sand;
- On 10 per cent of locations, one field triplicate (that is three separate samples taken at the same location) to determine the variability of the sediment physical and chemical characteristics;
- On five per cent of locations, samples should be thoroughly mixed then split into three containers to assess laboratory variation (split triplicate), with one of the three samples sent to a second (reference) laboratory for analysis; and
- One sample that has been analysed in a previous batch (if more than one batch is sent) to determine the analytical variation between batches.

In consideration of these requirements, the following QAQC protocol has been developed for this study.

- Trip blanks (one per sampling batch) will be taken and analysed as volatile organic carbon compounds, such as chlorinated hydrocarbons are being assessed.
- On 10% of locations (i.e. one location in each dredge management area, total of four locations) (refer to Table 5-4) one field triplicate (i.e. three separate samples taken at the same location) is collected to determine the variability of the sediment chemical and physical characteristics
- On 5% of locations (refer to Table 5-4, total of three locations) samples will be thoroughly mixed then split into three different containers to access laboratory variation, with one of the three (triplicate) samples sent to a second (reference) laboratory for analysis. All field triplicate (split) samples will be 'blind' labelled in the field with QC field numbers, which do not relate to sampling location names.
- All samples will be dispatched to the laboratory daily, but held in a cold room until all samples are collected to complete a single batch. However, if the program is undertaken over an extended timeframe, and there is a risk of holding time breach, one inter-batch duplicate will be collected and a second batch of samples submitted.

The analytical laboratory will need to comply with the laboratory and quality assurance procedures specified in Appendix F of the NAGD, which require *the laboratory quality assurance program to include the following quality control samples to be analysed in each batch (10-20 samples). This is in addition to its own internal procedures to ensure analytical procedures are conducted properly and produce reliable results:*

- one laboratory blank sample (sand) to be tested for volatiles
- for metals, one Standard Reference Material (SRM)
- for organics, one sample spiked with the parameters being determined at a concentration within the linear range of the method being employed to determine the recovery rate of the analytical method is adequate or not
- one replicate sample to determine the precision of the analysis; the standard deviation and coefficient of variation should be documented.

A validation of the analytical data obtained will be undertaken in accordance with Appendix F of the NAGD. This analysis will confirm that the analysis undertaken is of suitable quality to assess dredge material for suitability for sea disposal. This validation will include a consideration of results for blanks, standards and spikes, and replicate and duplicate samples. Relative standard deviations (RSD) between quality control triplicates and relative percent difference (RPD) for split triplicate samples will be compared against relevant criteria.

5.7 Analysis of Results

5.7.1 Phase II – Sediment Analysis for Total Concentrations

Chemical concentration levels for sediments will be compared against the screening levels listed in Appendix A, Table 2 of the NAGD, to assess whether the sediment is suitable for placement at sea or if further testing is required (e.g. elutriate, bioavailability and/or direct toxicity assessment).

The assessment against NAGD criteria involves the comparison of mean concentrations at the 95%UCL of the mean to the NAGD screening levels. Detections for organic parameters will be

normalised to % TOC where the recorded TOC value was within the range of 0.2 – 10%. If TOC values are outside this range, then the highest or lowest of the 0.2 – 10% range will be adopted as appropriate. For the purposes of calculation of normalised values and of 95% UCLs, values below detection limit will be set to one-half of the laboratory LOR in accordance with NAGD recommendations. For organic concentrations below detection, the half detection levels are not normalised to % TOC. Means, standard deviations and 95%UCLs will be calculated for each of the dredge areas. Means and 95% UCLs will be not calculated for contaminant groups that will be found to have concentrations below detection levels at all sampling locations.

The methods used to calculate the 95% UCLs will be based on the methods required in Appendix A of the NAGD (P38, Comparison of Data to Screening Levels as described below.

Normality of datasets will be determined using Shapiro-Wilks test and quantile-quantile plots in ProUCL Version 5 developed by the United States Environmental Protection Agency (USEPA 2016). Datasets will be determined as being either normal or log-normal, or neither in their distributions. Normal datasets will be analysed using the 1-tailed student's t UCL. Log-normal datasets will be analysed using non-parametric jackknife analysis as recommended in the NAGD. Datasets that will be neither normal nor log-normally distributed will be also analysed using non-parametric jackknife analysis.

According to the NAGD, if the 95%UCL values for all substances are below relevant screening levels, it is unlikely that contaminant substance concentrations in the sediment will have an adverse effect on organisms living in or on that sediment. Sediments are therefore considered non-toxic and there are no chemical obstacles to unconfined sea disposal.

5.7.2 Phase III – Elutriate Analysis

If required, elutriate analyses will be undertaken using sediments prepared in a 1:4 suspension of seawater from the DMPA.

The elutriate concentrations at the 95th percentile for the relevant dredge area will be compared with the relevant toxicant trigger level in the ANZECC/ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, following the procedures outlined in Appendix A of the NAGD (Commonwealth of Australia, 2009). Allowance will be made for dilution at the DMPA when comparing elutriate concentrations against guideline values.

5.7.3 Phase III – Bioavailability Analysis

If required, DAE results for metals will be analysed similar to total sediments within the difference being that the metals will be extracted using a weak acid (1M HCl). For organic contaminants, collected sediment samples would be pressure squeezed or centrifuged to provide the chemical laboratory with porewater for chemical analysis. The 95th percentile of porewater concentrations would be compared with the relevant trigger level in the ANZECC/ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, following the procedures outlined in Appendix A of the NAGD (Commonwealth of Australia, 2009).

5.7.4 Phase IV – Toxicity Analysis

If required, toxicity testing will be undertaken using appropriate tests, as recommended by a laboratory experienced in toxicity testing.

5.8 Reporting

A report detailing the following information will be prepared after the sampling and analysis program once laboratory results are completed:

- Executive Summary
- Introduction and description of the study area
- Details of the sampling methodology (including any deviation from the approved SAP)
- A figure showing the sampling locations
- Physical descriptions of the sediment samples, based upon photographs and sediment logs
- Descriptions of any observations or anomalies during sampling and/or analysis
- Table of laboratories used and the analytical methods employed
- QA/QC procedures and results
- Summary table of results for each parameter analysed
- Comparison and interpretation of results
- Conclusions
- Recommendations
- Appendices containing sampling data sheets, grab sheets and images, all laboratory reports and associated QAQC reporting.

The report will provide summary data tables with colour-coded results for any parameters for which the Screening Levels are exceeded at the 95%UCL of the mean. The original laboratory reports will be provided as appendices. Mapping will be undertaken for all parameters where the screening level is exceeded.

6 References

Commonwealth of Australia (2009) National Assessment Guidelines for Dredging. Commonwealth of Australia, Canberra.

Golder Associates (2013). 2013 Maintenance Dredging – Sediment Characterisation Report: Prepared for North Queensland Ports Corporation of Queensland.

Norwegian Pollution Control Authority, 2008. Screening of Polyfluorinated Organic Compounds at Four Fire Training Facilities in Norway (TA-2444/2008). Worleyparsons, 2007. Mackay Port Authority: Port of Mackay Harbour – Sediment Quality Assessment

WorleyParsons, 2010. NQBP Mackay Harbour and Spoil Ground 2009 Sediment Characterisation Report, document number 301001-00797-00-EN-REP-0001

WorleyParsons, 2010. North Queensland Bulk Ports (NQBP) Long Term Dredge Management Plan (LTDMP) Mackay Port 2010-2020, document number 301001-00797-00-EN-REP-0003 (WorleyParsons, 2010)

WorleyParsons (2013a). Dudgeon Point Coal Terminals Project – Sediment Characterisation Report for Marine Support Facilities – Revision C, report – 301001-01385-00-PM-REP-0004-069. WorleyParsons 12 April 2013

WorleyParsons (2013b). Dudgeon Point Coal Terminals Project: Dredge Material Relocation Options Report. Draft Unpublished Report prepared for North Queensland Bulk Ports.



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Sampling and Analysis Plan



Appendix A Sampling location co-ordinates





**North Queensland Bulk
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Site	Grid ID / Sample Location ID	GPS ID	Easting (MGA55)	Northing (MGA55)	Decimal Degrees		Degrees, Decimal Minutes	
					Longitude (GDA94)	Latitude (GDA94)	Longitude (GDA94)	Latitude (GDA94)
CSB-1 T1	SB_02	SB_01	731410	7664228	149.2278109	-21.10845956	149° 13.669'	-21° 6.508'
CSB-1 T2								
CSB-1 T3								
CSB-2	SB_16	SB_02	731635	7664358	149.2299582	-21.10725736	149° 13.797'	-21° 6.435'
CSB-3	SB_40	SB_03	731485	7664553	149.2284887	-21.10551575	149° 13.709'	-21° 6.331'
CSB-4	SB_45	SB_04	731860	7664553	149.2320967	-21.10546827	149° 13.926'	-21° 6.328'
CSB-5	SB_50	SB_05	731035	7664618	149.2241503	-21.10498576	149° 13.449'	-21° 6.299'
CSB-6	SB_52	SB_06	731185	7664618	149.2255935	-21.10496682	149° 13.536'	-21° 6.298'
CSB-7	SB_58	SB_07	731635	7664618	149.2299231	-21.10490991	149° 13.795'	-21° 6.295'
CSB-8	SB_79	SB_08	731410	7664748	149.2277408	-21.10376465	149° 13.664'	-21° 6.226'
D1								
D2								
BP-1 T1	B1_02	B1_01	731554	7664151	149.2292063	-21.10913246	149° 13.752'	-21° 6.548'
BP-1 T2								
BP-1 T3								
BP-2	B1_07	B1_02	731404	7664191	149.2277577	-21.1087903	149° 13.665'	-21° 6.527'
BP-3	B3_14	B3_01	731293	7664470	149.2266582	-21.10629166	149° 13.599'	-21° 6.377'
BP-4	B4_01	B4_01	731156	7664516	149.2253334	-21.10589074	149° 13.520'	-21° 6.353'
BP-5	B5_08	B5_01	731541	7664783	149.2289968	-21.10342928	149° 13.740'	-21° 6.206'
BP-6	B5_10	B5_02	731341	7664808	149.2270692	-21.10322886	149° 13.624'	-21° 6.194'
D3								
D4								
TB-1	TB_02	TB_01	731182	7664202	149.2256212	-21.10872646	149° 13.537'	-21° 6.524'
TB-2 T1	TB_05	TB_02	731272	7664202	149.2264871	-21.10871509	149° 13.589'	-21° 6.523'
TB-2 T2								
TB-2 T3								
TB-3	TB_12	TB_03	731332	7664222	149.2270617	-21.10852693	149° 13.624'	-21° 6.512'
TB-4	TB_18	TB_04	731212	7664262	149.2259018	-21.10818095	149° 13.554'	-21° 6.491'
TB-5	TB_26	TB_05	731302	7664282	149.226765	-21.107989	149° 13.606'	-21° 6.479'
TB-6	TB_29	TB_06	731242	7664302	149.226185	-21.10781601	149° 13.571'	-21° 6.469'
D5								
D6								
REF-1	REF_01	REF_01	735470	7660787	149.26734831800	-21.13900944550	149° 16.041'	-21° 8.341'
REF-2	REF_02	REF_02	735110	7661279	149.26382206600	-21.13460923840	149° 15.829'	-21° 8.077'
REF-3	REF_03	REF_03	734746	7661772	149.26024952400	-21.13021239410	149° 15.615'	-21° 7.813'
DMPA-1 T1	SG_01	SG_01	735827	7665589	149.2701256	-21.09560723	149° 16.208'	-21° 5.736'
DMPA-1 T2								
DMPA-1 T3								
DMPA-2	SG_02	SG_02	735468	7666082	149.26660046000	-21.09120697910	149° 15.996'	-21° 5.472'
DMPA-3	SG_03	SG_03	735103	7666574	149.26302901300	-21.08681008650	149° 15.782'	-21° 5.209'
H-3	H-3	H-3	731070	7664300	149.22453417300	149.22453417300	149° 13.472'	-21° 6.471'

NOTES:	
Triplicate samples	Triplicate split sample



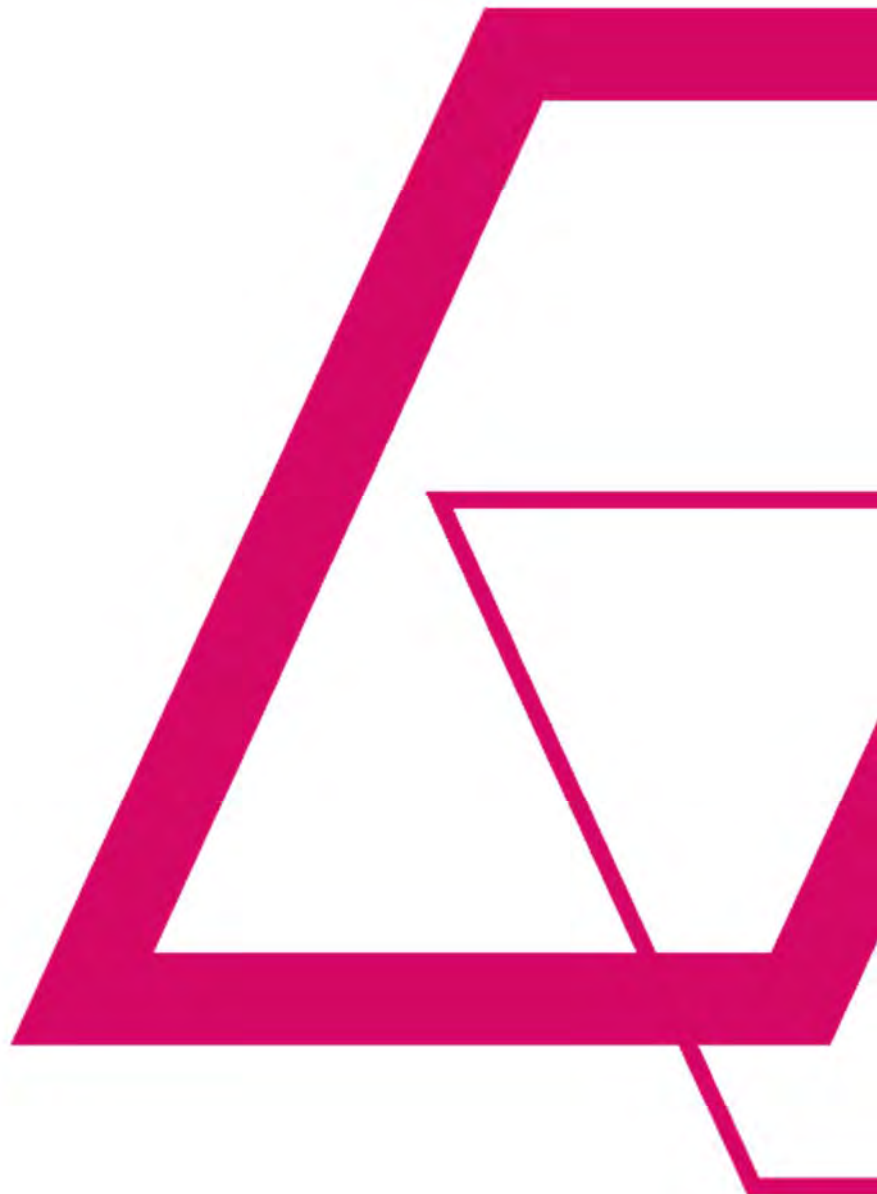
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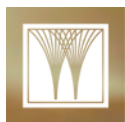
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Sampling and Analysis Plan



Appendix B Example log sheet





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301001-02095 – Port of Mackay Sediment Investigation

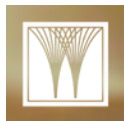
CLIENT: North Queensland Bulk Ports

DATE OF Grab/Core: _____

TIME OF Grab/Core: _____

Collection Details

General location of core of sampling location	
Site/location number	
Sample ID's assigned	
Easting/Longitude of core location (from onboard GPS)	
Northing/Latitude of core location (from onboard GPS)	
Water depth at core location	
Sample collector	
Type of core sampler	
Sea state at time of coring	
Conditions (e.g. weather, sea state, wind speed, level of shipping traffic)	
General comments	



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301001-02095 – Port of Mackay Sediment Investigation

Sediment Description

Sample Location									
Date / Sample Time									
Depth retained									
Strata Change (m)	Colour* (refer AS1726)	Field texture**	Moist.	Consist	Sand grain size	Plasticity	% stones	Shell/grit and/or biota	Odour

* Colour: black, white, grey, red, brown, orange, yellow, green, blue. Pale, dark, mottled. *e.g. grey mottled red-brown clay.*

**Field Texture: clay, silt, sand, gravel, etc



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Appendix C Laboratory Methods



Contaminants	Analytical method reference	Method summary	NAGD PQL	Laboratory LOR
Total metals and metalloids (As, Cd, Cr, Cu, Pb, Ni, Zn)	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. EG020-SD	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.	All 1 mg/kg Cd 0.1 mg/kg	All 1 mg/kg Cd 0.1 mg/kg
Hg	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) EG035T-LL	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 SnCl ₂ 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)	0.01 mg/kg	0.01 mg/kg
Organotins	In house: Referenced to USEPA SW 846 - 8270D EP090	Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quantified against an established calibration curve.	1 µgSn/kg	0.5 µgSn/kg
TPH / TRH	In house: Referenced to USEPA SW 846 - 8270D EP071-SD	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)	100 mg/kg	0.2-3 mg/kg
PAH (super ultra trace 20 analytes)	In house: Referenced to USEPA 8270D EP132-SD	GCMS Capillary column, SIM mode using large volume programmed temperature vaporisation injection.	100 µg/kg	4-5 µg/kg
Radionuclides (gross alpha and gross beta)	In house: Referenced to ISO 9697 / CSN 757611 EA250	Determination of Gross Alpha and Beta activity in soil and sediment by Thick Source method. An appropriate mass of sample is dried and pulverised prior to direct activity counting. (If required, Potassium may be determined separately and results corrected accordingly for 40K.) Analysis is performed by ALS (Czech Republic) who hold technical accreditation #1163 for Gross alpha and beta activity under CAI. CAI are a European accreditation body, equivalent to NATA in Australia and recognised internationally by NATA under ILAC.	N/A	500 bq/kg
OCP (ultra trace 21 analytes)	In house: Referenced to USEPA Method 3640 (GPC cleanup), 3620 (Florisil), 8081/8082 (GC/µECD/µECD) EP131A	This technique is compliant with NEPM (2013) Schedule B(3)	1 µg/kg	5 µg/kg
TOC	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 /	0.1%	0.1%

Contaminants	Analytical method reference	Method summary	NAGD PQL	Laboratory LOR
		catalysts. The evolved (Organic) Carbon (as CO ₂) is automatically measured by infra-red detector.		
Moisture content	In-house EA055	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).	0.1%	1%
PSD	AS 1289 3.6.3 (2003) EA150H	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003	Size distribution (sieve and hydrometer)	1%
Soil / sediment density	AS 1289.3.5.1-2006 EA152	Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method		
Settling velocity	In-house EA151-20	Determination of the settling rate of sediment or sludge in 20% solids slurries in seawater	Rates of settlement after 50% and 90% settlement	0.01 mm/min






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**Maintenance Dredging Sediment
Characterisation Report**
Port of Mackay






Appendix B Sediment 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)							
											
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)							
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 – Reference Site								
Site Number		REF_01								
Date/Sample Time		27/09/18, 0730								
Water Depth at Site		Estimated at <18m								
Type of Core Sampler		Grab								
Depth Retained		0.1m								
Weather Conditions		Choppy, Wind 7kts								
Comments										
PSD (%)										
Gravel (31%)		Sand (68%)		Silt & Clay (1%)						
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/ Biota	Odour	
0 – 0.1	Sand	Gravelly silty SAND	Moist	Loose	Coarse	Nil	10%	50%	Sulphur/marine	
General Location of Sampling		Port of Mackay – Reference Site								
Site Number		REF_02								
Date/Sample Time		27/09/18, 0745								
Water Depth at Site		Estimated at <18m								
Type of Core Sampler		Grab								
Depth Retained		0.1m								
Weather Conditions		Choppy, Wind 7kts								
Comments		Some coral/plant material								
PSD (%)										
Gravel (12%)		Sand (83%)		Silt & Clay (2%)						
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/ Biota	Odour	
0 – 0.1	Sand	SAND with shell	Moist	Loose	Coarse	Nil	2%	40%	Sulphur/marine	



General Location of Sampling		Port of Mackay – Reference Site								
Site Number		REF_03								
Date/Sample Time		27/09/18, 0800								
Water Depth at Site		Estimated at <18m								
Type of Core Sampler		Grab								
Depth Retained		0.1m								
Weather Conditions		Choppy, Wind 7kts								
Comments										
PSD (%)										
Gravel (NT)		Sand (NT)		Silt & Clay (NT)						
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour	
0 – 0.1	Sand	Gravelly SAND with shell	Moist	Loose	Coarse	Nil	10%	40%	Sulphur/marine	
General Location of Sampling		Port of Mackay – Spoil Ground								
Site Number		SG_01								
Date/Sample Time		27/09/18, 0930								
Water Depth at Site		Estimated at <30m								
Type of Core Sampler		Grab								
Depth Retained		0.1m								
Weather Conditions		Choppy, Wind 8kts								
Comments										
PSD (%)										
Gravel (67%)		Sand (30%)		Silt & Clay (3%)						
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour	
0 – 0.1	Brown	Sandy GRAVEL with shell	Wet	Dense	Coarse	Nil	30%	70%	Sulphur/marine	

General Location of Sampling		Port of Mackay – Spoil Ground								
Site Number		SG_02								
Date/Sample Time		27/09/18, 0945								
Water Depth at Site		Estimated at <27m								
Type of Core Sampler		Grab								
Depth Retained		0.1m								
Weather Conditions		Choppy, Wind 8kts								
Comments										
PSD (%)										
Gravel (36%)		Sand (63%)		Silt & Clay (1%)						
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour	
0 – 0.1	Brown / gray	SAND	Wet	Dense	Coarse	Nil	70%	30%	Sulphur/marine	
General Location of Sampling		Port of Mackay – Spoil Ground		<div>No photo taken</div>						
Site Number		SG_03								
Date/Sample Time		27/09/18, 1015								
Water Depth at Site		Estimated at <27m								
Type of Core Sampler		Grab								
Depth Retained		0.1m								
Weather Conditions		Choppy, Wind 5kts								
Comments										
PSD (%)										
Gravel (33%)		Sand (66%)		Silt & Clay (1%)						
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour	
0 – 0.1	Brown	Gravelly SAND	Wet	Dense	Coarse	Nil	20%	80%	Sulphur/marine	



Advisian
WorleyParsons Group

**Maintenance Dredging Sediment
Characterisation Report**
Port of Mackay



Appendix C Laboratory Certificates

CERTIFICATE OF ANALYSIS

Work Order	: EB1823470	Page	: 1 of 32
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	: 27-Sep-2018 09:00
Order number	: ----	Date Analysis Commenced	: 04-Oct-2018
C-O-C number	: ----	Issue Date	: 11-Dec-2018 10:52
Sampler	: NICHOLAS BANTON		
Site	: ----		
Quote number	: BN/185/18		
No. of samples received	: 58		
No. of samples analysed	: 40		



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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>
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 Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Kim McCabe	Senior Inorganic Chemist	Brisbane External Subcontracting, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Matt Frost	Senior Organic Chemist	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



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.

- EP080: Sample 'B1_07' 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.
- Radiological work undertaken by ALS Laboratory Group (Ceska Lipa) under CAI accreditation No. L1163. Report No. PR18A9577. NATA and CAI accreditations are both recognised under ILAC.
- EA151: Due to limited sample volume settleability results were unable to be reported for samples #56, #57 and #58.
- EA150H: Soil particle density results for sample #34 fell outside the scope of AS1289.3.6.3. Results should be scrutinised accordingly.
- EA150H: Soil particle density results for sample #14 fell outside the scope of AS1289.3.6.3. Results should be scrutinised accordingly.
- EA150H: Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1 2006 was unable to be performed on samples #4, #8, #11 to #23, #30, #31, #36 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.
- **Specialty Organics analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- EP132B-SD : Poor duplicate precision due to sample heterogeneity. Confirmed by re-extraction and re-analysis.
- ASS: EA033 (CRS Suite): Retained Acidity not required because pH KCl greater than or equal to 4.5
- Amendment (4/12/2018): This report has been amended and re-released to allow the removal of data for samples 40-43, 56-58 as well as Chromium suite, EC, Soluble Salts, Chloride and Organic Matter data. All analysis results are as per the previous report.
- Amendment (11/12/2018): This report has been amended and re-released to allow the removal of pH Field/Fox data. All analysis results are as per the previous report.
- Amendment (7/12/2018): This report has been amended following changes to the analytical data reported. The quality system is being utilised to resolve this issue. The specific data affected includes gross alpha/beta results.
- EP132B-SD : Poor matrix spike recovery due to sample heterogeneity. Confirmed by re-extraction and re-analysis.
- EP080-SD: The LOR for meta- & para-Xylene has been raised due to high moisture content.
- EP090 Organotin: Sample 'B1_02 (T3)', 'B1_07' and 'SB_02 (T2)' shows poor matrix spike recovery for MBT due to matrix interference. Confirmed by re-extraction and re-analysis.
- EP080-SD: Sample 'B1_02 (T3)' shows poor matrix spike recovery due to high moisture content. Confirmed by re-extraction and re-analysis.
- EP090 Organotin: High LCS recovery deemed acceptable as all associated analyte results are less than LOR
- EP071-SD: It is acknowledged that the duplicate for sample 'TB_05 (T1)' falls outside the RPD for >C10 - C40 calculated fraction. However, all the measured components of the Sum are within acceptance criteria.
- EG020-SD (Total Metals in Sediments by ICP-MS): Sample EB1823470-013 shows poor duplicate results due to sample heterogeneity. Confirmed by visual inspection.
- EG020-SD (Total Metals Sediments by ICP-MS): Sample EB1823470 - 001 (SB_02 (T1)) shows poor duplicate results due to sample heterogeneity. Confirmed by visual inspection.
- 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 (CaCO_3) 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.
- Radiological work undertaken by ALS Laboratory Group (Ceska Lipa) under CAI accreditation No. L1163. Report No. \$\$. NATA and CAI accreditations' are both recognised under ILAC.
- EA151: ALS does not hold NATA accreditation for Settleability.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB_02 (T1)	SB_02 (T2)	SB_02 (T3)	SB_16	SB_40
Client sampling date / time					24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-001	EB1823470-002	EB1823470-003	EB1823470-004	EB1823470-005
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		34.2	50.7	47.0	67.2	64.4
EA150: Particle Sizing									
+75µm	----	1	%		71	56	42	3	----
+150µm	----	1	%		68	53	39	2	----
+300µm	----	1	%		65	49	36	1	----
+425µm	----	1	%		61	45	33	<1	----
+600µm	----	1	%		52	38	26	<1	----
+1180µm	----	1	%		30	23	12	<1	----
+2.36mm	----	1	%		14	12	3	<1	----
+4.75mm	----	1	%		7	8	<1	<1	----
+9.5mm	----	1	%		5	7	<1	<1	----
+19.0mm	----	1	%		<1	<1	<1	<1	----
+37.5mm	----	1	%		<1	<1	<1	<1	----
+75.0mm	----	1	%		<1	<1	<1	<1	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		16	13	31	17	----
Silt (2-60 µm)	----	1	%		13	30	26	75	----
Sand (0.06-2.00 mm)	----	1	%		52	42	37	8	----
Gravel (>2mm)	----	1	%		19	15	6	<1	----
Cobbles (>6cm)	----	1	%		<1	<1	<1	<1	----
EA151: Settleability 10%									
∅ Underflow Density	----	0.01	g/cm3		1.52	1.34	1.21	1.11	----
∅ Underflow Solids	----	0.1	%		67.2	59.8	55.3	53.0	----
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		18.0	18.8	14.4	15.4	----
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		18.0	10.6	8.80	8.00	----
∅ Clarity	----	-	-		Clear	Clear	Clear	Clear	----
EA151: Settleability 20%									
∅ Underflow Density	----	0.01	g/cm3		1.53	1.51	1.36	1.13	----
∅ Underflow Solids	----	0.1	%		65.5	55.0	52.5	49.1	----
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		9.20	6.60	7.00	2.20	----
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		0.600	0.400	6.40	0.067	----
∅ Clarity	----	-	-		Clear	Clear	Clear	Clear	----
EA152: Soil Particle Density									
∅ Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.54	2.49	2.48	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB_02 (T1)	SB_02 (T2)	SB_02 (T3)	SB_16	SB_40
Client sampling date / time					24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-001	EB1823470-002	EB1823470-003	EB1823470-004	EB1823470-005
					Result	Result	Result	Result	Result
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		13.6	6.98	5.48	8.05	6.86
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		8.4	17.6	13.1	25.2	21.6
Copper	7440-50-8	1.0	mg/kg		9.0	15.9	10.9	16.5	14.6
Lead	7439-92-1	1.0	mg/kg		6.6	11.5	9.0	15.3	14.2
Nickel	7440-02-0	1.0	mg/kg		8.0	10.3	7.4	14.4	11.8
Zinc	7440-66-6	1.0	mg/kg		18.6	37.5	27.2	46.1	39.9
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	0.02	0.01	0.04	0.02
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.54	0.83	0.95	1.57	1.23
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg		<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	0.7	<0.5	<0.5	<0.5
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		61.7	64.3	69.6	74.1	70.7



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB_45	SB_50	SB_52	SB_58	SB_79
Client sampling date / time					24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-006	EB1823470-007	EB1823470-008	EB1823470-009	EB1823470-010
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		35.3	21.0	63.1	58.5	59.7
EA150: Particle Sizing									
+75µm	----	1	%		82	----	14	----	18
+150µm	----	1	%		48	----	6	----	7
+300µm	----	1	%		21	----	2	----	3
+425µm	----	1	%		14	----	1	----	2
+600µm	----	1	%		9	----	<1	----	2
+1180µm	----	1	%		5	----	<1	----	<1
+2.36mm	----	1	%		2	----	<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	%		5	----	34	----	36
Silt (2-60 µm)	----	1	%		6	----	42	----	41
Sand (0.06-2.00 mm)	----	1	%		86	----	24	----	23
Gravel (>2mm)	----	1	%		3	----	<1	----	<1
Cobbles (>6cm)	----	1	%		<1	----	<1	----	<1
EA151: Settleability 10%									
∅ Underflow Density	----	0.01	g/cm3		1.50	----	1.04	----	1.18
∅ Underflow Solids	----	0.1	%		66.6	----	37.0	----	23.4
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		26.0	----	4.60	----	2.40
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		19.6	----	0.058	----	0.108
∅ Clarity	----	-	-		Clear	----	Clear	----	Clear
EA151: Settleability 20%									
∅ Underflow Density	----	0.01	g/cm3		1.69	----	1.14	----	1.16
∅ Underflow Solids	----	0.1	%		59.2	----	19.8	----	23.0
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		15.4	----	0.050	----	0.050
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		6.00	----	0.008	----	0.006
∅ Clarity	----	-	-		Clear	----	Clear	----	Clear
EA152: Soil Particle Density									
∅ Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.59	----	----	----	2.50



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB_45	SB_50	SB_52	SB_58	SB_79
Client sampling date / time					24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-006	EB1823470-007	EB1823470-008	EB1823470-009	EB1823470-010
					Result	Result	Result	Result	Result
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		5.12	3.93	6.70	5.72	6.39
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		7.9	3.9	21.9	16.9	21.0
Copper	7440-50-8	1.0	mg/kg		5.4	2.7	16.2	12.2	15.1
Lead	7439-92-1	1.0	mg/kg		5.8	3.2	13.8	11.0	11.2
Nickel	7440-02-0	1.0	mg/kg		4.5	2.9	11.9	9.4	11.8
Zinc	7440-66-6	1.0	mg/kg		17.0	12.7	43.1	33.6	40.8
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	0.02	0.02	0.02
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		1.40	0.22	1.11	1.22	1.08
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg		<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	<0.5	<0.5	<0.5
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		49.6	56.6	70.8	142	71.0

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	D1	B1_02 (T1)	B1_02 (T2)	B1_02 (T3)	B1_07
Client sampling date / time				24-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00
Compound	CAS Number	LOR	Unit	EB1823470-011	EB1823470-013	EB1823470-014	EB1823470-015	EB1823470-016	
				Result	Result	Result	Result	Result	
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%	60.0	59.7	69.2	68.2	61.8	
EA150: Particle Sizing									
+75µm	----	1	%	16	28	2	2	----	
+150µm	----	1	%	6	18	<1	<1	----	
+300µm	----	1	%	2	8	<1	<1	----	
+425µm	----	1	%	1	4	<1	<1	----	
+600µm	----	1	%	<1	2	<1	<1	----	
+1180µm	----	1	%	<1	1	<1	<1	----	
+2.36mm	----	1	%	<1	<1	<1	<1	----	
+4.75mm	----	1	%	<1	<1	<1	<1	----	
+9.5mm	----	1	%	<1	<1	<1	<1	----	
+19.0mm	----	1	%	<1	<1	<1	<1	----	
+37.5mm	----	1	%	<1	<1	<1	<1	----	
+75.0mm	----	1	%	<1	<1	<1	<1	----	
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%	36	28	23	22	----	
Silt (2-60 µm)	----	1	%	37	35	66	67	----	
Sand (0.06-2.00 mm)	----	1	%	27	36	11	11	----	
Gravel (>2mm)	----	1	%	<1	1	<1	<1	----	
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	----	
EA151: Settleability 10%									
Ø Underflow Density	----	0.01	g/cm3	1.04	1.04	1.05	1.04	----	
Ø Underflow Solids	----	0.1	%	36.4	40.8	30.8	30.1	----	
Ø Settling Rate @ 50% of Settlement	----	0.001	mm/min	2.20	2.60	0.333	0.333	----	
Ø Settling Rate @ 90% of Settlement	----	0.001	mm/min	0.067	0.217	0.027	0.020	----	
Ø Clarity	----	-	-	Clear	Clear	Clear	Clear	----	
EA151: Settleability 20%									
Ø Underflow Density	----	0.01	g/cm3	1.16	1.15	1.11	1.11	----	
Ø Underflow Solids	----	0.1	%	21.0	30.6	24.9	20.8	----	
Ø Settling Rate @ 50% of Settlement	----	0.001	mm/min	0.250	0.050	0.033	0.009	----	
Ø Settling Rate @ 90% of Settlement	----	0.001	mm/min	0.004	0.015	0.009	0.009	----	
Ø Clarity	----	-	-	Clear	Clear	Clear	Clear	----	
EA152: Soil Particle Density									
Ø Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	----	2.40	2.58	----	



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	D1	B1_02 (T1)	B1_02 (T2)	B1_02 (T3)	B1_07
Client sampling date / time					24-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-011	EB1823470-013	EB1823470-014	EB1823470-015	EB1823470-016
					Result	Result	Result	Result	Result
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		6.68	7.94	9.70	9.22	6.80
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		21.2	22.0	32.2	30.1	22.3
Copper	7440-50-8	1.0	mg/kg		16.1	30.1	18.5	18.0	21.9
Lead	7439-92-1	1.0	mg/kg		13.6	10.9	15.2	14.2	16.0
Nickel	7440-02-0	1.0	mg/kg		12.2	12.2	16.3	15.3	13.1
Zinc	7440-66-6	1.0	mg/kg		41.8	83.0	59.0	56.8	57.9
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.02	0.02	0.03	0.03	0.02
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.93	0.75	0.86	0.90	0.73
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		----	6	14	15	6
>C16 - C34 Fraction	----	3	mg/kg		----	31	69	67	30
>C34 - C40 Fraction	----	5	mg/kg		----	10	34	30	12
>C10 - C40 Fraction (sum)	----	3	mg/kg		----	47	117	112	48
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		----	6	14	15	6
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		----	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg		----	6	14	15	6
C15 - C28 Fraction	----	3	mg/kg		----	22	44	45	21
C29 - C36 Fraction	----	5	mg/kg		----	16	50	45	16
^ C10 - C36 Fraction (sum)	----	3	mg/kg		----	44	108	105	43
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		----	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		----	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		----	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg		----	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		----	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		----	<0.4	<0.4	<0.4	<0.4
ortho-Xylene	95-47-6	0.2	mg/kg		----	<0.2	<0.2	<0.2	<0.2

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	D1	B1_02 (T1)	B1_02 (T2)	B1_02 (T3)	B1_07
Client sampling date / time				24-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00
Compound	CAS Number	LOR	Unit	EB1823470-011	EB1823470-013	EB1823470-014	EB1823470-015	EB1823470-016	
				Result	Result	Result	Result	Result	
EP080-SD: BTEXN - Continued									
^ Total Xylenes	----	0.5	mg/kg	----	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	----	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg	----	<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg	----	16	<5	<5	<5	12
2-Methylnaphthalene	91-57-6	5	µg/kg	----	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	----	5	<4	<4	<4	<5
Acenaphthene	83-32-9	4	µg/kg	----	14	<4	<4	<4	<5
Fluorene	86-73-7	4	µg/kg	----	12	<4	<4	<4	<5
Phenanthrene	85-01-8	4	µg/kg	----	99	<4	<4	<4	10
Anthracene	120-12-7	4	µg/kg	----	12	<4	<4	<4	7
Fluoranthene	206-44-0	4	µg/kg	----	210	6	7	7	18
Pyrene	129-00-0	4	µg/kg	----	159	6	6	6	15
Benz(a)anthracene	56-55-3	4	µg/kg	----	82	<4	4	4	11
Chrysene	218-01-9	4	µg/kg	----	66	<4	<4	<4	13
Benzo(b+j)fluoranthene	205-99-2	205-82-3	4	µg/kg	----	58	4	<4	9
Benzo(k)fluoranthene	207-08-9	4	µg/kg	----	33	4	<4	<4	6
Benzo(e)pyrene	192-97-2	4	µg/kg	----	32	<4	<4	<4	6
Benzo(a)pyrene	50-32-8	4	µg/kg	----	46	<4	<4	<4	8
Perylene	198-55-0	4	µg/kg	----	21	<4	<4	<4	12
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	----	26	<4	<4	<4	6
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	----	7	<4	<4	<4	5
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	----	24	<4	<4	<4	6
Coronene	191-07-1	5	µg/kg	----	6	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	----	928	20	17	17	144
EP080-SD: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%	----	68.2	58.8	64.0	64.0	66.3
Toluene-D8	2037-26-5	0.2	%	----	57.5	53.4	52.2	52.2	65.9
4-Bromofluorobenzene	460-00-4	0.2	%	----	77.4	64.2	77.0	77.0	84.2
EP090S: Organotin Surrogate									



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	D1	B1_02 (T1)	B1_02 (T2)	B1_02 (T3)	B1_07
Client sampling date / time					24-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-011	EB1823470-013	EB1823470-014	EB1823470-015	EB1823470-016
					Result	Result	Result	Result	Result
EP090S: Organotin Surrogate - Continued									
Tripopyltin	----	0.5	%		77.6	90.9	101	98.5	72.9
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		----	78.6	83.1	79.3	81.4
Anthracene-d10	1719-06-8	10	%		----	106	96.1	93.7	106
4-Terphenyl-d14	1718-51-0	10	%		----	85.7	82.5	78.9	83.1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	B3_14	B4_01	B5_08	B5_10	D3
Client sampling date / time					26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-017	EB1823470-018	EB1823470-019	EB1823470-020	EB1823470-021
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		65.0	69.4	58.2	67.3	68.2
EA150: Particle Sizing									
+75µm	----	1	%		10	3	----	4	4
+150µm	----	1	%		5	2	----	<1	<1
+300µm	----	1	%		3	<1	----	<1	<1
+425µm	----	1	%		2	<1	----	<1	<1
+600µm	----	1	%		1	<1	----	<1	<1
+1180µm	----	1	%		<1	<1	----	<1	<1
+2.36mm	----	1	%		<1	<1	----	<1	<1
+4.75mm	----	1	%		<1	<1	----	<1	<1
+9.5mm	----	1	%		<1	<1	----	<1	<1
+19.0mm	----	1	%		<1	<1	----	<1	<1
+37.5mm	----	1	%		<1	<1	----	<1	<1
+75.0mm	----	1	%		<1	<1	----	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		40	37	----	42	29
Silt (2-60 µm)	----	1	%		43	52	----	32	56
Sand (0.06-2.00 mm)	----	1	%		17	11	----	26	15
Gravel (>2mm)	----	1	%		<1	<1	----	<1	<1
Cobbles (>6cm)	----	1	%		<1	<1	----	<1	<1
EA151: Settleability 10%									
∅ Underflow Density	----	0.01	g/cm3		1.07	1.05	----	1.06	1.06
∅ Underflow Solids	----	0.1	%		35.8	29.8	----	32.7	32.5
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		3.20	2.60	----	2.60	4.20
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		0.133	0.092	----	0.133	0.025
∅ Clarity	----	-	-		Clear	Clear	----	Clear	Clear
EA151: Settleability 20%									
∅ Underflow Density	----	0.01	g/cm3		1.12	1.09	----	1.11	1.12
∅ Underflow Solids	----	0.1	%		25.0	26.1	----	31.1	33.1
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		0.670	0.050	----	0.050	0.017
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		0.024	0.016	----	0.015	0.019
∅ Clarity	----	-	-		Clear	Clear	----	Clear	Clear
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		8.42	8.96	6.98	8.05	7.66



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	B3_14	B4_01	B5_08	B5_10	D3
Client sampling date / time					26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-017	EB1823470-018	EB1823470-019	EB1823470-020	EB1823470-021
					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		24.7	28.5	20.4	24.4	22.0
Copper	7440-50-8	1.0	mg/kg		16.0	19.8	16.1	17.6	17.0
Lead	7439-92-1	1.0	mg/kg		13.0	15.4	11.9	14.2	13.2
Nickel	7440-02-0	1.0	mg/kg		13.6	16.1	12.2	14.5	13.5
Zinc	7440-66-6	1.0	mg/kg		48.3	58.3	41.8	50.0	48.7
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.02	0.03	0.02	0.02	0.02
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.98	1.20	0.82	0.88	0.87
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		8	6	4	6	5
>C16 - C34 Fraction	----	3	mg/kg		44	22	17	27	18
>C34 - C40 Fraction	----	5	mg/kg		19	8	8	10	6
>C10 - C40 Fraction (sum)	----	3	mg/kg		71	36	29	43	29
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		8	6	4	6	5
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg		8	6	4	6	5
C15 - C28 Fraction	----	3	mg/kg		29	17	12	20	14
C29 - C36 Fraction	----	5	mg/kg		27	10	10	14	8
^ C10 - C36 Fraction (sum)	----	3	mg/kg		64	33	26	40	27
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		<3.0	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.4	<0.4	<0.4	<0.4	<0.4
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	B3_14	B4_01	B5_08	B5_10	D3
Client sampling date / time					26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-017	EB1823470-018	EB1823470-019	EB1823470-020	EB1823470-021
					Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued									
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg		<0.2	<0.2	<0.2	<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		<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	1.4	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		11	15	10	12	16
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg		<5	<5	<5	<5	<5
Acenaphthene	83-32-9	4	µg/kg		<5	<5	<5	<5	<5
Fluorene	86-73-7	4	µg/kg		<5	5	<5	<5	<5
Phenanthrene	85-01-8	4	µg/kg		7	10	13	9	10
Anthracene	120-12-7	4	µg/kg		<5	<5	<5	<5	<5
Fluoranthene	206-44-0	4	µg/kg		10	19	28	14	16
Pyrene	129-00-0	4	µg/kg		8	17	24	11	13
Benz(a)anthracene	56-55-3	4	µg/kg		<5	10	18	6	7
Chrysene	218-01-9	4	µg/kg		5	10	15	8	8
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		6	11	18	8	8
Benzo(k)fluoranthene	207-08-9	4	µg/kg		<5	6	9	<5	<5
Benzo(e)pyrene	192-97-2	4	µg/kg		<5	7	11	<5	<5
Benzo(a)pyrene	50-32-8	4	µg/kg		<5	9	15	5	5
Perylene	198-55-0	4	µg/kg		11	16	15	13	14
Benzo(g,h,i)perylene	191-24-2	4	µg/kg		<5	7	11	<5	<5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg		<5	<5	<5	<5	<5
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg		<5	7	10	<5	<5
Coronene	191-07-1	5	µg/kg		<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg		58	149	197	86	97
EP080-SD: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		86.5	66.9	62.9	72.1	79.0
Toluene-D8	2037-26-5	0.2	%		62.2	56.3	50.0	62.0	67.5
4-Bromofluorobenzene	460-00-4	0.2	%		79.0	72.9	68.2	79.3	82.8
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		90.0	84.9	82.6	88.7	80.9



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	B3_14	B4_01	B5_08	B5_10	D3
Client sampling date / time					26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-017	EB1823470-018	EB1823470-019	EB1823470-020	EB1823470-021
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		98.5	77.8	85.2	80.4	88.3
Anthracene-d10	1719-06-8	10	%		101	107	103	101	108
4-Terphenyl-d14	1718-51-0	10	%		81.9	82.7	83.3	78.1	84.2



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TB_02	TB_05 (T1)	TB_05 (T2)	TB_05 (T3)	TB_12
Client sampling date / time					25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-023	EB1823470-024	EB1823470-025	EB1823470-026	EB1823470-027
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		63.7	62.0	58.5	57.1	67.3
EA150: Particle Sizing									
+75µm	----	1	%		20	----	----	----	----
+150µm	----	1	%		15	----	----	----	----
+300µm	----	1	%		9	----	----	----	----
+425µm	----	1	%		7	----	----	----	----
+600µm	----	1	%		4	----	----	----	----
+1180µm	----	1	%		1	----	----	----	----
+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	%		34	----	----	----	----
Silt (2-60 µm)	----	1	%		36	----	----	----	----
Sand (0.06-2.00 mm)	----	1	%		29	----	----	----	----
Gravel (>2mm)	----	1	%		1	----	----	----	----
Cobbles (>6cm)	----	1	%		<1	----	----	----	----
EA151: Settleability 10%									
∅ Underflow Density	----	0.01	g/cm3		1.06	----	----	----	----
∅ Underflow Solids	----	0.1	%		33.7	----	----	----	----
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		2.00	----	----	----	----
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		0.050	----	----	----	----
∅ Clarity	----	-	-		Clear	----	----	----	----
EA151: Settleability 20%									
∅ Underflow Density	----	0.01	g/cm3		1.14	----	----	----	----
∅ Underflow Solids	----	0.1	%		21.5	----	----	----	----
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		0.050	----	----	----	----
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		0.003	----	----	----	----
∅ Clarity	----	-	-		Clear	----	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		7.48	7.00	7.56	6.58	8.27



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TB_02	TB_05 (T1)	TB_05 (T2)	TB_05 (T3)	TB_12
Client sampling date / time					25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-023	EB1823470-024	EB1823470-025	EB1823470-026	EB1823470-027
					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		26.1	19.5	20.2	15.8	24.6
Copper	7440-50-8	1.0	mg/kg		26.2	20.3	20.8	18.9	22.3
Lead	7439-92-1	1.0	mg/kg		15.3	12.6	12.7	11.3	15.3
Nickel	7440-02-0	1.0	mg/kg		15.6	11.1	11.3	9.3	14.4
Zinc	7440-66-6	1.0	mg/kg		60.2	48.9	49.6	42.6	55.3
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.02	0.03	0.03	0.02	0.03
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.80	1.18	0.74	0.71	0.99
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		5	7	5	5	4
>C16 - C34 Fraction	----	3	mg/kg		25	64	32	45	22
>C34 - C40 Fraction	----	5	mg/kg		9	30	16	20	12
>C10 - C40 Fraction (sum)	----	3	mg/kg		39	101	53	70	38
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		5	7	5	5	4
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg		5	6	5	5	4
C15 - C28 Fraction	----	3	mg/kg		19	42	22	30	14
C29 - C36 Fraction	----	5	mg/kg		12	41	18	26	12
^ C10 - C36 Fraction (sum)	----	3	mg/kg		36	89	45	61	30
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		<3.0	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.4	<0.4	<0.4	<0.4	<0.4
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TB_02	TB_05 (T1)	TB_05 (T2)	TB_05 (T3)	TB_12
Client sampling date / time					25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-023	EB1823470-024	EB1823470-025	EB1823470-026	EB1823470-027
					Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued									
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg		<0.2	<0.2	<0.2	<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		1	1	<1	2	<1
Tributyltin	56573-85-4	0.5	µgSn/kg		2.5	5.3	1.7	3.6	0.8
EP131A: Organochlorine Pesticides									
Aldrin	309-00-2	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
alpha-BHC	319-84-6	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
beta-BHC	319-85-7	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
delta-BHC	319-86-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
4,4`-DDD	72-54-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
4,4`-DDE	72-55-9	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
4,4`-DDT	50-29-3	0.50	µg/kg		<0.50	<0.50	<0.50	<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	<0.50	<0.50	<0.50
Dieldrin	60-57-1	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
^ Endosulfan (sum)	115-29-7	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Endrin	72-20-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Heptachlor	76-44-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Heptachlor epoxide	1024-57-3	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
gamma-BHC	58-89-9	0.25	µg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
Methoxychlor	72-43-5	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
cis-Chlordane	5103-71-9	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
trans-Chlordane	5103-74-2	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
^ Total Chlordane (sum)	----	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Oxychlordane	27304-13-8	0.50	µg/kg		<0.50	<0.50	<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	<0.50	<0.50



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TB_02	TB_05 (T1)	TB_05 (T2)	TB_05 (T3)	TB_12
Client sampling date / time					25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-023	EB1823470-024	EB1823470-025	EB1823470-026	EB1823470-027
					Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		15	20	18	30	14
2-Methylnaphthalene	91-57-6	5	µg/kg		7	<5	<5	7	<5
Acenaphthylene	208-96-8	4	µg/kg		80	45	5	51	<5
Acenaphthene	83-32-9	4	µg/kg		53	4	<5	8	<5
Fluorene	86-73-7	4	µg/kg		128	20	<5	25	<5
Phenanthrene	85-01-8	4	µg/kg		2150	213	17	296	8
Anthracene	120-12-7	4	µg/kg		380	85	6	136	<5
Fluoranthene	206-44-0	4	µg/kg		6170	456	47	839	15
Pyrene	129-00-0	4	µg/kg		4140	362	40	644	13
Benz(a)anthracene	56-55-3	4	µg/kg		1970	240	24	435	7
Chrysene	218-01-9	4	µg/kg		1630	189	20	286	8
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		950	200	24	296	10
Benzo(k)fluoranthene	207-08-9	4	µg/kg		467	99	11	154	<5
Benzo(e)pyrene	192-97-2	4	µg/kg		421	109	14	162	6
Benzo(a)pyrene	50-32-8	4	µg/kg		527	218	21	329	7
Perylene	198-55-0	4	µg/kg		168	88	21	108	12
Benzo(g,h,i)perylene	191-24-2	4	µg/kg		147	115	14	167	7
Dibenz(a,h)anthracene	53-70-3	4	µg/kg		52	26	<5	39	<5
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg		172	107	13	159	6
Coronene	191-07-1	5	µg/kg		13	27	<5	41	<5
^ Sum of PAHs	----	4	µg/kg		19600	2620	295	4210	113
Radionuclides / Activity									
Gross alpha	----	500	Bq/kg DW		640	640	510	570	<500
Gross beta	----	500	Bq/kg DW		570	<500	560	530	530
EP080-SD: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		84.5	81.4	66.6	76.9	56.4
Toluene-D8	2037-26-5	0.2	%		70.9	64.8	55.6	61.6	54.8
4-Bromofluorobenzene	460-00-4	0.2	%		87.6	86.2	72.5	83.9	70.3
EP090S: Organotin Surrogate									
Tripopyltin	----	0.5	%		84.0	87.0	72.6	92.3	35.6
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.50	%		73.7	45.4	58.7	61.7	64.1
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		98.6	96.1	89.3	84.1	84.4

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 Work Order : EB1823470 Amendment 3
 Client : ADVISIAN PTY LTD
 Project : 301001.02018 - Port of Mackay Sediment Sampling



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TB_02	TB_05 (T1)	TB_05 (T2)	TB_05 (T3)	TB_12
Client sampling date / time					25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-023	EB1823470-024	EB1823470-025	EB1823470-026	EB1823470-027
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued									
Anthracene-d10	1719-06-8	10	%		86.2	83.4	112	100	82.6
4-Terphenyl-d14	1718-51-0	10	%		82.0	89.8	92.2	84.1	85.4



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TB_18	TB_26	TB_29	D5	REF_01
Client sampling date / time					25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	27-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-028	EB1823470-029	EB1823470-030	EB1823470-031	EB1823470-033
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		62.4	65.7	65.8	66.2	17.7
EA150: Particle Sizing									
+75µm	----	1	%		8	----	2	2	98
+150µm	----	1	%		3	----	<1	<1	97
+300µm	----	1	%		1	----	<1	<1	92
+425µm	----	1	%		<1	----	<1	<1	84
+600µm	----	1	%		<1	----	<1	<1	71
+1180µm	----	1	%		<1	----	<1	<1	42
+2.36mm	----	1	%		<1	----	<1	<1	26
+4.75mm	----	1	%		<1	----	<1	<1	12
+9.5mm	----	1	%		<1	----	<1	<1	9
+19.0mm	----	1	%		<1	----	<1	<1	<1
+37.5mm	----	1	%		<1	----	<1	<1	<1
+75.0mm	----	1	%		<1	----	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		34	----	36	38	<1
Silt (2-60 µm)	----	1	%		53	----	53	54	1
Sand (0.06-2.00 mm)	----	1	%		13	----	11	8	68
Gravel (>2mm)	----	1	%		<1	----	<1	<1	31
Cobbles (>6cm)	----	1	%		<1	----	<1	<1	<1
EA151: Settleability 10%									
∅ Underflow Density	----	0.01	g/cm3		1.07	----	1.07	1.08	1.93
∅ Underflow Solids	----	0.1	%		35.4	----	32.8	35.0	74.0
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		0.800	----	0.267	2.60	56.6
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		0.150	----	0.075	0.200	56.6
∅ Clarity	----	-	-		Clear	----	Clear	Clear	Clear
EA151: Settleability 20%									
∅ Underflow Density	----	0.01	g/cm3		1.15	----	1.11	1.10	1.96
∅ Underflow Solids	----	0.1	%		21.3	----	19.6	26.7	72.7
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		0.017	----	0.010	0.050	24.4
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		0.006	----	0.010	0.014	24.4
∅ Clarity	----	-	-		Clear	----	Clear	Clear	Clear
EA152: Soil Particle Density									
∅ Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.55	----	----	----	2.61



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TB_18	TB_26	TB_29	D5	REF_01
Client sampling date / time					25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	27-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-028	EB1823470-029	EB1823470-030	EB1823470-031	EB1823470-033
					Result	Result	Result	Result	Result
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		7.24	7.83	8.01	8.05	18.4
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		22.6	23.2	25.9	25.8	4.0
Copper	7440-50-8	1.0	mg/kg		23.4	19.5	23.4	24.1	3.6
Lead	7439-92-1	1.0	mg/kg		14.4	14.0	15.6	15.8	11.4
Nickel	7440-02-0	1.0	mg/kg		13.2	13.6	14.7	14.7	3.2
Zinc	7440-66-6	1.0	mg/kg		51.9	49.9	54.5	56.1	7.0
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.03	0.03	0.03	0.03	<0.01
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		1.15	1.05	0.92	0.90	0.23
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		4	6	6	6	<3
>C16 - C34 Fraction	----	3	mg/kg		26	40	33	47	10
>C34 - C40 Fraction	----	5	mg/kg		12	17	15	14	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg		42	63	54	67	10
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		4	6	6	6	<3
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg		4	6	6	5	<3
C15 - C28 Fraction	----	3	mg/kg		18	28	23	35	7
C29 - C36 Fraction	----	5	mg/kg		14	23	18	19	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg		36	57	47	59	7
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		<3.0	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.4	<0.4	<0.4	<0.4	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TB_18	TB_26	TB_29	D5	REF_01
Client sampling date / time					25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	27-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-028	EB1823470-029	EB1823470-030	EB1823470-031	EB1823470-033
					Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued									
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg		<0.2	<0.2	<0.2	<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		1	<1	<1	1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg		3.3	1.1	2.3	2.1	<0.5
EP131A: Organochlorine Pesticides									
Aldrin	309-00-2	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
alpha-BHC	319-84-6	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
beta-BHC	319-85-7	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
delta-BHC	319-86-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
4,4'-DDD	72-54-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
4,4'-DDE	72-55-9	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
4,4'-DDT	50-29-3	0.50	µg/kg		<0.50	<0.50	<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	<0.50	<0.50	----
Dieldrin	60-57-1	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
alpha-Endosulfan	959-98-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
beta-Endosulfan	33213-65-9	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
Endosulfan sulfate	1031-07-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
^ Endosulfan (sum)	115-29-7	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
Endrin	72-20-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
Endrin aldehyde	7421-93-4	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
Endrin ketone	53494-70-5	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
Heptachlor	76-44-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
Heptachlor epoxide	1024-57-3	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
gamma-BHC	58-89-9	0.25	µg/kg		<0.25	<0.25	<0.25	<0.25	----
Methoxychlor	72-43-5	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
cis-Chlordane	5103-71-9	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
trans-Chlordane	5103-74-2	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
^ Total Chlordane (sum)	----	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	----
Oxychlordane	27304-13-8	0.50	µg/kg		<0.50	<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	<0.50	----

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TB_18		TB_26		TB_29		D5		REF_01		
Client sampling date / time				25-Sep-2018 00:00		25-Sep-2018 00:00		25-Sep-2018 00:00		25-Sep-2018 00:00		27-Sep-2018 00:00			
Compound		CAS Number	LOR	Unit	EB1823470-028		EB1823470-029		EB1823470-030		EB1823470-031		EB1823470-033		
					Result		Result		Result		Result		Result		
EP131A: Organochlorine Pesticides - Continued															
EP132B: Polynuclear Aromatic Hydrocarbons															
Naphthalene		91-20-3	5	µg/kg	13		13		12		17		<5		
2-Methylnaphthalene		91-57-6	5	µg/kg	<5		<5		<5		<5		<5		
Acenaphthylene		208-96-8	4	µg/kg	<5		<5		<5		<5		<4		
Acenaphthene		83-32-9	4	µg/kg	<5		<5		<5		<5		<4		
Fluorene		86-73-7	4	µg/kg	<5		<5		<5		<5		<4		
Phenanthrene		85-01-8	4	µg/kg	20		10		9		11		<4		
Anthracene		120-12-7	4	µg/kg	6		<5		<5		<5		<4		
Fluoranthene		206-44-0	4	µg/kg	60		17		15		22		<4		
Pyrene		129-00-0	4	µg/kg	52		14		13		19		<4		
Benz(a)anthracene		56-55-3	4	µg/kg	30		8		8		12		<4		
Chrysene		218-01-9	4	µg/kg	25		8		8		11		<4		
Benzo(b+j)fluoranthene		205-99-2	205-82-3	4	µg/kg	33		9		10		10		<4	
Benzo(k)fluoranthene		207-08-9	4	µg/kg	13		<5		<5		5		<4		
Benzo(e)pyrene		192-97-2	4	µg/kg	19		5		6		7		<4		
Benzo(a)pyrene		50-32-8	4	µg/kg	28		7		7		9		<4		
Perylene		198-55-0	4	µg/kg	21		12		12		14		<4		
Benzo(g,h,i)perylene		191-24-2	4	µg/kg	22		7		7		7		<4		
Dibenz(a,h)anthracene		53-70-3	4	µg/kg	6		<5		<5		<5		<4		
Indeno(1.2.3.cd)pyrene		193-39-5	4	µg/kg	19		6		6		6		<4		
Coronene		191-07-1	5	µg/kg	8		<5		<5		<5		<5		
^ Sum of PAHs		----	4	µg/kg	375		116		113		150		<4		
Radionuclides / Activity															
Gross alpha		----	500	Bq/kg DW	<500		920		1100		670		----		
Gross beta		----	500	Bq/kg DW	<500		560		530		520		----		
EP080-SD: TPH(V)/BTEX Surrogates															
1,2-Dichloroethane-D4		17060-07-0	0.2	%	85.4		72.5		80.1		72.9		103		
Toluene-D8		2037-26-5	0.2	%	72.9		56.1		62.3		57.3		78.6		
4-Bromofluorobenzene		460-00-4	0.2	%	93.4		71.9		81.0		75.6		100		
EP090S: Organotin Surrogate															
Tripropyltin		----	0.5	%	68.8		84.6		78.1		89.6		95.5		
EP131S: OC Pesticide Surrogate															
Dibromo-DDE		21655-73-2	0.50	%	70.8		43.8		76.1		67.6		----		
EP132T: Base/Neutral Extractable Surrogates															

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 Work Order : EB1823470 Amendment 3
 Client : ADVISIAN PTY LTD
 Project : 301001.02018 - Port of Mackay Sediment Sampling



Analytical Results

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

Client sample ID

				TB_18	TB_26	TB_29	D5	REF_01
Client sampling date / time				25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	27-Sep-2018 00:00
Compound	CAS Number	LOR	Unit	EB1823470-028	EB1823470-029	EB1823470-030	EB1823470-031	EB1823470-033
				Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued								
2-Fluorobiphenyl	321-60-8	10	%	85.8	91.8	87.7	81.0	77.2
Anthracene-d10	1719-06-8	10	%	86.2	87.3	84.4	103	104
4-Terphenyl-d14	1718-51-0	10	%	88.4	85.4	84.2	80.3	84.5



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	REF_02	REF_03	SG_01	SG_02	SG_03
Client sampling date / time					27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-034	EB1823470-035	EB1823470-036	EB1823470-037	EB1823470-038
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		17.8	17.2	22.0	19.3	16.2
EA150: Particle Sizing									
+75µm	----	1	%		97	----	97	98	98
+150µm	----	1	%		95	----	96	97	97
+300µm	----	1	%		90	----	92	92	90
+425µm	----	1	%		85	----	88	86	81
+600µm	----	1	%		72	----	84	78	71
+1180µm	----	1	%		30	----	74	58	49
+2.36mm	----	1	%		8	----	64	26	26
+4.75mm	----	1	%		2	----	57	5	17
+9.5mm	----	1	%		<1	----	52	<1	13
+19.0mm	----	1	%		<1	----	33	<1	13
+37.5mm	----	1	%		<1	----	<1	<1	<1
+75.0mm	----	1	%		<1	----	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		1	----	1	<1	<1
Silt (2-60 µm)	----	1	%		1	----	2	1	1
Sand (0.06-2.00 mm)	----	1	%		83	----	30	63	66
Gravel (>2mm)	----	1	%		15	----	67	36	33
Cobbles (>6cm)	----	1	%		<1	----	<1	<1	<1
EA151: Settleability 10%									
∅ Underflow Density	----	0.01	g/cm3		1.99	----	1.83	1.74	1.79
∅ Underflow Solids	----	0.1	%		71.7	----	68.3	71.8	69.9
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		58.4	----	55.6	57.0	58.0
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		58.4	----	55.6	57.0	58.0
∅ Clarity	----	-	-		Clear	----	Clear	Clear	Clear
EA151: Settleability 20%									
∅ Underflow Density	----	0.01	g/cm3		1.99	----	2.10	2.06	1.78
∅ Underflow Solids	----	0.1	%		71.7	----	68.1	69.5	70.3
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		24.8	----	24.6	24.2	24.6
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		24.8	----	24.6	24.2	24.6
∅ Clarity	----	-	-		Clear	----	Clear	Clear	Clear
EA152: Soil Particle Density									
∅ Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		3.08	----	----	2.49	2.41



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	REF_02	REF_03	SG_01	SG_02	SG_03
Client sampling date / time					27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-034	EB1823470-035	EB1823470-036	EB1823470-037	EB1823470-038
					Result	Result	Result	Result	Result
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		9.70	9.88	5.62	6.69	8.64
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		3.7	3.1	4.0	2.2	2.6
Copper	7440-50-8	1.0	mg/kg		1.2	1.2	1.6	1.2	1.5
Lead	7439-92-1	1.0	mg/kg		3.1	2.4	2.7	2.2	2.4
Nickel	7440-02-0	1.0	mg/kg		1.7	1.5	2.0	1.4	1.7
Zinc	7440-66-6	1.0	mg/kg		4.0	4.3	5.3	3.4	6.2
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.25	0.20	0.24	0.20	0.19
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
>C16 - C34 Fraction	----	3	mg/kg		13	7	12	5	6
>C34 - C40 Fraction	----	5	mg/kg		6	<5	<5	<5	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg		19	7	12	5	6
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	<3	<3	<3	<3
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg		9	4	7	<3	4
C29 - C36 Fraction	----	5	mg/kg		7	<5	7	<5	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg		16	4	14	<3	4
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		<3.0	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	<0.2	<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	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	REF_02	REF_03	SG_01	SG_02	SG_03
Client sampling date / time				27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	
Compound	CAS Number	LOR	Unit	EB1823470-034	EB1823470-035	EB1823470-036	EB1823470-037	EB1823470-038	
				Result	Result	Result	Result	Result	
EP080-SD: BTEXN - Continued									
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	<0.2	<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	<1	<1	<1	<1	<1	
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	<0.5	<0.5	
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg	<5	<5	<5	<5	<5	
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5	
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	<4	
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4	
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<4	<4	
Phenanthrene	85-01-8	4	µg/kg	<4	<4	<4	<4	<4	
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	<4	<4	
Fluoranthene	206-44-0	4	µg/kg	<4	<4	<4	<4	<4	
Pyrene	129-00-0	4	µg/kg	<4	<4	<4	<4	<4	
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	<4	<4	
Chrysene	218-01-9	4	µg/kg	<4	<4	<4	<4	<4	
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	<4	<4	<4	<4	
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	<4	<4	
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	<4	<4	
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	<4	<4	<4	
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<4	<4	
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	<4	<4	<4	
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	<4	
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	<4	<4	
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5	
^ Sum of PAHs	----	4	µg/kg	<4	<4	<4	<4	<4	
EP080-SD: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%	101	89.3	92.7	91.8	91.3	
Toluene-D8	2037-26-5	0.2	%	83.8	91.4	91.4	91.6	87.6	
4-Bromofluorobenzene	460-00-4	0.2	%	102	93.4	94.5	92.6	92.9	
EP090S: Organotin Surrogate									



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	REF_02	REF_03	SG_01	SG_02	SG_03
Client sampling date / time					27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823470-034	EB1823470-035	EB1823470-036	EB1823470-037	EB1823470-038
					Result	Result	Result	Result	Result
EP090S: Organotin Surrogate - Continued									
Tripopyltin	----	0.5	%		149	94.4	89.4	86.3	153
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		83.6	83.2	83.8	73.4	95.7
Anthracene-d10	1719-06-8	10	%		103	112	105	94.9	80.6
4-Terphenyl-d14	1718-51-0	10	%		82.7	88.2	83.3	85.6	72.3



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	H-3	----	----	----	----
Client sampling date / time					25-Sep-2018 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1823470-039	-----	-----	-----	-----
				Result	----	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		52.3	----	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		7.30	----	----	----	----
Cadmium	7440-43-9	0.1	mg/kg		<0.1	----	----	----	----
Chromium	7440-47-3	1.0	mg/kg		16.0	----	----	----	----
Copper	7440-50-8	1.0	mg/kg		140	----	----	----	----
Lead	7439-92-1	1.0	mg/kg		27.7	----	----	----	----
Nickel	7440-02-0	1.0	mg/kg		8.4	----	----	----	----
Zinc	7440-66-6	1.0	mg/kg		165	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.03	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.77	----	----	----	----
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		18	----	----	----	----
Dibutyltin	1002-53-5	1	µgSn/kg		50	----	----	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg		177	----	----	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		115	----	----	----	----



Analytical Results

Sub-Matrix: **WATER**
 (Matrix: **WATER**)

Client sample ID

				Rinsate 1	Rinsate 2	Rinsate 3	Rinsate 4	----
Client sampling date / time				24-Sep-2018 00:00	25-Sep-2018 00:00	26-Sep-2018 00:00	27-Sep-2018 00:00	----
Compound	CAS Number	LOR	Unit	EB1823470-048	EB1823470-049	EB1823470-050	EB1823470-051	-----
				Result	Result	Result	Result	----
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----



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

Certificate of Analysis

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Newcastle, NSW



CLIENT: Bill Boylson

DATE REPORTED: 24-Oct-2018

COMPANY: ADVISIAN PTY LTD

DATE RECEIVED: 27-Sep-2018

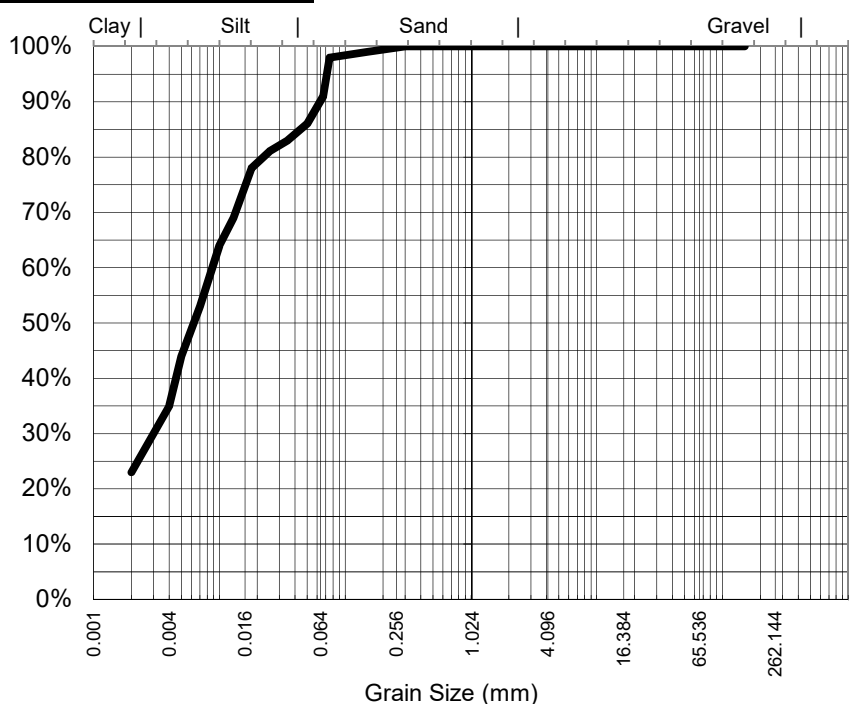
ADDRESS: LEVEL 3
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BRISBANE

REPORT NO: EB1823470-014 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: B1_02 (T2)

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	98%
Particle Size (microns)	
50	86%
35	83%
25	81%
18	78%
13	69%
10	64%
7	53%
5	44%
2	23%

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)*	<0.007
----------------------------	--------

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.4 (2.45)* g/cm³

D Blane

Dianne Blane
Laboratory Coordinator
Authorised Signatory



NATA Accreditation: 825 Site: Newcastle
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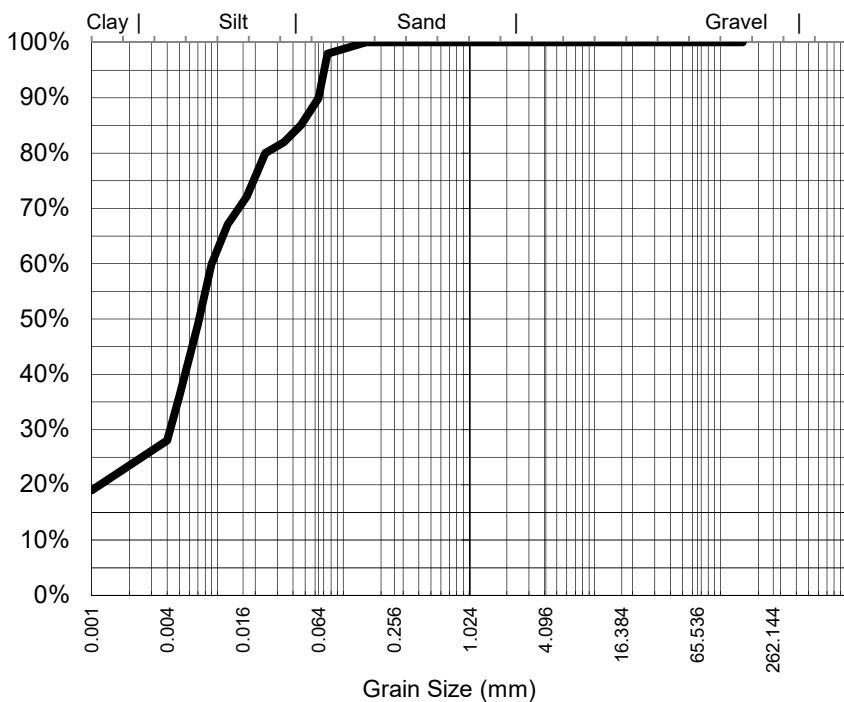
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REPORT NO: EB1823470-015 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: B1_02 (T3)

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
0.150	100%
0.075	98%
Particle Size (microns)	
46	85%
34	82%
24	80%
17	72%
12	67%
9	60%
7	49%
5	36%
1	19%

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

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

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.58 g/cm³

D Blane

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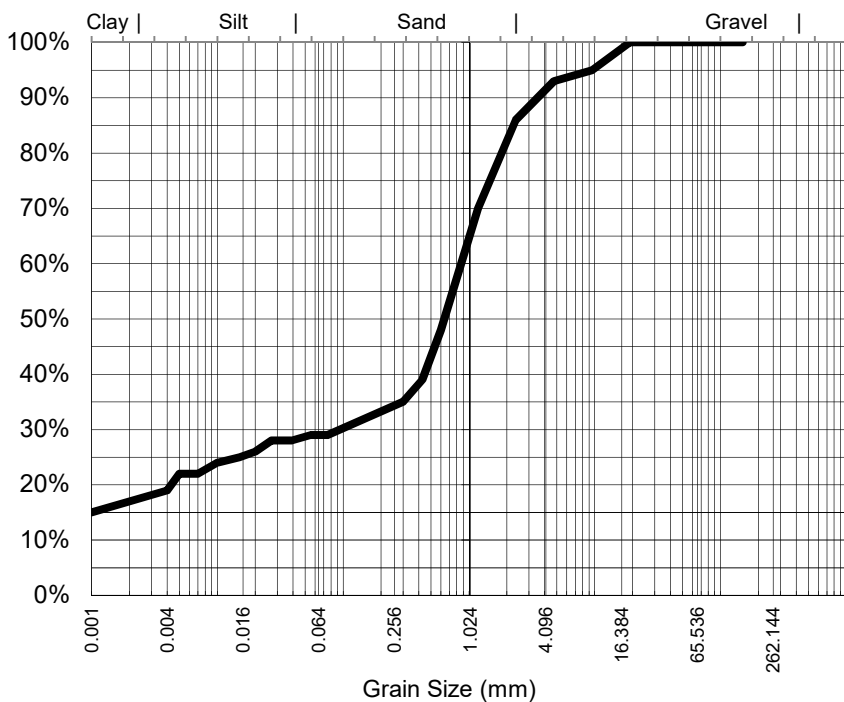
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BRISBANE

REPORT NO: EB1823470-001 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: SB_02 (T1)

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
19.0	100%
9.50	95%
4.75	93%
2.36	86%
1.18	70%
0.600	48%
0.425	39%
0.300	35%
0.150	32%
0.075	29%
Particle Size (microns)	
55	29%
39	28%
27	28%
20	26%
15	25%
10	24%
7	22%
5	22%
1	15%

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

Median Particle Size (mm)*	0.653
----------------------------	-------

Sample Comments:

Analysed: 8-Oct-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND, STONE

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.54 g/cm³

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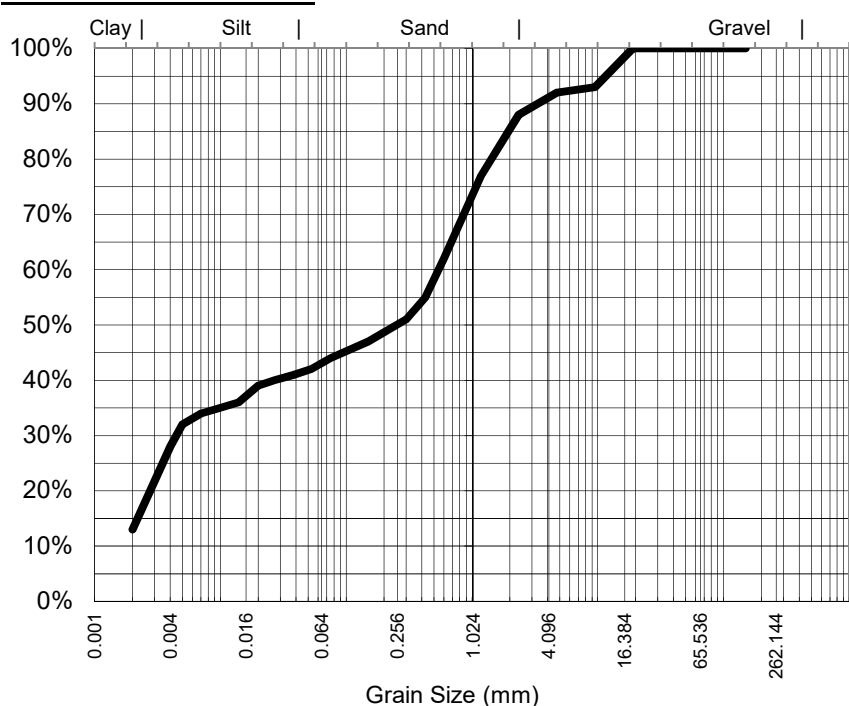
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REPORT NO: EB1823470-002 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: SB_02 (T2)

Particle Size Distribution



Particle Size (mm)	% Passing
19.0	100%
9.50	93%
4.75	92%
2.36	88%
1.18	77%
0.600	62%
0.425	55%
0.300	51%
0.150	47%
0.075	44%
Particle Size (microns)	
53	42%
38	41%
27	40%
20	39%
14	36%
10	35%
7	34%
5	32%
2	13%

Analysis Notes

Samples analysed as received.

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

Median Particle Size (mm)*	0.263
----------------------------	-------

Sample Comments:

Analysed: 8-Oct-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND, STONE

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.49 g/cm³

D Blane

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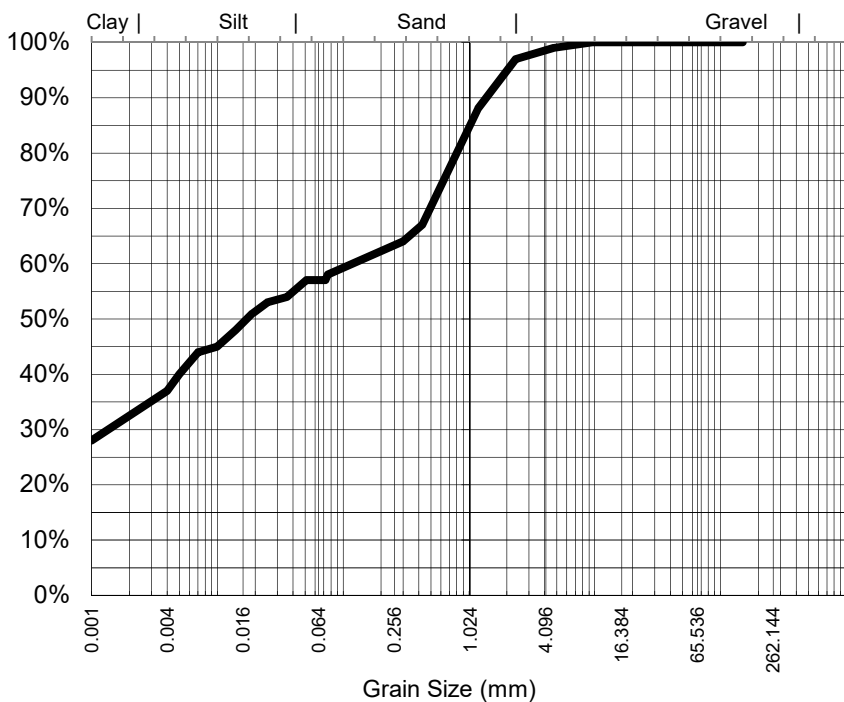
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BRISBANE

REPORT NO: EB1823470-003 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: SB_02 (T3)

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	97%
1.18	88%
0.600	74%
0.425	67%
0.300	64%
0.150	61%
0.075	58%
Particle Size (microns)	
51	57%
36	54%
25	53%
19	51%
14	48%
10	45%
7	44%
5	40%
1	28%

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

Median Particle Size (mm)*	0.017
----------------------------	-------

Sample Comments:

Analysed: 8-Oct-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND, STONE

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.48 g/cm³

D Blane

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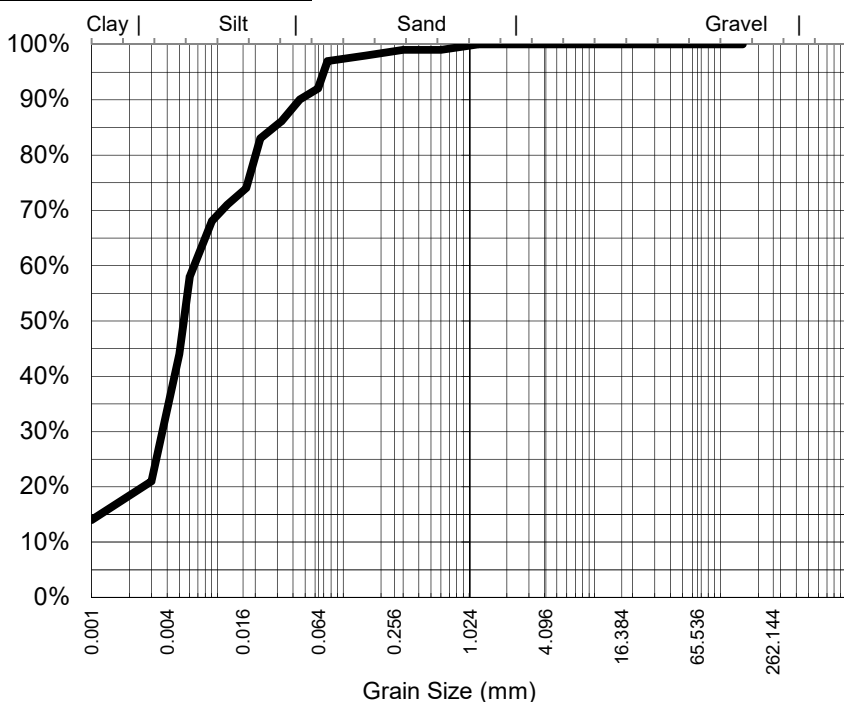
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REPORT NO: EB1823470-004 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: SB_16

Particle Size Distribution



Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	99%
0.300	99%
0.150	98%
0.075	97%
Particle Size (microns)	
45	90%
32	86%
22	83%
17	74%
12	71%
9	68%
6	58%
5	44%
1	14%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was unable to be performed 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.
Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

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

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) g/cm³

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Authorised Signatory

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CLIENT: Bill Boylson

DATE REPORTED: 24-Oct-2018

COMPANY: ADVISIAN PTY LTD

DATE RECEIVED: 27-Sep-2018

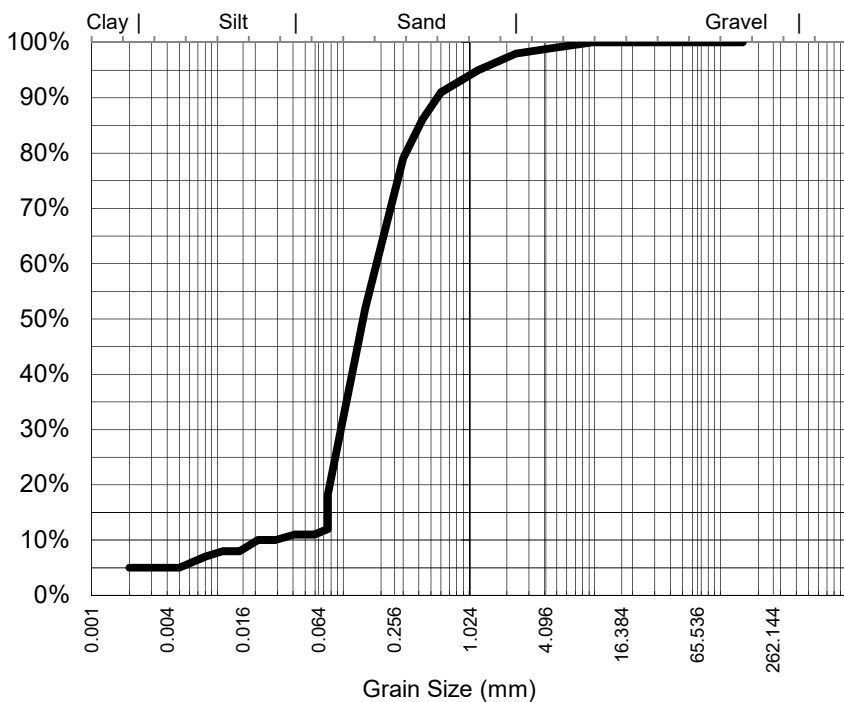
ADDRESS: LEVEL 3
60 ALBERT STREET
BRISBANE

REPORT NO: EB1823470-006 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: SB_45

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	98%
1.18	95%
0.600	91%
0.425	86%
0.300	79%
0.150	52%
0.075	18%
Particle Size (microns)	
59	11%
41	11%
29	10%
21	10%
15	8%
11	8%
8	7%
5	5%
2	5%

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

Median Particle Size (mm)*	0.146
----------------------------	-------

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.59 g/cm³



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Laboratory Coordinator
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Newcastle, NSW



CLIENT: Bill Boylson

DATE REPORTED: 24-Oct-2018

COMPANY: ADVISIAN PTY LTD

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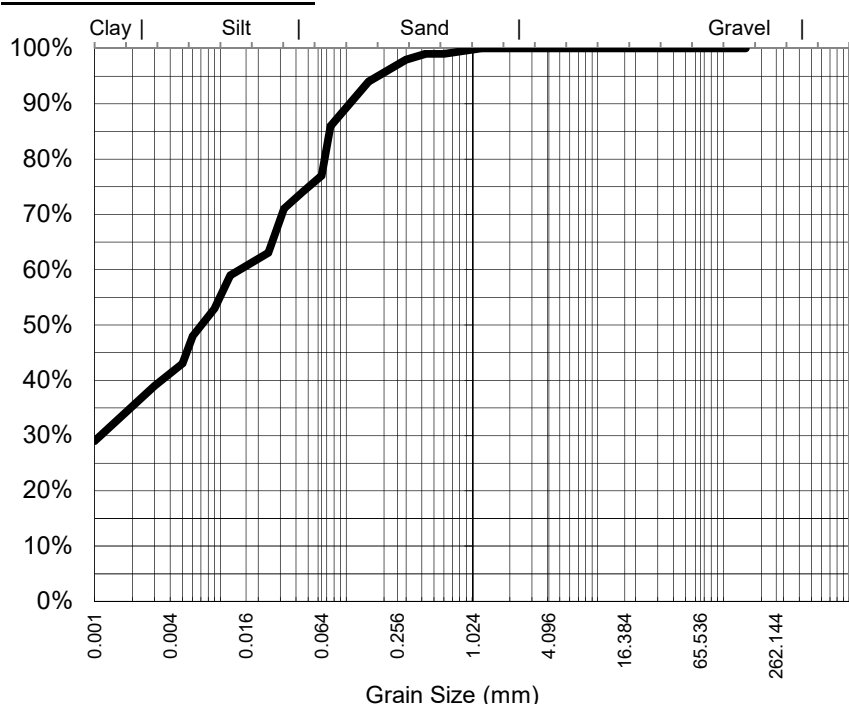
ADDRESS: LEVEL 3
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BRISBANE

REPORT NO: EB1823470-008 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: SB_52

Particle Size Distribution



Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	99%
0.300	98%
0.150	94%
0.075	86%
Particle Size (microns)	
45	74%
32	71%
24	63%
17	61%
12	59%
9	53%
6	48%
5	43%
1	29%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was unable to be performed 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.
Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

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

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) g/cm³

D Blane

Dianne Blane
Laboratory Coordinator
Authorised Signatory

NATA Accreditation: 825 Site: Newcastle
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ALS Environmental
Newcastle, NSW



CLIENT: Bill Boylson

DATE REPORTED: 24-Oct-2018

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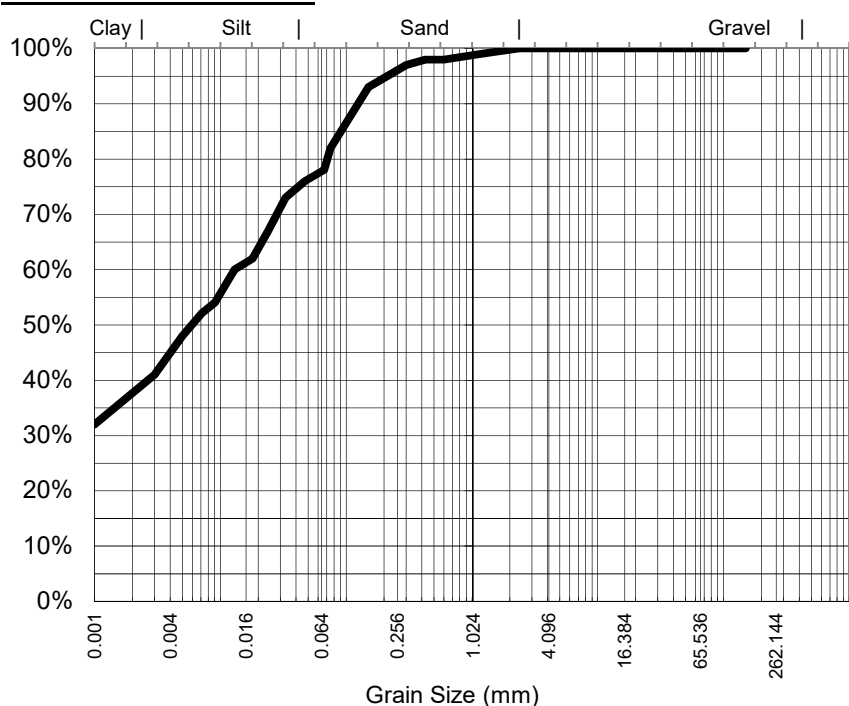
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REPORT NO: EB1823470-010 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: SB_79

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	98%
0.425	98%
0.300	97%
0.150	93%
0.075	82%
Particle Size (microns)	
47	76%
33	73%
24	67%
18	62%
13	60%
9	54%
7	52%
5	48%
1	32%

Analysis Notes

Samples analysed as received.

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

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

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.5 g/cm³

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CLIENT: Bill Boylson

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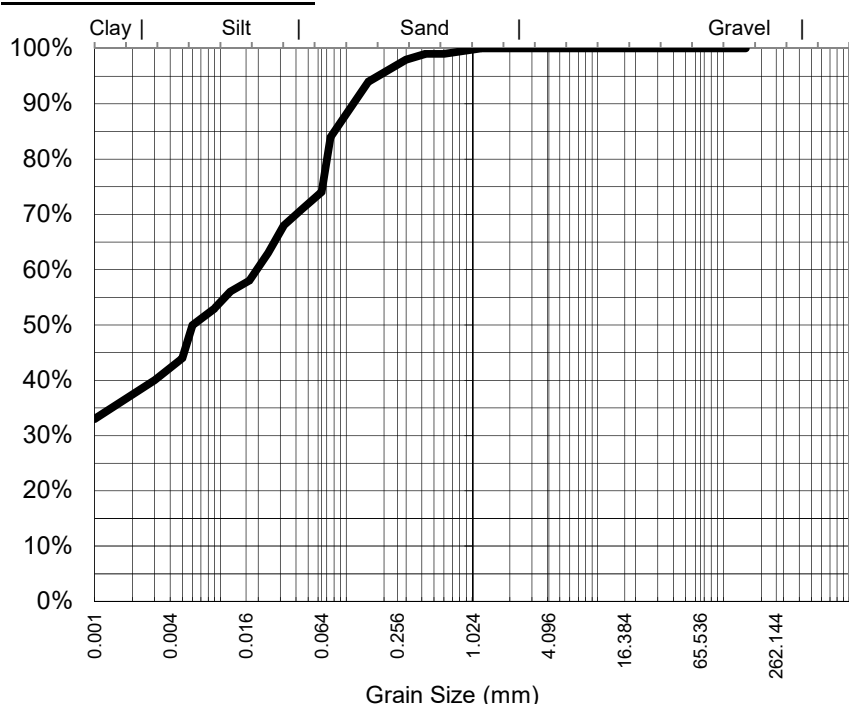
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REPORT NO: EB1823470-011 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: D1

Particle Size Distribution



Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	99%
0.300	98%
0.150	94%
0.075	84%
Particle Size (microns)	
45	71%
32	68%
24	63%
17	58%
12	56%
9	53%
6	50%
5	44%
1	33%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was unable to be performed 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.
Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

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

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) g/cm³

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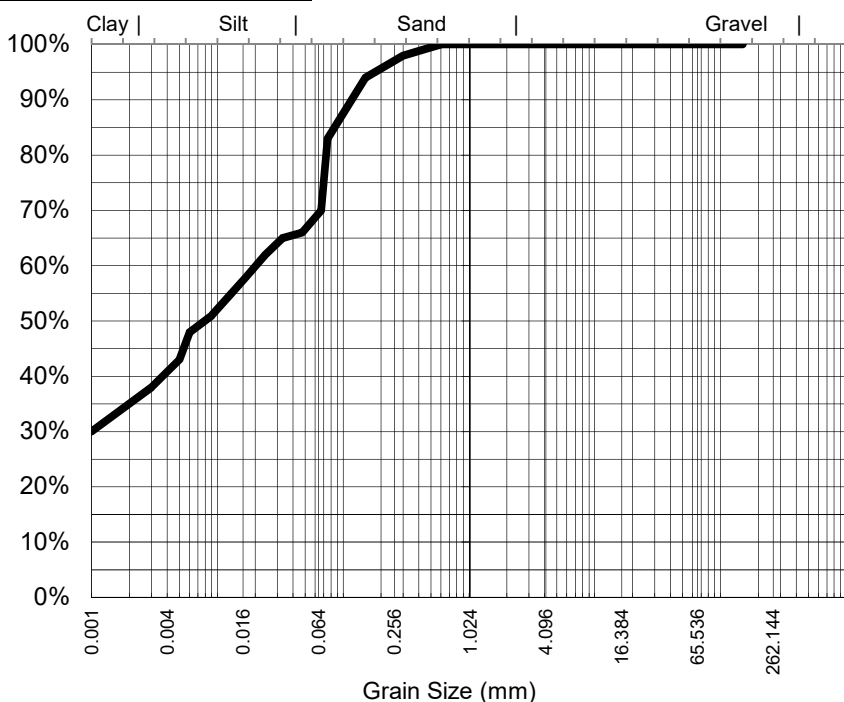
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PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** D2
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
0.600	100%
0.425	99%
0.300	98%
0.150	94%
0.075	83%
Particle Size (microns)	
47	66%
33	65%
24	62%
17	58%
13	55%
9	51%
6	48%
5	43%
1	30%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. 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)*	0.008
----------------------------	-------

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) #N/A g/cm³

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Dianne Blane
Laboratory Coordinator
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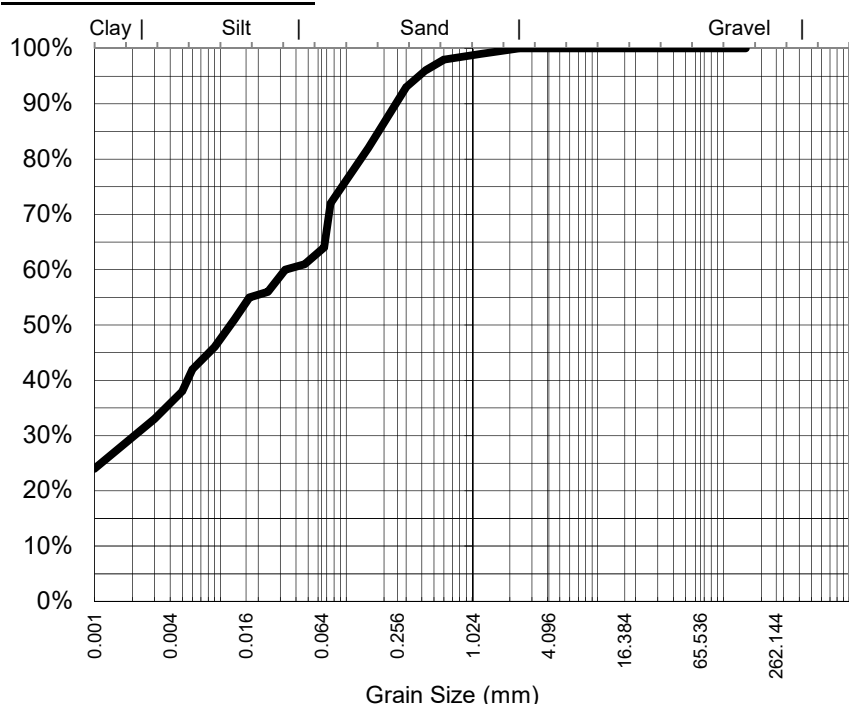
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REPORT NO: EB1823470-013 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: B1_02 (T1)

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	98%
0.425	96%
0.300	93%
0.150	82%
0.075	72%
Particle Size (microns)	
47	61%
33	60%
24	56%
17	55%
13	51%
9	46%
6	42%
5	38%
1	24%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was unable to be performed 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.

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

Median Particle Size (mm)*	0.012
----------------------------	-------

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) g/cm³

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Dianne Blane
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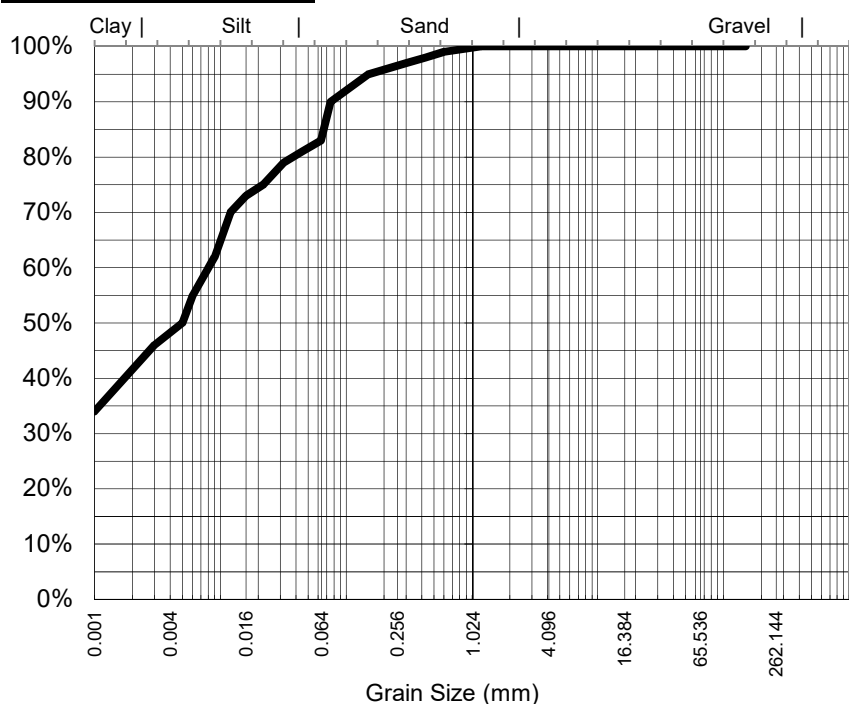
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REPORT NO: EB1823470-017 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: B3_14

Particle Size Distribution



Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	98%
0.300	97%
0.150	95%
0.075	90%
Particle Size (microns)	
45	81%
32	79%
22	75%
16	73%
12	70%
9	62%
6	55%
5	50%
1	34%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was unable to be performed 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.
Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

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

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) g/cm³

D Blane

Dianne Blane
Laboratory Coordinator
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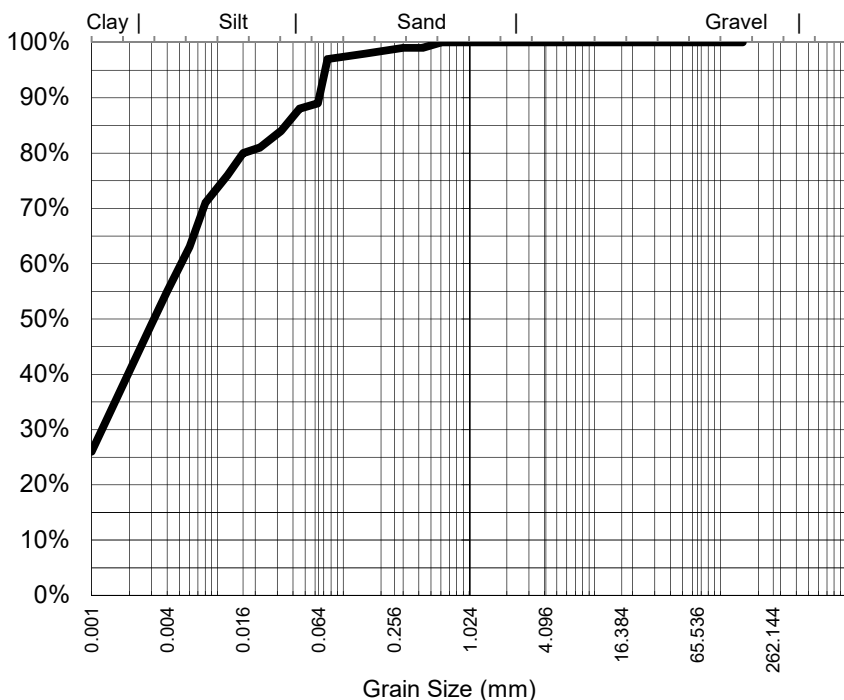
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REPORT NO: EB1823470-018 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: B4_01

Particle Size Distribution



Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was unable to be performed 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.
Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Particle Size (mm)	% Passing
0.600	100%
0.425	99%
0.300	99%
0.150	98%
0.075	97%
Particle Size (microns)	
45	88%
32	84%
22	81%
16	80%
12	76%
8	71%
6	63%
4	55%
1	26%

Sample Comments:

Loss on Pretreatment NA

Sample Description: FINES, SAND

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) g/cm³

Median Particle Size (mm)* <0.006

Analysed: 8-Oct-18

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

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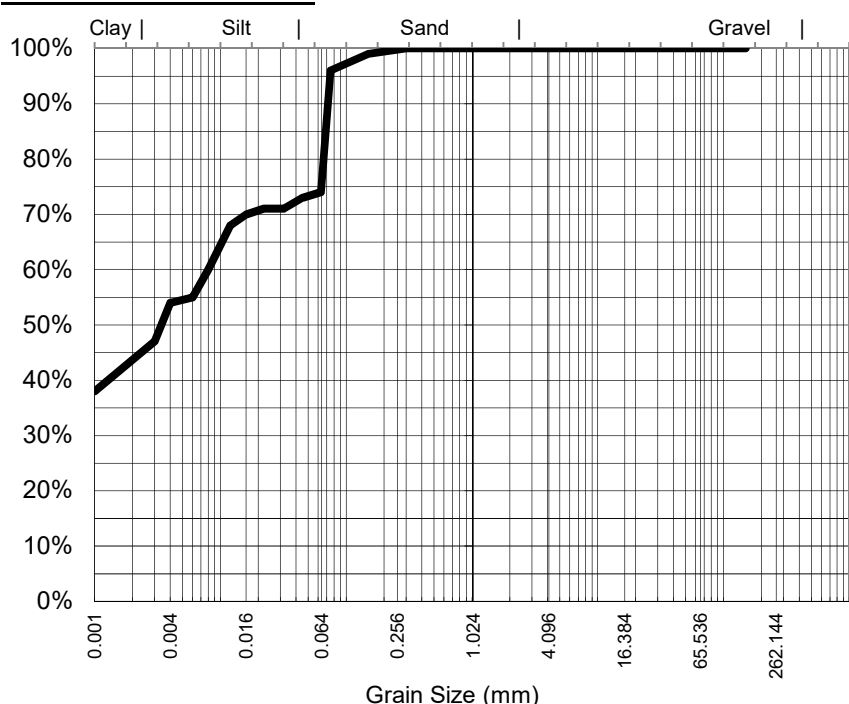
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REPORT NO: EB1823470-020 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: B5_10

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	96%
Particle Size (microns)	
45	73%
32	71%
22	71%
16	70%
12	68%
8	60%
6	55%
4	54%
1	38%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was unable to be performed 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.

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

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

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) g/cm³

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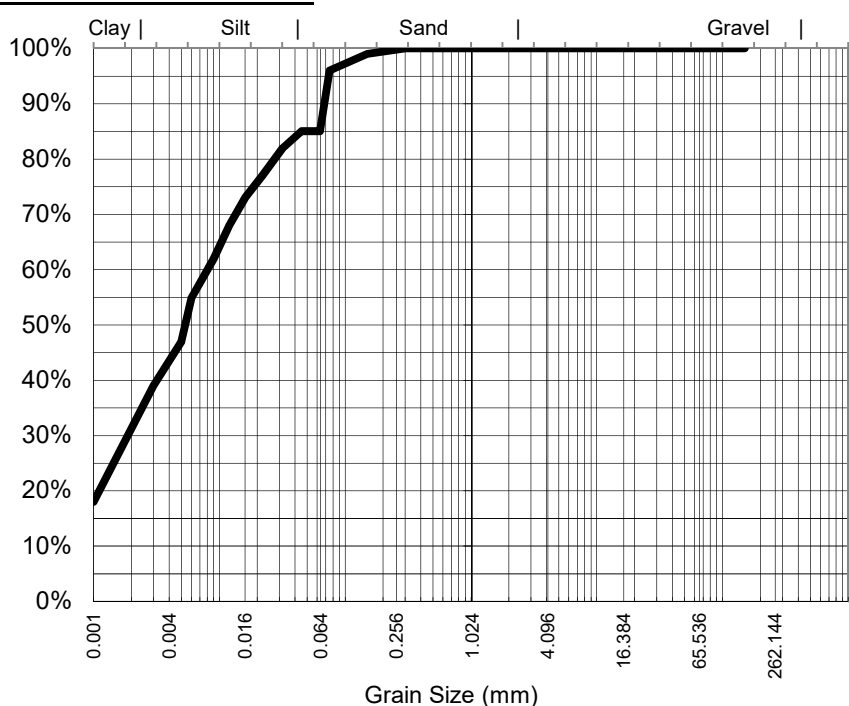
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REPORT NO: EB1823470-021 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: D3

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	96%
Particle Size (microns)	
45	85%
32	82%
22	77%
16	73%
12	68%
9	62%
6	55%
5	47%
1	18%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was unable to be performed 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.
Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

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

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) g/cm³

D Blane

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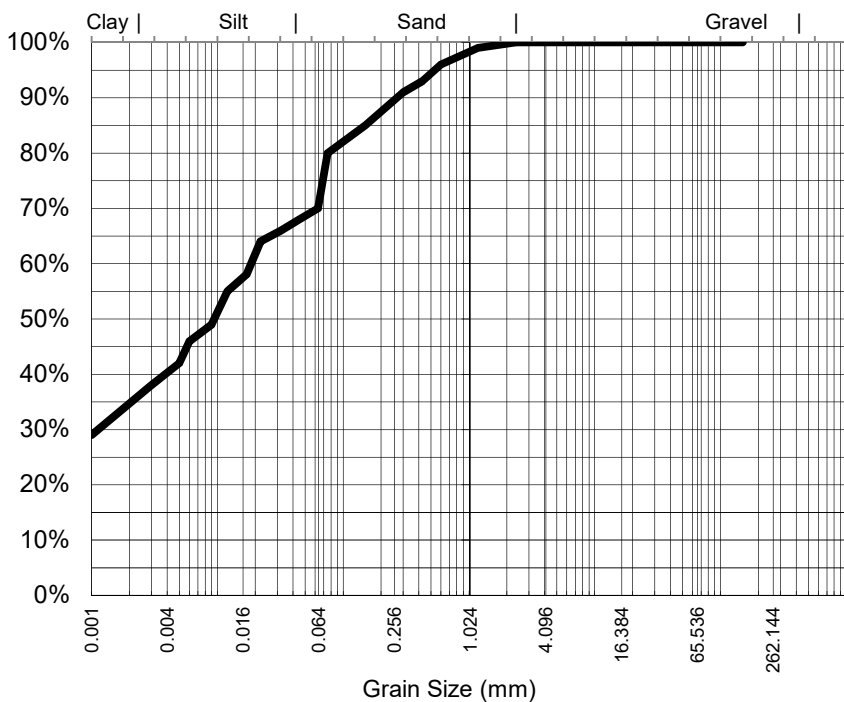
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REPORT NO: EB1823470-023 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: TB_02

Particle Size Distribution



Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was unable to be performed 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.
Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	96%
0.425	93%
0.300	91%
0.150	85%
0.075	80%
Particle Size (microns)	
45	68%
32	66%
22	64%
17	58%
12	55%
9	49%
6	46%
5	42%
1	29%

Sample Comments:

Loss on Pretreatment NA

Sample Description: FINES, SAND

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) g/cm³

Analysed: 8-Oct-18

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

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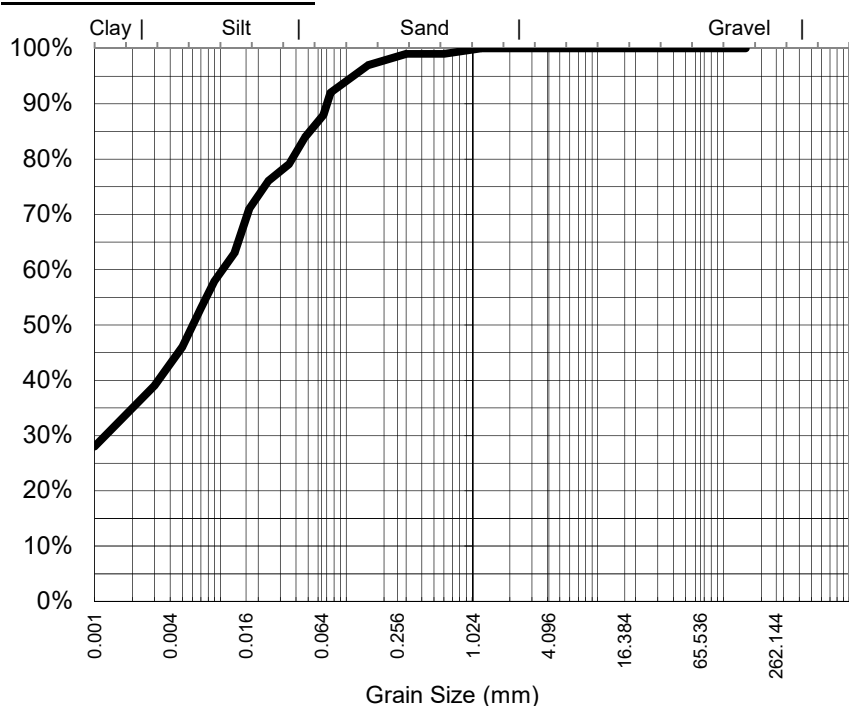
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REPORT NO: EB1823470-028 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: TB_18

Particle Size Distribution



Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	99%
0.300	99%
0.150	97%
0.075	92%
Particle Size (microns)	
47	84%
35	79%
24	76%
17	71%
13	63%
9	58%
7	53%
5	46%
1	28%

Analysis Notes

Samples analysed as received.

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

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

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.55 g/cm³

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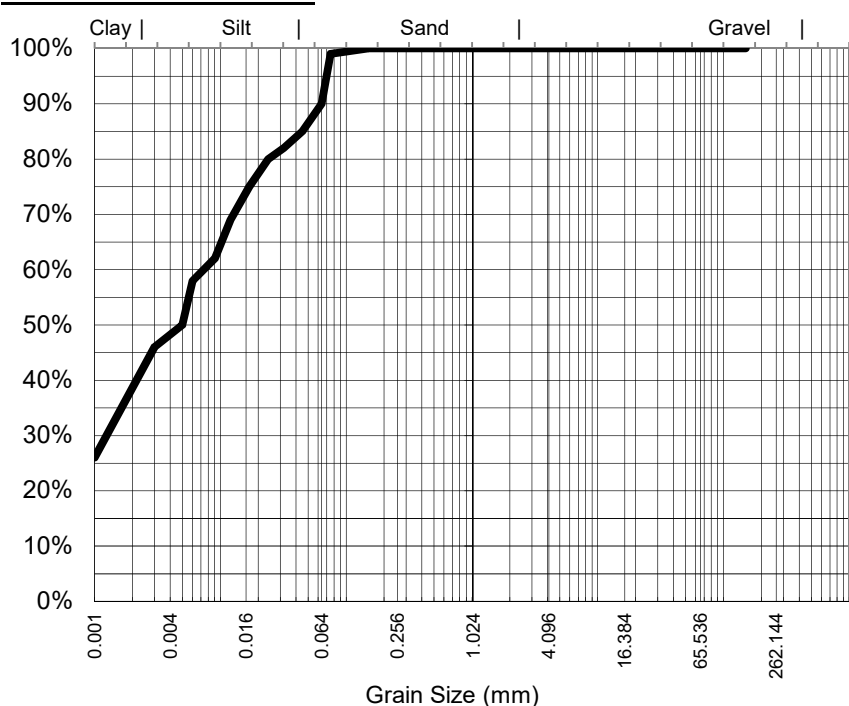
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REPORT NO: EB1823470-030 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: TB_29

Particle Size Distribution



Particle Size (mm)	% Passing
0.150	100%
0.075	99%
Particle Size (microns)	
45	85%
32	82%
24	80%
17	75%
12	69%
9	62%
6	58%
5	50%
1	26%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was unable to be performed 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.

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

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

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) g/cm³

D Blane

Dianne Blane
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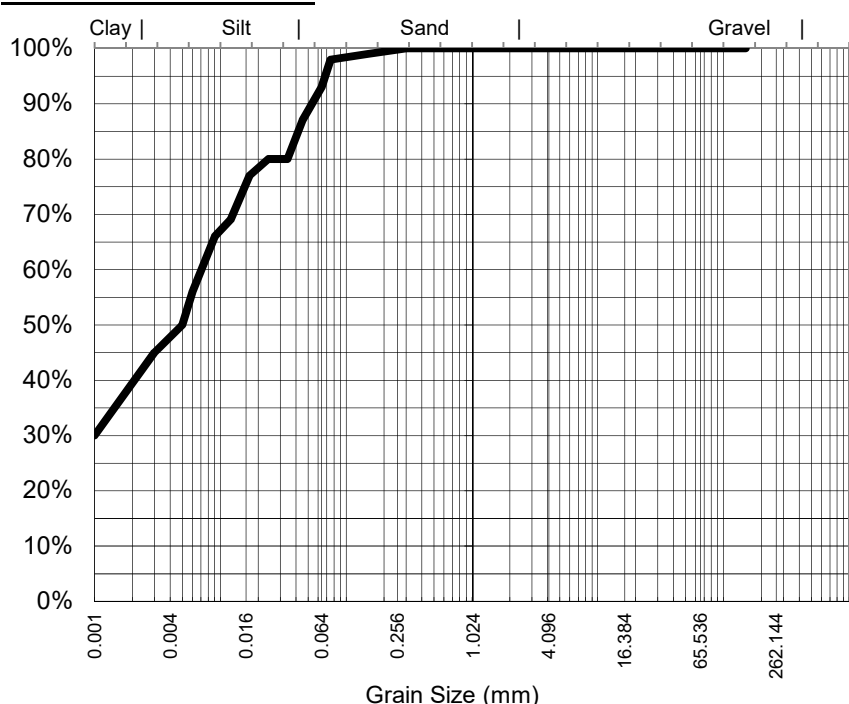
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BRISBANE

REPORT NO: EB1823470-031 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: D5

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	98%
Particle Size (microns)	
45	87%
34	80%
24	80%
17	77%
12	69%
9	66%
6	56%
5	50%
1	30%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was unable to be performed 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.

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

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

Sample Comments:

Analysed: 8-Oct-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

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) g/cm³

D Blane

Dianne Blane
Laboratory Coordinator
Authorised Signatory

NATA Accreditation: 825 Site: Newcastle
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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: 24-Oct-2018

COMPANY: ADVISIAN PTY LTD

DATE RECEIVED: 27-Sep-2018

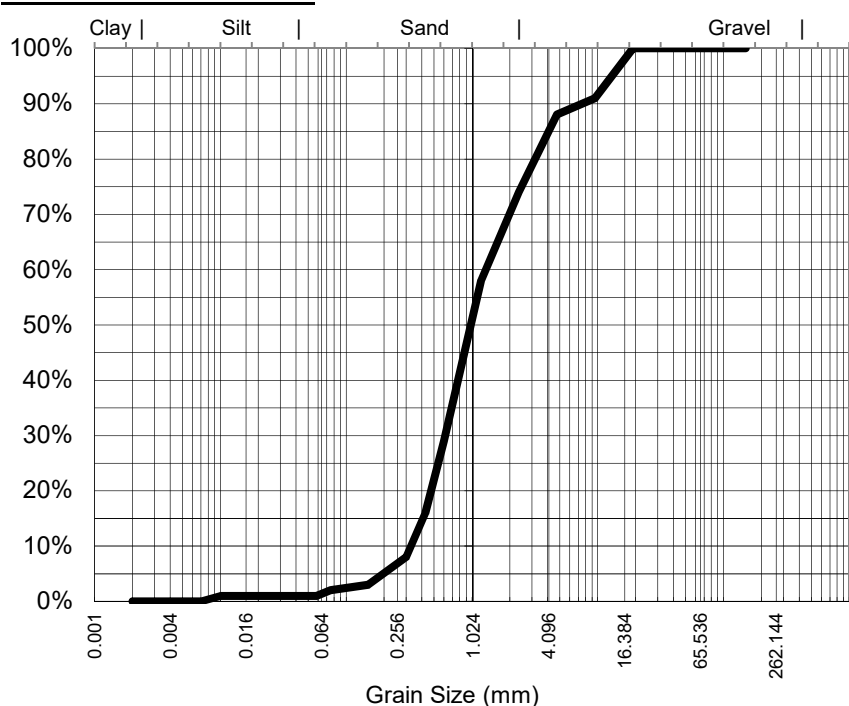
ADDRESS: LEVEL 3
60 ALBERT STREET
BRISBANE

REPORT NO: EB1823470-033 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: REF_01

Particle Size Distribution



Particle Size (mm)	% Passing
19.0	100%
9.50	91%
4.75	88%
2.36	74%
1.18	58%
0.600	29%
0.425	16%
0.300	8%
0.150	3%
0.075	2%
Particle Size (microns)	
58	1%
41	1%
29	1%
20	1%
15	1%
10	1%
7	0%

Analysis Notes

Samples analysed as received.

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

Median Particle Size (mm)*	1.020
----------------------------	-------

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: 8-Oct-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, STONE, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.61 g/cm³

Dianne Blane
Laboratory Coordinator
Authorised Signatory



NATA Accreditation: 825 Site: Newcastle
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samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Bill Boylson

DATE REPORTED: 24-Oct-2018

COMPANY: ADVISIAN PTY LTD

DATE RECEIVED: 27-Sep-2018

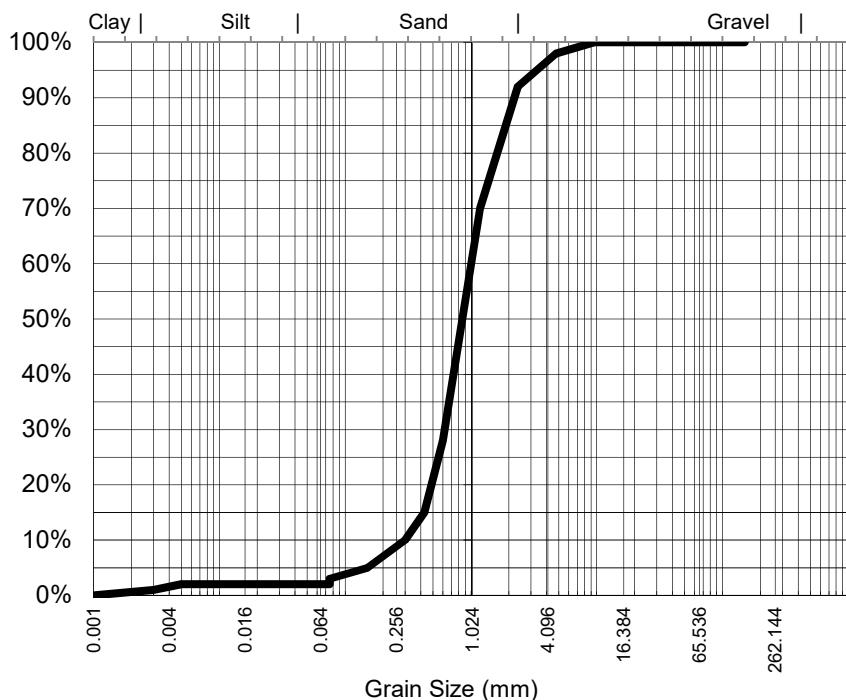
ADDRESS: LEVEL 3
60 ALBERT STREET
BRISBANE

REPORT NO: EB1823470-034 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: REF_02

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	98%
2.36	92%
1.18	70%
0.600	28%
0.425	15%
0.300	10%
0.150	5%
0.075	3%
Particle Size (microns)	
53	2%
38	2%
27	2%
19	2%
14	2%
10	2%
7	2%
5	2%
1	0%

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)*	0.904
----------------------------	-------

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

Loss on Pretreatment NA

Sample Description: SAND, STONE, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 3.08 (2.85)* g/cm³

Analysed: 8-Oct-18

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Dianne Blane
Laboratory Coordinator
Authorised Signatory

NATA Accreditation: 825 Site: Newcastle
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ALS Environmental
Newcastle, NSW



CLIENT: Bill Boylson

DATE REPORTED: 24-Oct-2018

COMPANY: ADVISIAN PTY LTD

DATE RECEIVED: 27-Sep-2018

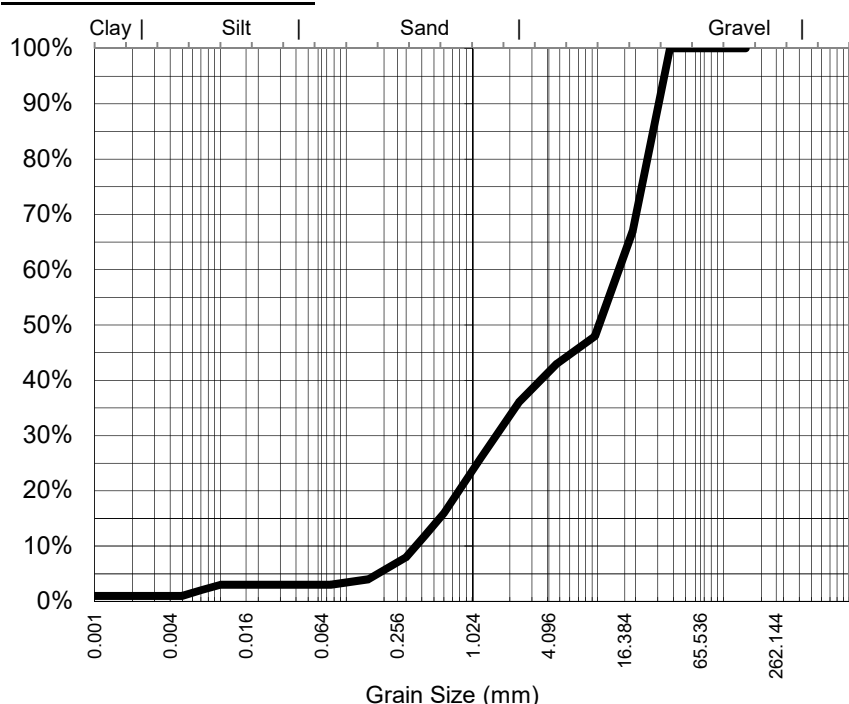
ADDRESS: LEVEL 3
60 ALBERT STREET
BRISBANE

REPORT NO: EB1823470-036 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: SG_01

Particle Size Distribution



Particle Size (mm)	% Passing
37.5	100%
19.0	67%
9.50	48%
4.75	43%
2.36	36%
1.18	26%
0.600	16%
0.425	12%
0.300	8%
0.150	4%
0.075	3%
Particle Size (microns)	
56	3%
40	3%
28	3%
20	3%
15	3%
10	3%
7	2%
5	1%
1	1%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was unable to be performed 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.

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

Median Particle Size (mm)*	10.500
----------------------------	--------

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: 8-Oct-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, STONE, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) g/cm³

NATA Accreditation: 825 Site: Newcastle

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Dianne Blane
Laboratory Coordinator
Authorised Signatory

Certificate of Analysis

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5/585 Maitland Road
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pH 02 4014 2500
fax 02 4968 0349
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ALS Environmental
Newcastle, NSW



CLIENT: Bill Boylson

DATE REPORTED: 24-Oct-2018

COMPANY: ADVISIAN PTY LTD

DATE RECEIVED: 27-Sep-2018

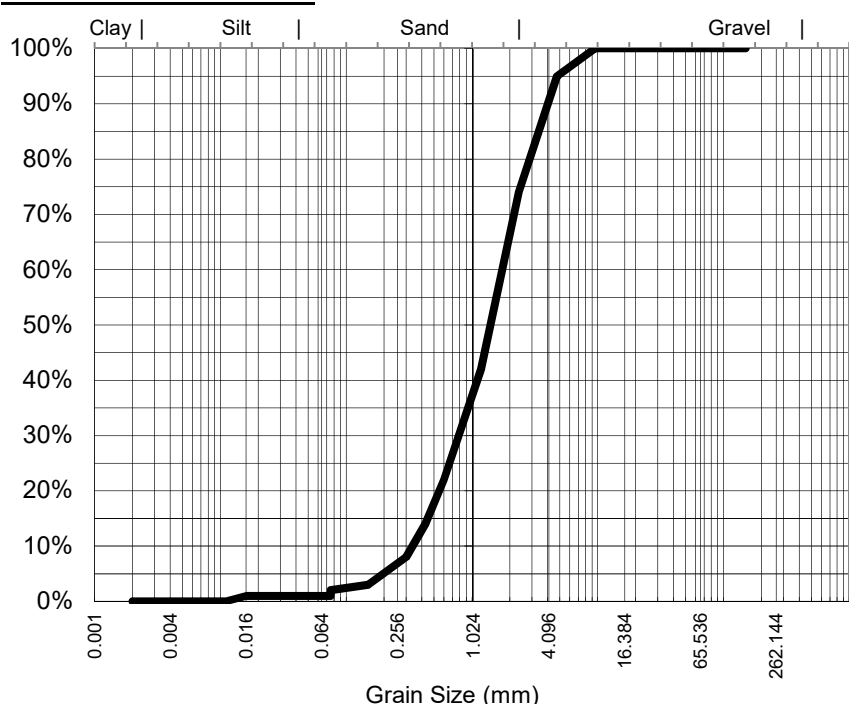
ADDRESS: LEVEL 3
60 ALBERT STREET
BRISBANE

REPORT NO: EB1823470-037 / PSD

PROJECT: 301001.02018 - Port Of Mackay
Sediment Sampling

SAMPLE ID: SG_02

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	95%
2.36	74%
1.18	42%
0.600	22%
0.425	14%
0.300	8%
0.150	3%
0.075	2%
Particle Size (microns)	
60	1%
43	1%
30	1%
21	1%
16	1%
11	0%

Analysis Notes

Samples analysed as received.

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

Median Particle Size (mm)*	1.475
----------------------------	-------

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: 8-Oct-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, STONE, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.49 g/cm³

D Blane

Dianne Blane
Laboratory Coordinator
Authorised Signatory



NATA Accreditation: 825 Site: Newcastle
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Certificate of Analysis

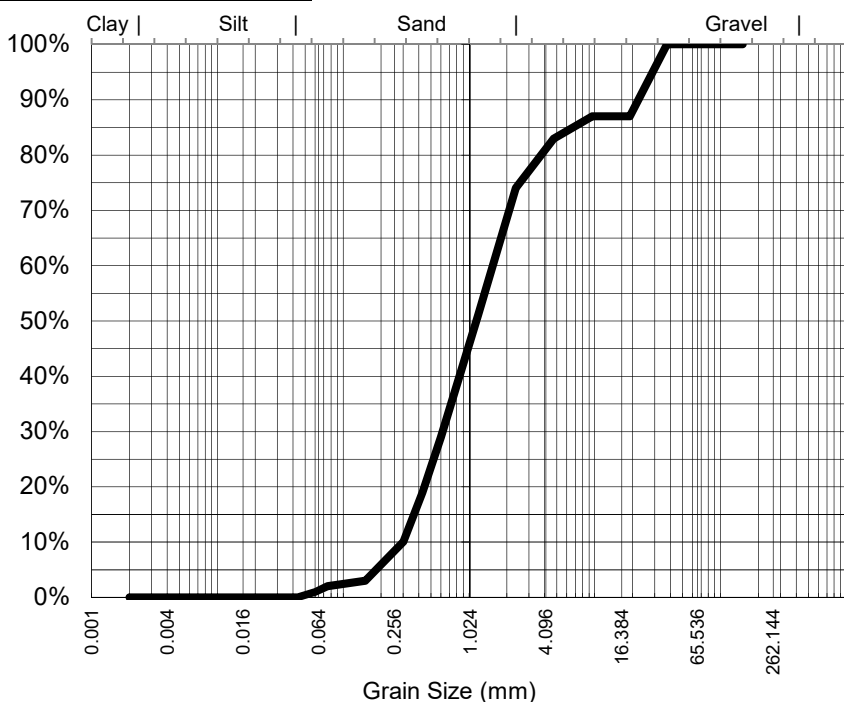
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Bill Boylson **DATE REPORTED:** 24-Oct-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 27-Sep-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1823470-038 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** SG_03
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
37.5	100%
19.0	87%
9.50	87%
4.75	83%
2.36	74%
1.18	51%
0.600	29%
0.425	19%
0.300	10%
0.150	3%
0.075	2%
Particle Size (microns)	
60	1%
43	0%

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)*	1.154
----------------------------	-------

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

Loss on Pretreatment NA

Sample Description: SAND, STONE, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.41 (2.45)* g/cm³

Analysed: 8-Oct-18

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Dianne Blane
Laboratory Coordinator
Authorised Signatory



NATA Accreditation: 825 Site: Newcastle
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CERTIFICATE OF ANALYSIS

Work Order	: PR18A9577	Issue Date	: 06-Nov-2018
Customer	: ALS ENVIRONMENTAL	Laboratory	: ALS Czech Republic, s.r.o.
Contact	: results address	Contact	: Client Service
Address	: 2 Byth Street 4051 Stafford QLD Australia	Address	: Na Harfe 336/9 Prague 9 - Vysocany Czech Republic 190 00
E-mail	: subresults.bri@alsglobal.com	E-mail	: customer.support@alsglobal.com
Telephone	: ----	Telephone	: +420 226 226 228
Project	: EB1823470	Page	: 1 of 3
Order number	: 503857	Date Samples	: 25-Sep-2018
		Received	
		Quote number	: PR2015ALSEN-AU0002 (CZ-251-15-0965)
Site	: ----	Date of test	: 23-Oct-2018 - 05-Nov-2018
Sampled by	: client	QC Level	: ALS CR Standard Quality Control Schedule

General Comments

This report shall not be reproduced except in full, without prior written approval from the laboratory.
The laboratory declares that the test results relate only to the listed samples.

Responsible for accuracy

Testing Laboratory No. 1163
Accredited by CAI according to
CSN EN ISO/IEC 17025:2005

Signatories

Zdeněk Jiráček

Position

Environmental Business Unit
Manager





Analytical Results

Sub-Matrix: SOIL				Client sample ID		TB_02		TB_05 (T1)		TB_05 (T2)	
				Laboratory sample ID		PR18A9577-001		PR18A9577-002		PR18A9577-003	
				Client sampling date / time		22-Oct-2018 00:00		22-Oct-2018 00:00		22-Oct-2018 00:00	
Parameter		Method	LOR	Unit	Result	MU	Result	MU	Result	MU	
Physical Parameters											
Dry matter @ 105°C		S-DRY-GRCI	0.10	%	96.6	± 6.0%	96.5	± 6.0%	97.0	± 6.0%	
Radiological Parameters											
Gross alpha activity		S-GAA-PRO	500	Bq/kg DW	640	± 54.4%	640	± 54.4%	510	± 66.8%	
Gross beta activity		S-GBA-PRO	500	Bq/kg DW	570	± 60.2%	<500	----	560	± 60.8%	

Sub-Matrix: SOIL				Client sample ID		TB_05 (T3)		TB_12		TB_18	
				Laboratory sample ID		PR18A9577-004		PR18A9577-005		PR18A9577-006	
				Client sampling date / time		22-Oct-2018 00:00		22-Oct-2018 00:00		22-Oct-2018 00:00	
Parameter		Method	LOR	Unit	Result	MU	Result	MU	Result	MU	
Physical Parameters											
Dry matter @ 105°C		S-DRY-GRCI	0.10	%	97.2	± 6.0%	96.1	± 6.0%	96.6	± 6.0%	
Radiological Parameters											
Gross alpha activity		S-GAA-PRO	500	Bq/kg DW	570	± 60.0%	<500	----	<500	----	
Gross beta activity		S-GBA-PRO	500	Bq/kg DW	530	± 64.2%	530	± 65.0%	<500	----	

Sub-Matrix: SOIL				Client sample ID		TB_26		TB_29		D5	
				Laboratory sample ID		PR18A9577-007		PR18A9577-008		PR18A9577-009	
				Client sampling date / time		22-Oct-2018 00:00		22-Oct-2018 00:00		22-Oct-2018 00:00	
Parameter		Method		LOR	Unit	Result	MU	Result	MU	Result	MU
Physical Parameters											
Dry matter @ 105°C		S-DRY-GRCI		0.10	%	96.3	± 6.0%	96.5	± 6.0%	96.6	± 6.0%
Radiological Parameters											
Gross alpha activity		S-GAA-PRO		500	Bq/kg DW	920	± 39.3%	1100	± 33.7%	670	± 52.1%
Gross beta activity		S-GBA-PRO		500	Ba/ka DW	560	± 61.6%	530	± 65.0%	520	± 66.2%

Sub-Matrix: SOIL				Client sample ID		D6		----		----	
				Laboratory sample ID		PR18A9577-010		----		----	
				Client sampling date / time		22-Oct-2018 00:00		----		----	
Parameter		Method		LOR	Unit	Result	MU	Result	MU	Result	MU
Physical Parameters											
Dry matter @ 105°C		S-DRY-GRCI		0.10	%	96.4	± 6.0%	----	----	----	----
Radiological Parameters											
Gross alpha activity		S-GAA-PRO		500	Bq/kg DW	540	± 63.2%	----	----	----	----
Gross beta activity		S-GBA-PRO		500	Bq/kg DW	540	± 63.4%	----	----	----	----

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, delivery date in brackets without a time component will be displayed instead. Measurement uncertainty is expressed as expanded measurement uncertainty with coverage factor k = 2, representing 95% confidence level.

Key: LOR = Limit of reporting; MU = Measurement Uncertainty

The end of result part of the certificate of analysis

Brief Method Summaries

Analytical Methods	Method Descriptions
Location of test performance: Bendlova 1687/7 Ceska Lipa Czech Republic 470 01	
S-DRY-GRCI	CZ_SOP_D06_01_045 (CSN ISO 11465, CSN EN 12880, CSN EN 14346), CZ_SOP_D06_07_046 (CSN ISO 11465, CSN EN 12880, CSN EN 14346, CSN 46 5735) Determination of dry matter by gravimetry and determination of moisture by calculation from measured values.
S-GAA-PRO	CZ_SOP_D06_07_368 (CSN 75 7611 and ISO 9696) Determination of gross alpha mass activity by direct measurement of the sample by means of alpha radiation analyzer.



Analytical Methods	Method Descriptions
S-GBA-PRO	CZ_SOP_D06_07_369 (CSN 75 7612, CSN EN ISO 9697) Determination of gross beta mass activity by direct measurement of the sample by means of beta radiation analyzer.
Preparation Methods	Method Descriptions
Location of test performance: Bendlova 1687/7 Ceska Lipa Czech Republic 470 01	
*S-PPHOM.07	CZ_SOP_D06_07_P01 Preparation of solid samples for analysis (crushing, milling and pulverizing).
*S-PPHOM0.3	CZ_SOP_D06_07_P01 Preparation of solid samples for analysis (crushing, milling and pulverizing).

A `` symbol preceding any method indicates laboratory or subcontractor non-accredited test. In the case when a procedure belonging to an accredited method was used for non-accredited matrix, would apply that the reported results are non-accredited. Please refer to General Comment section on front page for information. If the report contains subcontracted analysis, those are made in a subcontracted laboratory outside the laboratories ALS Czech Republic, s.r.o.

The calculation methods of summation parameters are available on request in the client service.



Environmental

QUALITY CONTROL REPORT

Work Order : **EB1823470**

Page : 1 of 23

Amendment : **3**

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 : **58**

No. of samples analysed : **40**

Laboratory : **Environmental Division Brisbane**

Contact : **Caroline Hill**

Address : **2 Byth Street Stafford QLD Australia 4053**

Telephone : **+61 7 3552 8662**

Date Samples Received : **27-Sep-2018**

Date Analysis Commenced : **04-Oct-2018**

Issue Date : **11-Dec-2018**



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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.

Signatories	Position	Accreditation Category
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 Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Kim McCabe	Senior Inorganic Chemist	Brisbane External Subcontracting, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Matt Frost	Senior Organic Chemist	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



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				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: 1963208)									
EB1823470-013	B1_02 (T1)	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.02	0.02	0.00	0% - 20%
EB1823470-025	TB_05 (T2)	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.03	0.02	0.00	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 1963597)									
EB1823470-035	REF_03	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 1963602)									
EB1823470-001	SB_02 (T1)	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	0% - 20%
EB1823470-011	D1	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: 2002069)									
EB1823470-014	B1_02 (T2)	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.03	0.02	0.00	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 1963219)									
EB1823470-013	B1_02 (T1)	EA055: Moisture Content	----	0.1	%	59.7	59.9	0.352	0% - 20%
EB1823470-025	TB_05 (T2)	EA055: Moisture Content	----	0.1	%	58.5	58.6	0.00	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 1963601)									
EB1823470-035	REF_03	EA055: Moisture Content	----	0.1	%	17.2	17.3	0.736	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 1963610)									
EB1823470-001	SB_02 (T1)	EA055: Moisture Content	----	0.1	%	34.2	34.1	0.382	0% - 20%
EB1823470-011	D1	EA055: Moisture Content	----	0.1	%	60.0	59.9	0.192	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2002082)									
EB1823470-014	B1_02 (T2)	EA055: Moisture Content	----	0.1	%	69.2	68.7	0.726	0% - 20%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 1963207)									
EB1823470-013	B1_02 (T1)	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	7.94	8.52	7.02	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	22.0	21.1	3.88	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 (%)
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 1963207) - continued									
EB1823470-013	B1_02 (T1)	EG020-SD: Copper	7440-50-8	1	mg/kg	30.1	33.6	11.1	0% - 20%
		EG020-SD: Lead	7439-92-1	1	mg/kg	10.9	11.3	3.53	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	12.2	11.7	4.42	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	83.0	# 276	108	0% - 20%
EB1823470-025	TB_05 (T2)	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	7.56	7.28	3.84	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	20.2	19.1	5.76	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	20.8	20.3	2.84	0% - 20%
		EG020-SD: Lead	7439-92-1	1	mg/kg	12.7	13.3	5.03	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	11.3	11.0	2.46	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	49.6	47.7	3.75	0% - 20%
		EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 1963596)							
EB1823470-035	REF_03	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	9.88	9.45	4.46	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	3.1	2.9	9.43	No Limit
		EG020-SD: Copper	7440-50-8	1	mg/kg	1.2	1.1	10.7	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	2.4	2.2	7.35	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	1.5	1.3	14.7	No Limit
		EG020-SD: Zinc	7440-66-6	1	mg/kg	4.3	4.3	0.00	No Limit
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 1963603)									
EB1823470-001	SB_02 (T1)	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	13.6	# 3.71	114	0% - 50%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	8.4	7.6	9.59	No Limit
		EG020-SD: Copper	7440-50-8	1	mg/kg	9.0	5.9	42.2	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	6.6	5.2	24.0	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	8.0	4.6	53.0	No Limit
		EG020-SD: Zinc	7440-66-6	1	mg/kg	18.6	15.9	15.8	0% - 50%
EB1823470-011	D1	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	6.68	5.98	11.1	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	21.2	19.1	10.4	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	16.1	14.1	13.1	0% - 50%
		EG020-SD: Lead	7439-92-1	1	mg/kg	13.6	12.9	5.00	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	12.2	11.2	8.04	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	41.8	39.2	6.37	0% - 20%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 2002068)									
EB1823470-014	B1_02 (T2)	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	9.70	9.38	3.42	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	32.2	30.6	5.35	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	18.5	17.7	4.42	0% - 50%
		EG020-SD: Lead	7439-92-1	1	mg/kg	15.2	14.5	4.82	0% - 50%



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: 2002068) - continued									
EB1823470-014	B1_02 (T2)	EG020-SD: Nickel	7440-02-0	1	mg/kg	16.3	15.3	6.22	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	59.0	56.6	4.11	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 1971923)									
EB1823470-001	SB_02 (T1)	EP003: Total Organic Carbon	----	0.02	%	0.54	0.53	2.16	0% - 20%
EB1823470-011	D1	EP003: Total Organic Carbon	----	0.02	%	0.93	0.85	8.31	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 1971924)									
EB1823470-024	TB_05 (T1)	EP003: Total Organic Carbon	----	0.02	%	1.18	1.16	2.20	0% - 20%
EB1823470-035	REF_03	EP003: Total Organic Carbon	----	0.02	%	0.20	0.22	7.76	0% - 50%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2015080)									
EB1822885-021	Anonymous	EP003: Total Organic Carbon	----	0.02	%	2.22	2.15	3.32	0% - 20%
EB1824945-029	Anonymous	EP003: Total Organic Carbon	----	0.02	%	3.54	3.60	1.52	0% - 20%
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1963210)									
EB1823470-013	B1_02 (T1)	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	6	7	0.00	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	22	28	23.0	No Limit
		EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	44	58	27.4	0% - 50%
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	16	23	35.3	No Limit
EB1823470-024	TB_05 (T1)	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	6	6	0.00	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	42	45	6.74	0% - 50%
		EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	89	95	6.52	0% - 20%
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	41	44	7.37	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1963211)									
EB1823470-013	B1_02 (T1)	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
EB1823470-024	TB_05 (T1)	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1963598)									
EB1823470-035	REF_03	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	4	<3	28.9	No Limit
		EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	4	<3	28.6	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: 1963599)									
EB1823470-035	REF_03	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 2002072)									
EB1823470-014	B1_02 (T2)	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	14	13	0.00	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	44	43	3.95	0% - 50%
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	50	36	33.1	0% - 50%
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 2002073)									
EB1823470-014	B1_02 (T2)	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 1963210)									
EB1823470-013	B1_02 (T1)	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	6	7	18.6	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: 1963210) - continued									
EB1823470-013	B1_02 (T1)	EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	31	41	26.5	0% - 50%
		EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	47	# 63	29.1	0% - 20%
		EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	10	15	33.2	No Limit
EB1823470-024	TB_05 (T1)	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	7	8	0.00	No Limit
		EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	64	69	7.49	0% - 20%
		EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	101	110	8.53	0% - 20%
		EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	30	33	10.5	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 1963211)									
EB1823470-013	B1_02 (T1)	EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	0.00	No Limit
EB1823470-024	TB_05 (T1)	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: 1963598)									
EB1823470-035	REF_03	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	7	5	32.5	No Limit
		EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	7	5	33.3	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: 1963599)									
EB1823470-035	REF_03	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: 2002072)									
EB1823470-014	B1_02 (T2)	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	14	14	0.00	No Limit
		EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	69	59	15.6	0% - 20%
		EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	34	24	31.5	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 2002073)									
EB1823470-014	B1_02 (T2)	EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	0.00	No Limit
EP080-SD: BTEXN (QC Lot: 1963211)									
EB1823470-013	B1_02 (T1)	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	<0.4	<0.4	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
EB1823470-024	TB_05 (T1)	EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		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	<0.4	<0.4	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	



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: BTEXN (QC Lot: 1963211) - continued									
EB1823470-024	TB_05 (T1)	EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
EP080-SD: BTEXN (QC Lot: 1963599)									
EB1823470-035	REF_03	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: 2002073)									
EB1823470-014	B1_02 (T2)	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	<0.4	<0.4	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: 1963209)									
EB1823470-013	B1_02 (T1)	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
EB1823470-025	TB_05 (T2)	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	1.7	1.9	6.97	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: 1963600)									
EB1823470-035	REF_03	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: 1963604)									
EB1823470-001	SB_02 (T1)	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
EB1823470-011	D1	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: 2002075)									
EB1823470-014	B1_02 (T2)	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	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 (%)
EP090: Organotin Compounds (QC Lot: 2002075) - continued									
EB1823470-014	B1_02 (T2)	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: 1964998)									
EB1823470-023	TB_02	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
		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
EB1823470-042	NA_03	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



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: 1964998) - continued											
EB1823470-042	NA_03	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		
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1965783)											
EB1823470-013	B1_02 (T1)	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	5	6	0.00	No Limit		
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	14	16	11.8	No Limit		
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	12	15	18.6	No Limit		
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	99	# 171	53.6	0% - 20%		
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	12	21	56.5	No Limit		
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	210	# 337	46.4	0% - 20%		
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	159	# 258	47.8	0% - 20%		
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	82	# 132	46.5	0% - 20%		
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	66	96	36.1	0% - 50%		
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4	µg/kg	58	89	41.7	0% - 50%		
			205-82-3								
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	33	45	32.3	No Limit		
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	32	47	38.8	No Limit		
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	46	73	44.1	0% - 50%		
		EP132B-SD: Perylene	198-55-0	4	µg/kg	21	28	31.2	No Limit		
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	26	40	43.3	No Limit		
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	7	9	29.8	No Limit		
		EP132B-SD: Indeno(1,2,3.cd)pyrene	193-39-5	4	µg/kg	24	37	41.7	No Limit		
		EP132B-SD: Sum of PAHs	----	4	µg/kg	928	# 1470	45.3	0% - 20%		
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	16	34	69.5	No Limit		
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	8	43.2	No Limit		
		EP132B-SD: Coronene	191-07-1	5	µg/kg	6	10	48.2	No Limit		
		EB1823470-026	TB_05 (T3)	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	51	69	29.0	0% - 50%
				EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	8	23	100	No Limit
EP132B-SD: Fluorene	86-73-7			4	µg/kg	25	# 81	105	0% - 50%		



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: 1965783) - continued									
EB1823470-026	TB_05 (T3)	EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	296	# 617	70.4	0% - 20%
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	136	154	13.0	0% - 20%
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	839	807	3.91	0% - 20%
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	644	742	14.2	0% - 20%
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	435	410	6.13	0% - 20%
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	286	328	13.5	0% - 20%
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4	µg/kg	296	334	12.1	0% - 20%
			205-82-3						
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	154	143	7.59	0% - 20%
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	162	186	13.8	0% - 20%
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	329	347	5.24	0% - 20%
		EP132B-SD: Perylene	198-55-0	4	µg/kg	108	# 82	26.8	0% - 20%
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	167	168	0.917	0% - 20%
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	39	42	7.24	No Limit
		EP132B-SD: Indeno(1,2,3.cd)pyrene	193-39-5	4	µg/kg	159	152	4.12	0% - 20%
		EP132B-SD: Sum of PAHs	----	4	µg/kg	4210	4740	11.8	0% - 20%
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	30	10	96.9	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	7	6	0.00	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	41	42	0.00	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1965784)									
EB1823470-037	SG_02	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	<4	<4	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	<4	<4	0.00	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4	µg/kg	<4	<4	0.00	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	<4	0.00	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	0.00	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	<4	0.00	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/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 (%)
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1965784) - continued									
EB1823470-037	SG_02	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: 2005516)									
EB1823470-014	B1_02 (T2)	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	<4	<4	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	6	6	0.00	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	6	6	0.00	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4	µg/kg	4	<4	0.00	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	<4	0.00	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	0.00	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	<4	0.00	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	20	12	50.0	No Limit
		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
Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals by ICP-MS (QC Lot: 1963246)									
EB1823470-048	Rinsate 1	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
EB1823813-005	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit

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Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals by ICP-MS (QC Lot: 1963246) - continued									
EB1823813-005	Anonymous	EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1963186)									
EB1823470-048	Rinsate 1	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	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: 1963208)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.0555 mg/kg	96.8	70	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 1963597)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.0555 mg/kg	130	70	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 1963602)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.0555 mg/kg	86.5	70	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 2002069)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.0555 mg/kg	89.5	70	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1963207)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	101 mg/kg	120	80	124
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.8 mg/kg	109	87	122
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	16.8 mg/kg	114	79	129
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	41.7 mg/kg	115	85	118
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	53.4 mg/kg	114	86	119
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	12.2 mg/kg	118	77	123
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	112 mg/kg	126	71	127
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1963596)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	101 mg/kg	107	80	124
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.8 mg/kg	97.6	87	122
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	16.8 mg/kg	112	79	129
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	41.7 mg/kg	111	85	118
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	53.4 mg/kg	104	86	119
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	12.2 mg/kg	111	77	123
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	112 mg/kg	106	71	127
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1963603)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	101 mg/kg	101	80	124
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.8 mg/kg	108	87	122
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	16.8 mg/kg	107	79	129
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	41.7 mg/kg	107	85	118
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	66.3 mg/kg	101	86	119
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	12.2 mg/kg	107	77	123
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	112 mg/kg	104	71	127
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 2002068)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	116 mg/kg	95.3	80	124



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: 2002068) - continued								
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	102	79	129
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	52.9 mg/kg	91.8	85	118
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	66.3 mg/kg	90.1	86	119
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	14.7 mg/kg	100.0	77	123
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	183 mg/kg	75.9	71	127
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 1971923)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.66 %	100	70	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 1971924)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	1.03 %	102	70	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 2015080)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	1.94 %	99.2	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1963210)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	157 mg/kg	98.8	43	126
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	245 mg/kg	104	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: 1963211)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	16 mg/kg	76.2	66	120
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1963598)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	157 mg/kg	108	43	126
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	245 mg/kg	117	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: 1963599)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	16 mg/kg	100	66	120
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 2002072)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	157 mg/kg	102	43	126
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	245 mg/kg	110	66	140
EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	----	----	----	----
EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	<6	----	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 2002073)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	16 mg/kg	88.1	66	120
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1963210)								
EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	227 mg/kg	100	40	134
EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	162 mg/kg	106	66	136
EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	----	----	----	----

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				
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1963210) - continued								
EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1963211)								
EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	18.5 mg/kg	72.8	66	119
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1963598)								
EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	227 mg/kg	111	40	134
EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	162 mg/kg	119	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: 1963599)								
EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	18.5 mg/kg	101	66	119
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 2002072)								
EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	227 mg/kg	104	40	134
EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	162 mg/kg	110	66	136
EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	----	----	----	----
EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<6	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 2002073)								
EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	18.5 mg/kg	88.8	66	119
EP080-SD: BTEXN (QCLot: 1963211)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	75.8	73	105
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	1 mg/kg	86.8	73	105
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	1 mg/kg	85.0	67	104
EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	2 mg/kg	88.9	66	106
	106-42-3							
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	1 mg/kg	90.4	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	96.8	72	115
EP080-SD: BTEXN (QCLot: 1963599)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	95.2	73	105
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	1 mg/kg	94.6	73	105
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	1 mg/kg	95.5	67	104
EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	2 mg/kg	97.2	66	106
	106-42-3							
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	1 mg/kg	95.4	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	88.5	72	115
EP080-SD: BTEXN (QCLot: 2002073)								



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				
EP080-SD: BTEXN (QCLot: 2002073) - continued								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	87.0	73	105
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	1 mg/kg	84.6	73	105
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	1 mg/kg	83.5	67	104
EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	2 mg/kg	86.1	66	106
	106-42-3							
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	1 mg/kg	87.6	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	84.8	72	115
EP090: Organotin Compounds (QCLot: 1963209)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	75.0	36	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	93.6	42	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	79.3	52	139
EP090: Organotin Compounds (QCLot: 1963600)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	85.5	36	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	91.1	42	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	62.3	52	139
EP090: Organotin Compounds (QCLot: 1963604)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	59.2	36	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	84.6	42	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	96.5	52	139
EP090: Organotin Compounds (QCLot: 2002075)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	# 129	36	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	122	42	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	119	52	139
EP131A: Organochlorine Pesticides (QCLot: 1964998)								
EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	5 µg/kg	49.5	38	139
EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	5 µg/kg	53.2	18	136
EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	5 µg/kg	59.9	31	131
EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	5 µg/kg	64.6	37	140
EP131A: 4,4'-DDD	72-54-8	0.5	µg/kg	<0.50	5 µg/kg	63.4	26	141
EP131A: 4,4'-DDE	72-55-9	0.5	µg/kg	<0.50	5 µg/kg	47.2	35	129
EP131A: 4,4'-DDT	50-29-3	0.5	µg/kg	<0.50	5 µg/kg	75.0	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	55.6	30	140
EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	5 µg/kg	50.8	38	140
EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	5 µg/kg	45.4	32	152



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				
EP131A: Organochlorine Pesticides (QCLot: 1964998) - continued								
EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	5 µg/kg	59.6	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	70.1	26	158
EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	5 µg/kg	39.3	20	118
EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	5 µg/kg	45.2	13	135
EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	5 µg/kg	57.7	39	155
EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	5 µg/kg	42.1	34	148
EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	5 µg/kg	38.5	26	152
EP131A: gamma-BHC	58-89-9	0.25	µg/kg	<0.25	5 µg/kg	36.7	31	137
EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	5 µg/kg	84.5	36	152
EP131A: cis-Chlordane	5103-71-9	0.25	µg/kg	<0.25	5 µg/kg	84.7	36	142
EP131A: trans-Chlordane	5103-74-2	0.25	µg/kg	<0.25	5 µg/kg	40.7	30	138
EP131A: Total Chlordane (sum)	----	0.25	µg/kg	<0.25	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1965783)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	101	63	129
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	114	64	128
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	88.6	65	129
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	85.2	68	132
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	79.0	68	124
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	85.8	64	134
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	83.7	65	131
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	81.2	64	130
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	86.5	67	133
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	87.4	62	130
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	83.4	65	133
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4	µg/kg	<4	25 µg/kg	80.6	68	120
	205-82-3							
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	83.4	61	133
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	83.2	63	127
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	78.2	66	118
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	81.8	69	119
EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	84.0	66	120
EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	79.2	64	122
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	81.0	64	120
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	84.1	68	136
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1965784)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	93.4	63	129
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	90.0	64	128



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				
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1965784) - continued								
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	93.8	65	129
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	86.5	68	132
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	87.0	68	124
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	88.2	64	134
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	88.8	65	131
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	85.5	64	130
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	83.4	67	133
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	91.1	62	130
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	89.1	65	133
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4	µg/kg	<4	25 µg/kg	90.8	68	120
	205-82-3							
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	82.4	61	133
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	83.3	63	127
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	88.6	66	118
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	88.3	69	119
EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	89.1	66	120
EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	89.3	64	122
EP132B-SD: Indeno(1,2,3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	88.4	64	120
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	91.9	68	136
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 2005516)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	89.2	63	129
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	108	64	128
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	107	65	129
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	105	68	132
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	113	68	124
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	112	64	134
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	107	65	131
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	111	64	130
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	109	67	133
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	115	62	130
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	104	65	133
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4	µg/kg	<4	25 µg/kg	102	68	120
	205-82-3							
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	103	61	133
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	105	63	127
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	107	66	118
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	106	69	119
EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	110	66	120



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit		Result	Concentration	LCS	Low
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 2005516) - continued								
EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	110	64	122
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	110	64	120
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	108	68	136
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020T: Total Metals by ICP-MS (QCLot: 1963246)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	101	88	112
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	95.5	88	111
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	102	89	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.2 mg/L	109	88	116
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	99.2	89	112
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	103	88	116
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.2 mg/L	100	84	114
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1963186)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	101	84	118

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 (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number		MS	Low	High
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 1963208)							
EB1823470-016	B1_07	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	91.2	70	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 1963597)							
EB1823470-036	SG_01	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	84.3	70	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 1963602)							
EB1823470-002	SB_02 (T2)	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	82.7	70	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 2002069)							
EB1823470-015	B1_02 (T3)	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	84.8	70	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1963207)							
EB1823470-016	B1_07	EG020-SD: Arsenic	7440-38-2	50 mg/kg	95.1	70	130
		EG020-SD: Cadmium	7440-43-9	25 mg/kg	95.9	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	86.5	70	130

Matrix Spike (MS) Report

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike	SpikeRecovery(%)	Recovery Limits (%)	
				Concentration	MS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1963207) - continued							
EB1823470-016	B1_07	EG020-SD: Copper	7440-50-8	50 mg/kg	82.4	70	130
		EG020-SD: Lead	7439-92-1	50 mg/kg	101	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	94.2	70	130
		EG020-SD: Zinc	7440-66-6	50 mg/kg	79.9	70	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1963596)							
EB1823470-036	SG_01	EG020-SD: Arsenic	7440-38-2	50 mg/kg	93.4	70	130
		EG020-SD: Cadmium	7440-43-9	25 mg/kg	100	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	91.5	70	130
		EG020-SD: Copper	7440-50-8	50 mg/kg	91.7	70	130
		EG020-SD: Lead	7439-92-1	50 mg/kg	103	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	92.6	70	130
		EG020-SD: Zinc	7440-66-6	50 mg/kg	88.5	70	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1963603)							
EB1823470-002	SB_02 (T2)	EG020-SD: Arsenic	7440-38-2	50 mg/kg	89.2	70	130
		EG020-SD: Cadmium	7440-43-9	25 mg/kg	101	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	83.2	70	130
		EG020-SD: Copper	7440-50-8	50 mg/kg	87.0	70	130
		EG020-SD: Lead	7439-92-1	50 mg/kg	107	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	86.8	70	130
		EG020-SD: Zinc	7440-66-6	50 mg/kg	81.8	70	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 2002068)							
EB1823470-015	B1_02 (T3)	EG020-SD: Arsenic	7440-38-2	50 mg/kg	95.3	70	130
		EG020-SD: Cadmium	7440-43-9	25 mg/kg	96.2	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	97.4	70	130
		EG020-SD: Copper	7440-50-8	50 mg/kg	90.4	70	130
		EG020-SD: Lead	7439-92-1	50 mg/kg	98.4	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	99.2	70	130
		EG020-SD: Zinc	7440-66-6	50 mg/kg	102	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1963210)							
EB1823470-016	B1_07	EP071-SD: C10 - C14 Fraction	----	157 mg/kg	88.8	70	130
		EP071-SD: C15 - C28 Fraction	----	245 mg/kg	95.8	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1963211)							
EB1823470-016	B1_07	EP080-SD: C6 - C9 Fraction	----	8 mg/kg	# 69.3	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1963598)							
EB1823470-036	SG_01	EP071-SD: C10 - C14 Fraction	----	157 mg/kg	102	70	130
		EP071-SD: C15 - C28 Fraction	----	245 mg/kg	109	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1963599)							



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 Petroleum Hydrocarbons (QCLot: 1963599) - continued							
EB1823470-036	SG_01	EP080-SD: C6 - C9 Fraction	----	8 mg/kg	89.2	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 2002072)							
EB1823470-015	B1_02 (T3)	EP071-SD: C10 - C14 Fraction	----	157 mg/kg	90.4	70	130
		EP071-SD: C15 - C28 Fraction	----	245 mg/kg	107	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 2002073)							
EB1823470-015	B1_02 (T3)	EP080-SD: C6 - C9 Fraction	----	8 mg/kg	# 69.9	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1963210)							
EB1823470-016	B1_07	EP071-SD: >C10 - C16 Fraction	----	227 mg/kg	91.6	70	130
		EP071-SD: >C16 - C34 Fraction	----	162 mg/kg	97.8	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1963211)							
EB1823470-016	B1_07	EP080-SD: C6 - C10 Fraction	C6_C10	8 mg/kg	# 69.8	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1963598)							
EB1823470-036	SG_01	EP071-SD: >C10 - C16 Fraction	----	227 mg/kg	104	70	130
		EP071-SD: >C16 - C34 Fraction	----	162 mg/kg	112	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1963599)							
EB1823470-036	SG_01	EP080-SD: C6 - C10 Fraction	C6_C10	8 mg/kg	89.9	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 2002072)							
EB1823470-015	B1_02 (T3)	EP071-SD: >C10 - C16 Fraction	----	227 mg/kg	95.8	70	130
		EP071-SD: >C16 - C34 Fraction	----	162 mg/kg	108	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 2002073)							
EB1823470-015	B1_02 (T3)	EP080-SD: C6 - C10 Fraction	C6_C10	8 mg/kg	72.2	70	130
EP080-SD: BTEXN (QCLot: 1963211)							
EB1823470-016	B1_07	EP080-SD: Benzene	71-43-2	2 mg/kg	# 63.9	70	130
		EP080-SD: Toluene	108-88-3	2 mg/kg	# 68.9	70	130
EP080-SD: BTEXN (QCLot: 1963599)							
EB1823470-036	SG_01	EP080-SD: Benzene	71-43-2	2 mg/kg	94.6	70	130
		EP080-SD: Toluene	108-88-3	2 mg/kg	91.7	70	130
EP080-SD: BTEXN (QCLot: 2002073)							
EB1823470-015	B1_02 (T3)	EP080-SD: Benzene	71-43-2	2 mg/kg	# 57.4	70	130
		EP080-SD: Toluene	108-88-3	2 mg/kg	# 57.5	70	130
EP090: Organotin Compounds (QCLot: 1963209)							
EB1823470-016	B1_07	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# 7.59	35	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	65.1	20	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	57.2	20	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
EP090: Organotin Compounds (QCLot: 1963600)							
EB1823470-036	SG_01	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	56.0	35	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	90.9	20	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	74.8	20	130
EP090: Organotin Compounds (QCLot: 1963604)							
EB1823470-002	SB_02 (T2)	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# 9.01	35	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	102	20	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	126	20	130
EP090: Organotin Compounds (QCLot: 2002075)							
EB1823470-015	B1_02 (T3)	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# 18.3	35	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	67.8	20	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	98.2	20	130
EP131A: Organochlorine Pesticides (QCLot: 1964998)							
EB1823470-024	TB_05 (T1)	EP131A: Aldrin	309-00-2	5 µg/kg	88.3	23	153
		EP131A: alpha-BHC	319-84-6	5 µg/kg	57.9	18	156
		EP131A: beta-BHC	319-85-7	5 µg/kg	72.7	25	153
		EP131A: delta-BHC	319-86-8	5 µg/kg	84.1	25	147
		EP131A: 4,4'-DDD	72-54-8	5 µg/kg	29.0	26	150
		EP131A: 4,4'-DDE	72-55-9	5 µg/kg	59.4	31	125
		EP131A: 4,4'-DDT	50-29-3	5 µg/kg	83.6	23	163
		EP131A: Dieldrin	60-57-1	5 µg/kg	55.3	30	140
		EP131A: alpha-Endosulfan	959-98-8	5 µg/kg	42.3	29	135
		EP131A: beta-Endosulfan	33213-65-9	5 µg/kg	45.2	23	141
		EP131A: Endosulfan sulfate	1031-07-8	5 µg/kg	68.8	16	156
		EP131A: Endrin	72-20-8	5 µg/kg	83.2	18	162
		EP131A: Endrin aldehyde	7421-93-4	5 µg/kg	50.6	20	116
		EP131A: Endrin ketone	53494-70-5	5 µg/kg	45.2	13	151
		EP131A: Heptachlor	76-44-8	5 µg/kg	53.9	24	170
		EP131A: Heptachlor epoxide	1024-57-3	5 µg/kg	45.2	28	140
		EP131A: Hexachlorobenzene (HCB)	118-74-1	5 µg/kg	28.9	18	144
		EP131A: gamma-BHC	58-89-9	5 µg/kg	45.5	22	158
		EP131A: Methoxychlor	72-43-5	5 µg/kg	94.4	24	158
		EP131A: cis-Chlordane	5103-71-9	5 µg/kg	41.8	27	139
		EP131A: trans-Chlordane	5103-74-2	5 µg/kg	47.0	30	138
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1965783)							
EB1823470-013	B1_02 (T1)	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	115	70	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	119	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	103	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	103	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: 1965783) - continued							
EB1823470-013	B1_02 (T1)	EP132B-SD: Fluorene	86-73-7	25 µg/kg	98.1	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	98.3	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	102	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	77.4	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	82.1	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	101	70	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	25 µg/kg	82.2	70	130
			205-82-3				
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	75.9	70	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	84.1	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	83.2	70	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	99.4	70	130
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	25 µg/kg	85.0	70	130
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	25 µg/kg	86.5	70	130
		EP132B-SD: Indeno(1,2,3.cd)pyrene	193-39-5	25 µg/kg	89.1	70	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	107	70	130
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1965784)							
EB1823470-037	SG_02	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	104	70	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	108	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	105	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	88.4	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	89.7	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	90.9	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	94.0	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	93.7	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	91.6	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	94.2	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	87.8	70	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	25 µg/kg	112	70	130
			205-82-3				
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	88.2	70	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	90.9	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	104	70	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	104	70	130
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	25 µg/kg	97.7	70	130
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	25 µg/kg	94.8	70	130
		EP132B-SD: Indeno(1,2,3.cd)pyrene	193-39-5	25 µg/kg	98.0	70	130

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 Work Order : EB1823470 Amendment 3
 Client : ADVISIAN PTY LTD
 Project : 301001.02018 - Port of Mackay Sediment Sampling



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: 1965784) - continued							
EB1823470-037	SG_02	EP132B-SD: Coronene	191-07-1	25 µg/kg	113	70	130
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 2005516)							
EB1823470-014	B1_02 (T2)	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	86.4	70	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	83.7	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	88.2	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	86.1	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	104	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	86.0	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	89.4	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	90.2	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	86.5	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	92.9	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	82.9	70	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	25 µg/kg	81.3	70	130
			205-82-3				
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	82.6	70	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	85.5	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	89.3	70	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	86.0	70	130
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	25 µg/kg	86.4	70	130
		EP132B-SD: Dibenzo(a,h)anthracene	53-70-3	25 µg/kg	85.0	70	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	87.4	70	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	88.4	70	130

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 1963246)							
EB1823470-049	Rinsate 2	EG020A-T: Arsenic	7440-38-2	0.1 mg/L	110	70	130
		EG020A-T: Cadmium	7440-43-9	0.1 mg/L	99.3	70	130
		EG020A-T: Chromium	7440-47-3	0.1 mg/L	102	70	130
		EG020A-T: Copper	7440-50-8	0.2 mg/L	101	70	130
		EG020A-T: Lead	7439-92-1	0.1 mg/L	102	70	130
		EG020A-T: Nickel	7440-02-0	0.1 mg/L	104	70	130
		EG020A-T: Zinc	7440-66-6	0.2 mg/L	106	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1963186)							
EB1823470-049	Rinsate 2	EG035T: Mercury	7439-97-6	0.01 mg/L	106	70	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB1823470	Page	: 1 of 17
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	: 27-Sep-2018
Site	: ----	Issue Date	: 11-Dec-2018
Sampler	: NICHOLAS BANTON	No. of samples received	: 58
Order number	:	No. of samples analysed	: 40

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.
- Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.

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	EB1823470--001	SB_02 (T1)	Arsenic	7440-38-2	114 %	0% - 50%	RPD exceeds LOR based limits
EG020-SD: Total Metals in Sediments by ICPMS	EB1823470--013	B1_02 (T1)	Zinc	7440-66-6	108 %	0% - 20%	RPD exceeds LOR based limits
EP080-SD / EP071-SD: Total Recoverable Hydrocarbon	EB1823470--013	B1_02 (T1)	>C10 - C40 Fraction (sum)	----	29.1 %	0% - 20%	RPD exceeds LOR based limits
EP132B: Polynuclear Aromatic Hydrocarbons	EB1823470--026	TB_05 (T3)	Fluorene	86-73-7	105 %	0% - 50%	RPD exceeds LOR based limits
EP132B: Polynuclear Aromatic Hydrocarbons	EB1823470--013	B1_02 (T1)	Phenanthrene	85-01-8	53.6 %	0% - 20%	RPD exceeds LOR based limits
EP132B: Polynuclear Aromatic Hydrocarbons	EB1823470--026	TB_05 (T3)	Phenanthrene	85-01-8	70.4 %	0% - 20%	RPD exceeds LOR based limits
EP132B: Polynuclear Aromatic Hydrocarbons	EB1823470--013	B1_02 (T1)	Fluoranthene	206-44-0	46.4 %	0% - 20%	RPD exceeds LOR based limits
EP132B: Polynuclear Aromatic Hydrocarbons	EB1823470--013	B1_02 (T1)	Pyrene	129-00-0	47.8 %	0% - 20%	RPD exceeds LOR based limits
EP132B: Polynuclear Aromatic Hydrocarbons	EB1823470--013	B1_02 (T1)	Benz(a)anthracene	56-55-3	46.5 %	0% - 20%	RPD exceeds LOR based limits
EP132B: Polynuclear Aromatic Hydrocarbons	EB1823470--026	TB_05 (T3)	Perylene	198-55-0	26.8 %	0% - 20%	RPD exceeds LOR based limits
EP132B: Polynuclear Aromatic Hydrocarbons	EB1823470--013	B1_02 (T1)	Sum of PAHs	----	45.3 %	0% - 20%	RPD exceeds LOR based limits
Laboratory Control Spike (LCS) Recoveries							
EP090: Organotin Compounds	QC-2002075-002	----	Monobutyltin	78763-54-9	129 %	36-128%	Recovery greater than upper control limit
Matrix Spike (MS) Recoveries							
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons	EB1823470--016	B1_07	C6 - C9 Fraction	----	69.3 %	70-130%	Recovery less than lower data quality objective
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons	EB1823470--015	B1_02 (T3)	C6 - C9 Fraction	----	69.9 %	70-130%	Recovery less than lower data quality objective
EP080-SD / EP071-SD: Total Recoverable Hydrocarbon	EB1823470--016	B1_07	C6 - C10 Fraction	C6_C10	69.8 %	70-130%	Recovery less than lower data quality objective
EP080-SD: BTEXN	EB1823470--016	B1_07	Benzene	71-43-2	63.9 %	70-130%	Recovery less than lower data quality objective
EP080-SD: BTEXN	EB1823470--015	B1_02 (T3)	Benzene	71-43-2	57.4 %	70-130%	Recovery less than lower data quality objective
EP080-SD: BTEXN	EB1823470--016	B1_07	Toluene	108-88-3	68.9 %	70-130%	Recovery less than lower data quality objective
EP080-SD: BTEXN	EB1823470--015	B1_02 (T3)	Toluene	108-88-3	57.5 %	70-130%	Recovery less than lower data quality objective
EP090: Organotin Compounds	EB1823470--016	B1_07	Monobutyltin	78763-54-9	7.59 %	35-130%	Recovery less than lower data quality objective
EP090: Organotin Compounds	EB1823470--002	SB_02 (T2)	Monobutyltin	78763-54-9	9.01 %	35-130%	Recovery less than lower data quality objective
EP090: Organotin Compounds	EB1823470--015	B1_02 (T3)	Monobutyltin	78763-54-9	18.3 %	35-130%	Recovery less than lower data quality objective

Regular Sample Surrogates

Sub-Matrix: **SOIL**



Sub-Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP090S: Organotin Surrogate	EB1823470-038	SG_03	Tripropyltin	----	153 %	35-130 %	Recovery greater than upper data quality objective
EP090S: Organotin Surrogate	EB1823470-009	SB_58	Tripropyltin	----	142 %	35-130 %	Recovery greater than upper data quality objective
EP090S: Organotin Surrogate	EB1823470-034	REF_02	Tripropyltin	----	149 %	35-130 %	Recovery greater than upper data quality objective

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved							
B1_02 (T2),	B1_02 (T3)	----	----	----	25-Oct-2018	10-Oct-2018	15
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved							
B1_02 (T2),	B1_02 (T3)	26-Oct-2018	24-Oct-2018	2	29-Oct-2018	24-Oct-2018	5
EP003: Total Organic Carbon (TOC) in Soil							
Pulp Bag							
B1_02 (T2),	B1_02 (T3)	01-Nov-2018	24-Oct-2018	8	01-Nov-2018	24-Oct-2018	8
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved							
B1_02 (T2),	B1_02 (T3)	26-Oct-2018	10-Oct-2018	16	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved							
B1_02 (T2),	B1_02 (T3)	26-Oct-2018	10-Oct-2018	16	26-Oct-2018	10-Oct-2018	16
Soil Glass Jar - Unpreserved							
B1_02 (T2),	B1_02 (T3)	26-Oct-2018	10-Oct-2018	16	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons							
Soil Glass Jar - Unpreserved							
B1_02 (T2),	B1_02 (T3)	26-Oct-2018	10-Oct-2018	16	26-Oct-2018	10-Oct-2018	16
EP080-SD: BTEXN							
Soil Glass Jar - Unpreserved							
B1_02 (T2),	B1_02 (T3)	26-Oct-2018	10-Oct-2018	16	26-Oct-2018	10-Oct-2018	16
EP090: Organotin Compounds							
Soil Glass Jar - Unpreserved							
B1_02 (T2),	B1_02 (T3)	26-Oct-2018	10-Oct-2018	16	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved							
B1_02 (T2),	B1_02 (T3)	30-Oct-2018	10-Oct-2018	20	----	----	----



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	
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055) SB_02 (T1), SB_02 (T3), SB_40, SB_50, SB_58, D1	SB_02 (T2), SB_16, SB_45, SB_52, SB_79,	24-Sep-2018	----	----	----	04-Oct-2018	08-Oct-2018	✓
Soil Glass Jar - Unpreserved (EA055) TB_02, TB_05 (T2), TB_12, TB_26, D5,	TB_05 (T1), TB_05 (T3), TB_18, TB_29, H-3	25-Sep-2018	----	----	----	04-Oct-2018	09-Oct-2018	✓
Soil Glass Jar - Unpreserved (EA055) B1_02 (T1), B3_14, B5_08, D3	B1_07, B4_01, B5_10,	26-Sep-2018	----	----	----	04-Oct-2018	10-Oct-2018	✓
Soil Glass Jar - Unpreserved (EA055) B1_02 (T2),	B1_02 (T3)	26-Sep-2018	----	----	----	25-Oct-2018	10-Oct-2018	✗
Soil Glass Jar - Unpreserved (EA055) REF_01, REF_03, SG_02,	REF_02, SG_01, SG_03	27-Sep-2018	----	----	----	04-Oct-2018	11-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
EA150: Particle Sizing								
Snap Lock Bag (EA150H) SB_02 (T1), SB_02 (T3), SB_45, SB_79,	SB_02 (T2), SB_16, SB_52, D1	24-Sep-2018	----	----	----	16-Oct-2018	23-Mar-2019	✓
Snap Lock Bag (EA150H) TB_02, TB_29,	TB_18, D5	25-Sep-2018	----	----	----	16-Oct-2018	24-Mar-2019	✓
Snap Lock Bag (EA150H) B1_02 (T2),	B1_02 (T3)	26-Sep-2018	----	----	----	05-Nov-2018	25-Mar-2019	✓
Snap Lock Bag (EA150H) B1_02 (T1), B4_01, D3	B3_14, B5_10,	26-Sep-2018	----	----	----	16-Oct-2018	25-Mar-2019	✓
Snap Lock Bag (EA150H) REF_01, SG_01, SG_03	REF_02, SG_02,	27-Sep-2018	----	----	----	16-Oct-2018	26-Mar-2019	✓
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H) SB_02 (T1), SB_02 (T3), SB_45, SB_79,	SB_02 (T2), SB_16, SB_52, D1	24-Sep-2018	----	----	----	16-Oct-2018	23-Mar-2019	✓
Snap Lock Bag (EA150H) TB_02, TB_29,	TB_18, D5	25-Sep-2018	----	----	----	16-Oct-2018	24-Mar-2019	✓
Snap Lock Bag (EA150H) B1_02 (T2),	B1_02 (T3)	26-Sep-2018	----	----	----	05-Nov-2018	25-Mar-2019	✓
Snap Lock Bag (EA150H) B1_02 (T1), B4_01, D3	B3_14, B5_10,	26-Sep-2018	----	----	----	16-Oct-2018	25-Mar-2019	✓
Snap Lock Bag (EA150H) REF_01, SG_01, SG_03	REF_02, SG_02,	27-Sep-2018	----	----	----	16-Oct-2018	26-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_02 (T1), SB_02 (T3), SB_45, SB_79,	SB_02 (T2), SB_16, SB_52, D1	24-Sep-2018	----	----	----	16-Oct-2018	23-Mar-2019	✓
Snap Lock Bag (EA151-10)								
TB_02, TB_29,	TB_18, D5	25-Sep-2018	----	----	----	16-Oct-2018	24-Mar-2019	✓
Snap Lock Bag (EA151-10)								
B1_02 (T2),	B1_02 (T3)	26-Sep-2018	----	----	----	01-Nov-2018	25-Mar-2019	✓
Snap Lock Bag (EA151-10)								
B1_02 (T1), B4_01, D3	B3_14, B5_10,	26-Sep-2018	----	----	----	16-Oct-2018	25-Mar-2019	✓
Snap Lock Bag (EA151-10)								
REF_01, SG_01, SG_03	REF_02, SG_02,	27-Sep-2018	----	----	----	16-Oct-2018	26-Mar-2019	✓
EA151: Settleability 20%								
Snap Lock Bag (EA151-20)								
SB_02 (T1), SB_02 (T3), SB_45, SB_79,	SB_02 (T2), SB_16, SB_52, D1	24-Sep-2018	----	----	----	16-Oct-2018	23-Mar-2019	✓
Snap Lock Bag (EA151-20)								
TB_02, TB_29,	TB_18, D5	25-Sep-2018	----	----	----	16-Oct-2018	24-Mar-2019	✓
Snap Lock Bag (EA151-20)								
B1_02 (T2),	B1_02 (T3)	26-Sep-2018	----	----	----	01-Nov-2018	25-Mar-2019	✓
Snap Lock Bag (EA151-20)								
B1_02 (T1), B4_01, D3	B3_14, B5_10,	26-Sep-2018	----	----	----	16-Oct-2018	25-Mar-2019	✓
Snap Lock Bag (EA151-20)								
REF_01, SG_01, SG_03	REF_02, SG_02,	27-Sep-2018	----	----	----	16-Oct-2018	26-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
EA152: Soil Particle Density								
Snap Lock Bag (EA152) SB_02 (T1), SB_02 (T3), SB_79	SB_02 (T2), SB_45,	24-Sep-2018	----	----	----	16-Oct-2018	23-Mar-2019	✓
Snap Lock Bag (EA152) TB_18		25-Sep-2018	----	----	----	16-Oct-2018	24-Mar-2019	✓
Snap Lock Bag (EA152) B1_02 (T2),	B1_02 (T3)	26-Sep-2018	----	----	----	05-Nov-2018	25-Mar-2019	✓
Snap Lock Bag (EA152) REF_01, SG_02,	REF_02, SG_03	27-Sep-2018	----	----	----	16-Oct-2018	26-Mar-2019	✓
EG020-SD: Total Metals in Sediments by ICPMS								
Soil Glass Jar - Unpreserved (EG020-SD) SB_02 (T1), SB_02 (T3), SB_40, SB_50, SB_58, D1	SB_02 (T2), SB_16, SB_45, SB_52, SB_79,	24-Sep-2018	09-Oct-2018	23-Mar-2019	✓	10-Oct-2018	23-Mar-2019	✓
Soil Glass Jar - Unpreserved (EG020-SD) TB_02, TB_05 (T2), TB_12, TB_26, D5	TB_05 (T1), TB_05 (T3), TB_18, TB_29,	25-Sep-2018	08-Oct-2018	24-Mar-2019	✓	11-Oct-2018	24-Mar-2019	✓
Soil Glass Jar - Unpreserved (EG020-SD) H-3		25-Sep-2018	09-Oct-2018	24-Mar-2019	✓	10-Oct-2018	24-Mar-2019	✓
Soil Glass Jar - Unpreserved (EG020-SD) B1_02 (T1), B3_14, B5_08, D3	B1_07, B4_01, B5_10,	26-Sep-2018	08-Oct-2018	25-Mar-2019	✓	11-Oct-2018	25-Mar-2019	✓
Soil Glass Jar - Unpreserved (EG020-SD) B1_02 (T2),	B1_02 (T3)	26-Sep-2018	26-Oct-2018	25-Mar-2019	✓	29-Oct-2018	25-Mar-2019	✓
Soil Glass Jar - Unpreserved (EG020-SD) REF_01,	REF_02	27-Sep-2018	08-Oct-2018	26-Mar-2019	✓	11-Oct-2018	26-Mar-2019	✓
Soil Glass Jar - Unpreserved (EG020-SD) REF_03, SG_02,	SG_01, SG_03	27-Sep-2018	09-Oct-2018	26-Mar-2019	✓	10-Oct-2018	26-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
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035T-LL)								
SB_02 (T1), SB_02 (T3), SB_40, SB_50, SB_58, D1	SB_02 (T2), SB_16, SB_45, SB_52, SB_79,	24-Sep-2018	09-Oct-2018	22-Oct-2018	✓	10-Oct-2018	22-Oct-2018	✓
Soil Glass Jar - Unpreserved (EG035T-LL)								
TB_02, TB_05 (T2), TB_12, TB_26, D5	TB_05 (T1), TB_05 (T3), TB_18, TB_29,	25-Sep-2018	08-Oct-2018	23-Oct-2018	✓	11-Oct-2018	23-Oct-2018	✓
Soil Glass Jar - Unpreserved (EG035T-LL)								
H-3		25-Sep-2018	09-Oct-2018	23-Oct-2018	✓	10-Oct-2018	23-Oct-2018	✓
Soil Glass Jar - Unpreserved (EG035T-LL)								
B1_02 (T1), B3_14, B5_08, D3	B1_07, B4_01, B5_10,	26-Sep-2018	08-Oct-2018	24-Oct-2018	✓	11-Oct-2018	24-Oct-2018	✓
Soil Glass Jar - Unpreserved (EG035T-LL)								
B1_02 (T2),	B1_02 (T3)	26-Sep-2018	26-Oct-2018	24-Oct-2018	✗	29-Oct-2018	24-Oct-2018	✗
Soil Glass Jar - Unpreserved (EG035T-LL)								
REF_01,	REF_02	27-Sep-2018	08-Oct-2018	25-Oct-2018	✓	11-Oct-2018	25-Oct-2018	✓
Soil Glass Jar - Unpreserved (EG035T-LL)								
REF_03, SG_02,	SG_01, SG_03	27-Sep-2018	09-Oct-2018	25-Oct-2018	✓	10-Oct-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) SB_02 (T1), SB_02 (T3), SB_40, SB_50, SB_58, D1	SB_02 (T2), SB_16, SB_45, SB_52, SB_79,	24-Sep-2018	09-Oct-2018	22-Oct-2018	✓		09-Oct-2018	22-Oct-2018	✓
Pulp Bag (EP003) TB_02, TB_05 (T2), TB_12, TB_26, D5,	TB_05 (T1), TB_05 (T3), TB_18, TB_29, H-3	25-Sep-2018	09-Oct-2018	23-Oct-2018	✓		09-Oct-2018	23-Oct-2018	✓
Pulp Bag (EP003) B1_02 (T2),	B1_02 (T3)	26-Sep-2018	01-Nov-2018	24-Oct-2018	✗		01-Nov-2018	24-Oct-2018	✗
Pulp Bag (EP003) B1_02 (T1), B3_14, B5_08, D3	B1_07, B4_01, B5_10,	26-Sep-2018	09-Oct-2018	24-Oct-2018	✓		09-Oct-2018	24-Oct-2018	✓
Pulp Bag (EP003) REF_01, REF_03, SG_02,	REF_02, SG_01, SG_03	27-Sep-2018	09-Oct-2018	25-Oct-2018	✓		09-Oct-2018	25-Oct-2018	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
Soil Glass Jar - Unpreserved (EP071-SD) TB_02, TB_05 (T2), TB_12, TB_26, D5	TB_05 (T1), TB_05 (T3), TB_18, TB_29,	25-Sep-2018	05-Oct-2018	09-Oct-2018	✓		10-Oct-2018	14-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP071-SD) B1_02 (T1), B3_14, B5_08, D3	B1_07, B4_01, B5_10,	26-Sep-2018	05-Oct-2018	10-Oct-2018	✓		10-Oct-2018	14-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP071-SD) B1_02 (T2),	B1_02 (T3)	26-Sep-2018	26-Oct-2018	10-Oct-2018	✗		29-Oct-2018	05-Dec-2018	✓
Soil Glass Jar - Unpreserved (EP071-SD) REF_01, REF_03, SG_02,	REF_02, SG_01, SG_03	27-Sep-2018	05-Oct-2018	11-Oct-2018	✓		10-Oct-2018	14-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)								
TB_02, TB_05 (T2), TB_12, TB_26, D5	TB_05 (T1), TB_05 (T3), TB_18, TB_29,	25-Sep-2018	04-Oct-2018	09-Oct-2018	✓	08-Oct-2018	09-Oct-2018	✓
Soil Glass Jar - Unpreserved (EP071-SD)								
TB_02, TB_05 (T2), TB_12, TB_26, D5	TB_05 (T1), TB_05 (T3), TB_18, TB_29,	25-Sep-2018	05-Oct-2018	09-Oct-2018	✓	10-Oct-2018	14-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP080-SD)								
B1_02 (T1), B3_14, B5_08, D3	B1_07, B4_01, B5_10,	26-Sep-2018	04-Oct-2018	10-Oct-2018	✓	08-Oct-2018	10-Oct-2018	✓
Soil Glass Jar - Unpreserved (EP071-SD)								
B1_02 (T1), B3_14, B5_08, D3	B1_07, B4_01, B5_10,	26-Sep-2018	05-Oct-2018	10-Oct-2018	✓	10-Oct-2018	14-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP080-SD)								
B1_02 (T2)		26-Sep-2018	26-Oct-2018	10-Oct-2018	✗	26-Oct-2018	10-Oct-2018	✗
Soil Glass Jar - Unpreserved (EP071-SD)								
B1_02 (T2)		26-Sep-2018	26-Oct-2018	10-Oct-2018	✗	29-Oct-2018	05-Dec-2018	✓
Soil Glass Jar - Unpreserved (EP080-SD)								
B1_02 (T3)		26-Sep-2018	26-Oct-2018	10-Oct-2018	✗	26-Oct-2018	10-Oct-2018	✗
Soil Glass Jar - Unpreserved (EP071-SD)								
B1_02 (T3)		26-Sep-2018	26-Oct-2018	10-Oct-2018	✗	29-Oct-2018	05-Dec-2018	✓
Soil Glass Jar - Unpreserved (EP080-SD)								
REF_01, REF_03, SG_02,	REF_02, SG_01, SG_03	27-Sep-2018	04-Oct-2018	11-Oct-2018	✓	08-Oct-2018	11-Oct-2018	✓
Soil Glass Jar - Unpreserved (EP071-SD)								
REF_01, REF_03, SG_02,	REF_02, SG_01, SG_03	27-Sep-2018	05-Oct-2018	11-Oct-2018	✓	10-Oct-2018	14-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 Recoverable Hydrocarbons								
Soil Glass Jar - Unpreserved (EP080-SD)								
TB_02, TB_05 (T2), TB_12, TB_26, D5	TB_05 (T1), TB_05 (T3), TB_18, TB_29,	25-Sep-2018	04-Oct-2018	09-Oct-2018	✔	08-Oct-2018	09-Oct-2018	✔
Soil Glass Jar - Unpreserved (EP080-SD)								
B1_02 (T1), B3_14, B5_08, D3	B1_07, B4_01, B5_10,	26-Sep-2018	04-Oct-2018	10-Oct-2018	✔	08-Oct-2018	10-Oct-2018	✔
Soil Glass Jar - Unpreserved (EP080-SD)								
B1_02 (T2),	B1_02 (T3)	26-Sep-2018	26-Oct-2018	10-Oct-2018	✖	26-Oct-2018	10-Oct-2018	✖
Soil Glass Jar - Unpreserved (EP080-SD)								
REF_01, REF_03, SG_02,	REF_02, SG_01, SG_03	27-Sep-2018	04-Oct-2018	11-Oct-2018	✔	08-Oct-2018	11-Oct-2018	✔
EP080-SD: BTEXN								
Soil Glass Jar - Unpreserved (EP080-SD)								
TB_02, TB_05 (T2), TB_12, TB_26, D5	TB_05 (T1), TB_05 (T3), TB_18, TB_29,	25-Sep-2018	04-Oct-2018	09-Oct-2018	✔	08-Oct-2018	09-Oct-2018	✔
Soil Glass Jar - Unpreserved (EP080-SD)								
B1_02 (T1), B3_14, B5_08, D3	B1_07, B4_01, B5_10,	26-Sep-2018	04-Oct-2018	10-Oct-2018	✔	08-Oct-2018	10-Oct-2018	✔
Soil Glass Jar - Unpreserved (EP080-SD)								
B1_02 (T2),	B1_02 (T3)	26-Sep-2018	26-Oct-2018	10-Oct-2018	✖	26-Oct-2018	10-Oct-2018	✖
Soil Glass Jar - Unpreserved (EP080-SD)								
REF_01, REF_03, SG_02,	REF_02, SG_01, SG_03	27-Sep-2018	04-Oct-2018	11-Oct-2018	✔	08-Oct-2018	11-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) SB_02 (T1), SB_02 (T3), SB_40, SB_50, SB_58, D1	SB_02 (T2), SB_16, SB_45, SB_52, SB_79,	24-Sep-2018	05-Oct-2018	08-Oct-2018	✓	09-Oct-2018	14-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP090) H-3		25-Sep-2018	08-Oct-2018	09-Oct-2018	✓	10-Oct-2018	17-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP090) TB_02, TB_05 (T2), TB_12, TB_26, D5	TB_05 (T1), TB_05 (T3), TB_18, TB_29,	25-Sep-2018	08-Oct-2018	09-Oct-2018	✓	11-Oct-2018	17-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP090) B1_02 (T1), B3_14, B5_08, D3	B1_07, B4_01, B5_10,	26-Sep-2018	08-Oct-2018	10-Oct-2018	✓	11-Oct-2018	17-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP090) B1_02 (T2),	B1_02 (T3)	26-Sep-2018	26-Oct-2018	10-Oct-2018	✗	30-Oct-2018	05-Dec-2018	✓
Soil Glass Jar - Unpreserved (EP090) REF_03, SG_02,	SG_01, SG_03	27-Sep-2018	08-Oct-2018	11-Oct-2018	✓	10-Oct-2018	17-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP090) REF_01,	REF_02	27-Sep-2018	08-Oct-2018	11-Oct-2018	✓	11-Oct-2018	17-Nov-2018	✓
EP131A: Organochlorine Pesticides								
Soil Glass Jar - Unpreserved (EP131A) TB_02, TB_05 (T2), TB_12, TB_26, D5	TB_05 (T1), TB_05 (T3), TB_18, TB_29,	25-Sep-2018	05-Oct-2018	09-Oct-2018	✓	11-Oct-2018	14-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	
EP132B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP132B-SD) TB_02, TB_05 (T2), TB_12, TB_26, D5	TB_05 (T1), TB_05 (T3), TB_18, TB_29, D5	25-Sep-2018	05-Oct-2018	09-Oct-2018	✓	08-Oct-2018	14-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP132B-SD) B1_02 (T1), B3_14, B5_08, D3	B1_07, B4_01, B5_10, D3	26-Sep-2018	05-Oct-2018	10-Oct-2018	✓	08-Oct-2018	14-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP132B-SD) B1_02 (T2),	B1_02 (T3)	26-Sep-2018	30-Oct-2018	10-Oct-2018	✗	01-Nov-2018	09-Dec-2018	✓
Soil Glass Jar - Unpreserved (EP132B-SD) SG_02,	SG_03	27-Sep-2018	05-Oct-2018	11-Oct-2018	✓	05-Oct-2018	14-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP132B-SD) REF_01, REF_03,	REF_02, SG_01	27-Sep-2018	05-Oct-2018	11-Oct-2018	✓	08-Oct-2018	14-Nov-2018	✓

Matrix: **WATER**

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
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Natural (EG020A-T) Rinsate 1	24-Sep-2018	09-Oct-2018	23-Mar-2019	✓	09-Oct-2018	23-Mar-2019	✓
Clear Plastic Bottle - Natural (EG020A-T) Rinsate 2	25-Sep-2018	09-Oct-2018	24-Mar-2019	✓	09-Oct-2018	24-Mar-2019	✓
Clear Plastic Bottle - Natural (EG020A-T) Rinsate 3	26-Sep-2018	09-Oct-2018	25-Mar-2019	✓	09-Oct-2018	25-Mar-2019	✓
Clear Plastic Bottle - Natural (EG020A-T) Rinsate 4	27-Sep-2018	09-Oct-2018	26-Mar-2019	✓	09-Oct-2018	26-Mar-2019	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Natural (EG035T) Rinsate 1	24-Sep-2018	----	----	----	10-Oct-2018	22-Oct-2018	✓
Clear Plastic Bottle - Natural (EG035T) Rinsate 2	25-Sep-2018	----	----	----	10-Oct-2018	23-Oct-2018	✓
Clear Plastic Bottle - Natural (EG035T) Rinsate 3	26-Sep-2018	----	----	----	10-Oct-2018	24-Oct-2018	✓
Clear Plastic Bottle - Natural (EG035T) Rinsate 4	27-Sep-2018	----	----	----	10-Oct-2018	25-Oct-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)							
Moisture Content	EA055	6	39	15.38	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	6	36	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	4	24	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	6	36	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	6	36	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	6	51	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	4	24	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	4	24	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	4	36	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	3	24	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	4	36	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	4	36	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	3	51	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	3	24	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	3	24	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	4	36	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	3	24	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	4	36	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	4	36	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	3	51	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	3	24	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	3	24	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	4	36	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	3	24	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	4	36	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	4	36	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	3	24	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	3	24	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Matrix: **WATER**

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)							
Total Mercury by FIMS	EG035T	1	5	20.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Total Mercury by FIMS	EG035T	1	5	20.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Total Mercury by FIMS	EG035T	1	5	20.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Mercury by FIMS	EG035T	1	5	20.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	17	5.88	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
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
Gross Alpha and Beta activity in solids	EA250	SOIL	In house: Referenced to ISO 9697 / CSN 757611. Determination of Gross Alpha and Beta activity in soil and sediment by Thick Source method. An appropriate mass of sample is dried and pulverised prior to direct activity counting. (If required, Potassium may be determined separately and results corrected accordingly for 40K.) Analysis is performed by ALS (Czech Republic) who hold technical accreditation #1163 for Gross alpha and beta activity under CAI. CAI are a European accreditation body, equivalent to NATA in Australia and recognised internationally by NATA under ILAC.
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 (SnCl ₂)(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 SnCl ₂ 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 CO ₂) is automatically measured by infra-red detector.
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.



Analytical Methods	Method	Matrix	Method Descriptions
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	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.
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ 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)
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, Na ₂ SO ₄ 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, Na ₂ SO ₄ 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.
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)

**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EB1823470**

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	: +61-7-3243 7222
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Page	: 1 of 7
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	: 27-Sep-2018 09:00	Issue Date	: 16-Oct-2018
Client Requested Due	: 12-Oct-2018	Scheduled Reporting Date	: 08-Nov-2018
Date			

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 6	Temperature	: 1.6<->4.8°C - Ice present
Receipt Detail	: MEDIUM ESKY	No. of samples received / analysed	: 58 / 42

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, due to limited sample volume submitted, PSD analysis has been removed from "REF_03" & "NA_02".**
- **16/10/18: SRN has been resent to acknowledge that PFAS has been added to the requested samples . For any further information regarding these adjustments please contact client services at ALSEnviro.Brisbane@alsglobal.com.**
- **16/10/18: SRN has been resent to acknowledge that PFAS has been removed and logged under EB1824883. For any further information regarding these adjustments please contact client services at ALSEnviro.Brisbane@alsglobal.com.**
- 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.

Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
Total Mercury by FIMS : EG035T		
Rinsate 1	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Unfiltered
Rinsate 2	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Unfiltered
Rinsate 3	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Unfiltered
Rinsate 4	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Unfiltered
Total Metals by ICP-MS - Suite A : EG020A-T		
Rinsate 1	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Unfiltered
Rinsate 2	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Unfiltered
Rinsate 3	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Unfiltered
Rinsate 4	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Unfiltered

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 - EA151-10 Settleability 10%	SOIL - EA151-20 Settleability 20%	SOIL - EA152 Soil Particle Density for Hydrometer Analysis	SOIL - EG035T-LL Total Mercury by FIMS - Low Level (SOLID)	SOIL - EP090 (solids) Organotins
EB1823470-001	24-Sep-2018 00:00	SB_02 (T1)	✓	✓	✓	✓	✓	✓	✓
EB1823470-002	24-Sep-2018 00:00	SB_02 (T2)	✓	✓	✓	✓	✓	✓	✓
EB1823470-003	24-Sep-2018 00:00	SB_02 (T3)	✓	✓	✓	✓	✓	✓	✓
EB1823470-004	24-Sep-2018 00:00	SB_16	✓	✓	✓	✓	✓	✓	✓
EB1823470-005	24-Sep-2018 00:00	SB_40	✓					✓	✓
EB1823470-006	24-Sep-2018 00:00	SB_45	✓	✓	✓	✓	✓	✓	✓
EB1823470-007	24-Sep-2018 00:00	SB_50	✓					✓	✓
EB1823470-008	24-Sep-2018 00:00	SB_52	✓	✓	✓	✓	✓	✓	✓
EB1823470-009	24-Sep-2018 00:00	SB_58	✓					✓	✓
EB1823470-010	24-Sep-2018 00:00	SB_79	✓	✓	✓	✓	✓	✓	✓
EB1823470-011	24-Sep-2018 00:00	D1	✓	✓	✓	✓	✓	✓	✓
EB1823470-013	26-Sep-2018 00:00	B1_02 (T1)	✓	✓	✓	✓	✓	✓	✓
EB1823470-016	26-Sep-2018 00:00	B1_07	✓					✓	✓
EB1823470-017	26-Sep-2018 00:00	B3_14	✓	✓	✓	✓	✓	✓	✓
EB1823470-018	26-Sep-2018 00:00	B4_01	✓	✓	✓	✓	✓	✓	✓
EB1823470-019	26-Sep-2018 00:00	B5_08	✓					✓	✓
EB1823470-020	26-Sep-2018 00:00	B5_10	✓	✓	✓	✓	✓	✓	✓
EB1823470-021	26-Sep-2018 00:00	D3	✓	✓	✓	✓	✓	✓	✓
EB1823470-023	25-Sep-2018 00:00	TB_02	✓	✓	✓	✓	✓	✓	✓
EB1823470-024	25-Sep-2018 00:00	TB_05 (T1)	✓					✓	✓



			SOIL - EA055-103 Moisture Content	SOIL - EA150H Particle Size Analysis by Hydrometer: AS 1289	SOIL - EA151-10 Settleability 10%	SOIL - EA151-20 Settleability 20%	SOIL - EA152 Soil Particle Density for Hydrometer Analysis	SOIL - EG035T-LL Total Mercury by FIMS - Low Level (SOLID)	SOIL - EP090 (solids) Organotins
EB1823470-025	25-Sep-2018 00:00	TB_05 (T2)	✓					✓	✓
EB1823470-026	25-Sep-2018 00:00	TB_05 (T3)	✓					✓	✓
EB1823470-027	25-Sep-2018 00:00	TB_12	✓					✓	✓
EB1823470-028	25-Sep-2018 00:00	TB_18	✓	✓	✓	✓	✓	✓	✓
EB1823470-029	25-Sep-2018 00:00	TB_26	✓					✓	✓
EB1823470-030	25-Sep-2018 00:00	TB_29	✓	✓	✓	✓	✓	✓	✓
EB1823470-031	25-Sep-2018 00:00	D5	✓	✓	✓	✓	✓	✓	✓
EB1823470-033	27-Sep-2018 00:00	REF_01	✓	✓	✓	✓	✓	✓	✓
EB1823470-034	27-Sep-2018 00:00	REF_02	✓	✓	✓	✓	✓	✓	✓
EB1823470-035	27-Sep-2018 00:00	REF_03	✓					✓	✓
EB1823470-036	27-Sep-2018 00:00	SG_01	✓	✓	✓	✓	✓	✓	✓
EB1823470-037	27-Sep-2018 00:00	SG_02	✓	✓	✓	✓	✓	✓	✓
EB1823470-038	27-Sep-2018 00:00	SG_03	✓	✓	✓	✓	✓	✓	✓
EB1823470-039	25-Sep-2018 00:00	H-3	✓					✓	✓
EB1823470-040	27-Sep-2018 00:00	NA_01	✓	✓	✓	✓	✓	✓	✓
EB1823470-041	27-Sep-2018 00:00	NA_02	✓					✓	✓
EB1823470-042	27-Sep-2018 00:00	NA_03	✓	✓	✓	✓	✓	✓	✓
EB1823470-043	27-Sep-2018 00:00	NA_04	✓	✓	✓	✓	✓	✓	✓
			SOIL - EA010 (solids): Electrical Conductivity (1:5)	SOIL - EA014 Total Soluble Salts	SOIL - EA037 ASS Field Screening Analysis	SOIL - ED045G (solids) Chloride Soluble by Discrete Analyser	SOIL - EG020-SD Total Metals in Sediments by ICPMS (NODG)	SOIL - EP003 Total Organic Carbon (TOC) in Soil	SOIL - EP004 Organic Matter in Soil (Walkley Black)
EB1823470-001	24-Sep-2018 00:00	SB_02 (T1)					✓	✓	
EB1823470-002	24-Sep-2018 00:00	SB_02 (T2)					✓	✓	
EB1823470-003	24-Sep-2018 00:00	SB_02 (T3)					✓	✓	
EB1823470-004	24-Sep-2018 00:00	SB_16					✓	✓	
EB1823470-005	24-Sep-2018 00:00	SB_40					✓	✓	
EB1823470-006	24-Sep-2018 00:00	SB_45	✓	✓	✓	✓	✓	✓	✓
EB1823470-007	24-Sep-2018 00:00	SB_50					✓	✓	
EB1823470-008	24-Sep-2018 00:00	SB_52	✓	✓	✓	✓	✓	✓	✓
EB1823470-009	24-Sep-2018 00:00	SB_58	✓	✓	✓	✓	✓	✓	✓
EB1823470-010	24-Sep-2018 00:00	SB_79					✓	✓	
EB1823470-011	24-Sep-2018 00:00	D1					✓	✓	
EB1823470-013	26-Sep-2018 00:00	B1_02 (T1)	✓	✓	✓	✓	✓	✓	✓

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 - EA037 ASS Field Screening Analysis	SOIL - ED045G (solids) Chloride Soluble by Discrete Analyser	SOIL - EG020-SD Total Metals in Sediments by ICPMS (NODG)	SOIL - EP003 Total Organic Carbon (TOC) in Soil	SOIL - EP004 Organic Matter in Soil (Walkley Black)
EB1823470-016	26-Sep-2018 00:00	B1_07					✓	✓	
EB1823470-017	26-Sep-2018 00:00	B3_14	✓	✓	✓	✓	✓	✓	✓
EB1823470-018	26-Sep-2018 00:00	B4_01	✓	✓	✓	✓	✓	✓	✓
EB1823470-019	26-Sep-2018 00:00	B5_08	✓	✓	✓	✓	✓	✓	✓
EB1823470-020	26-Sep-2018 00:00	B5_10					✓	✓	
EB1823470-021	26-Sep-2018 00:00	D3					✓	✓	
EB1823470-023	25-Sep-2018 00:00	TB_02					✓	✓	
EB1823470-024	25-Sep-2018 00:00	TB_05 (T1)					✓	✓	
EB1823470-025	25-Sep-2018 00:00	TB_05 (T2)					✓	✓	
EB1823470-026	25-Sep-2018 00:00	TB_05 (T3)					✓	✓	
EB1823470-027	25-Sep-2018 00:00	TB_12					✓	✓	
EB1823470-028	25-Sep-2018 00:00	TB_18					✓	✓	
EB1823470-029	25-Sep-2018 00:00	TB_26			✓		✓	✓	
EB1823470-030	25-Sep-2018 00:00	TB_29					✓	✓	
EB1823470-031	25-Sep-2018 00:00	D5					✓	✓	
EB1823470-033	27-Sep-2018 00:00	REF_01					✓	✓	
EB1823470-034	27-Sep-2018 00:00	REF_02					✓	✓	
EB1823470-035	27-Sep-2018 00:00	REF_03					✓	✓	
EB1823470-036	27-Sep-2018 00:00	SG_01					✓	✓	
EB1823470-037	27-Sep-2018 00:00	SG_02					✓	✓	
EB1823470-038	27-Sep-2018 00:00	SG_03					✓	✓	
EB1823470-039	25-Sep-2018 00:00	H-3					✓	✓	
EB1823470-040	27-Sep-2018 00:00	NA_01					✓	✓	
EB1823470-041	27-Sep-2018 00:00	NA_02					✓	✓	
EB1823470-042	27-Sep-2018 00:00	NA_03					✓	✓	
EB1823470-043	27-Sep-2018 00:00	NA_04					✓	✓	

Matrix: **SOIL**

Laboratory sample ID Client sampling date / time Client sample ID

			(On Hold) SOIL No analysis requested	SOIL - EA250 (Subcontracted) Gross beta/alpha activity in Soils	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
EB1823470-013	26-Sep-2018 00:00	B1_02 (T1)			✓	✓		✓
EB1823470-014	26-Sep-2018 00:00	B1_02 (T2)	✓					
EB1823470-015	26-Sep-2018 00:00	B1_02 (T3)	✓					
EB1823470-016	26-Sep-2018 00:00	B1_07			✓	✓		✓



			(On Hold) SOIL No analysis requested	SOIL - EA250 (Subcontracted) Gross beta/alpha activity in Soils	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
EB1823470-017	26-Sep-2018 00:00	B3_14			✓	✓		✓
EB1823470-018	26-Sep-2018 00:00	B4_01			✓	✓		✓
EB1823470-019	26-Sep-2018 00:00	B5_08			✓	✓		✓
EB1823470-020	26-Sep-2018 00:00	B5_10			✓	✓		✓
EB1823470-021	26-Sep-2018 00:00	D3			✓	✓		✓
EB1823470-022	26-Sep-2018 00:00	D4	✓					
EB1823470-023	25-Sep-2018 00:00	TB_02		✓	✓	✓	✓	✓
EB1823470-024	25-Sep-2018 00:00	TB_05 (T1)		✓	✓	✓	✓	✓
EB1823470-025	25-Sep-2018 00:00	TB_05 (T2)		✓	✓	✓	✓	✓
EB1823470-026	25-Sep-2018 00:00	TB_05 (T3)		✓	✓	✓	✓	✓
EB1823470-027	25-Sep-2018 00:00	TB_12		✓	✓	✓	✓	✓
EB1823470-028	25-Sep-2018 00:00	TB_18		✓	✓	✓	✓	✓
EB1823470-029	25-Sep-2018 00:00	TB_26		✓	✓	✓	✓	✓
EB1823470-030	25-Sep-2018 00:00	TB_29		✓	✓	✓	✓	✓
EB1823470-031	25-Sep-2018 00:00	D5		✓	✓	✓	✓	✓
EB1823470-032	25-Sep-2018 00:00	D6	✓					
EB1823470-033	27-Sep-2018 00:00	REF_01			✓	✓		✓
EB1823470-034	27-Sep-2018 00:00	REF_02			✓	✓		✓
EB1823470-035	27-Sep-2018 00:00	REF_03			✓	✓		✓
EB1823470-036	27-Sep-2018 00:00	SG_01			✓	✓		✓
EB1823470-037	27-Sep-2018 00:00	SG_02			✓	✓		✓
EB1823470-038	27-Sep-2018 00:00	SG_03			✓	✓		✓
EB1823470-040	27-Sep-2018 00:00	NA_01			✓	✓	✓	✓
EB1823470-041	27-Sep-2018 00:00	NA_02			✓	✓	✓	✓
EB1823470-042	27-Sep-2018 00:00	NA_03			✓	✓	✓	✓
EB1823470-043	27-Sep-2018 00:00	NA_04			✓	✓	✓	✓
EB1823470-052	24-Sep-2018 00:00	Trip Blank Sand 1	✓					
EB1823470-053	25-Sep-2018 00:00	Trip Blank Sand 2	✓					
EB1823470-054	26-Sep-2018 00:00	Trip Blank Sand 3	✓					
EB1823470-055	27-Sep-2018 00:00	Trip Blank Sand 4	✓					
EB1823470-056	27-Sep-2018 00:00	OP2_42 / 0.0-0.5	✓					
EB1823470-057	27-Sep-2018 00:00	OP2_42 / 0.5-1.0	✓					
EB1823470-058	27-Sep-2018 00:00	OP2_42 / 1.0-1.5	✓					



Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) WATER No analysis requested
EB1823470-044	27-Sep-2018 00:00	W1	✓
EB1823470-045	27-Sep-2018 00:00	W2	✓
EB1823470-046	27-Sep-2018 00:00	W3	✓
EB1823470-047	27-Sep-2018 00:00	W4	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - W-02T 8 metals (Total)
EB1823470-048	24-Sep-2018 00:00	Rinsate 1	✓
EB1823470-049	25-Sep-2018 00:00	Rinsate 2	✓
EB1823470-050	26-Sep-2018 00:00	Rinsate 3	✓
EB1823470-051	27-Sep-2018 00:00	Rinsate 4	✓

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
- 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
- A4 - AU Tax Invoice (INV)	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

CLIENT: Activision Pty Ltd		TURNAROUND REQUIREMENTS : <input checked="" type="checkbox"/> Standard TAT (List show date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)		FOR LAB USE ONLY	
OFFICE: Lvl 31, 12 Creek Street, Brisbane 4005		<input type="checkbox"/> Non Standard or urgent TAT (List show date):		Duties/Spec	
PROJECT: Port of Mermaid Sediment Sampling		PROJECT NO.: 381081.02018		Pipe ID /	
ORDER NUMBER:		PURCHASE ORDER NO.:		Random 5m	
PROJECT MANAGER: Bill Boynton		COUNTRY OF ORIGIN:		Other cons.	
CONTACT PH: 0457906120		COD SEQUENCE NUMBER (Circle)			
SAMPLER: Nicholas Bairton		COD: 1 2 3 4 5 6 8 7			
SAMPLER MODEL: 0427407332		OF: 1 2 3 4 5 6 8 7			
OOC Emailed to ALS? / YES / NO		RELINQUISHED BY:		RECEIVED BY:	
EDD FORM (or default):		Nicholas Bairton			
Email Reports to (w/e default) to PM or in other addresses are listed: bill.boyton@activision.com, stephen.neshe@activision.com, nicholas.bairton@activision.com		DATE/TIME: 28.06.18 @ 16:15		DATE/TIME:	
Email Inquiries to (w/e default) to PM or in other addresses are listed: bill.boyton@activision.com, bill.boyton@activision.com				DATE/TIME:	



Telephone : + 61-7-3243 7222

ALS USE ONLY	SAMPLE DETAILS MATRIX: Soil(S) Water(W)		CONTAINER INFORMATION			ANALYSIS REQUIRED including SUTES (NB: Sute Dc Where Metals are required, specify Total but Residue(s) required or ...)										Comments on likely contaminant suite(s), dilutions, or samples requiring specific GC analysis etc.
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	TOD and Moisture	Metals / Organotins	THP&H	OCp	Residue(s)	NO & settling rate	ASB Bery	ECG-Gas/Headspace DM			
1	SB_02 (T1)	24.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1									1 Jar HOLD, 1 bag HOLD
2	SB_02 (T2)	24.09.18	S	None	2 x 250ml Jar 1 x Bag	1	1									1 Jar HOLD
3	SB_02 (T3)	24.09.18	S	None	2 x 250ml Jar 1 x Bag	1	1									1 Jar HOLD
4	SB_16	24.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1									1 Jar HOLD, 1 bag HOLD
5	SB_40	24.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1									1 Jar HOLD, 1 bag HOLD
6	SB_45	24.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1									1 Jar HOLD, 1 bag HOLD
7	SB_50	24.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1									1 Jar HOLD, 1 bag HOLD
8	SB_52	24.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1									1 Jar HOLD, 1 bag HOLD
9	SB_58	24.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1									1 Jar HOLD, 1 bag HOLD
10	SB_79	24.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1									1 Jar HOLD, 1 bag HOLD
11	D1	24.09.18	S	None	2 x 250ml Jar 1 x Bag	1	1									1 Jar HOLD
12	D2	24.09.18	S	None	2 x 250ml Jar 1 x Bag	1	1									1 Jar HOLD, 1 bag HOLD
13	B1_02 (T1)	26.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1									1 Jar HOLD, 1 bag HOLD
14	B1_02 (T2)	26.09.18	S	None	3 x 250ml Jar 1 x Bag											1 Jar HOLD, 1 bag HOLD
15	B1_02 (T3)	26.09.18	S	None	3 x 250ml Jar 1 x Bag											1 Jar HOLD, 1 bag HOLD
16	B1_07	26.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1	1								1 Jar HOLD, 2 bag HOLD
17	B2_14	26.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1	1								1 Jar HOLD, 1 bag HOLD
18	B4_01	26.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1	1								1 Jar HOLD, 1 bag HOLD
19	B6_08	26.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1	1								1 Jar HOLD, 1 bag HOLD
20	B6_10	26.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1	1								1 Jar HOLD, 1 bag HOLD
21	D3	26.09.18	S	None	2 x 250ml Jar 1 x Bag	1	1	1								
22	D4	26.09.18	S	None	2 x 250ml Jar 1 x Bag	1	1	1								
23	TB_02	26.09.18	S	None	4 x 250ml Jar 3 x Bag	1	1	1	1	1	1					1 Jar HOLD, 1 bag HOLD
24	TB_05 (T1)	26.09.18	S	None	4 x 250ml Jar 3 x Bag	1	1	1	1	1	1					1 Jar HOLD, 1 bag HOLD
25	TB_05 (T2)	26.09.18	S	None	4 x 250ml Jar 2 x Bag		1	1	1	1	1					2 Jars HOLD, 1 bag HOLD
26	TB_05 (T3)	26.09.18	S	None	4 x 250ml Jar 2 x Bag	1	1	1	1	1	1					2 Jars HOLD, 1 bag HOLD
27	TB_12	26.09.18	S	None	4 x 250ml Jar 3 x Bag	1	1	1	1	1	1					2 Jars HOLD, 1 bag HOLD
28	TB_16	26.09.18	S	None	4 x 250ml Jar 3 x Bag	1	1	1	1	1	1					2 Jars HOLD, 1 bag HOLD
29	TB_26	26.09.18	S	None	4 x 250ml Jar 3 x Bag	1	1	1	1	1	1					2 Jars HOLD, 1 bag HOLD
30	TB_29	26.09.18	S	None	4 x 250ml Jar 3 x Bag	1	1	1	1	1	1					2 Jars HOLD, 1 bag HOLD
31	D5	26.09.18	S	None	2 x 250ml Jar 2 x Bag	1	1	1	1							
32	D8	26.09.18	S	None	2 x 250ml Jar 2 x Bag	1	1	1	1	1	1					
33	REF_01	27.09.18	S	None	2 x 250ml Jar 1 x Bag	1	1	1								
34	REF_02	27.09.18	S	None	2 x 250ml Jar 1 x Bag	1	1	1								
35	REF_03	27.09.18	S	None	2 x 250ml Jar 1 x Bag	1	1	1								
36	SG_01	27.09.18	S	None	2 x 250ml Jar 2 x Bag	1	1	1								
37	SG_02	27.09.18	S	None	2 x 250ml Jar 2 x Bag	1	1	1								
38	SG_03	27.09.18	S	None	2 x 250ml Jar 2 x Bag	1	1	1								
39	HA-3	26.09.18	S	None	4 x 250ml Jar 2 x Bag	1	1									2 Jars HOLD, 1 bag HOLD
40	NA_01	27.09.18	S	None	2 x 250ml Jar 2 x Bag	1	1	1	1							
41	NA_02	27.09.18	S	None	2 x 250ml Jar	1	1	1	1							NO BAG DUE TO NOT ENOUGH SAMPLE
42	NA_03	27.09.18	S	None	2 x 250ml Jar 1 x Bag	1	1	1	1							
43	NA_04	27.09.18	S	None	2 x 250ml Jar 1 x Bag	1	1	1	1							
44	W1	27.09.18	W	None	1 x 10L Container											
45	W2	27.09.18	W	None	1 x 10L Container											
46	W3	27.09.18	W	None	1 x 10L Container											
47	W4	27.09.18	W	None	1 x 10L Container											
48	Rinse 1	24.09.18	W	None	80ml Bottle		1									Metals Only
49	Rinse 2	25.09.18	W	None	80ml Bottle		1									Metals Only
50	Rinse 3	26.09.18	W	None	80ml Bottle		1									Metals Only
51	Rinse 4	27.09.18	W	None	80ml Bottle		1									Metals Only
52	Trip Blank Sand 1	24.09.18	W	None				1								BTEX and Volatiles
53	Trip Blank Sand 2	25.09.18	W	None				1								BTEX and Volatiles
54	Trip Blank Sand 3	26.09.18	W	None				1								BTEX and Volatiles
55	Trip Blank Sand 4	27.09.18	W	None				1								BTEX and Volatiles
TOTAL																

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cl Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airtight Unpreserved Plastic
V = VOA/Vial HCl Preserved; VS = VOA/Vial Sodium Bisulfate Preserved; AV = Airtight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation Bottle; SP = Sulfuric Preserved Glass;
F = Formaldehyde Preserved Glass;
Z = Toxic Antidote - Atropine PK-600, Bz-AChE Inhibitor, Pralidoxime Chloride, Solis Rx, Unpreserved Bottles; LUN = Lincocin Unpreserved Bottles; KTT = Ketamine Sodium Thiosulfate Preserved Bottles.

CERTIFICATE OF ANALYSIS

Work Order	: EB1828594	Page	: 1 of 5
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 17:54
Order number	: ----	Date Analysis Commenced	: 23-Nov-2018
C-O-C number	: ----	Issue Date	: 30-Nov-2018 15:40
Sampler	: NICHOLAS BAINTON		
Site	: ----		
Quote number	: BN/185/18		
No. of samples received	: 4		
No. of samples analysed	: 4		



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>
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Matt Frost	Senior Organic Chemist	Brisbane Organics, 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.

- EN68: This analysis in accordance with National Ocean Disposal Guidelines, Commonwealth of Australia, 2002 - (modified). Results reported are those determined on a 1:4 sediment/seawater elutriate without blank correction.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR.
Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.



Analytical Results

Sub-Matrix: ELUTRIATE
 (Matrix: WATER)

Client sample ID

				TB02	BLANK	----	----	----
Client sampling date / time				25-Sep-2018 00:00	25-Sep-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EB1828594-001	EB1828594-004	-----	-----	-----
				Result	Result	----	----	----

EN68: Seawater Elutriate Testing Procedure

Seawater Sampling Date	----	-	-	----	25/11/2018	----	----	----
------------------------	------	---	---	------	------------	------	------	------

EP075(SIM)B: Polynuclear Aromatic Hydrocarbons

Naphthalene	91-20-3	1.0	µg/L	<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	<0.5	----	----	----

EP075(SIM)S: Phenolic Compound Surrogates

Phenol-d6	13127-88-3	1.0	%	36.1	27.9	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%	78.4	65.3	----	----	----
2,4,6-Tribromophenol	118-79-6	1.0	%	67.7	54.6	----	----	----

EP075(SIM)T: PAH Surrogates

2-Fluorobiphenyl	321-60-8	1.0	%	81.0	84.7	----	----	----
Anthracene-d10	1719-06-8	1.0	%	56.2	54.4	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%	58.5	57.0	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TB02	TB02	TB02	----	----
Client sampling date / time					25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	----	----
Compound	CAS Number	LOR	Unit		EB1828594-001	EB1828594-002	EB1828594-003	-----	-----
					Result	Result	Result	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		64.4	64.4	64.4	----	----
EN68: Seawater Elutriate Testing Procedure									
Seawater Sampling Date	----	-	-		25/11/2018	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	0.6	0.6	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	1.2	1.2	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		126	122	130	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%		120	114	124	----	----
2,4,6-Tribromophenol	118-79-6	0.5	%		112	109	113	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		105	101	109	----	----
Anthracene-d10	1719-06-8	0.5	%		106	102	110	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		104	97.0	107	----	----



Surrogate Control Limits

Sub-Matrix: ELUTRIATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	72
2-Chlorophenol-D4	93951-73-6	27	130
2,4,6-Tribromophenol	118-79-6	19	181
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	14	146
Anthracene-d10	1719-06-8	35	137
4-Terphenyl-d14	1718-51-0	36	154

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	35	155
2-Chlorophenol-D4	93951-73-6	42	153
2,4,6-Tribromophenol	118-79-6	26	157
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	34	157
Anthracene-d10	1719-06-8	37	153
4-Terphenyl-d14	1718-51-0	42	172

QUALITY CONTROL REPORT

Work Order	: EB1828594	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
Order number	:	Date Analysis Commenced	: 23-Nov-2018
C-O-C number	: ----	Issue Date	: 30-Nov-2018
Sampler	: NICHOLAS BAINTON		
Site	: ----		
Quote number	: BN/185/18		
No. of samples received	: 4		
No. of samples analysed	: 4		



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>
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Matt Frost	Senior Organic Chemist	Brisbane Organics, Stafford, QLD

Page : 3 of 6
 Work Order : EB1828594
 Client : ADVISIAN PTY LTD
 Project : 301001.02018 - Port of Mackay Sediment Sampling



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 2057574) - continued									
EB1828292-001	Anonymous	EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.0005 mg/L	<0.5	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.0005 mg/L	<0.5	0.00	No Limit
		EP075(SIM): Naphthalene	91-20-3	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Anthracene	120-12-7	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Pyrene	129-00-0	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Chrysene	218-01-9	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Dibenz(a,h)anthracene	53-70-3	1	µg/L	<0.0010 mg/L	<1.0	0.00	No Limit
		EP075(SIM): Benzo(g,h,i)perylene	191-24-2	1	µg/L	<0.0010 mg/L	<1.0	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**

Method Blank (MB) Report				Laboratory Control Spike (LCS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	LCS	Low	High
EN68: Seawater Elutriate Testing Procedure (QCLot: 2056290)							
EN68a: Seawater Sampling Date	----	----	-	25/11/2018	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2052992)							
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	1.5 mg/kg	# 127	119
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	1.5 mg/kg	# 126	118
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	1.5 mg/kg	# 126	121
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	1.5 mg/kg	# 125	116
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	1.5 mg/kg	# 135	117
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	1.5 mg/kg	# 136	115
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	1.5 mg/kg	# 135	116
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	1.5 mg/kg	# 135	134
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	1.5 mg/kg	# 130	120
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	1.5 mg/kg	# 129	119
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2	0.5	mg/kg	<0.5	1.5 mg/kg	121	129
	205-82-3						
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	1.5 mg/kg	126	129
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	1.5 mg/kg	# 127	121
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	1.5 mg/kg	124	135
EP075(SIM): Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	1.5 mg/kg	123	134
EP075(SIM): Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	1.5 mg/kg	123	131

Sub-Matrix: **WATER**

Method Blank (MB) Report				Laboratory Control Spike (LCS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	LCS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2057574)							
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	10 µg/L	78.7	110
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	10 µg/L	89.8	124
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	10 µg/L	86.8	114
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	10 µg/L	89.3	119
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	10 µg/L	87.2	127
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	10 µg/L	63.7	127
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	10 µg/L	66.5	127
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	10 µg/L	67.0	126
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	10 µg/L	68.7	136
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	10 µg/L	65.5	129



Sub-Matrix: **WATER**

Sub-Matrix: WATER				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				
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2057574) - continued								
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2	1	µg/L	<1.0	10 µg/L	101	55	132
	205-82-3							
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	10 µg/L	99.7	58	128
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	10 µg/L	104	55	131
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	10 µg/L	103	52	133
EP075(SIM): Dibenz(a,h)anthracene	53-70-3	1	µg/L	<1.0	10 µg/L	107	48	137
EP075(SIM): Benzo(g,h,i)perylene	191-24-2	1	µg/L	<1.0	10 µg/L	100	53	131
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2067258)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	10 µg/L	77.6	50	110
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	10 µg/L	82.5	49	124
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	10 µg/L	81.8	55	114
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	10 µg/L	82.2	55	119
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	10 µg/L	78.3	51	127
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	10 µg/L	56.1	55	127
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	10 µg/L	57.1	55	127
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	10 µg/L	57.9	54	126
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	10 µg/L	55.0	47	136
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	10 µg/L	57.5	51	129
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2	1	µg/L	<1.0	10 µg/L	94.8	55	132
	205-82-3							
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	10 µg/L	79.6	58	128
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	10 µg/L	89.4	55	131
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	10 µg/L	79.0	52	133
EP075(SIM): Dibenz(a,h)anthracene	53-70-3	1	µg/L	<1.0	10 µg/L	67.3	48	137
EP075(SIM): Benzo(g,h,i)perylene	191-24-2	1	µg/L	<1.0	10 µg/L	82.8	53	131

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	SpikeRecovery(%) MS	Recovery Limits (%) Low High	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2052992)							
EB1828528-002	Anonymous	EP075(SIM): Acenaphthene	83-32-9	1.5 mg/kg	118	70	130
		EP075(SIM): Pyrene	129-00-0	1.5 mg/kg	123	70	130

Sub-Matrix: **WATER**

Matrix Spike (MS) Report		
Spike	SpikeRecovery(%)	Recovery Limits (%)



Sub-Matrix: WATER

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2057574)							
EB1828851-001	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 µg/L	79.7	70	130
		EP075(SIM): Pyrene	129-00-0	10 µg/L	92.6	70	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB1828594	Page	: 1 of 5
Client	: ADVISIAN PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR BILL BOYLSO	Telephone	: +61 7 3552 8662
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Date Samples Received	: 21-Nov-2018
Site	: ----	Issue Date	: 30-Nov-2018
Sampler	: NICHOLAS BAINTON	No. of samples received	: 4
Order number	:	No. of samples analysed	: 4

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** Matrix Spike outliers occur.
- Laboratory Control 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
Laboratory Control Spike (LCS) Recoveries							
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	QC-2052992-002	----	Naphthalene	91-20-3	127 %	74-119%	Recovery greater than upper control limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	QC-2052992-002	----	Acenaphthylene	208-96-8	126 %	74-118%	Recovery greater than upper control limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	QC-2052992-002	----	Acenaphthene	83-32-9	126 %	83-121%	Recovery greater than upper control limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	QC-2052992-002	----	Fluorene	86-73-7	125 %	81-116%	Recovery greater than upper control limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	QC-2052992-002	----	Phenanthrene	85-01-8	135 %	72-117%	Recovery greater than upper control limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	QC-2052992-002	----	Anthracene	120-12-7	136 %	72-115%	Recovery greater than upper control limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	QC-2052992-002	----	Fluoranthene	206-44-0	135 %	70-116%	Recovery greater than upper control limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	QC-2052992-002	----	Pyrene	129-00-0	135 %	70-134%	Recovery greater than upper control limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	QC-2052992-002	----	Benz(a)anthracene	56-55-3	130 %	64-120%	Recovery greater than upper control limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	QC-2052992-002	----	Chrysene	218-01-9	129 %	66-119%	Recovery greater than upper control limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	QC-2052992-002	----	Benzo(a)pyrene	50-32-8	127 %	76-121%	Recovery greater than upper control limit

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved TB02, TB02	TB02,	----	----	----	23-Nov-2018	09-Oct-2018	45
EN68: Seawater Elutriate Testing Procedure							
Non-Volatile Leach: 14 day HT(e.g. SV organics) TB02,	BLANK	26-Nov-2018	09-Oct-2018	48	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved TB02, TB02	TB02,	24-Nov-2018	09-Oct-2018	46	----	----	----



Matrix: **WATER**

Method Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons						
Amber Glass Bottle - Unpreserved BLANK	30-Nov-2018	02-Oct-2018	59	----	----	----

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
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)								
TB02,	TB02,	25-Sep-2018	----	----	----	23-Nov-2018	09-Oct-2018	✘
TB02								
EN68: Seawater Elutriate Testing Procedure								
Non-Volatile Leach: 14 day HT(e.g. SV organics) (EN68a)								
TB02,	BLANK	25-Sep-2018	26-Nov-2018	09-Oct-2018	✘	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP075(SIM))								
TB02,	TB02,	25-Sep-2018	24-Nov-2018	09-Oct-2018	✘	26-Nov-2018	03-Jan-2019	✔
TB02								

Matrix: **WATER**

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
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM)) BLANK	25-Sep-2018	30-Nov-2018	02-Oct-2018	✖	30-Nov-2018	09-Jan-2019	✔
Amber Glass Bottle - Unpreserved (EP075(SIM)) TB02	26-Nov-2018	26-Nov-2018	03-Dec-2018	✔	26-Nov-2018	05-Jan-2019	✔



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)							
Moisture Content	EA055	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	9	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	9	11.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	9	11.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Seawater Elutriate Testing Procedure	EN68a	1	2	50.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	9	11.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	2	8	25.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	2	8	25.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	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
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).
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
Seawater Elutriate Testing Procedure	EN68a	SOIL	USEPA Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Guide, 1991, EPA-503/8-91/001, USEPA and US Army Corps of Engineers. ANZECC Interim Ocean Disposal Guidelines, December, 1998 This Procedure outlines the preparation of leachate designed to simulate release of contaminants from sediment during the disposal of dredged material. Release can occur by physical processes or a variety of chemical changes such as oxidation of metal sulphides and release of contaminants adsorbed to particles or organic matter.
Separatory Funnel Extraction of Liquids	ORG14	SOIL	In house: Referenced to USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

Kylie Codd

From: Kochnieff, Alex (Brisbane) [<mailto:ALEX.KOCHNIEFF@advisian.com>]
Sent: Wednesday, 21 November 2018 5:54 PM
To: Caroline Hill <caroline.hill@ALSGlobal.com>
Subject: EB1823470 - Rebatch

Good evening Caroline,

I have yet another rebatch required.

Could you please analyse sample EB1823470023 (Advisian ID TB_02) for:

- PAHs in triplicate
- PAHs in elutriate

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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Environmental Division
Brisbane
Work Order Reference
EB1828594



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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

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

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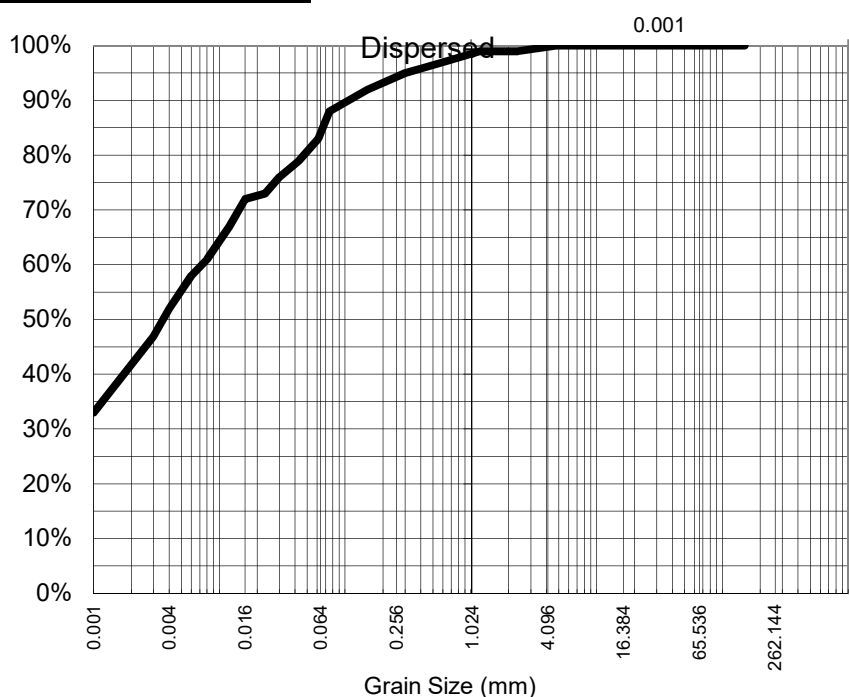
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pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

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

D Blane

Dianne Blane
Laboratory Coordinator
Authorised Signatory



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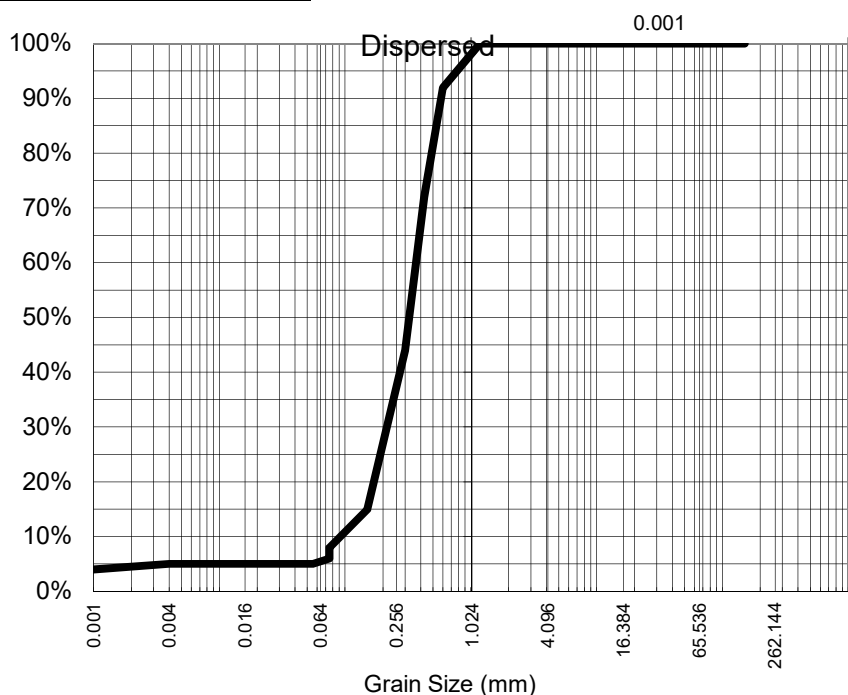
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COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-002 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** SB_50
Sediment Sampling

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

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Authorised Signatory

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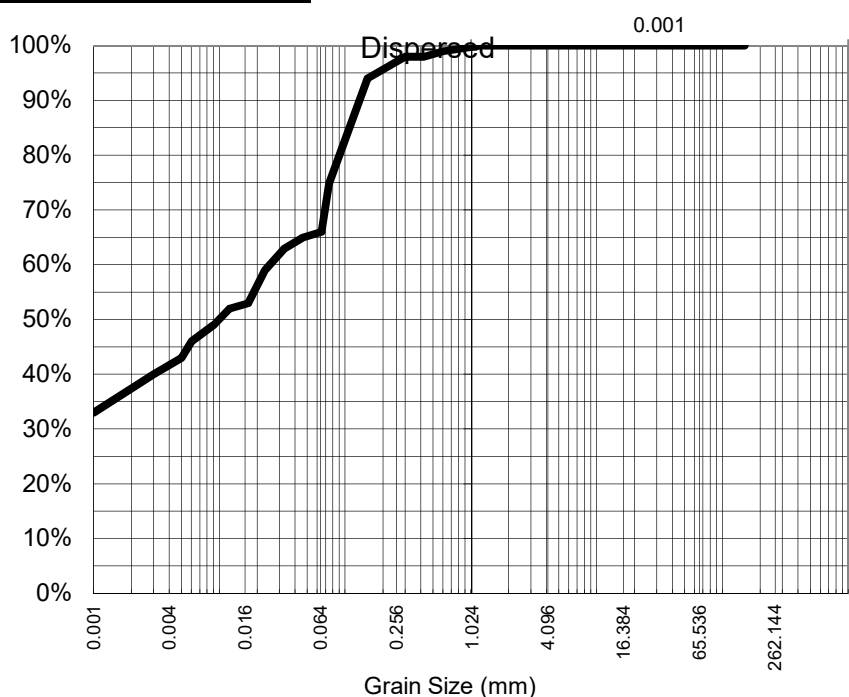
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Newcastle, NSW



CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-003 / 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

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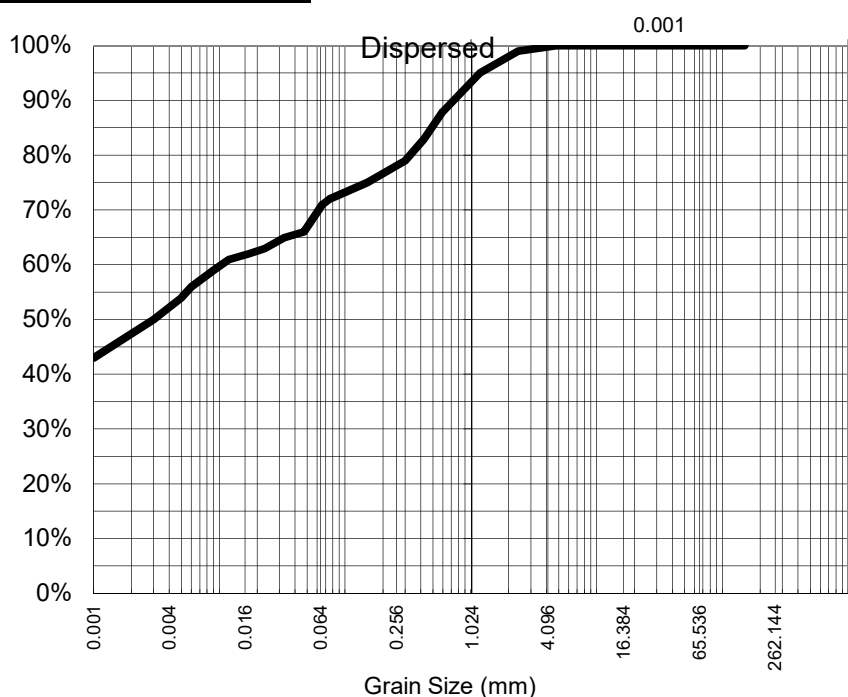
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Newcastle, NSW



CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-004 / 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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Laboratory Coordinator
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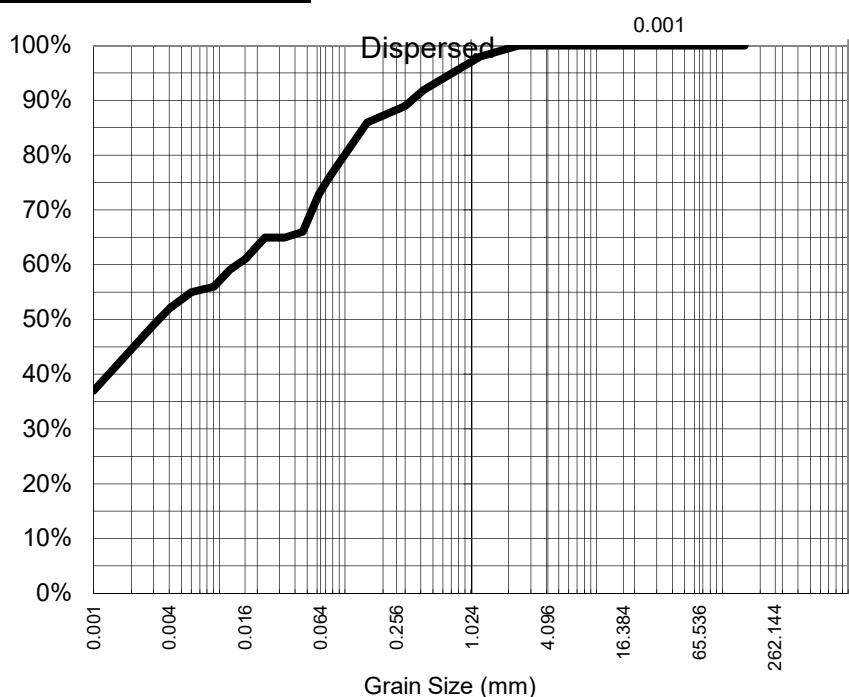
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COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-005 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** B5_08
Sediment Sampling

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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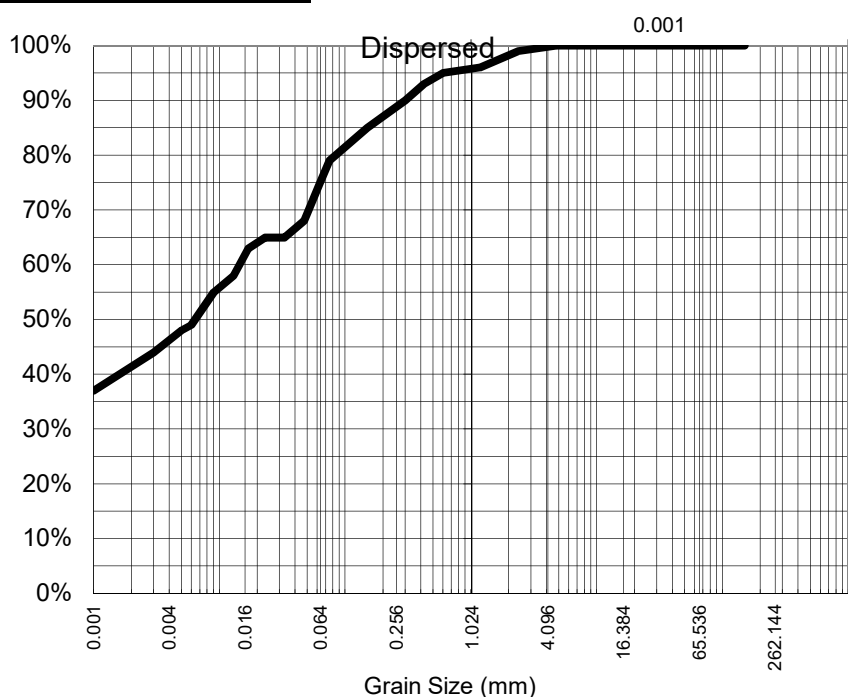
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Newcastle, NSW



CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-006 / 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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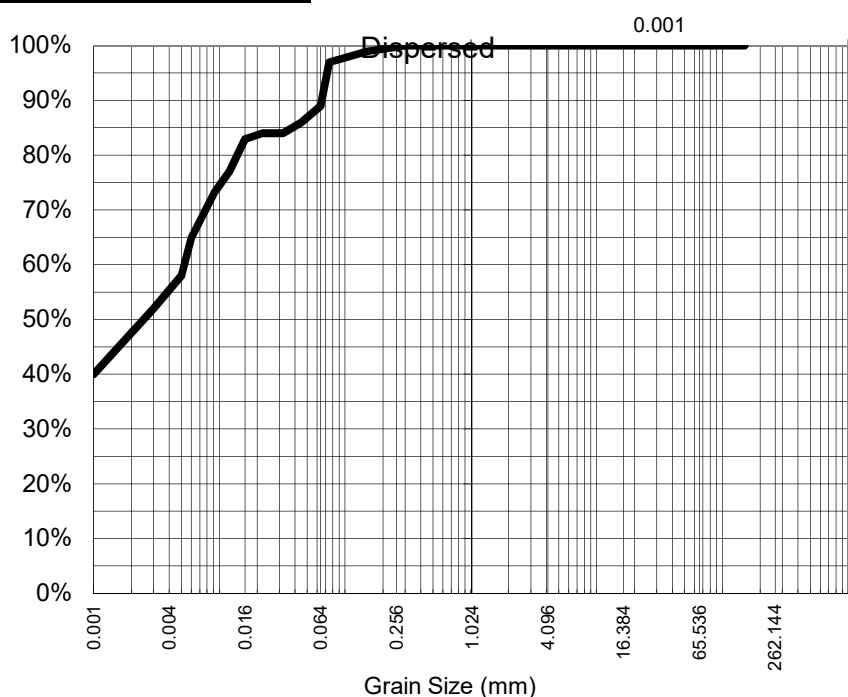
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Newcastle, NSW



CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-007 / 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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Laboratory Coordinator
Authorised Signatory



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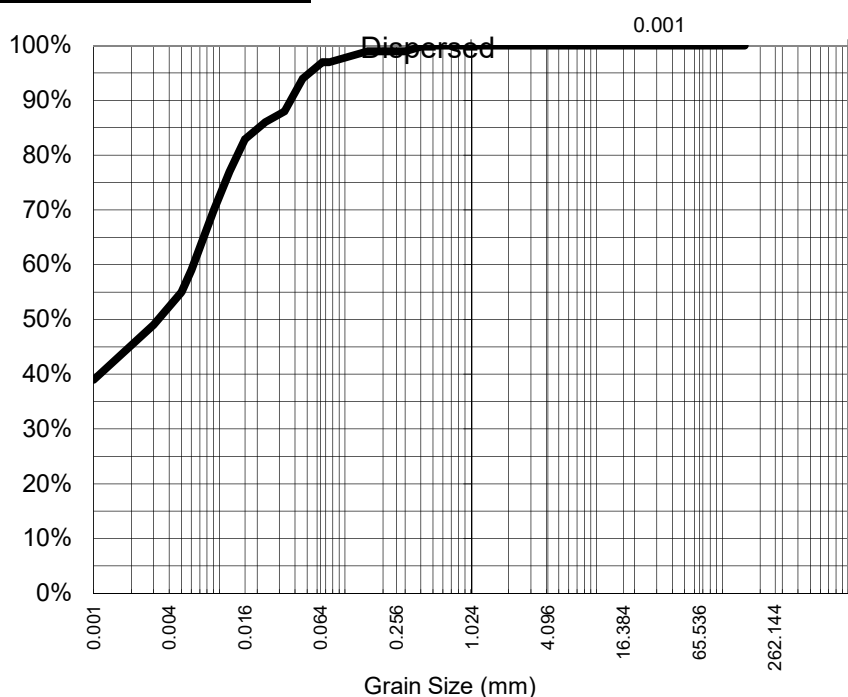
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Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

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:** EB1828853-008 / 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)*

NATA Accreditation: 825 Site: Newcastle
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Dianne Blane
Laboratory Coordinator
Authorised Signatory

Certificate of Analysis

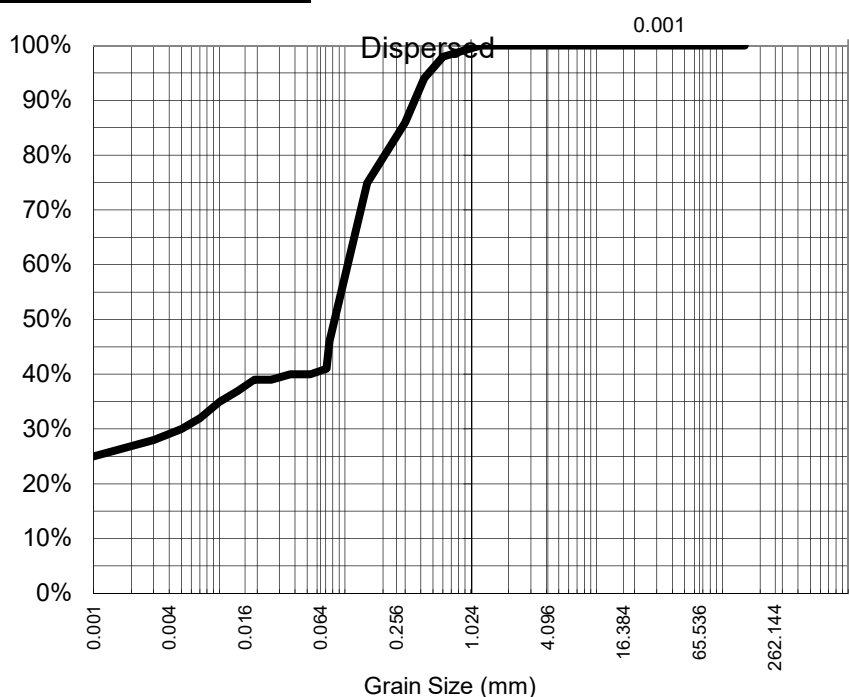
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

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:** EB1828853-009 / 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

D Blane

Dianne Blane
Laboratory Coordinator
Authorised Signatory



NATA Accreditation: 825 Site: Newcastle
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Certificate of Analysis

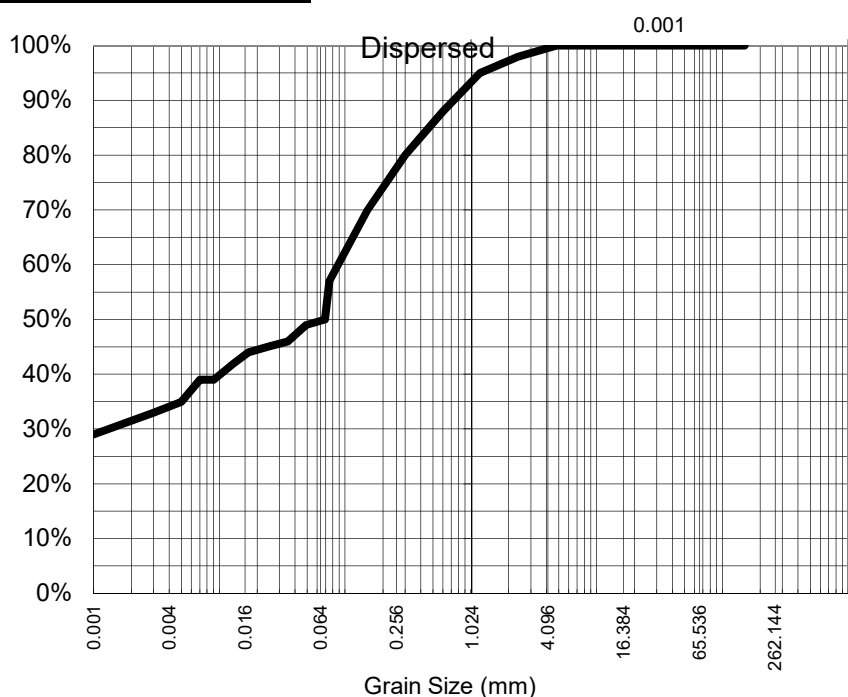
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

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:** EB1828853-010 / 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

D Blane

Dianne Blane
Laboratory Coordinator
Authorised Signatory



NATA Accreditation: 825 Site: Newcastle
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Certificate of Analysis

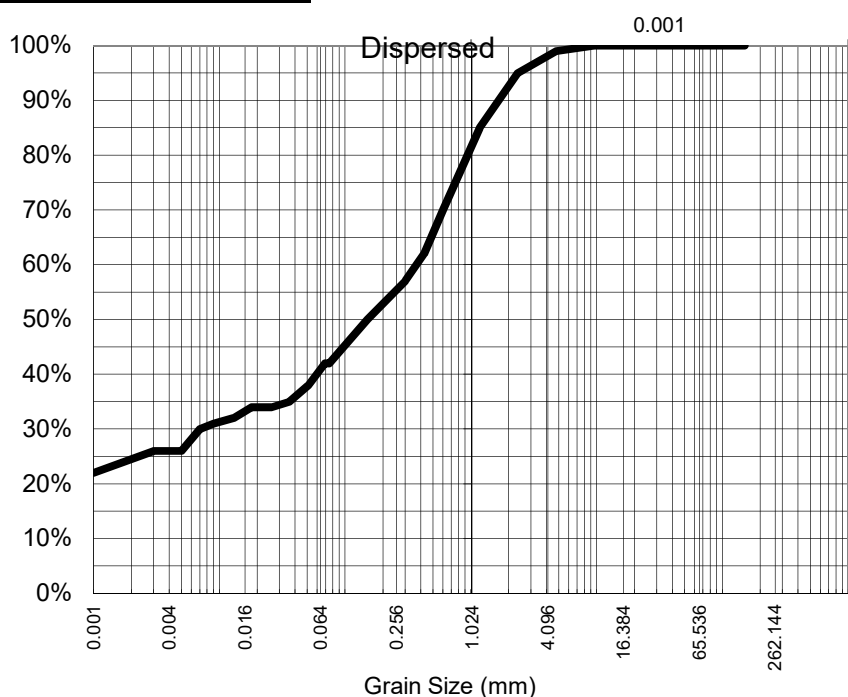
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

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:** EB1828853-011 / 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

D Blane

Dianne Blane
Laboratory Coordinator
Authorised Signatory



NATA Accreditation: 825 Site: Newcastle
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Certificate of Analysis

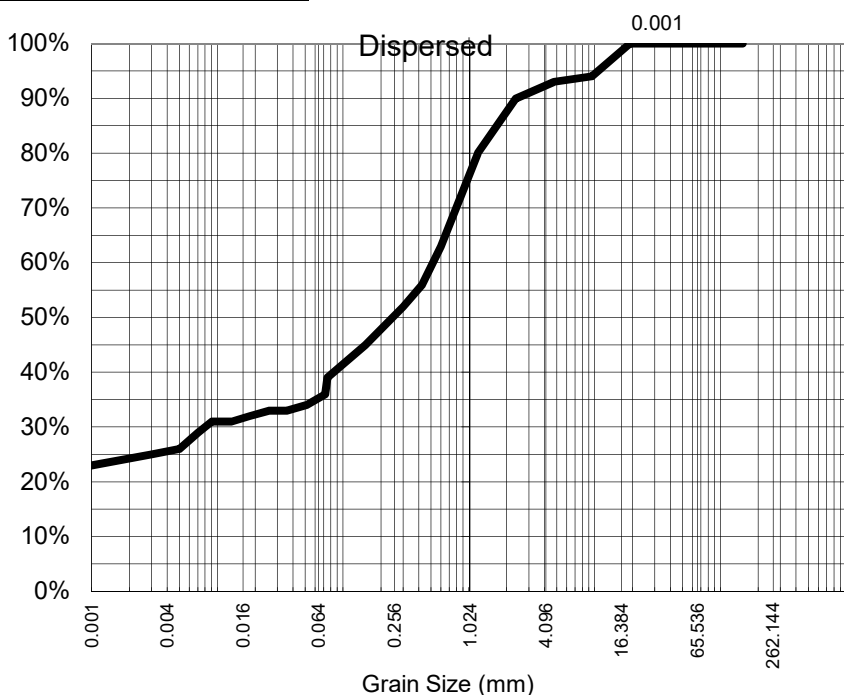
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

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:** EB1828853-012 / 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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Dianne Blane
Laboratory Coordinator
Authorised Signatory

Certificate of Analysis

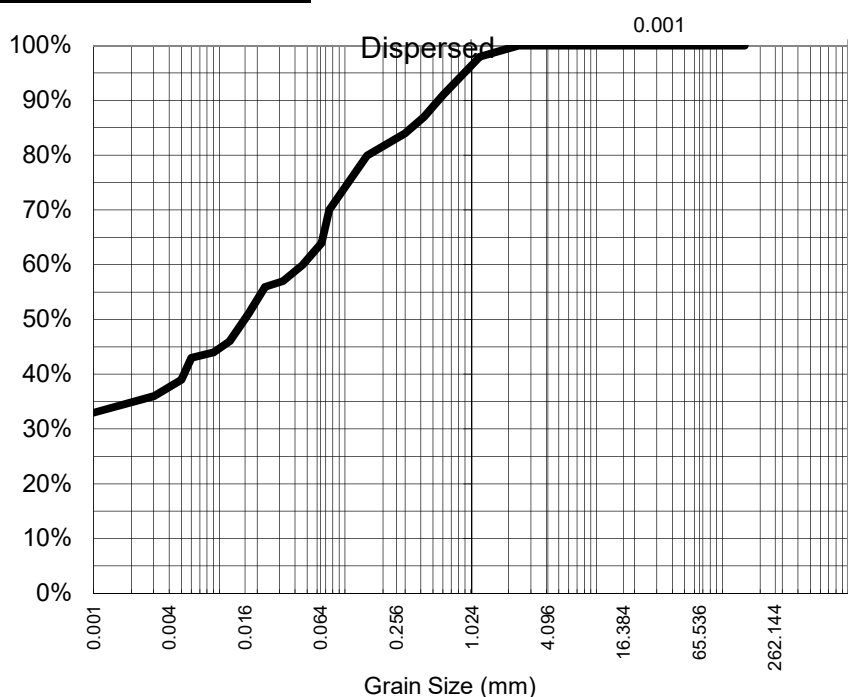
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

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:** EB1828853-013 / 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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Laboratory Coordinator
Authorised Signatory

Certificate of Analysis

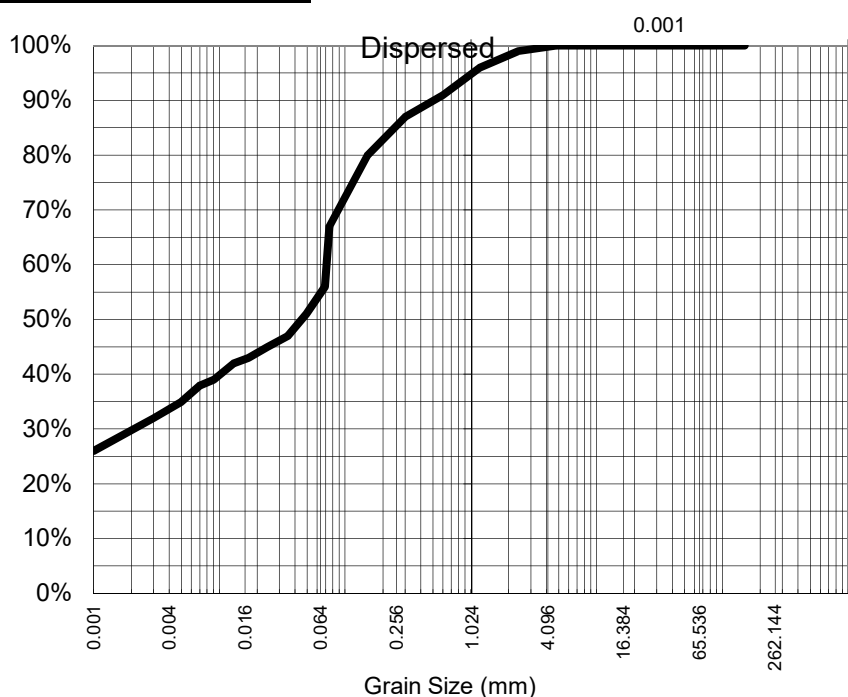
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

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:** EB1828853-014 / 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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Dianne Blane
Laboratory Coordinator
Authorised Signatory

Certificate of Analysis

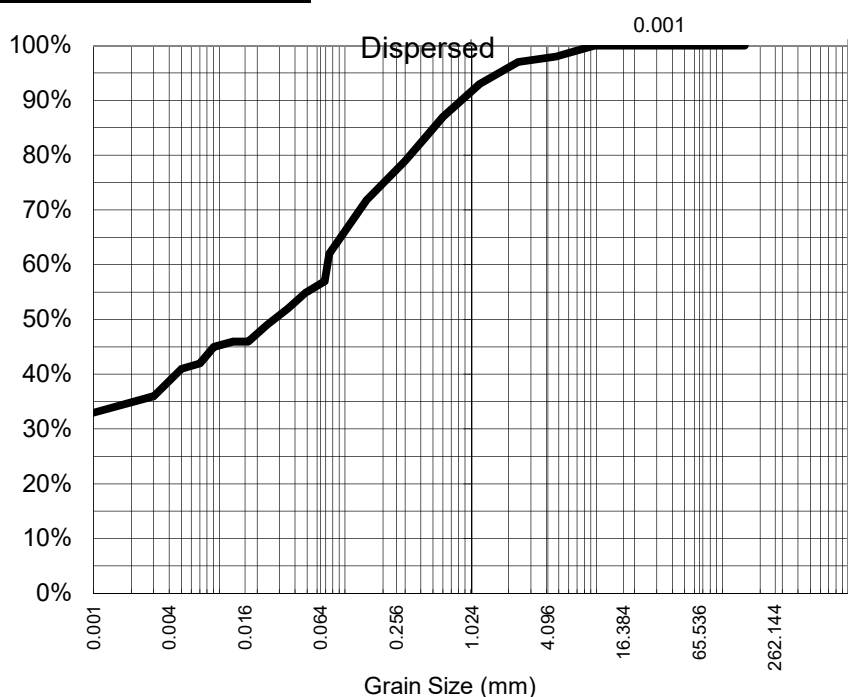
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

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:** EB1828853-015 / 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

D Blane

Dianne Blane
Laboratory Coordinator
Authorised Signatory



NATA Accreditation: 825 Site: Newcastle
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**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EB1828853**

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 3
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	: 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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World's Fastest Growing

Environmental Division
Brisbane
Work Order Reference
EB1828853



Telephone : +61-7-3243 7222