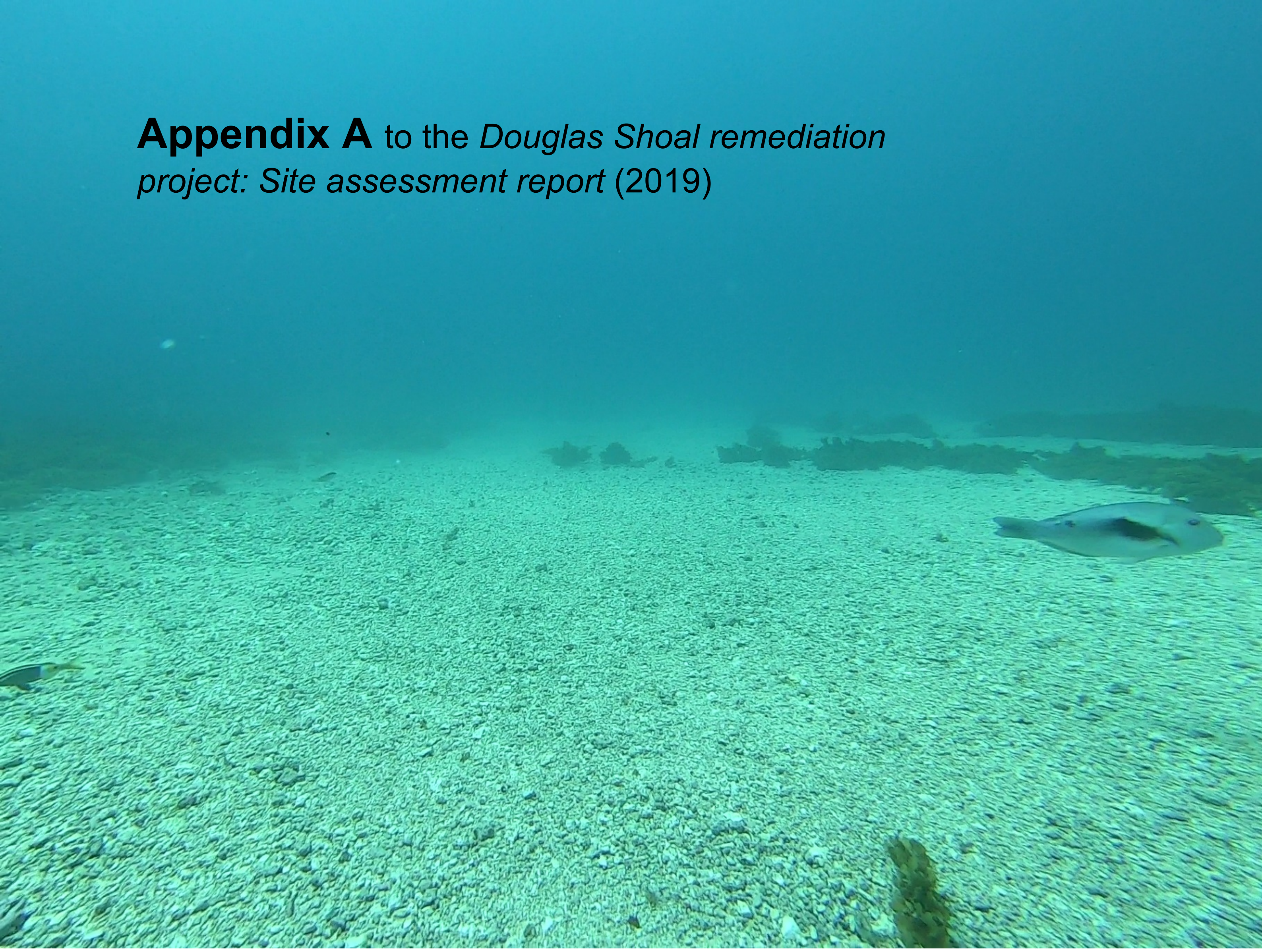
Appendix A to the *Douglas Shoal remediation project: Site assessment report* (2019)



Sediment Characterisation Report

Douglas Shoal Remediation Project

Great Barrier Reef Marine Park Authority

3 October 2019

Level 25, 12 Creek Street
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301001-02112-EN-REP-0005 Sediment Characterisation Report: Douglas Shoal Remediation Project

Rev	Description	Author	Review	Advisian approval	Date
0	Client Use	J Hogg M Priestly	B Boylson S Neale	B Mitchell	3 Oct 2019

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Acronym or Term	Definition
AFP	Antifouling Paint (AFP) is applied to the hull of marine vessels to control biofouling (the build-up of living organisms and organic or inorganic compounds) and as a barrier against corrosion. Typical constituents include copper compounds and biocides. Prior to 2003, tributyltin was a common constituent of AFP applied to marine vessels.
ANZG	The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) provide guidance on the management of water quality in Australia and New Zealand. It sets water quality and sediment quality objectives to sustain natural and semi-natural community values for water resources.
dbRDA	Distance-based Redundancy Analysis (dbRDA) plots show which factors are driving variability in a data set and where significant differences occur between factors. The data used for the plots is derived from DistLM.
DBT	Dibutyltin (DBT) is a breakdown product of tributyltin.
DistLM	Distance Based Linear Modelling (DistLM) is used to identify which combination of factors are driving variability in a data set and what proportion of variability they account for. The factors are fitted against the data according to a multiple linear regression.
DUP	A Laboratory Duplicate (DUP) is a laboratory QA/QC test to monitor precision of the results. A sample is split, and both tested as standard.
Heterogeneous sediments	Heterogeneous sediments are non-uniform in composition and character including shape, size, colour, texture and chemical composition.
Homogeneous sediments	Homogenous sediments are uniform in composition or character including shape, size, colour, texture and chemical composition.
LCS	A Laboratory Control Sample (LCS) is a laboratory QA/QC test to monitor the precision and accuracy of the methodology independent of the sample matrix. A certified reference material or known interference free matrix is spiked with target analytes and tested as standard.
LOR	The Limit of Reporting (LOR) is the smallest concentration of an analyte that can practically reported by the laboratory.
MB	A Method Blank (MB) is a laboratory QA/QC test to monitor potential laboratory contamination. All reagents are added to an analyte free matrix in the same volumes or proportions as in standard sample preparation and then concentrations are tested as in standard analysis.
MBT	Monobutyltin (MBT) is a breakdown product of tributyltin.

Acronym or Term	Definition
MS	A Matrix Spike (MS) is a laboratory QA/QC test to monitor potential matrix effects on the recovery of analytes. It involves an intra-laboratory split of a sample, of which one is spiked with a representative set of target analytes and tested as standard.
NAGD	The National Assessment Guidelines for Dredging (NAGD) provide clarity and a framework around the assessment and permitting process of ocean disposal of dredged material.
nMDS plots	Non-metric Multi-Dimensional Scaling (nMDS) plots are visual representations of the position of data in multi-dimensional space where points that are closer together are more similar. The distances between points are coded as rank orders. Vectors on the plots show what factors are important in driving differences between points.
PERMANOVA	Permutational Analysis of Variance (PERMANOVA) examines if there are significant differences or interactions between factors across a multivariate data cloud. PERMANOVA is the same as ANOVA with the exception that there are multiple variables (a data cloud) instead of singular. A significant p-value (<0.05) indicates that there are significant differences in the multivariate data cloud between that factor or interaction.
PSD	Particle Size Distribution (PSD) categorises sediment particles into categories from 75µm to +75mm and reports it as a percentage.
QA/QC	Quality Assurance/Quality Control (QA/QC) procedures ensure that samples and data collected provide for rigorous assessment. To satisfy field QA/QC requirements, field triplicates, field duplicates and rinsate blanks must be taken to the intensity specified in the NAGD. Laboratory QA/QC testing is completed by the laboratory and includes Method Blanks, Laboratory Duplicates, Laboratory Control Samples, Matrix Spikes and Surrogates.
QC Frequency	Quality Control Frequency (QC Frequency) defines the number of laboratory QA/QC samples that should be completed to satisfy the QA/QC requirements of that work order.
RPD	Relative percent difference (RPD) is calculated as part of field QA/QC to assess the validity, confidence and accuracy of results. The RPD of field duplicates should be ± 35%.
RSD	Relative standard deviation (RSD) is calculated as part of field QA/QC to assess the validity, confidence and accuracy of results. The RSD of field triplicates should be ± 50%.
Rubble	Rubble is the angular sediment particles generated by the grounding of the ship on the calcium carbonate reef matrix.

Acronym or Term	Definition
SAP	The Sampling and Analysis Plan (SAP) provides details on the proposed fieldwork, analysis and reporting to be undertaken.
Sub-area	Within each Priority Area, sub-areas were developed as part of the Sampling Analysis Plan to ensure statistical rigour in the contamination assessment. Multiple discrete sampling sites are included in each sub-area.
TBT	Tributyltin (TBT) is a highly toxic organotin that was a major constituent of AFP. The addition of TBT to AFP's was banned in 2003, however in older vessels the TBT infused AFP may still be present beneath non-toxic outer coatings of AFP.
TOC	Total Organic Carbon (TOC) is the amount of organic carbon found in sediment. When other contaminants are normalised to this it provides a measure of bioavailability.
1M HCl	A 1 mole of hydrochloric acid (HCl) per litre of solution (1M HCl) dilution is a weak acid digestion extraction test which provides a measure of the bioavailability of analytes.

1 Introduction

The bulk carrier 'Shen Neng 1' ran aground on Douglas Shoal in April 2010 and remained on the reef for 10-days before being re-floated. The total area directly impacted was approximately 42 ha which makes this incident the largest ship grounding scar known in the Great Barrier Reef Marine Park, and possibly the largest reef-related direct shipping impact in the world. The Great Barrier Reef Marine Park Authority (the Authority) established the Douglas Shoal Remediation Project (the Project) in late 2016 with funds from a court settlement associated with the grounding incident.

The primary desired outcome of the Project is that remediation activities support natural recovery at Douglas Shoal.

The Authority has identified three key concerns for ongoing natural recovery in the grounding footprint at Douglas Shoal:

- Antifouling paint (AFP) – previous estimates are that up to 20 tonnes of AFP may have been scraped from the vessel and left on Douglas Shoal as large and small flakes of paint
- Rubble – significant amounts of rubble of various sizes were generated across the impact area by the vessel grounding
- Compaction – the previously complex topography of the site was 'ground down' to a relatively flat topography by the vessel.

Findings from studies undertaken at Douglas Shoal since the grounding were compiled and summarised in the Douglas Shoal Preliminary Site Assessment Report (Costen et al. 2017). The report identified that no data are available for 77% of the grounding footprint and surmised that the distribution of physical damage and contamination is focused at four distinct areas, described as Priority Areas A, C, E and F. The report indicated that these areas represent priorities for further investigation and possible remediation.

In October 2018, Advisian were awarded a contract to provide Planning and Project Management services to the Authority for the Douglas Shoal Remediation Project. The planning services include the conduct of targeted fieldwork at Douglas Shoal within the grounding footprint and surrounds, followed by desktop investigations which include remediation area delineation and options analysis.

The targeted field work includes two main components:

- Seafloor sediment sampling and subsequent laboratory analysis for both physical and chemical characteristics of sediment within the grounding footprint and surrounding areas – described in the Sediment Sampling Field Report (Advisian 2019b)
- Visual seafloor surveys to examine the extent of the physical damage and to characterise the benthic structure both inside and outside the grounding footprint – described in the Visual Surveys Field Report (Advisian 2019c).

This Sediment Characterisation Report (the report) provides a validation of the analytical data reported, describes the results of the laboratory and statistical analysis, and provides detailed information on the physical and chemical characteristics of the sediments at Douglas Shoal to support the Site Assessment Report (Advisian 2019d).

1.1 Sampling and analysis plan

A Sampling and Analysis Plan (SAP) was prepared by Advisian (Advisian 2019a). The SAP was designed to align with the National Assessment Guidelines for Dredging (NAGD, Commonwealth of Australia (2009)). The SAP was submitted to the Authority and approved in March 2019 prior to undertaking the sediment characterisation field work.

1.2 Objectives

The sediment characterisation fieldwork was implemented based on the approved SAP (Advisian 2019a). The primary objectives of the sediment characterisation described in this report are to:

- Provide a description of the sampling carried out and issues encountered or deviations from the procedures set out in the SAP (Advisian 2019a), including justification for deviations
- Present and review the results of sampling and analysis, including Quality Assurance / Quality Control (QA/QC) assessment of field and laboratory data, comparison to data quality objectives and data validation
- Assess results against the NAGD (2009) guidelines and the 95th and 99th % species protection levels outlined in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
- Use statistical data analysis to address critical knowledge gaps regarding the seafloor substrate including Particle Size Distribution (PSD) of sediments and the spatial extent of AFP contamination.

1.3 Report structure

The structure of this report is set out in Table 1-1.

Table 1-1 Report structure

Description	Relevant Sections
Methods – Field activities and variations from the SAP	Section 2.1
Methods – Statistical analysis of chemical and physical data	Section 2.2
Results – Chemical characteristics	Section 3.1
Results – Physical characteristics	Section 3.2
Data validation – Field and laboratory QA/QC	Section 3.3

2 Methods

2.1 Field activity

The sediment sampling field work was conducted over a 17-day period between the 6th and the 22nd of March 2019 (including mobilisation and demobilisation). Fieldwork was carried out in accordance with the approved SAP (Advisian 2019a). Minor variations to the SAP occurred during the planning and execution of field work. These variations were based on technical considerations and logistical and health and safety learnings identified during a scouting trip to Douglas Shoal in January 2019 and the sediment sampling fieldwork in March 2019.

- A total of 237 of the proposed 300 discrete sites were targeted for sediment sampling from the four priority remediation areas (Priority Areas A, C, E, and F) and reference area (R) (Table 2-1).

The location of sampling sites (such as A1-1, A1-2, etc.) within sub-areas (such as A1, A2, etc.) and priority areas is shown in Figure 2-1 and Figure 2-2. At each of the 237 sampling sites, five sediment depth measurements were taken. A total of 267 samples (includes triplicate and duplicate samples) were sent to the laboratories for analysis of a range of chemical and physical characteristics. The chemical and physical characteristics analysed include:

- Metals and metalloids (total and bioavailable)– aluminium (Al), antimony (Sb), arsenic (As), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), selenium (Se), silver (Ag), vanadium (V), zinc (Zn)
- Organotins – monobutyltin (MBT), dibutyltin (DBT), tributyltin (TBT)
- Percent (%) moisture content
- Total Organic Carbon (TOC)
- Particle Size Distribution (PSD) and full range PSD (<75µm to +75mm) (range specified by the primary laboratory, ALS, scale)
- Soil particle density
- Settleability (10% and 20%)
- Phase III Elutriate – zineb, tributyltin (TBT), copper (Cu), zinc (Zn)

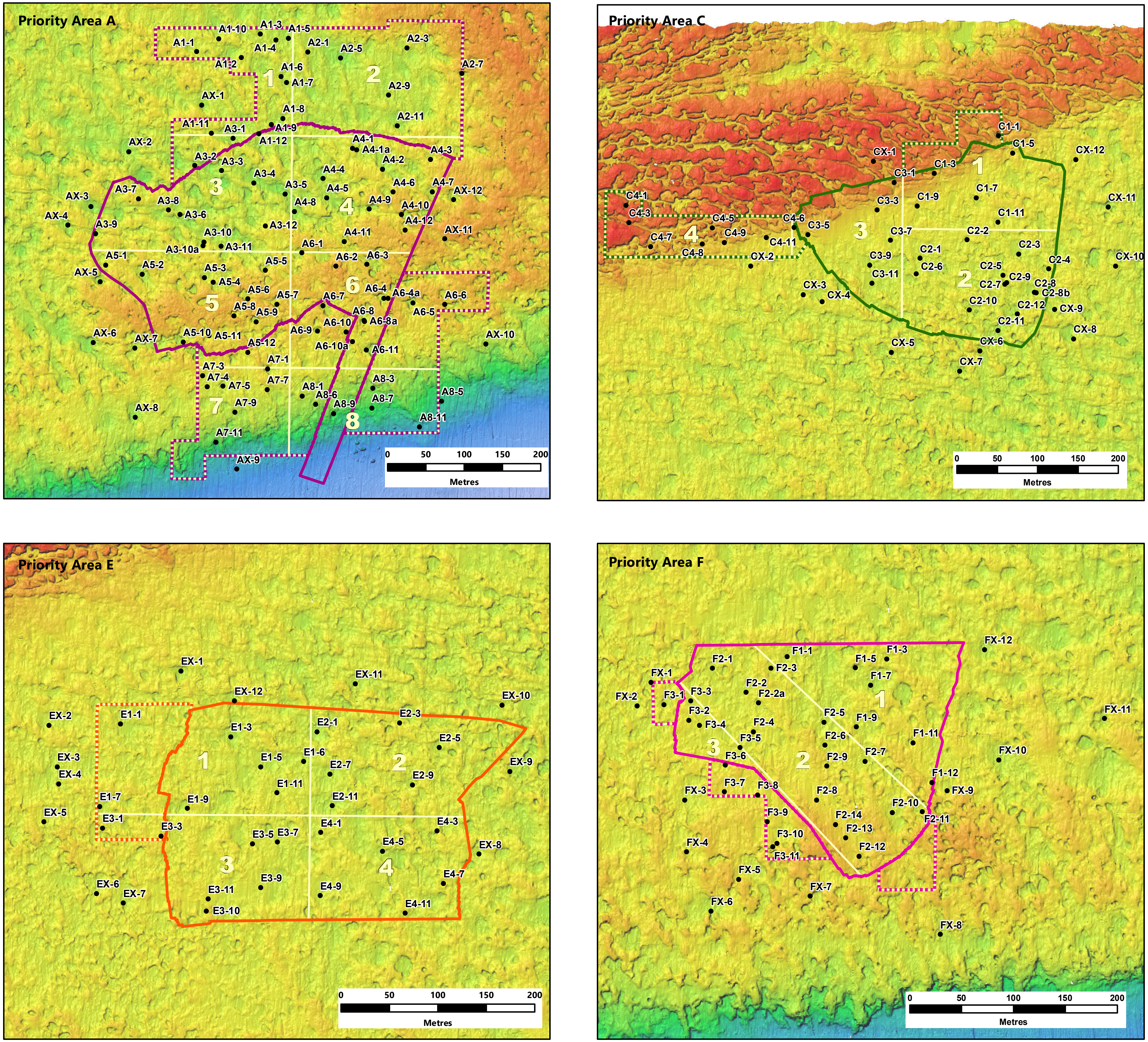
Of the 237 sampling sites, 39 sampling sites that had been sampled during previous field trips were re-visited, and 198 sampling sites were new sites not previously investigated. Of the 237 sampling sites, 48 sampling sites were outside the priority areas, and an additional twelve sites were well outside the grounding footprint (reference sites) (Figure 2-1 and Figure 2-2).

Table 2-1: Detailed summary of sampling and data collected

Priority Area	Site ID	No. of sampling sites	TOC	Metals	Organotins	Zineb	PSD	Settleability	Field Triplicate	Split Replicate
Area A	A1	12	12	12	12	0	6	1		✓
	A2	6	6	6	6	0	6	1		
	A3	13	13	13	13	11	9	3		✓
	A4	13	13	13	13	8	10	2		✓
	A5	12	12	12	12	8	7	1	✓ (x2)	
	A6	15	15	15	15	13	13	2	✓	
	A7	7	7	7	7	2	7	1		
	A8	7	7	7	7	3	7	1		
	AX	12	12	12	12	2	6	4		✓
Area C	C1	6	6	6	6	3	6	2		
	C2	13	13	13	13	6	11	1		
	C3	6	6	6	6	4	6	2		
	C4	8	8	8	8	7	7	1	✓	✓
	CX	12	12	12	12	1	8	2	✓	
Area E	E1	7	7	7	7	0	7	1		
	E2	6	6	6	6	0	5	1	✓	
	E3	7	7	7	7	2	7	3		
	E4	6	6	6	6	0	5	2		
	EX	12	12	12	12	1	7	1		✓
Area F	F1	7	7	7	7	0	6	1		✓
	F2	15	15	15	15	0	13	1		
	F3	11	11	11	11	0	10	2		
	FX	12	12	12	12	0	7	2		
Reference	R1	6	6	6	6	0	5	2		✓
	R2	6	6	6	6	1	6	3	✓	
Totals		**237**	**237**	**237**	**237**	**72**	**187**	**43**	**7**	**8**

Douglas Shoal Remediation Planning Sediment Characterisation Report

Figure 2-1
Sediment Sampling Sites
Priority Areas A, C, E and F



Priority Area

- A
- A - outside grounding footprint
- C
- C - outside grounding footprint
- E
- E - outside grounding footprint
- F
- F - outside grounding footprint
- Sediment sampling location
- Priority Area Sub-area
- Grounding footprint

Bathymetry

-23.0m — -9.0m

Source Information:
Sediment sampling locations
Advisian 2019
Priority areas, Grounding footprint
Cardno 2017

Bathymetry (50cm LAT)
Acoustic Imaging 2019

Coordinate System: GCS GDA 1994
Datum: GDA 1994

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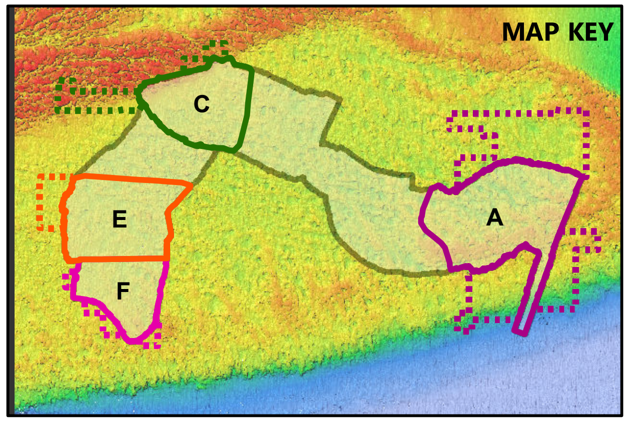

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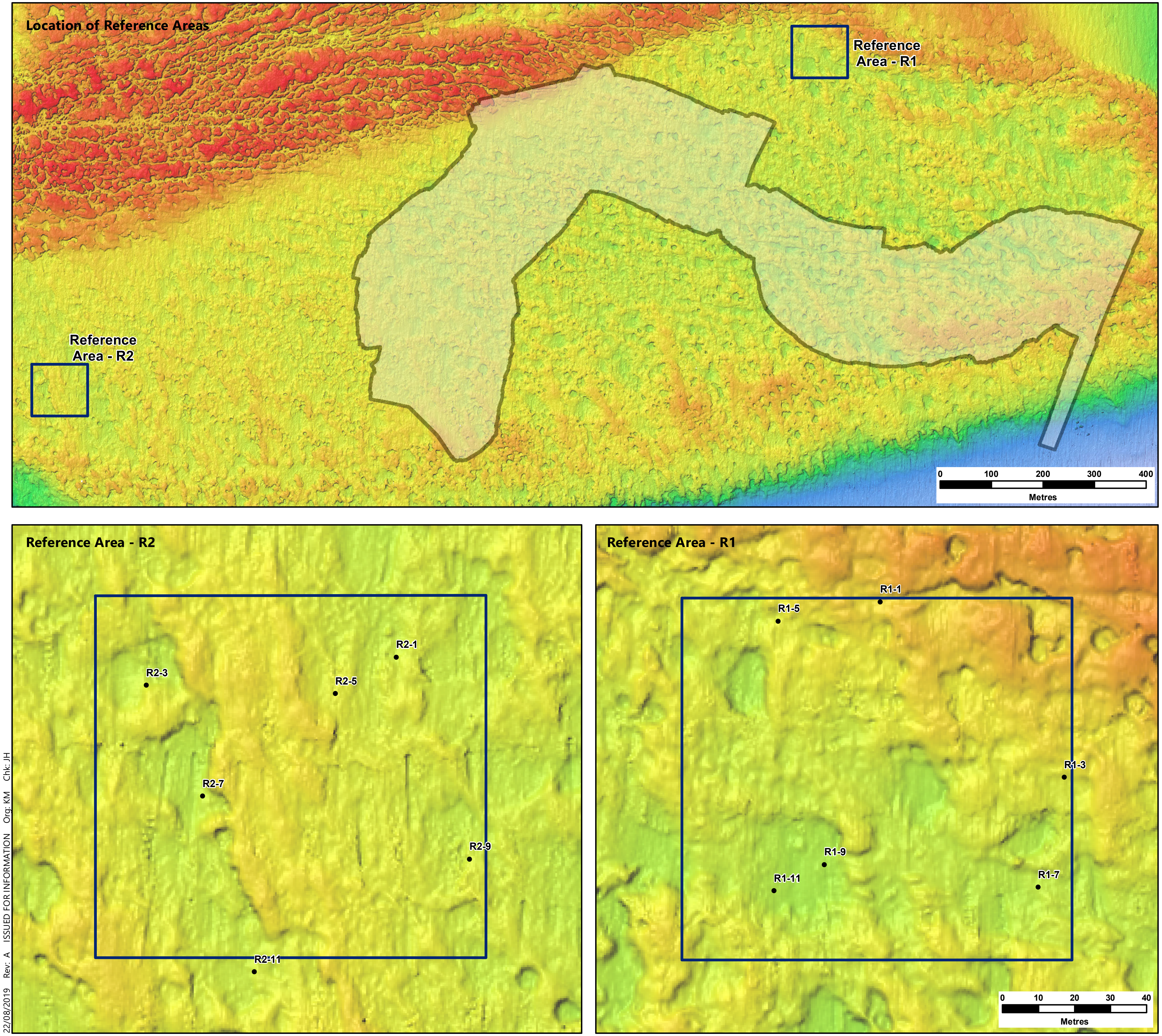
Douglas Shoal Remediation Planning
Sediment Characterisation Report

Figure 2-2
Sediment Sampling Sites
Reference Areas



Sediment sampling location

Grounding footprint

Reference areas

Bathymetry

-23.0m -9.0m

Source Information:
Sediment sampling locations
Advisian 2019
Grounding footprint
Cardno 2017

Bathymetry (50cm LAT)
Acoustic Imaging 2019

While every care is taken to ensure the accuracy of this data, Worley 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.

Coordinate System: GCS GDA 1994
Datum: GDA 1994

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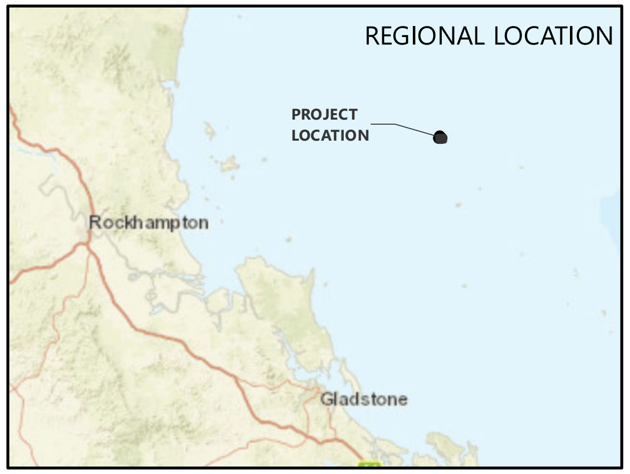

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User

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PSD analysis was undertaken for sediments from 187 sampling sites (a total of 210 samples analysed for PSD when triplicate and duplicate samples are included) and settleability analysis was undertaken for sediments from 43 sampling sites.

Where sediment concentrations of total or weak acid digest (bioavailable) metals and metalloids, or normalised TBT (normalised to 1% TOC) were near or above the NAGD (2009) guidelines, the samples were flagged for Phase III elutriate testing and the results of the testing were compared to the ANZG (2018) 99% species protection guideline. This was completed for 72 sampling sites, with three also tested for copper and zinc (Table 2-2). The Phase III elutriate test was also utilized to test for the biocide zineb, which is a constituent applied to the Shen Neng 1. A total of 72 sampling sites were tested for zineb (Table 2-1). The Phase III elutriation method outlined in the NAGD (2009) was used rather than the method proposed by the laboratories as outlined in the SAP (Advisian 2019a). The original method was altered due to the explosive nature of the calcium carbonate sample when the original methods were applied.

Table 2-2 Site locations of Phase III elutriate sampling

Priority area	Sub-area	Total number of sampling sites	Phase III Elutriate		
			TBT	Copper	Zinc
Area A	A1	12	0	0	0
	A2	6	0	0	0
	A3	13	11	0	0
	A4	13	8	1	1
	A5	12	8	0	0
	A6	15	13	1	1
	A7	7	2	0	0
	A8	7	3	0	0
	AX	12	2	0	0
Area C	C1	6	3	0	0
	C2	13	6	1	1
	C3	6	4	0	0
	C4	8	7	0	0
	CX	12	1	0	0
Area E	E1	7	0	0	0
	E2	6	0	0	0
	E3	7	2	0	0
	E4	6	0	0	0

Priority area	Sub-area	Total number of sampling sites	Phase III Elutriate		
			TBT	Copper	Zinc
	EX	12	1	0	0
Area F	F1	7	0	0	0
	F2	15	0	0	0
	F3	11	0	0	0
	FX	12	0	0	0
Reference	R1	6	0	0	0
	R2	6	1	0	0
Totals		**237**	**72**	**3**	**3**

A reduced number of triplicate and duplicate samples were collected (Table 2-3) compared to those outlined in the SAP (Advisian 2019a). At 15 of the 237 sampling sites spread across each of the priority remediation areas, triplicate and duplicate samples were collected to facilitate intra and inter laboratory QA/QC comparisons. Collection of duplicate and triplicate samples at Douglas Shoal presented challenges as follows:

- Sediment depths measured by the diver were on average less that 10cm
- The collection of three samples (three separate full sample tubes) at many sites was restricted by the quantity of sediment available in proximity to the diver (within 10m).

Given the scarcity of sediment, the collection of samples at some sites presented logistical challenges and a potential health and safety hazard during high current periods. These were associated with drag during diver descent and traverse due to carrying additional sampling equipment, and the additional weight during ascent which affected diver buoyancy.

Additional QA/QC analysis undertaken included eight inter-batch laboratory analyses of Certified Reference Materials (CRM) (refer to Laboratory Analysis Report (Advisian 2019e)).

Table 2-3: Site locations of field triplicates and split replicates

Priority Area	Site ID	Field triplicate	Split replicate
Area A	A1-12		✓
	A3-3		✓
	A4-5		✓
	A5-8	✓	
	A5-9	✓	
	A6-4	✓	

Priority Area	Site ID	Field triplicate	Split replicate
Area AX	AX-11		✓
Area C	C4-9		✓
	C4-11	✓	
Area CX	CX-9	✓	
Area E	E2-11	✓	
Area EX	EX-5		✓
Area F	F1-7		✓
Area R	R1-5		✓
	R2-7	✓	

2.2 Statistical analysis

Statistical analysis of the data was undertaken in PRIMER with PERMANOVA (v7) (Clarke & Gorley 2015) to identify:

- Significant differences in the contamination status between remediation priority areas and reference areas
- Differences in PSD between remediation priority areas, external sites and reference areas
- Hotspot contamination areas
- Sources of variability in the dataset and whether observed patterns in the data are due to spatial factors (area or sampling sites) or sediment characteristics (PSD, TOC, soil particle density, soil moisture, sediment settling rate or sediment depth).

2.2.1 Data processing

Data processing included the following steps:

1. Chemical and physical characteristic data were merged into a single dataset.
2. Contaminant data were reviewed and where values were below the limit of reporting (LOR) they were set to half the LOR value. This is the recommended procedure by ANZG (2018). Some parameters in some samples had raised LORs due to the matrix characteristics or spectral interference for that batch (Section 3.3.2). This was considered in the interpretation and analysis of the dataset as, for example, if differences were found between values which were below different LORs this should not be considered a significant difference.
3. Although a 'normal' distribution is not a requirement of the analyses used in this study, the data should not be heavily skewed as outliers can have a strong influence on the results. Where a roughly normal distribution could not be achieved it was excluded from the analysis (Anderson et al. 2008). Contaminants for which all values were below the LOR were not graphed or included in the statistical analysis. This included total antimony (mg/kg), total silver (mg/kg), bioavailable

cadmium (mg/kg), bioavailable cobalt (mg/kg), bioavailable mercury (mg/kg), bioavailable selenium (mg/kg) and bioavailable silver (mg/kg) (Table 2-4). The respective LOR for these metals was well below the respective NAGD (2009) guidelines.

4. Concentrations of TBT were normalised to 1% TOC as required by the NAGD (2009) guideline.
5. For multivariate analyses, the data was transformed (log + 1) to achieve a similar distribution among data as the results were in different ranges. The resulting dataset was used to make a resemblance matrix, which is a matrix of scores that represents the similarity between each pairwise comparison of data points. The Euclidean distance measure was used as it is well suited to contaminant data and parameters with a large quantity of zeros or same values (such as for variables which are mostly below the LOR as expected in this program.
6. For distance based linear modelling (DistLM) analysis, where two parameters are highly collinear ($r \geq 0.95$) it is recommended that one is removed prior to analysis (Anderson et al. 2008). The rationale is that where two parameters are highly correlated, they effectively contain the same information and using both is redundant for the purposes of the analysis. The parameter that is retained acts as a proxy for the redundant parameter. This recommendation was followed. Cobalt was excluded from the analysis as it had a 98% correlation to lead and 99% correlation to cadmium (Table 2-4). Apart from two values, all samples had cobalt concentrations below the LOR.

Table 2-4: Summary of parameters and guidelines used in multivariate analysis including the ANZG (2018) default guideline value (DGV) and upper guideline value (GV-high)

Group	Parameter	Units	LOR	NAGD (2009) / ANZG (2018) DGV	ANZG (2018) GV-high	Notes
Total metals and metalloids	Aluminium, Al	mg/kg	50	--	--	
	Antimony, Sb	mg/kg	0.25	2.0	25	Excluded from analyses – all below LOR
	Arsenic, As	mg/kg	0.5	20	70	
	Cadmium, Cd	mg/kg	0.05-0.15	1.5	10	
	Chromium, Cr	mg/kg	1.0	80	370	
	Cobalt, Co	mg/kg	0.25	--	--	Excluded from DistLM analysis – high correlation to lead and cadmium
	Copper, Cu	mg/kg	0.5	65	270	
	Iron, Fe	mg/kg	50	--	--	
	Lead, Pb	mg/kg	0.5	50	220	

Group	Parameter	Units	LOR	NAGD (2009) / ANZG (2018) DGV	ANZG (2018) GV-high	Notes
	Manganese, Mn	mg/kg	5.0	--	--	
	Mercury, Hg	mg/kg	0.005 -0.02	0.15	1.0	
	Nickel, Ni	mg/kg	0.5	21	52	
	Selenium, Se	mg/kg	0.1-0.15	--	--	
	Silver, Ag	mg/kg	0.1-0.15	1.0	4.0	Excluded from analyses – all below LOR
	Vanadium, V	mg/kg	1	--	--	
	Zinc, Zn	mg/kg	0.5	200	410	
Bioavailable metals and metalloids	Aluminium, Al	mg/kg	25-60	--	--	
	Antimony, Se	mg/kg	1	2.0	--	
	Arsenic, As	mg/kg	0.5	20	--	
	Cadmium, Cd	mg/kg	0.06-0.065	1.5	--	Excluded from analyses – all below LOR
	Chromium, Cr	mg/kg	0.5	80	--	
	Cobalt, Co	mg/kg	0.25	--	--	Excluded from analyses – all below LOR
	Copper, Cu	mg/kg	0.5	65	--	
	Iron, Fe	mg/kg	25	--	--	
	Lead, Pb	mg/kg	0.5	50	--	
	Manganese, Mn	mg/kg	5	--	--	
	Mercury, Hg	mg/kg	0.05	0.1	--	Excluded from analyses – all below LOR
	Nickel, Ni	mg/kg	0.5	21	--	

Group	Parameter	Units	LOR	NAGD (2009) / ANZG (2018) DGV	ANZG (2018) GV-high	Notes
	Selenium, Se	mg/kg	0.25	--	--	Excluded from analyses – all below LOR
	Silver, Ag	mg/kg	0.5	1.0	--	Excluded from analyses – all below LOR
	Vanadium, V	mg/kg	1	--	--	
	Zinc, Zn	mg/kg	1	200	--	
Organotins	Monobutyltin	µg Sn/kg	0.5	--	--	
	Dibutyltin	µg Sn/kg	0.5	--	--	
	Tributyltin	µg Sn/kg	0.25	9µg Sn/kg (normalised to 1% TOC)	70µg Sn/kg (normalised to 1% TOC)	TBT normalised to 1% TOC used in analyses
Sediment characteristics	Moisture	%	--	--	--	
	Total organic carbon	%	--	--	--	
	Density	g/cm3	--	--	--	
	Settleability	mm/min	--	--	--	50% and 90% settlement rates were tested with identical results
	Depth	mm	--	--	--	
Full Range particle size distribution	<75µm	%	1	--	--	
	+75µm	%	1	--	--	
	+150µm	%	1	--	--	
	+300µm	%	1	--	--	
	+425µm	%	1	--	--	
	+600µm	%	1	--	--	
	+1180µm	%	1	--	--	
	+2.36mm	%	1	--	--	

Group	Parameter	Units	LOR	NAGD (2009) / ANZG (2018) DGV	ANZG (2018) GV-high	Notes
	+4.75mm	%	1	--	--	
	+9.5mm	%	1	--	--	
	+19mm	%	1	--	--	
	+37.5mm	%	1	--	--	
	+75mm	%	1	--	--	

2.2.2 Graphs

Graphs of individual contaminant parameters and sediment characteristics plotted versus site were prepared using PRIMER to present the average and standard error. Graphs were prepared for all contaminant and sediment parameters which had detections above the LOR. Where applicable, the graphs also included the NAGD (2009) and ANZG (2018) guideline levels as per Table 2-4.

2.2.3 Non-metric multidimensional scaling plots

The resemblance matrix was used to generate non-metric multidimensional scaling (nMDS) plots which were subsequently overlaid with the factors of interest of area and site. nMDS plots are visual representations of the similarity matrix where points that are closer together are more similar. For each nMDS plot that is overlaid by a different factor, the points are in the same position but are highlighted and symbolized in different colours and shapes by different factors. The vectors on the graphs show which factors were important in driving differences between sites as determined by the length and direction of the vector.

nMDS plots were made for both the similarity matrixes of PSD and contaminant concentrations.

2.2.4 Permutational analysis of variance

Permutational analysis of variance (PERMANOVA) was undertaken to determine significant differences between sites in the multivariate profile of contaminants. A level of $p<0.01$ was considered significant.

2.2.5 Bubble plots

Bubble plots were produced to further examine the concentrations of organotins, copper and zinc (AFP components) within a hotspot area identified during analysis.

2.2.6 Distance based linear modelling

Distance based linear modelling (DistLM) and distance-based redundancy analysis (dbRDA) plots was undertaken to determine which factors were driving variability in the datasets. DistLM is similar to regression but on a multivariate dataset (i.e. the similarity matrix) while a dbRDA plot is a visual model that is used to represent (i.e. illustrate) the results of DistLM analysis.

Two factors known to be very important for the assessment of contaminants in sediments is sediment grain size and TOC (ANZG 2018):

- The bioavailability and toxicity of contaminants is dependent on sediment grain size whereby finer sediment fractions will typically have higher concentrations of contaminants. Generally, the finer fraction (<63µm) is of concern as it can be resuspended and ingested by biota.
- An increasing organic content favours partitioning of metals and organic contaminants to sediment particles.

Sediment characteristics likely to have large influences on the variability of the dataset were used in the analysis. This meant the analysis could estimate how much variability was associated with different factors and determine the proportion of variability associated with the factor of 'site', after accounting for sediment characteristics.

Model selection was initially performed using the BEST selection procedure in the DistLM function of PRIMER. The Akaike Information Criteria and Bayesian Information Criteria were utilised and the top 20 models suggested by each criterion were compared to select factors to include in the final model. The analysis was then refined and repeated by removing factors which weren't among the most significant contributors of variability to the dataset. This included removal of the factor of sediment depth (mm).

DistLM analysis was repeated using the step-wise selection procedure and adjusted R2 criterion with environmental, spatial and temporal factors ranked in order of their contribution to variability. dbRDA plots were generated for the final model. Spatial factors (i.e. area or site) were included last as recommended by Anderson *et al.* (2008) in order to determine if there were spatial impacts after accounting for environmental and temporal variability. In DistLM models, there is a set amount of variability and a proportion which will be shared among some factors. The shared variability is assigned to the factor which is listed first in the model.

2.2.7 Summary

A summary of each of the above analyses and associated parameters used in the statistical analyses is shown in Table 2-5. Results are compared to the relevant NAGD (2009) and ANZG (2018) guidelines where applicable and as outlined in Table 2-4.

Table 2-5: Summary of statistical analyses

Analysis	Factors	Parameters	Rationale for analysis
Graphs	Sub-area (A1-A9, AX; C1-C4, CX; E1-E4, EX; F1-F3, FX; R1, R2)	All data (except those which were all <LOR as indicated in Table 2-4)	To compare average (± standard error) concentrations across priority areas and sub-areas To identify which sampling sites exceeded the NAGD (2009) guidelines.

Analysis	Factors	Parameters	Rationale for analysis
nMDS	Sub-area (A1-A9, AX; C1-C4, CX; E1-E4, EX; F1-F3, FX; R1, R2) Grounding footprint (sub-areas inside footprint (A1-A9, C1-C4, E1-E4 and F1-F3) vs. sub-areas external to footprint (AX, CX, EX and FX) vs. reference (R1, R2))	Multivariate profile of PSD	Identify if there are differences in the PSD of sub-areas within the grounding footprint in comparison to sub-areas outside the grounding footprint.
	Sub-areas (A1-A9, AX; C1-C4, CX; E1-E4, EX; F1-F3, FX; R1, R2)	Multivariate profile of contaminants (Table 2-4)	Identify which sub-areas are different in their chemical profile and which specific contaminants are driving differences.
PERMANOVA	Priority area sub-areas (A1-A9, AX; C1-C4, CX; E1-E4, EX; F1-F3, FX) compared to reference area sub-areas (R1, R2)	Multivariate profile of contaminants (Table 2-4)	Identify which sub-areas were significantly different to reference area sub-areas.
Bubble plots	Priority Area A sub-areas (A1-A9, AX)	TBT, MBT, DBT, copper, zinc	Visualise contamination concentrations for selected parameters for sub-areas within Priority Area A based on previous analyses which showed this is the main area of contamination.
DistLM	Sub-areas (A1-A9, AX; C1-C4, CX; E1-E4, EX; F1-F3, FX; R1, R2) Sediment characteristics as in Table 2-4	Multivariate profile of contaminants (Table 2-4)	Identify which factors are important in driving variability in the dataset. Determine if there is a significant difference between sub-areas after accounting for key sediment characteristics which influence contamination concentrations.

3 Results

3.1 Chemical characteristics

The following sections contain detailed discussion of the results of laboratory analysis of sediments collected from Douglas Shoal including concentrations of total and bioavailable metals and metalloids, organotins and elutriate water (on selected samples). The discussion is focused on the main potential contaminants contained in the AFP applied to the Shen Neng 1, which include TBT, copper, zinc and zineb. Discussion of results for additional metals are also provided and discussed. Analytes for which all results were below the LOR were not graphed, as described in Table 2-4.

The results for the AFP constituent concentrations from each site (bioavailable copper and zinc and normalised TBT only) are overlaid onto maps of each of the Priority Area and reference areas to help visualise the spatial spread of the AFP contamination – Priority Areas A (Figure 3-14), Priority Area C (Figure 3-15), Priority Area E (Figure 3-16), Priority Area F (Figure 3-17) and Reference Areas (Figure 3-18)

3.1.1 Total metals and metalloids

The mean concentrations (± standard error) of total metals and metalloids were graphed to compare across sub-areas and priority areas and to identify where samples exceeded the NAGD (2009) guideline level. These graphs are shown in Figure 3-1 to Figure 3-13 with ± standard error in each sub-area shown by vertical blue lines, and concentration scales varying between contaminants.

Elevated mean concentrations of AFP constituents were found in sub-areas within the priority areas compared to the reference areas; however, results for these sub-areas also showed a high standard error. The variation was due to higher concentrations in only one or two of the sampling sites of those sub-areas. Significant results for AFP constituents include:

- The mean concentration of copper (mg/kg) was higher at sub-areas A4 and A6 in comparison to the reference areas (R1 and R2) and all other sub-areas (Figure 3-1). The elevated mean concentrations at A4 and A6 were due to high values in one of 13 sampling sites in sub-area A4 and one of 15 sampling sites in sub-area A6.
- The mean concentration of zinc (mg/kg) was highest at sub-area A6 in comparison to reference areas R1 and R2 and all other sub-areas (Figure 3-2). The elevated mean concentration was due to a high value in one of 15 sampling sites in sub-area A6.
- For the reference areas, the concentrations of copper (mg/kg) and zinc (mg/kg) were below LOR for all sampling sites (Figure 3-1 and Figure 3-2).

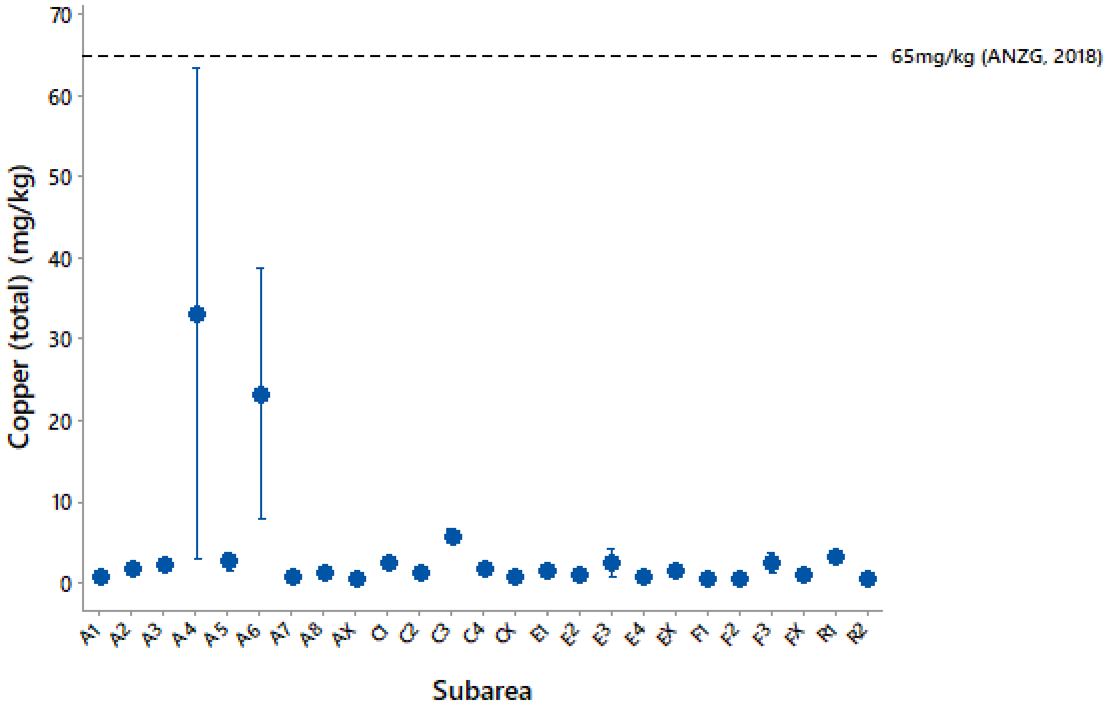


Figure 3-1: Mean concentrations of total copper (mg/kg) by sub-area with the NAGD (2009) guideline level of 65 mg/kg

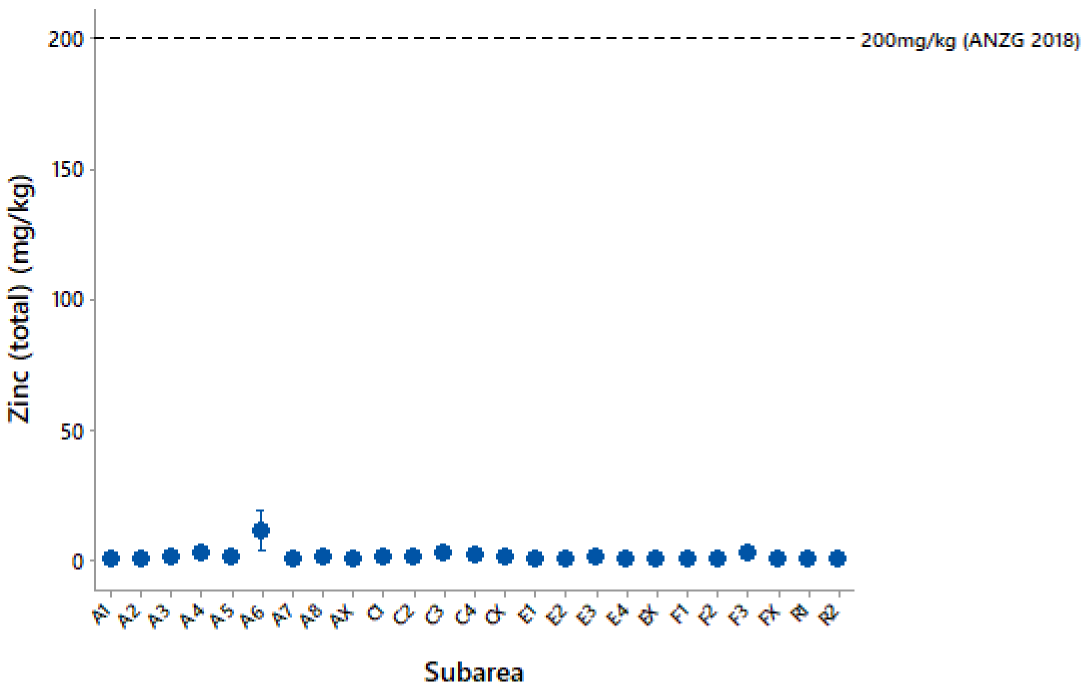


Figure 3-2: Mean concentrations of total zinc (mg/kg) by sub-area with the NAGD (2009) guideline level of 200 mg/kg

For several metals and metalloids there was a pattern of increased concentration in some sub-areas in comparison to the reference areas:

- Mean concentration of total aluminium (mg/kg) was higher at sub-areas C3, C4 and F3 in comparison to reference area sub-areas R1 and R2 (Figure 3-3)
- Mean concentration of total chromium (mg/kg) was higher at sub-area F3 in comparison to reference area sub-areas R1 and R2 (Figure 3-4)
- Mean concentration of total iron (mg/kg) was higher at sub-areas C3, C4, F2 and F3 in comparison to reference area sub-areas R1 and R2 (Figure 3-5)
- Mean concentrations of arsenic (mg/kg) (Figure 3-6), cobalt (mg/kg) (Figure 3-7), cadmium (mg/kg) (Figure 3-8), lead (mg/kg) (Figure 3-9) and nickel (mg/kg) (Figure 3-10) were all higher at sub-area F3 in comparison to reference area sub-areas R1 and R2, with the elevated mean concentrations due to high values in one of 11 samples in sub-area F3
- Mean concentrations of manganese (mg/kg) (Figure 3-11), selenium (mg/kg) (Figure 3-12) and vanadium (mg/kg) (Figure 3-13) showed no pattern across priority areas or sub-areas.

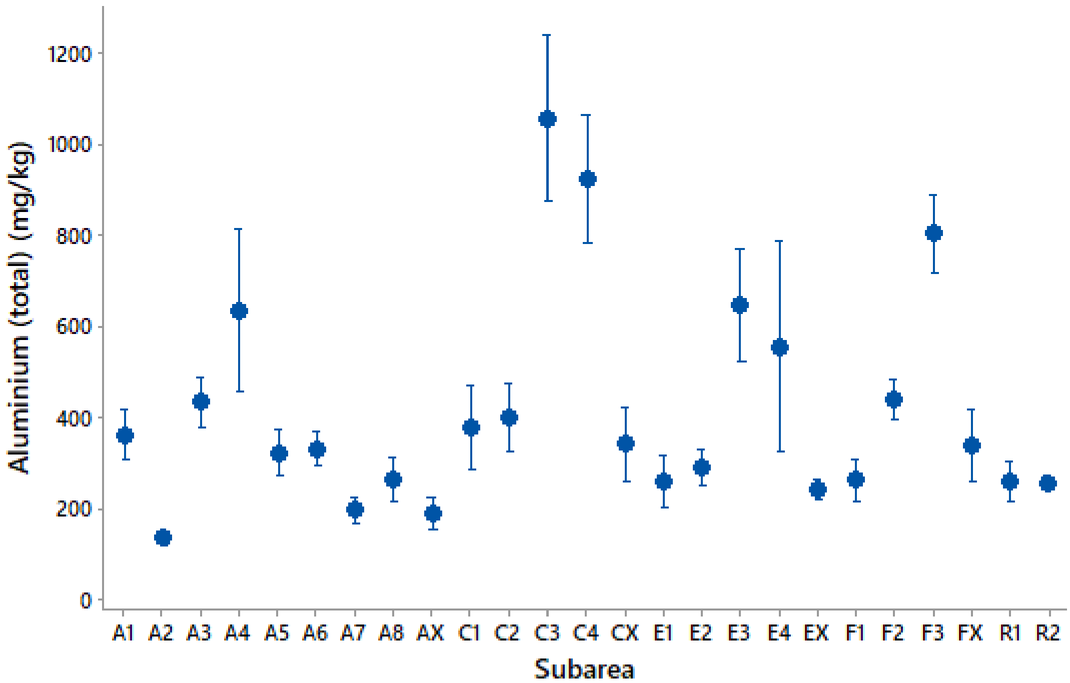


Figure 3-3: Mean concentrations of total aluminium (mg/kg) by sub-area

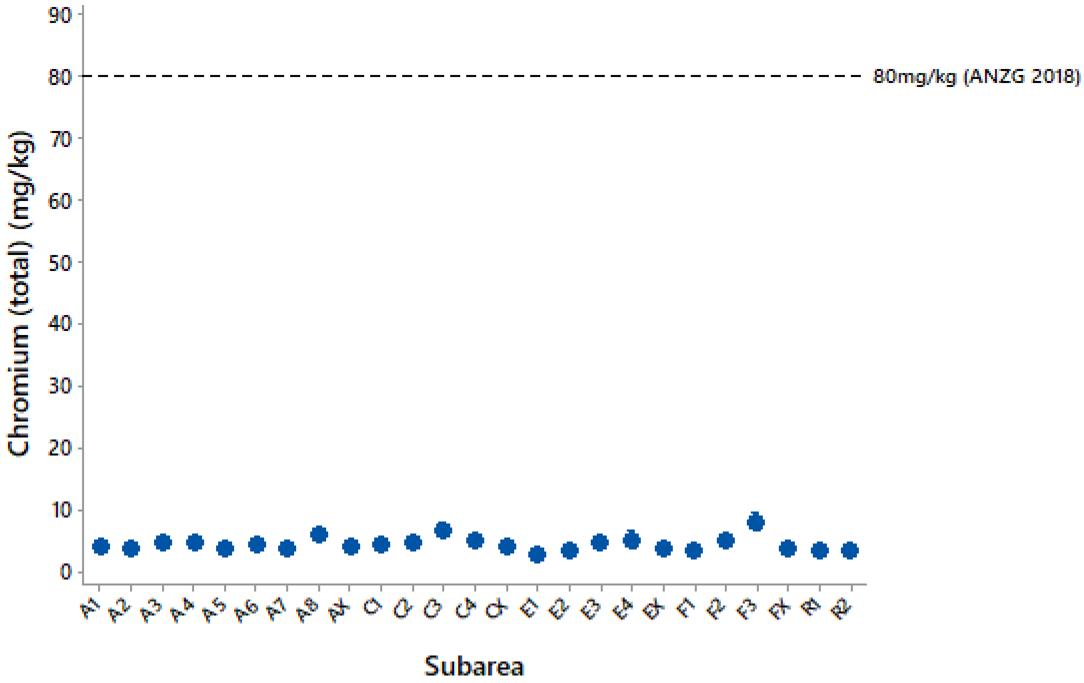


Figure 3-4: Mean concentrations of total chromium (mg/kg) by sub-area with the NAGD (2009) guideline level of 80 mg/kg.

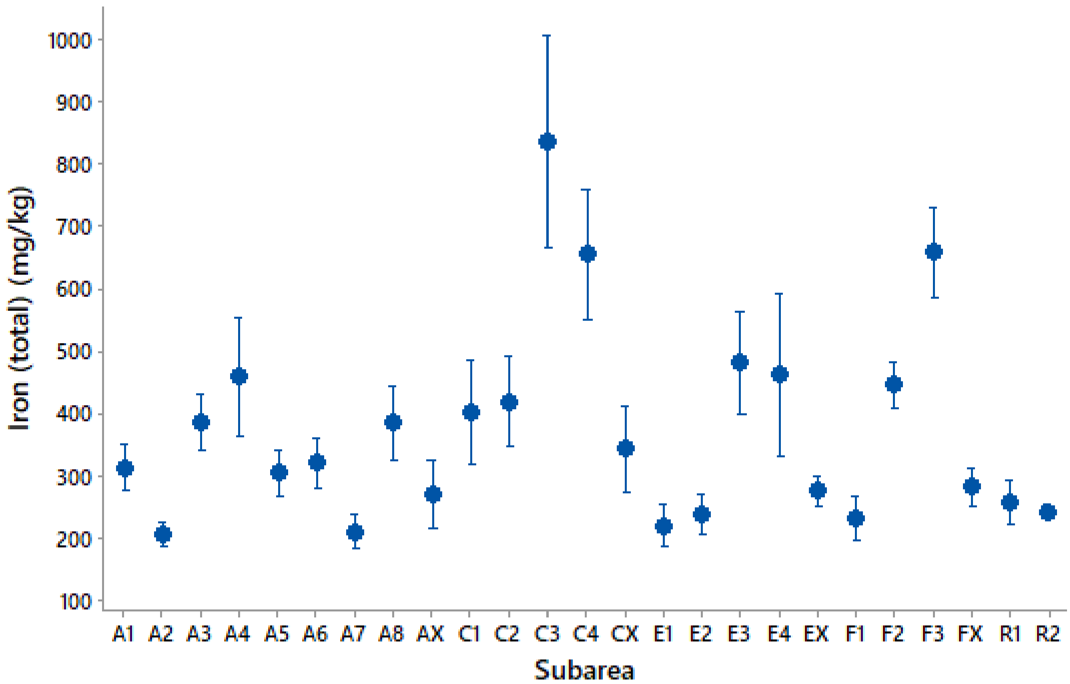


Figure 3-5: Mean concentrations of total iron (mg/kg) by sub-area

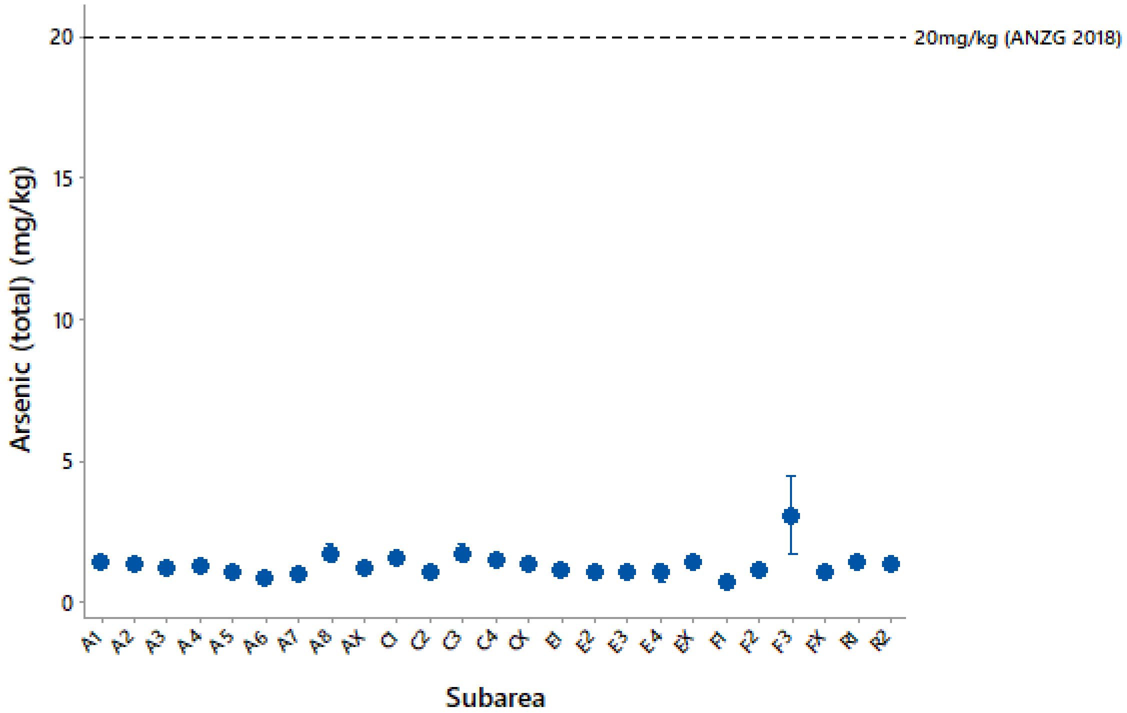


Figure 3-6: Mean concentrations of total arsenic (mg/kg) by sub-area with the NAGD (2009) guideline level of 20 mg/kg

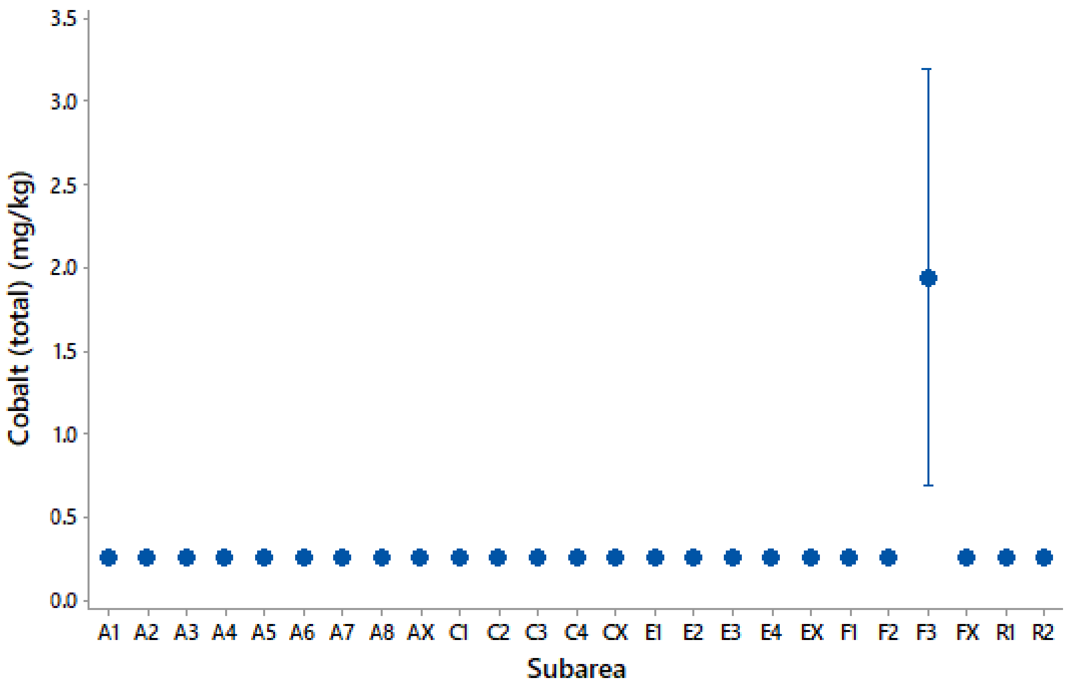


Figure 3-7: Mean concentrations of total cobalt (mg/kg) by sub-area

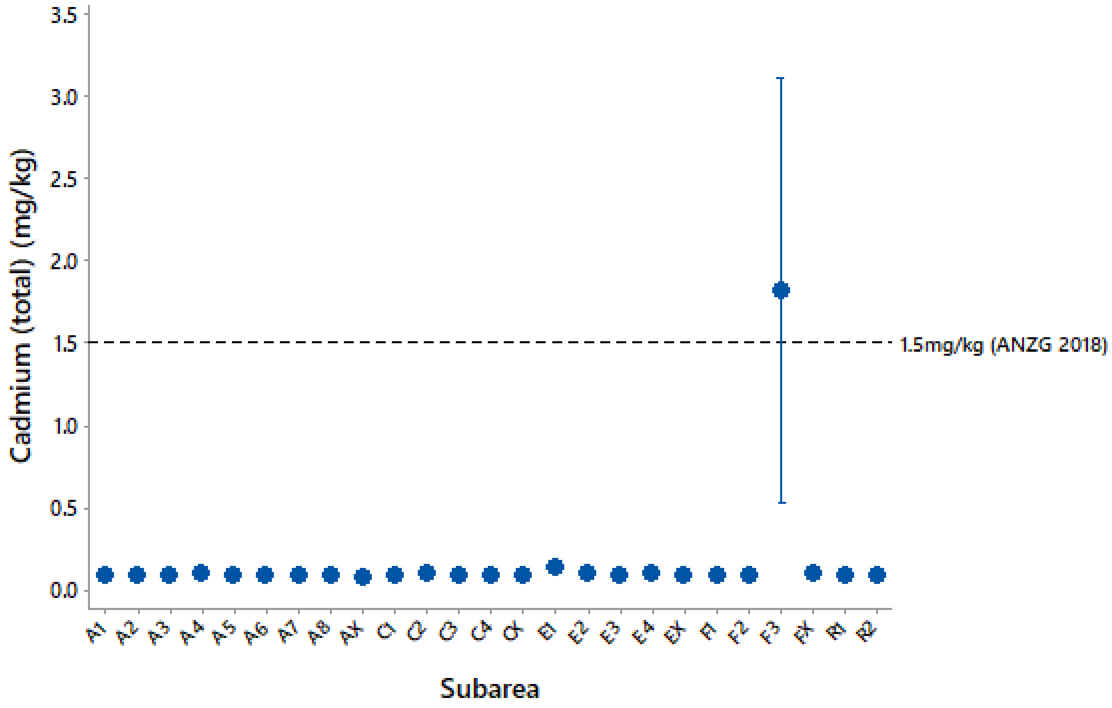


Figure 3-8: Mean concentrations of total cadmium (mg/kg) by sub-area with the NAGD (2009) guideline level of 1.5 mg/kg

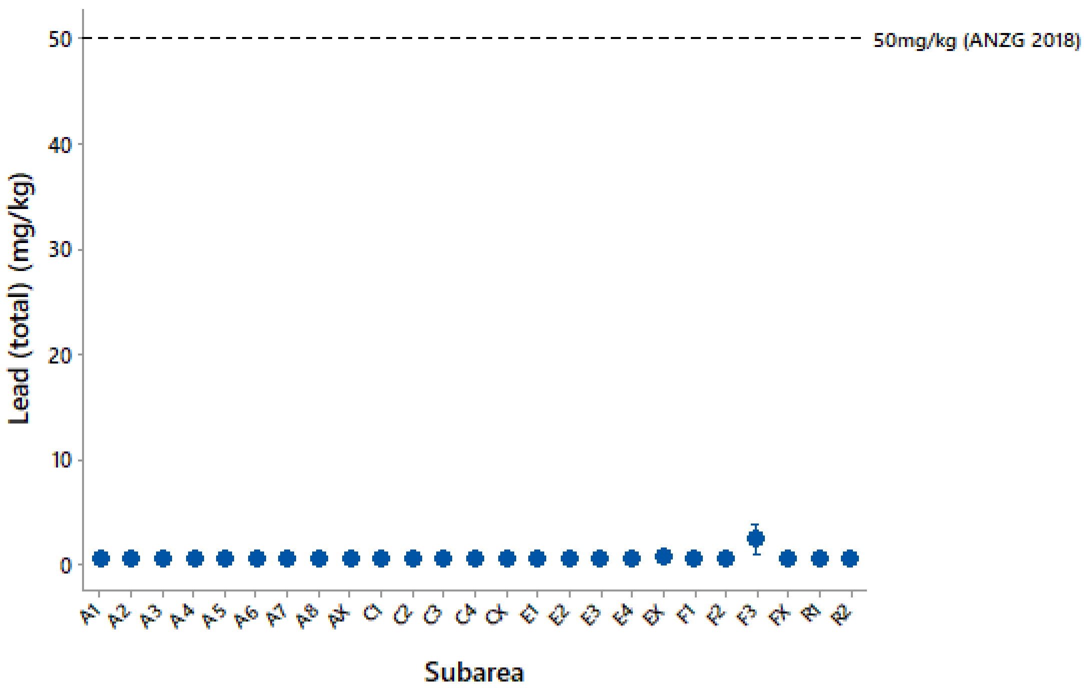


Figure 3-9: Mean concentrations of total lead (mg/kg) by sub-area with NAGD (2009) guideline level of 50 mg/kg

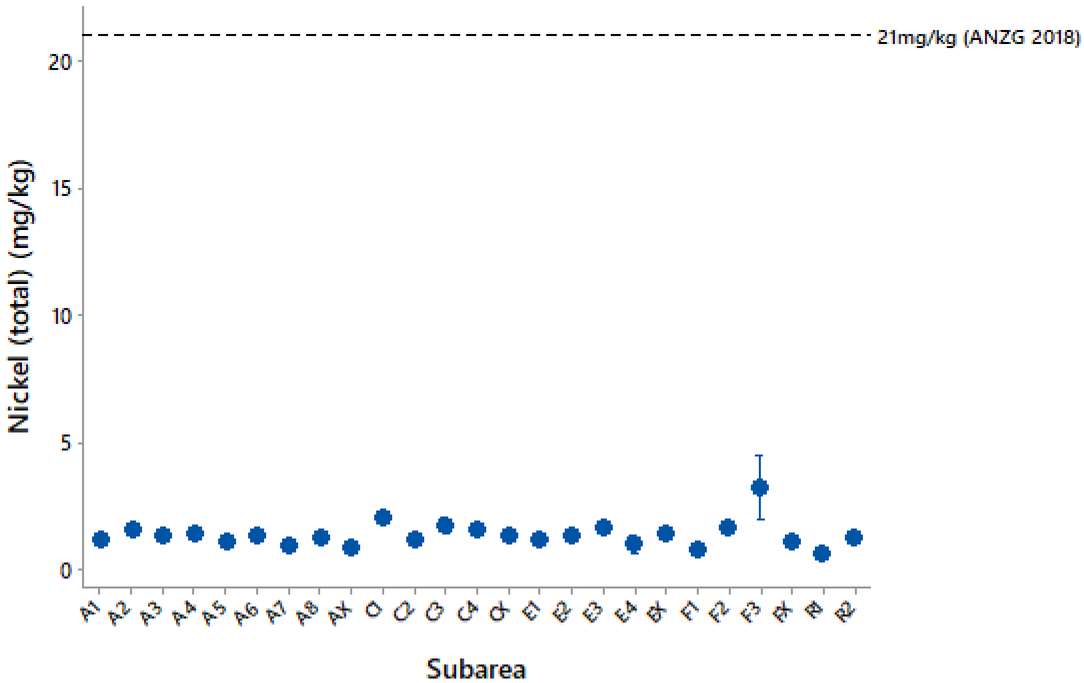


Figure 3-10: Mean concentrations of total nickel (mg/kg) by sub-area with the NAGD (2009) guideline of 21 mg/kg

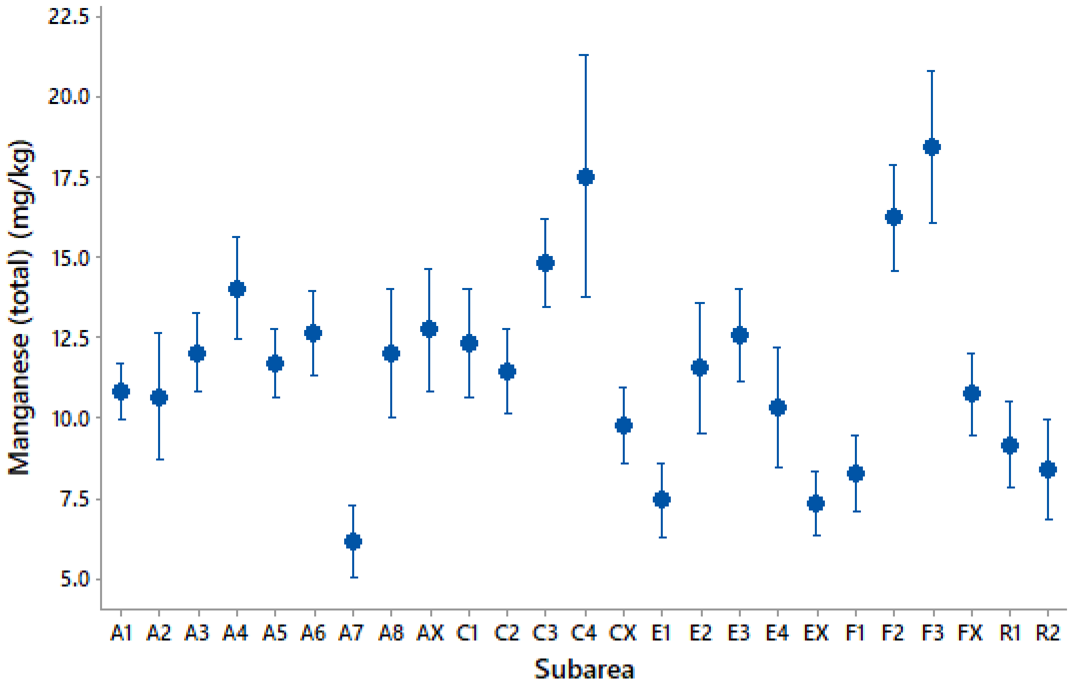


Figure 3-11: Mean concentrations of total manganese (mg/kg) by sub-area

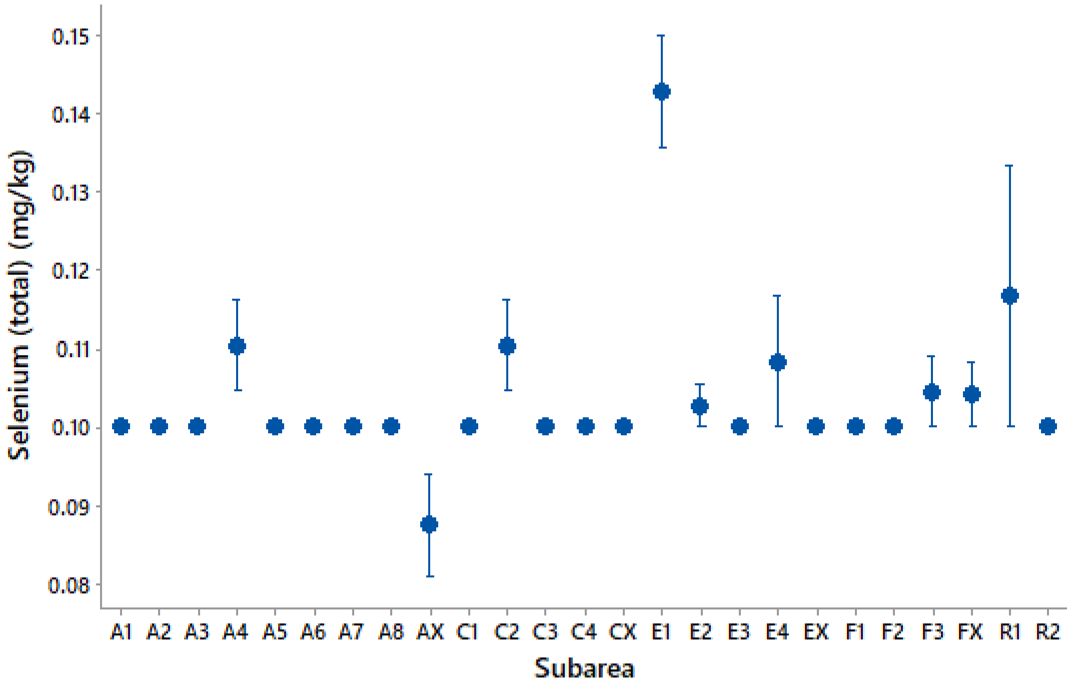


Figure 3-12: Mean concentrations of total selenium (mg/kg) by sub-area

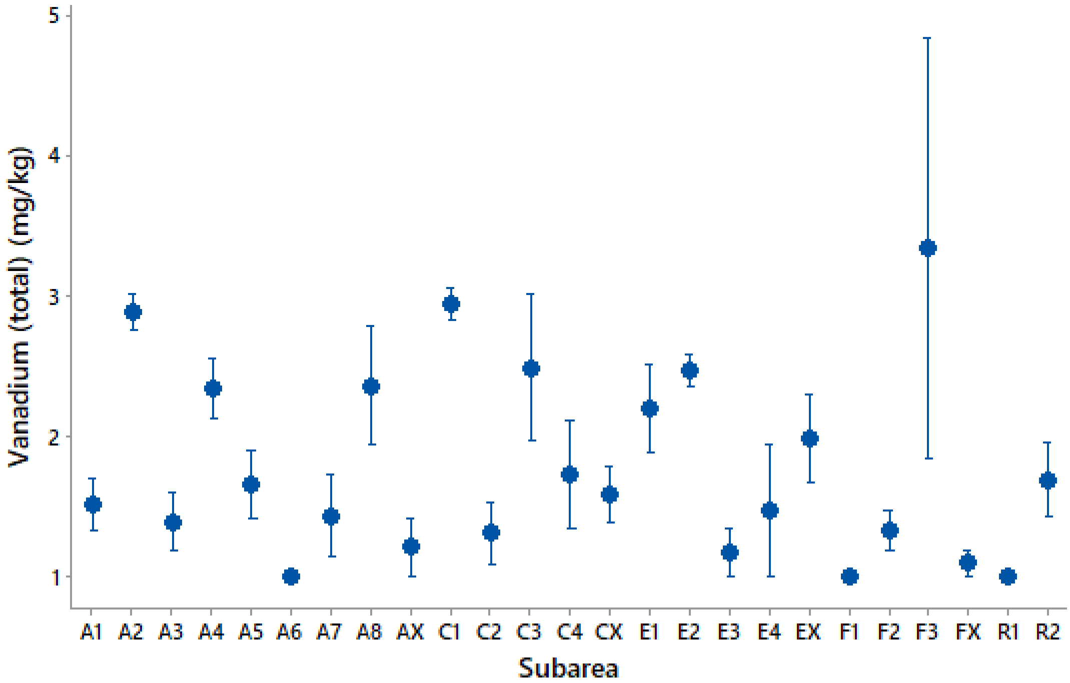


Figure 3-13: Mean concentrations of total vanadium (mg/kg) by sub-area

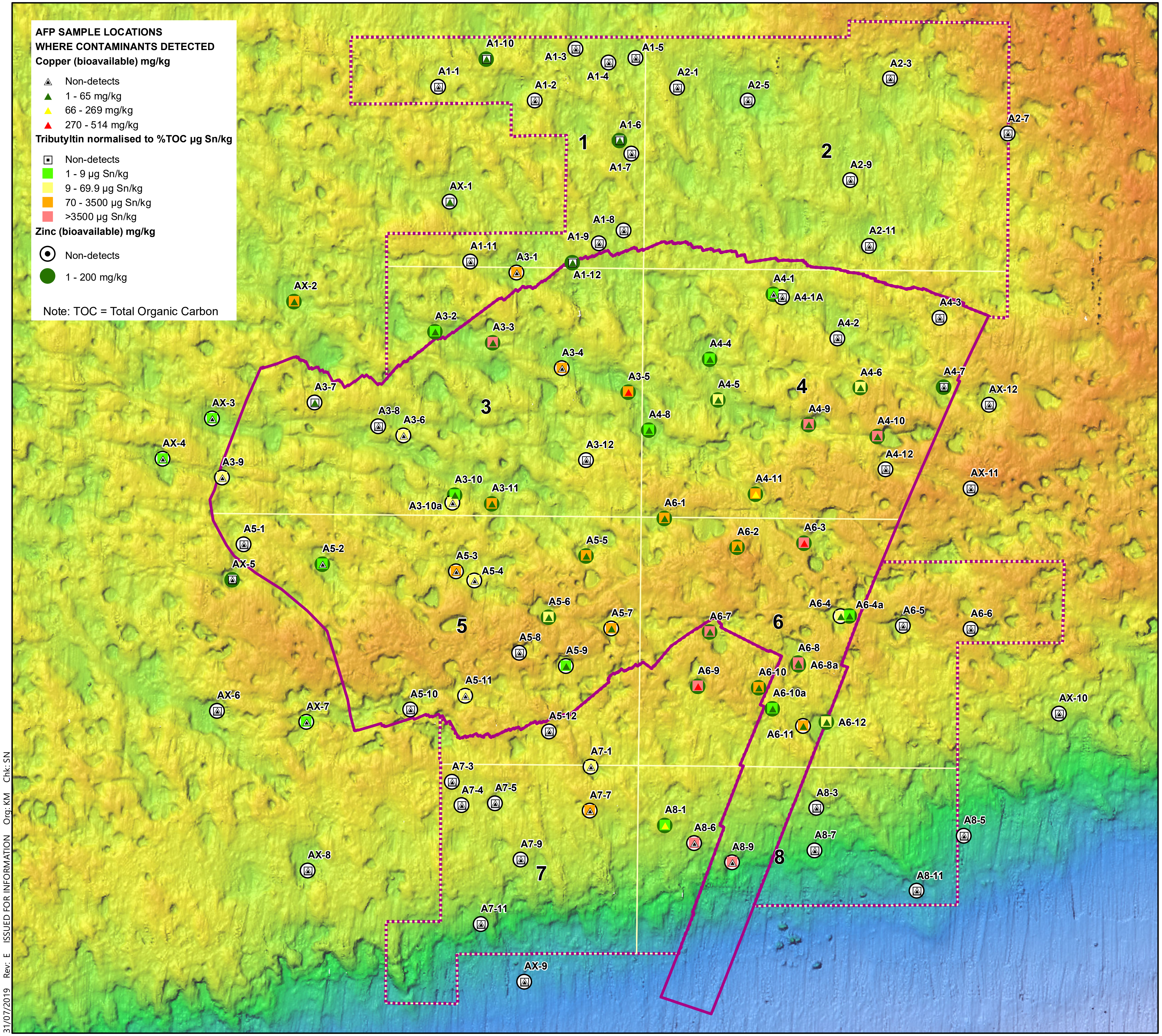
3.1.2 Bioavailable metals and metalloids

The mean concentrations (± standard error) of 1M HCl (1 mole of hydrochloric acid (HCl) per liter of solution) bioavailable metals and metalloids were graphed to compare across sub-areas and priority areas and to identify where samples exceeded the NAGD (2009) guideline level. These graphs are shown in Figure 3-21 to Figure 3-28 with ± standard error in each sub-area shown by vertical blue lines, and concentration scales varying between contaminants. The results for the AFP constituent concentrations from each site (bioavailable copper and zinc and normalised TBT only) are overlaid onto maps of each of the Priority Area and reference areas to help visualise the spatial spread of the AFP contamination – Priority Areas A (Figure 3-14), Priority Area C (Figure 3-15), Priority Area E (Figure 3-16), Priority Area F (Figure 3-17) and Reference Areas (Figure 3-18)

There was a general pattern in the concentrations of aluminium (mg/kg), copper (mg/kg), iron (mg/kg) and zinc (mg/kg) whereby the concentrations in sub-areas within some priority areas were elevated in comparison to the reference areas. In some of these situations, this pattern was not statistically detected due to there being a high variation and standard error in concentration within sub-areas. This applied to aluminium and chromium in the reference area sub-areas, and chromium, copper and zinc in priority area sub-areas. This was due to one or two of the sampling sites containing higher concentrations.

The results of analysis showed that:

- Mean concentration of bioavailable copper (mg/kg) (a component of AFP) was higher at sub-areas A3 and A6 in comparison to reference areas (R1 and R2) in which all sample concentrations were below the LOR (Figure 3-19 and Figure 3-14 to Figure 3-17). The elevated mean in sub-areas A3 and A6 was due to one or two sampling sites in sub-areas A3 and A6 which had concentrations above the NAGD (2009) guideline of 65 mg/kg.
- Mean concentration of bioavailable zinc (mg/kg) (a component of AFP) was higher at sub-areas A1, A3, A4, A6 and A8 in comparison to reference areas (R1 and R2) (Figure 3-20 and Figure 3-14 to Figure 3-17). The elevated mean was due to high values in one or two sampling sites in each sub-area. Note, the NAGD (2009) guideline level of 200 mg/kg not shown.
- Mean concentration of bioavailable aluminium (mg/kg) was higher at sub-areas C3 and C4 in comparison to reference area R2 but not to reference area R1 due to its high variability (Figure 3-21).
- Mean concentration of bioavailable iron (mg/kg) was higher at sub-areas C3 and C4 in comparison to reference areas R1 and R2 (Figure 3-22).
- No pattern of mean concentrations of bioavailable arsenic (mg/kg) (Figure 3-23), chromium (mg/kg) (Figure 3-24), lead (mg/kg) (Figure 3-25), manganese (mg/kg) (Figure 3-26), nickel (mg/kg) (Figure 3-27) or vanadium (mg/kg) (Figure 3-28) were found.



Douglas Shoal Remediation Planning

Sediment Characterisation Report

Figure 3-14

AFP* Constituent Concentrations at Sediment Sampling Sites in Priority Area A

Priority Area
A
A - outside grounding footprint
Priority area A sampling subarea

Bathymetry
-23.0m -9.0m

AFP* - Anti Fouling Paint

Source Information:
Grounding footprint, Priority areas
Cardno 2017
Sampling locations and contaminant concentration
Advisian - March 2019
Bathymetry (50cm LAT)
Acoustic Imaging 2019

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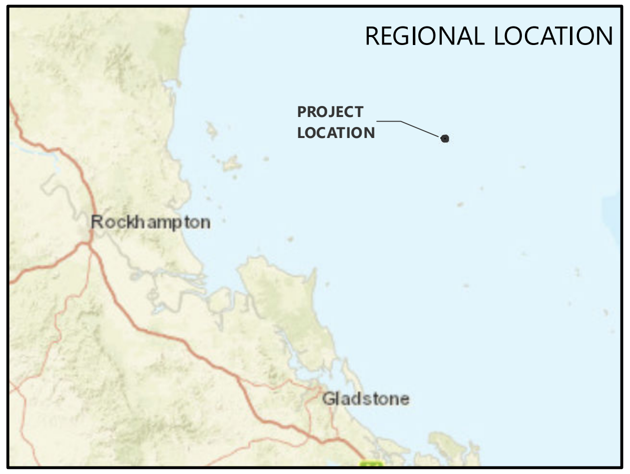
Coordinate System: GCS GDA 1994
Datum: GDA 1994
Scale at A3 - 1:2,200

0 25 50 75 100
Metres

N



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

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31/07/2019 Rev: E ISSUED FOR INFORMATION Org: KM Chk: SN

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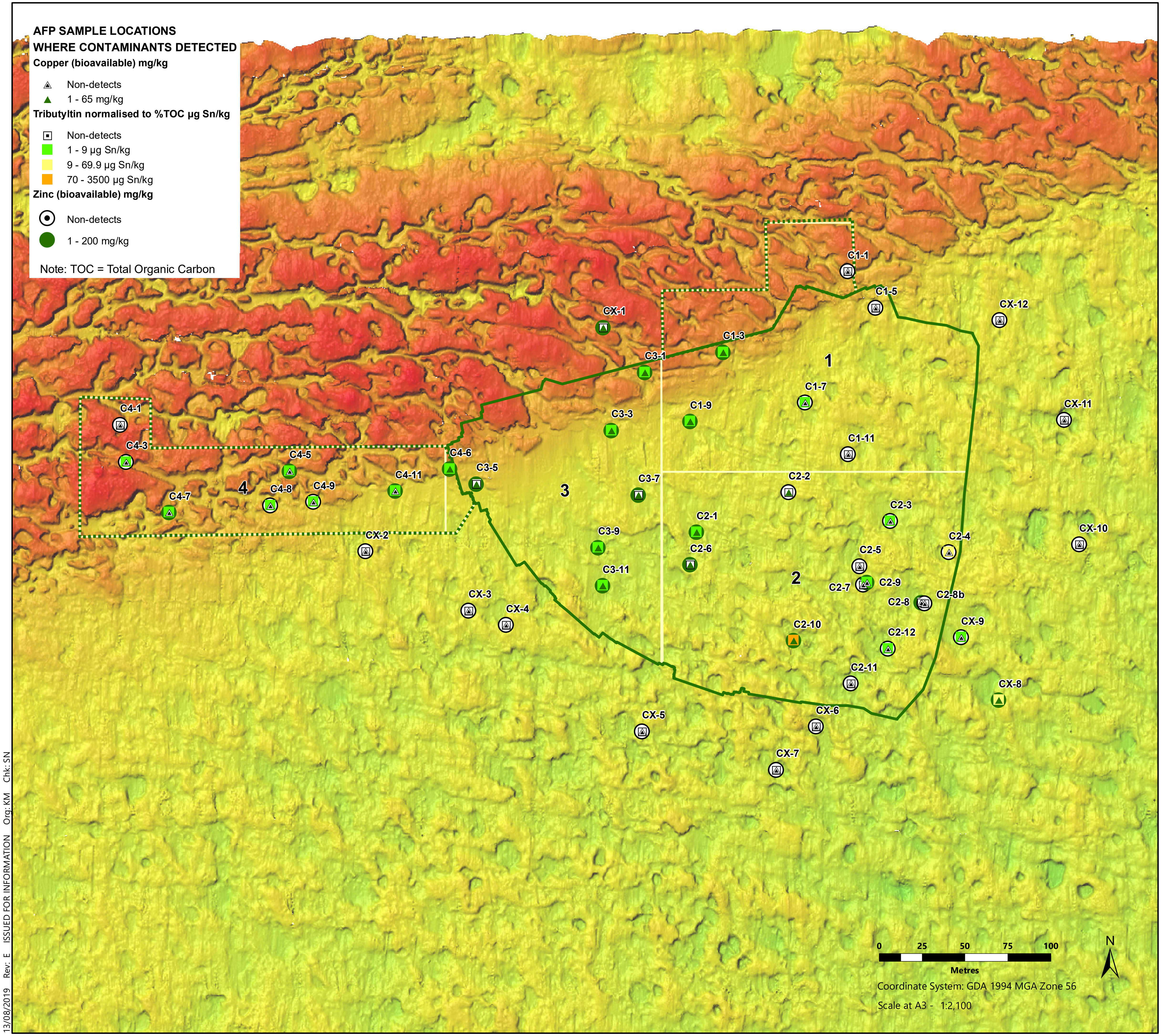
Sediment Characterisation Report

Figure 3-15
AFP* Constituent Concentrations at Sediment Sampling Sites in Priority Area C



Priority
C
C - outside grounding footprint
Priority Area C Sampling Sub-area

Bathymetry
-23.0m -9.0m

AFP* - Anti Fouling Paint

Source Information:
Grounding footprint, Priority areas
Cardno 2017
Sampling locations and contaminant concentration
Advisian - March 2019
Bathymetry (50cm LAT)
Acoustic Imaging 2019

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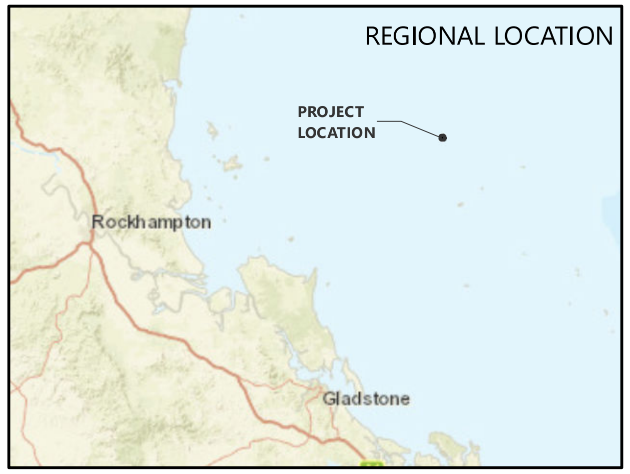

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User

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13/08/2019 Rev: E ISSUED FOR INFORMATION Org: KM Chk: SN

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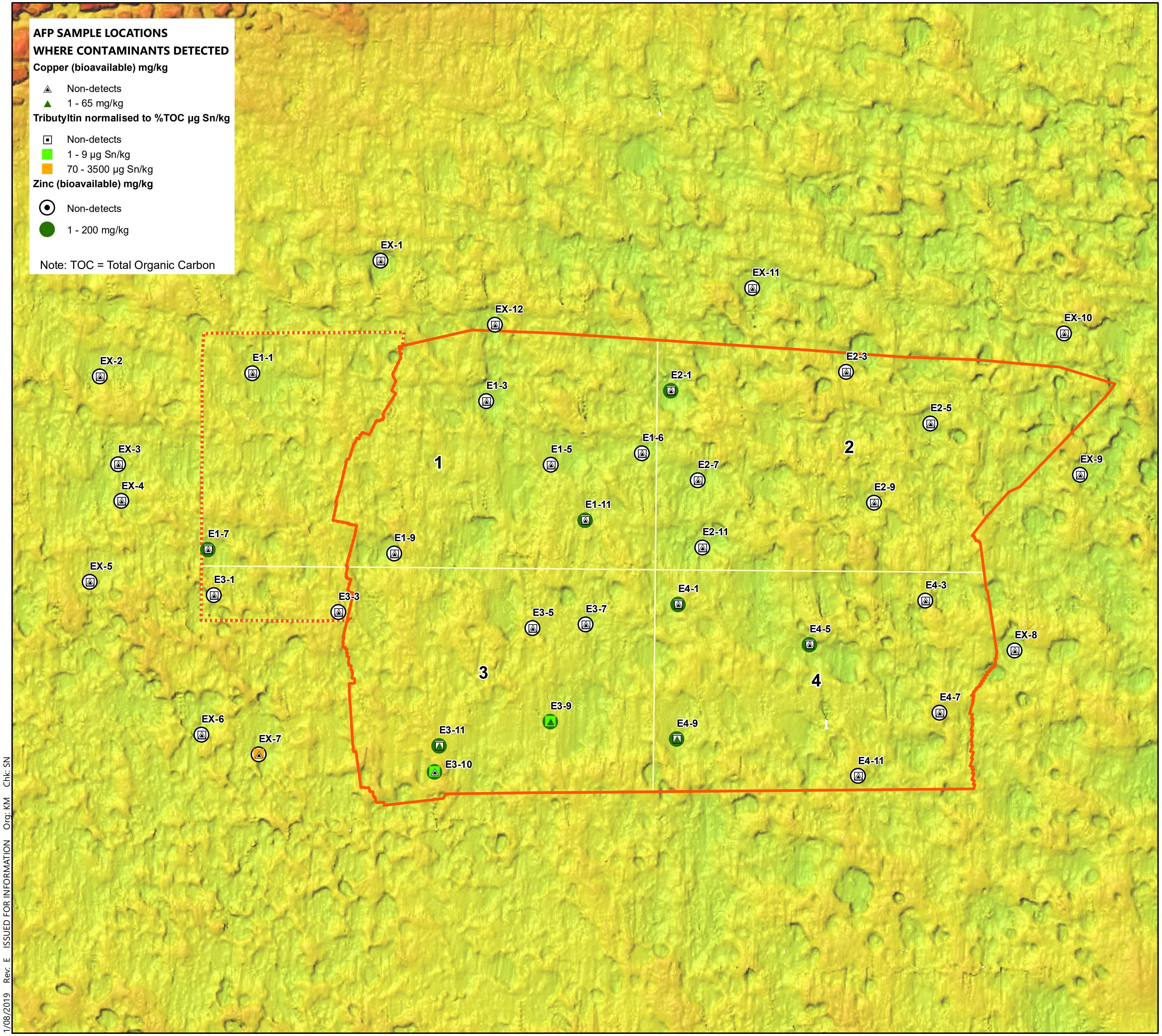
Sediment Characterisation Report

Figure 3-16
AFP* Constituent Concentrations at Sediment Sampling Sites in Priority Area E



Priority Area
E
E - outside grounding footprint
Priority Area E Sampling Sub-area

Bathymetry
-23.0m
-9.0m

AFP* - Anti Fouling Paint

Source Information:
Grounding footprint, Priority areas
Cardno 2017
Sampling locations and contaminant concentration
Advisian - March 2019
Bathymetry (50cm LAT)
Acoustic Imaging 2019

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Datum: GDA 1994
Scale at A3 - 1:1,750

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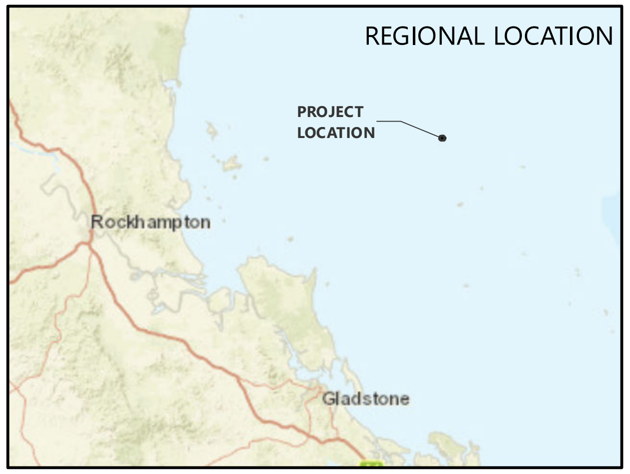
Metres
N



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

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1/08/2019 Rev: E ISSUED FOR INFORMATION Org: KM Chk: SN

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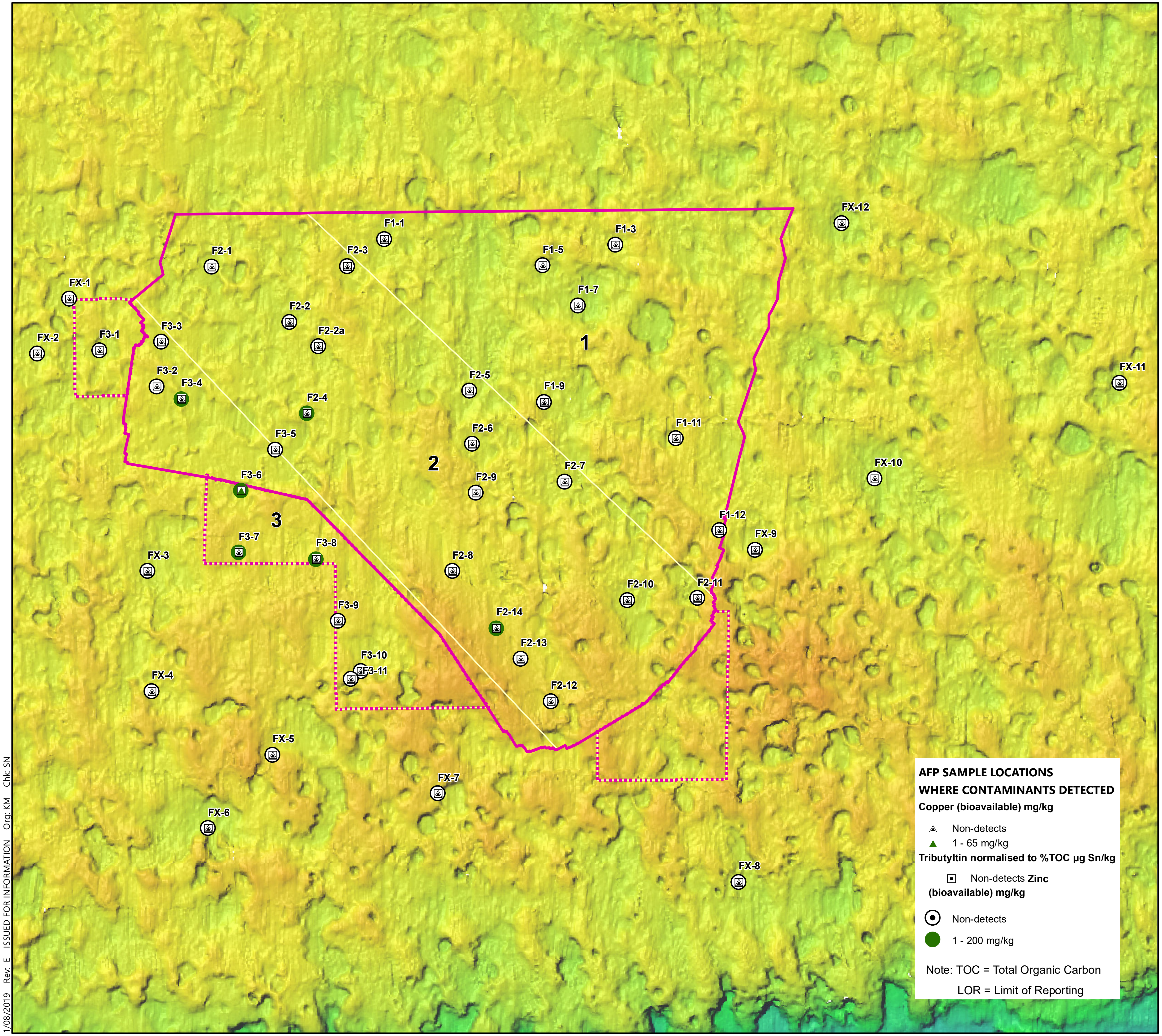
Sediment Characterisation Report

Figure 3-17
AFP* Constituent Concentrations at Sediment Sampling Sites in Priority Area F



Priority Area

F

F - outside grounding footprint

Priority Area F Sampling Sub-area

Bathymetry

-23.0m -9.0m

AFP* - Anti Fouling Paint

Source Information:
Grounding footprint, Priority areas
Cardno 2017
Sampling locations and contaminant concentration
Advisian - March 2019
Bathymetry (50cm LAT)
Acoustic Imaging 2019

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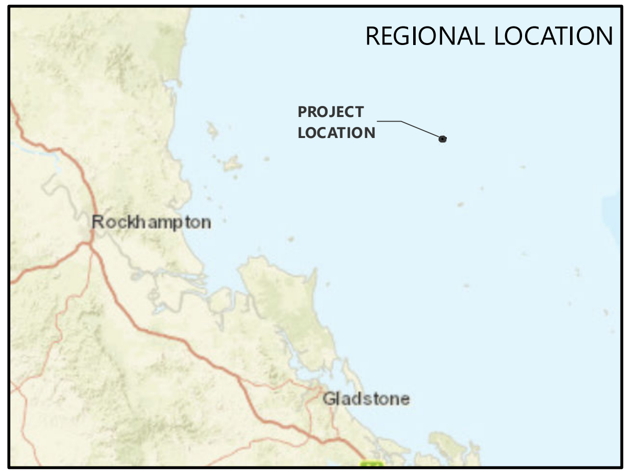
Coordinate System: GCS GDA 1994
Datum: GDA 1994
Scale at A3 - 1:1,500

N

0 25 50 75 100
Metres



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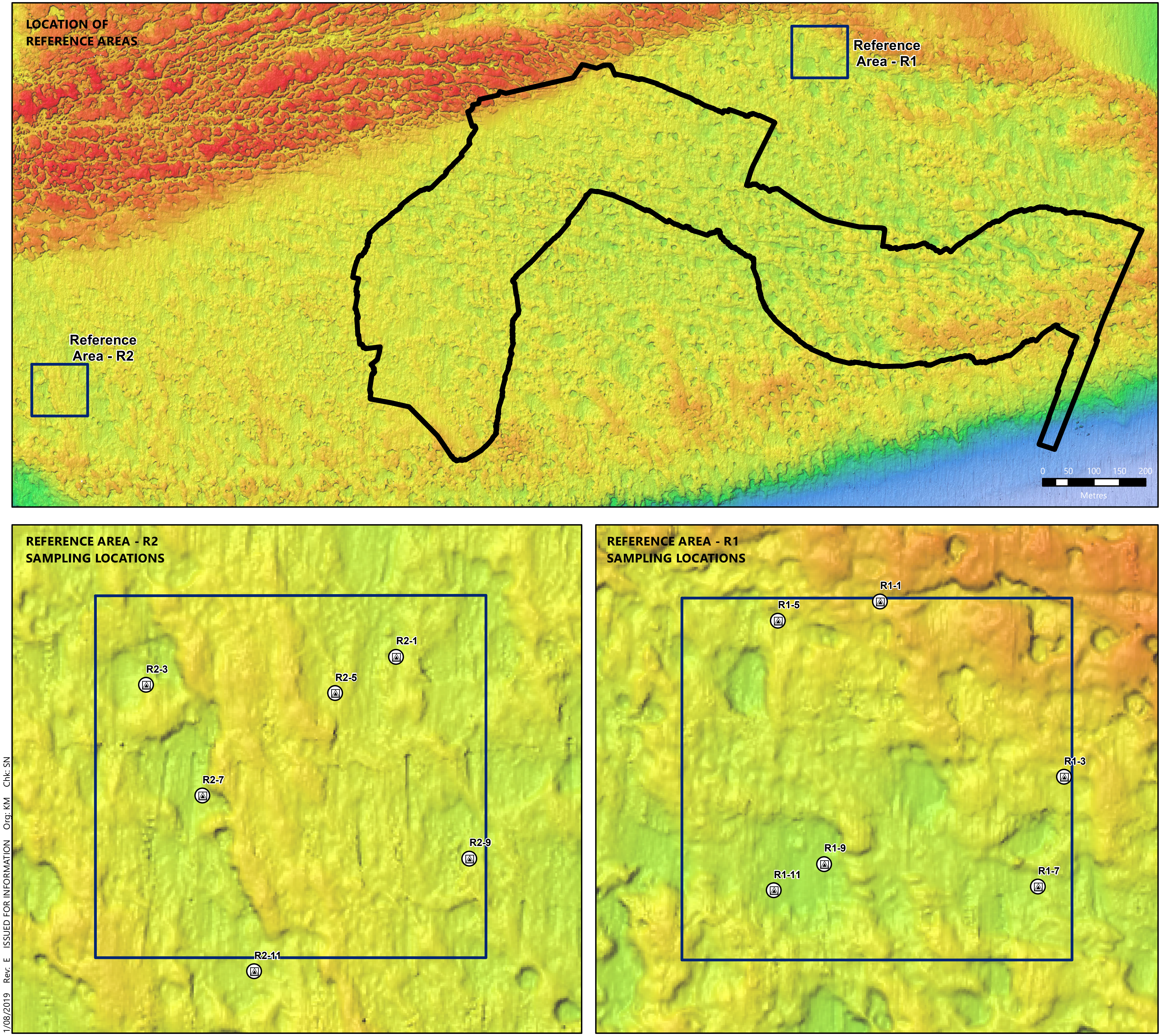
1/08/2019 Rev: E ISSUED FOR INFORMATION Org: KM Chk: SN

Douglas Shoal Remediation Planning

Sediment Characterisation Report

Figure 3-18
AFP* Constituent Concentrations at Sediment Sampling Sites in the Reference Areas



Reference areas

Grounding footprint

Bathymetry

-23.0m -9.0m

AFP SAMPLE LOCATIONS WHERE CONTAMINANTS DETECTED

Copper (bioavailable) mg/kg

Non-detects

Tributyltin normalised to %TOC µg Sn/kg

Non-detects **Zinc (bioavailable) mg/kg**

Non-detects

AFP* - Anti Fouling Paint

Source Information:
Grounding footprint, Priority areas
Cardno 2017
Sampling locations and contaminant concentration
Advisian - March 2019
Bathymetry (50cm LAT)
Acoustic Imaging 2019

Coordinate System: GCS GDA 1994
Datum: GDA 1994

N

Advisian
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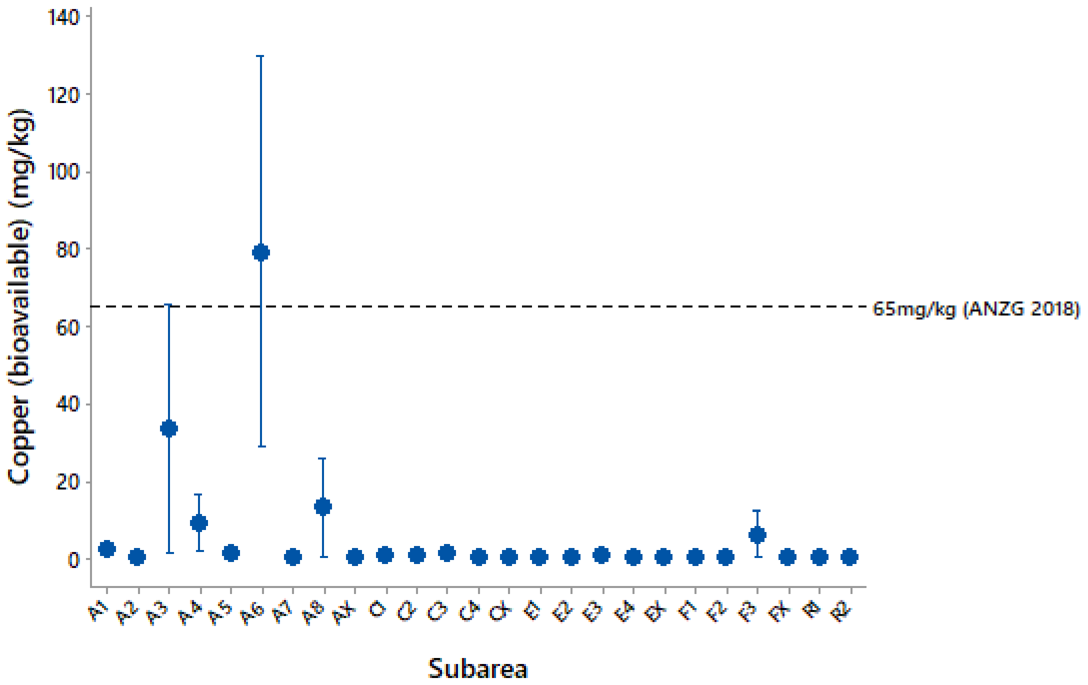


Figure 3-19: Mean concentration of bioavailable copper (mg/kg) by sub-area with the NAGD (2009) guideline level of 65 mg/kg in red

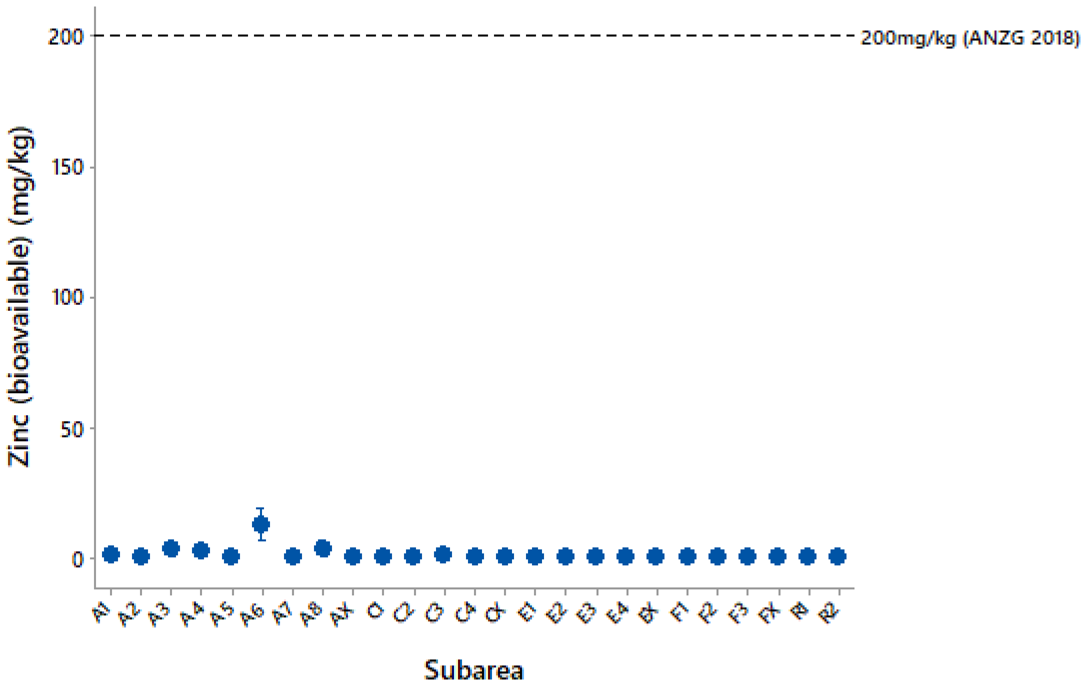


Figure 3-20: Mean concentrations of bioavailable zinc (mg/kg) by sub-area with NAGD guideline level of 200 mg/kg

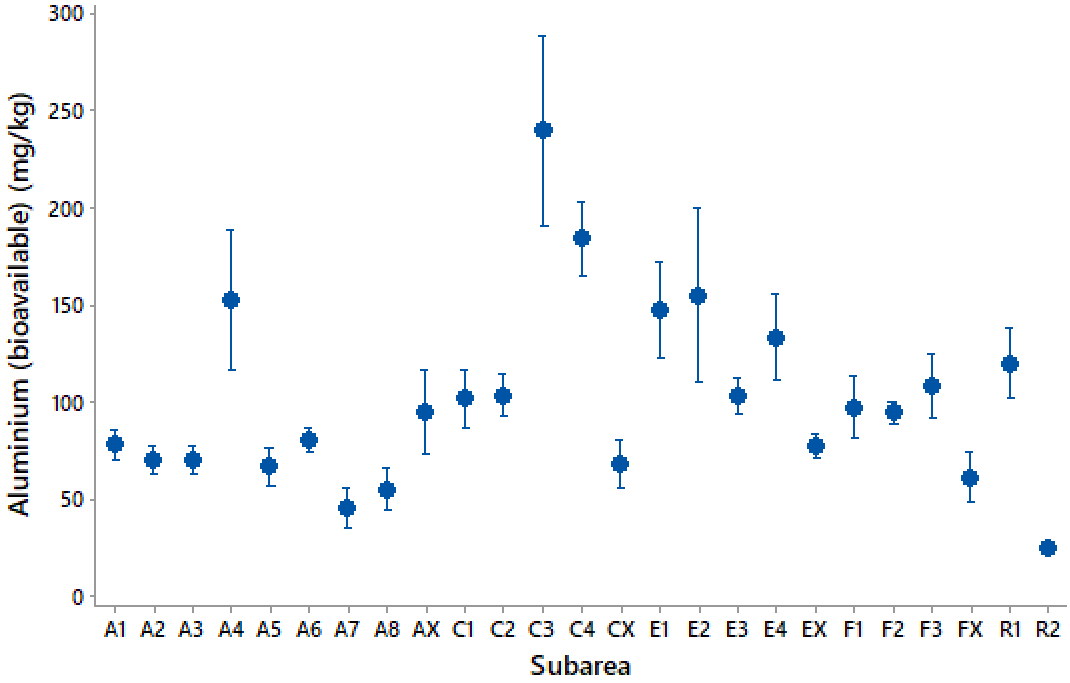


Figure 3-21: Mean concentrations of bioavailable aluminium (mg/kg) by sub-area

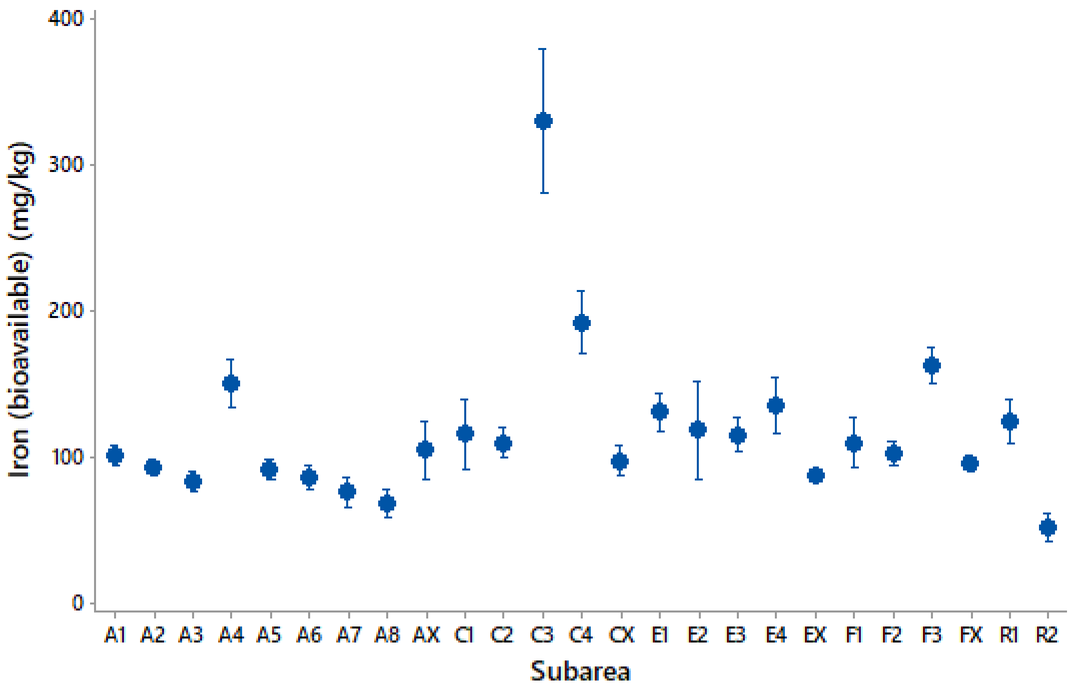


Figure 3-22: Mean concentrations of bioavailable iron (mg/kg) by sub-area

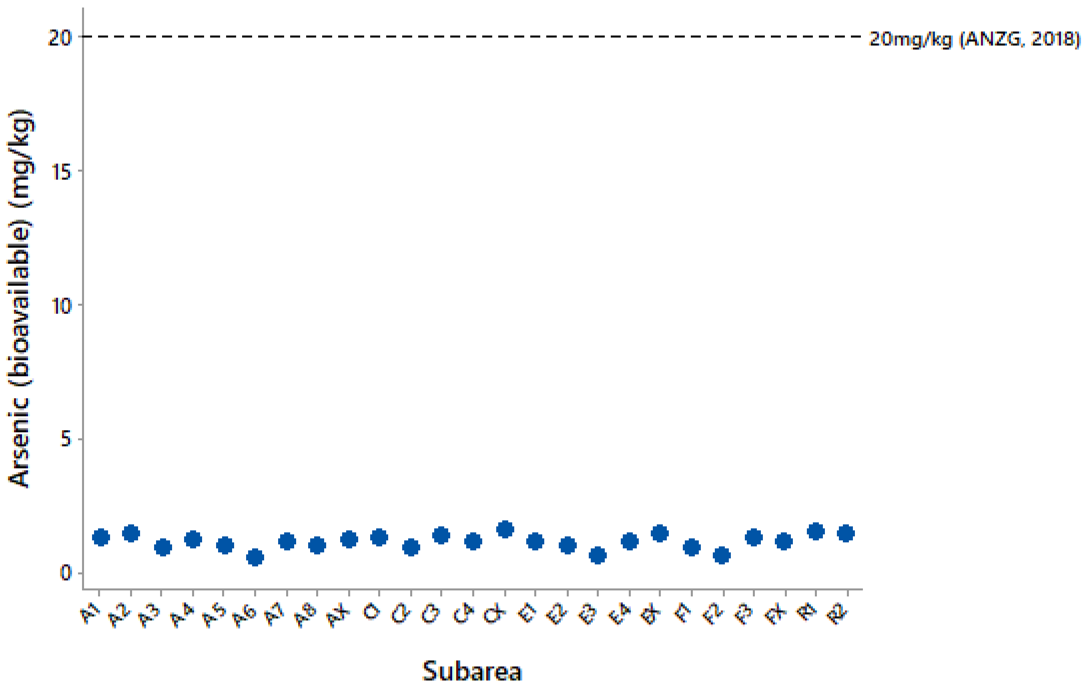


Figure 3-23: Mean concentrations of bioavailable arsenic (mg/kg) by sub-area with the NAGD (2009) guideline level of 20 mg/kg

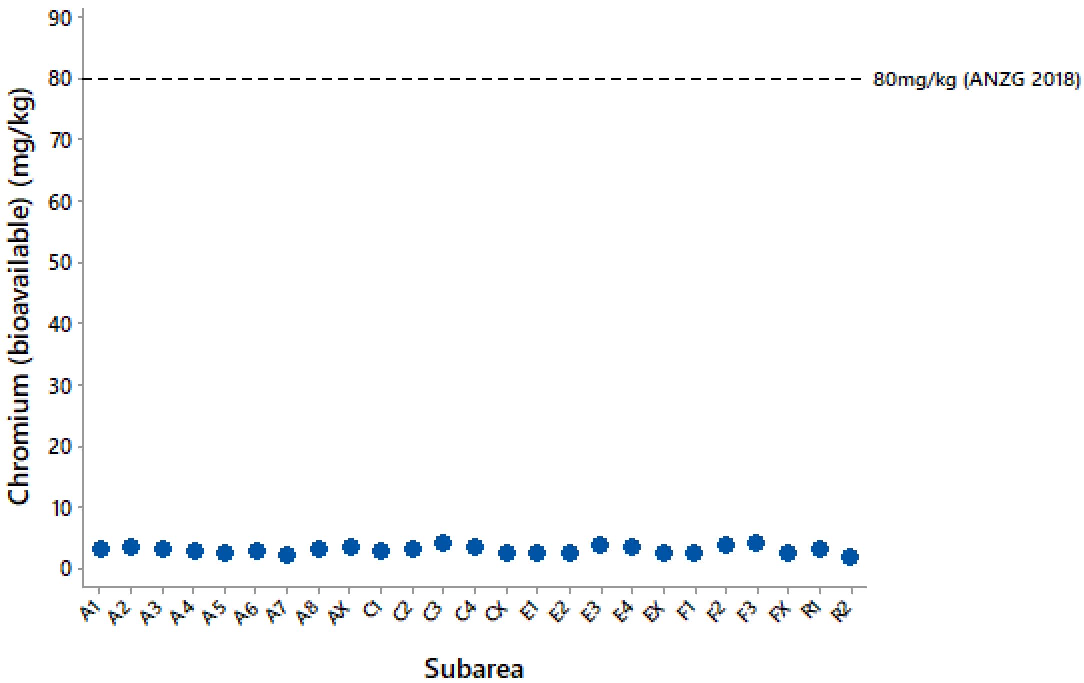


Figure 3-24: Mean concentrations of bioavailable chromium (mg/kg) by sub-area with the NAGD (2009) guideline level of 80 mg/kg

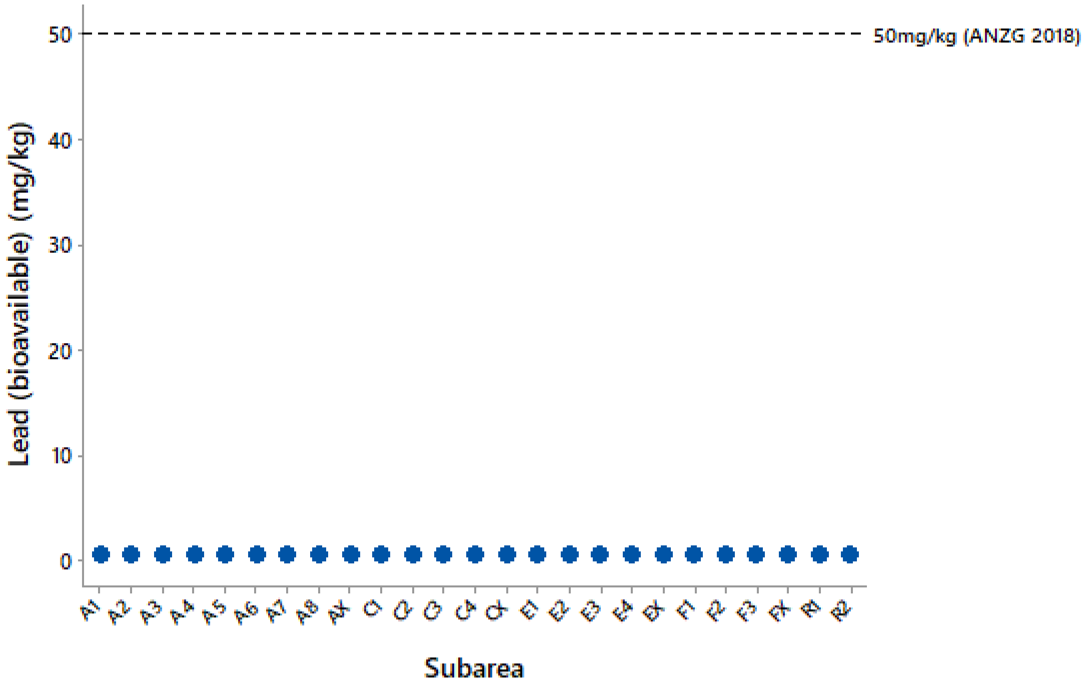


Figure 3-25: Mean concentrations of bioavailable lead (mg/kg) by sub-area with NAGD guideline level of 50 mg/kg

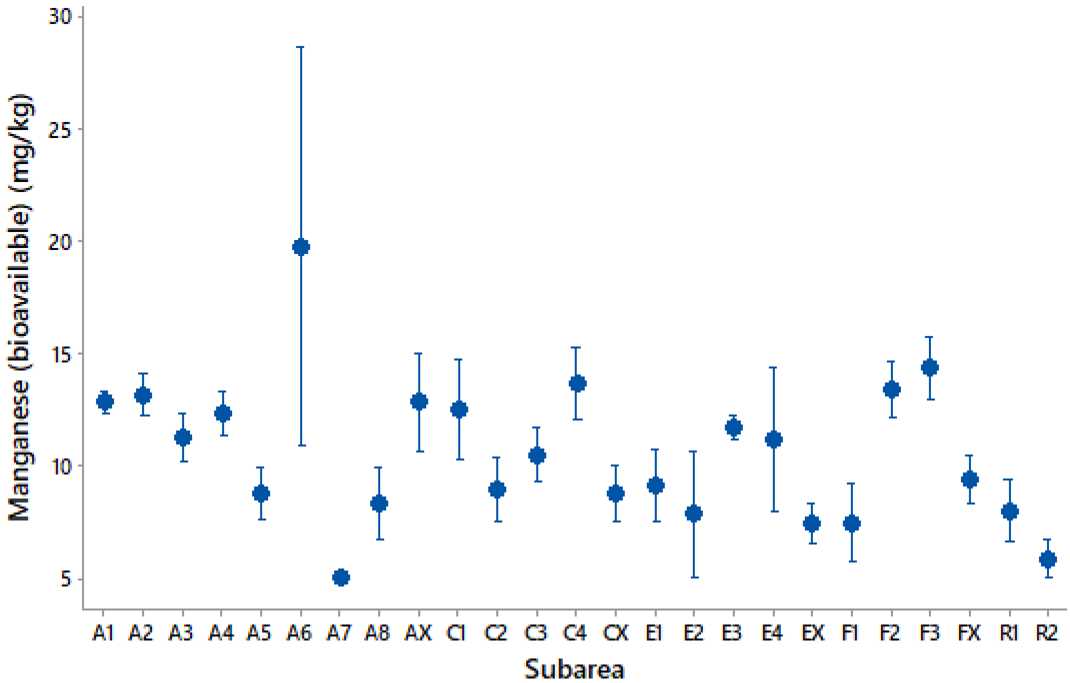


Figure 3-26: Mean concentrations of bioavailable manganese (mg/kg) by sub-area

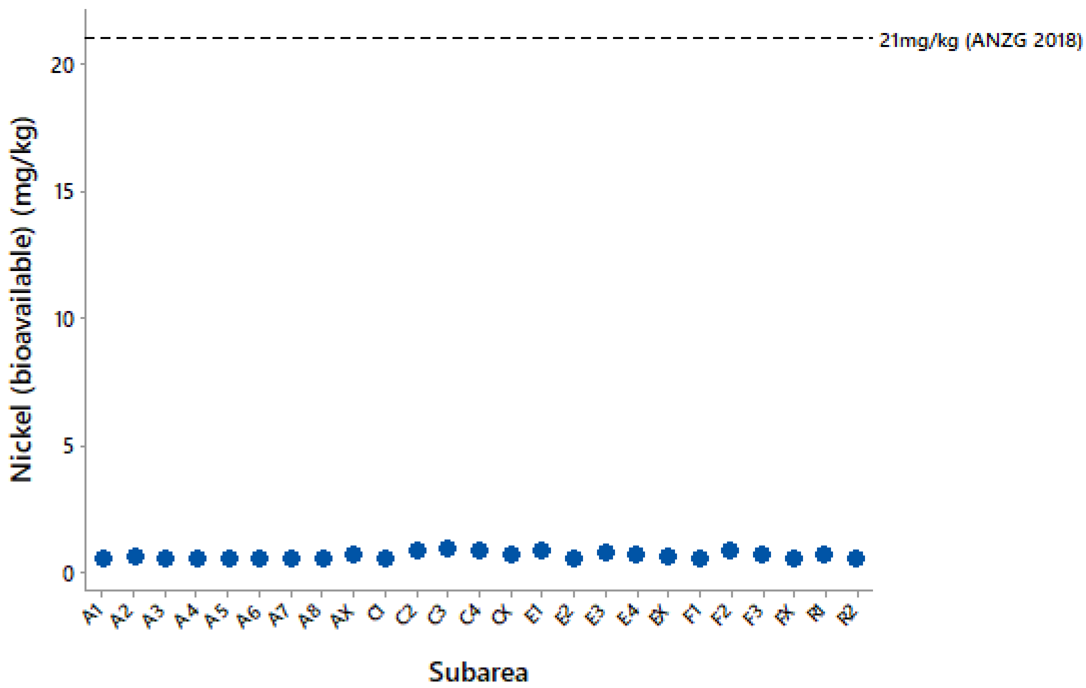


Figure 3-27: Mean concentrations of bioavailable nickel (mg/kg) by sub-area with the NAGD (2009) guideline level of 21 mg/kg

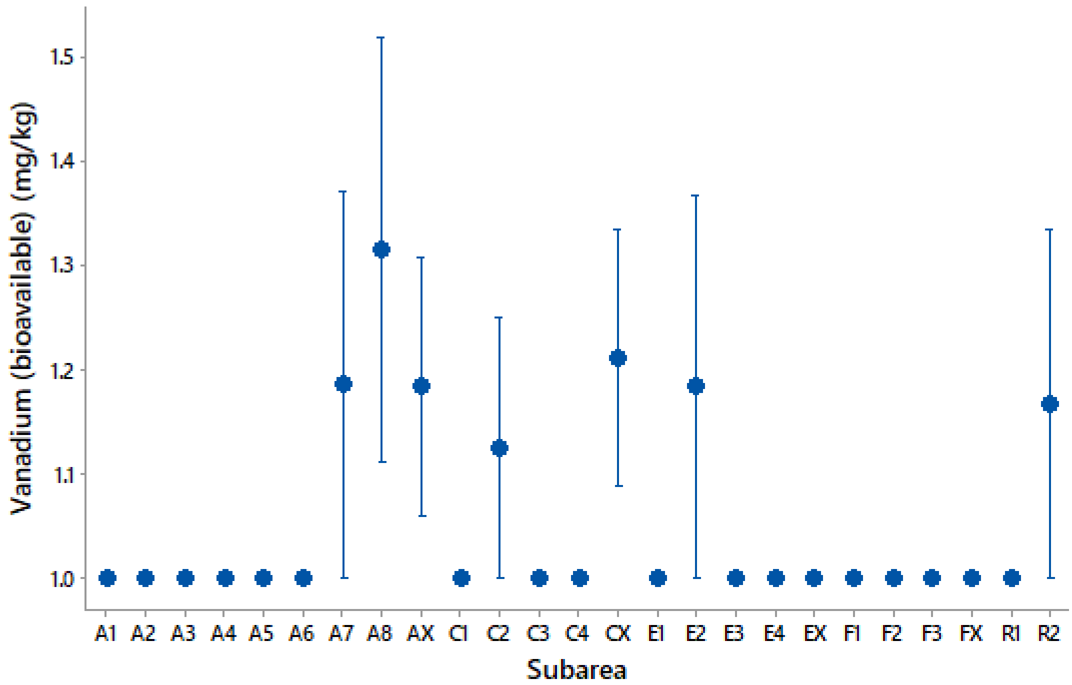


Figure 3-28: Mean concentrations of bioavailable vanadium (mg/kg) by sub-area

3.1.3 Organotins

The mean concentrations (± standard error) of organotins (TBT, DBT and MBT) were graphed to compare across sub-areas and priority areas and to identify where samples exceeded the NAGD (2009) guideline level. These graphs are shown in Figure 3-29 to Figure 3-31 with ± standard error in each sub-area shown by vertical blue lines, and concentration scales varying between contaminants. Please refer to Figure 3-14 to Figure 3-18 to visualise the spatial extent of the TBT (normalised to 1% TOC) contamination.

There was high within sub-area variability as shown by the high standard errors. This is as expected given the heterogenous nature of organotin concentrations in samples. This was partially addressed for TBT following normalisation to 1% TOC as required by the NAGD (2009) guidelines. The results showed that;

- Concentrations of MBT (µg Sn/kg) (Figure 3-29), DBT (µg Sn/kg) (Figure 3-30) and TBT (µg Sn/kg) (Figure 3-31 and Figure 3-14 to Figure 3-18) are higher in sub-areas A3, A4, A5, A6 and A8, and to a lesser degree A7, in comparison to all other sub-areas, including reference areas R1 and R2.
- Concentrations of TBT (µg Sn/kg) were below LOR throughout Priority Area F (Figure 3-17) and the reference areas (figure not provided for this reason).

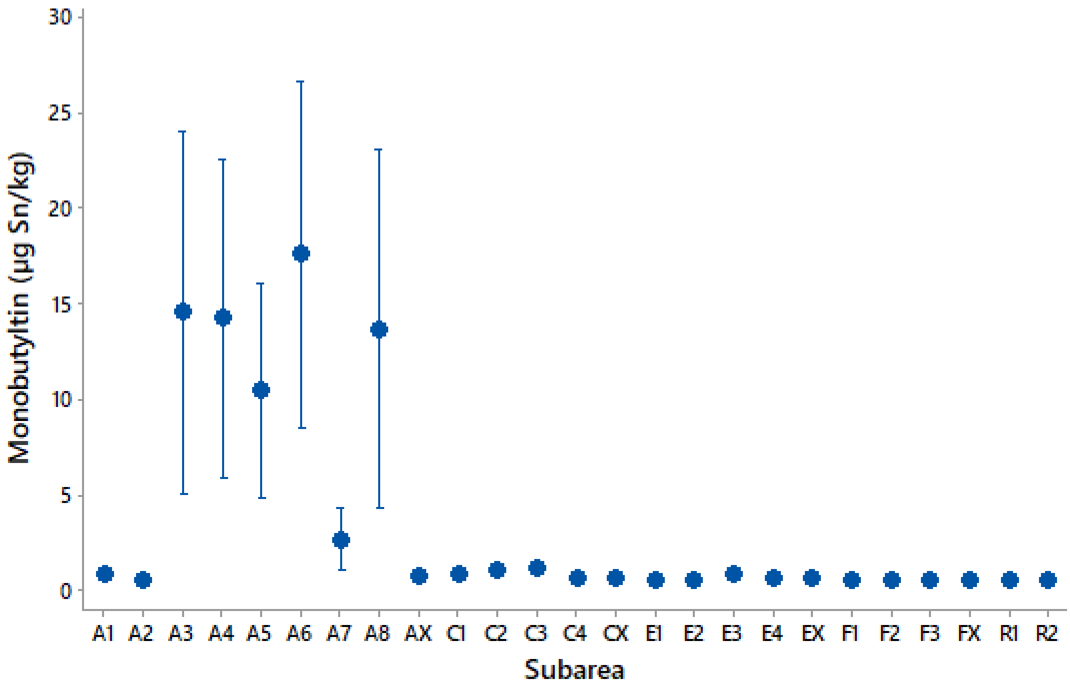


Figure 3-29: Mean concentrations of MBT (µg Sn/kg) by sub-area

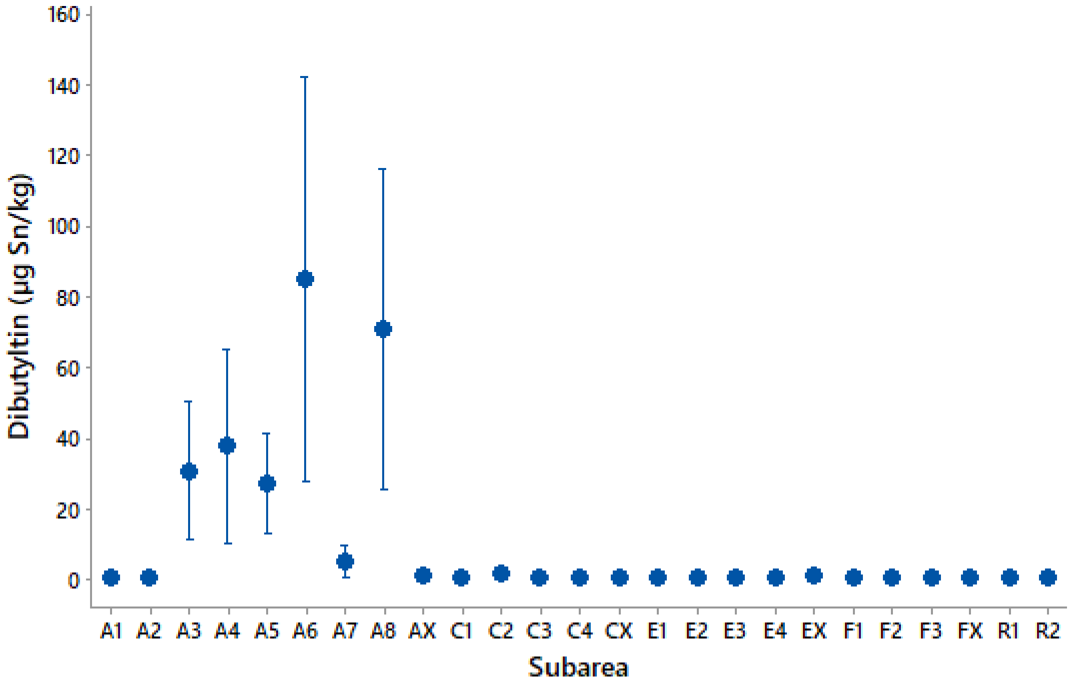


Figure 3-30: Mean concentrations of DBT (µg Sn/kg) by sub-area

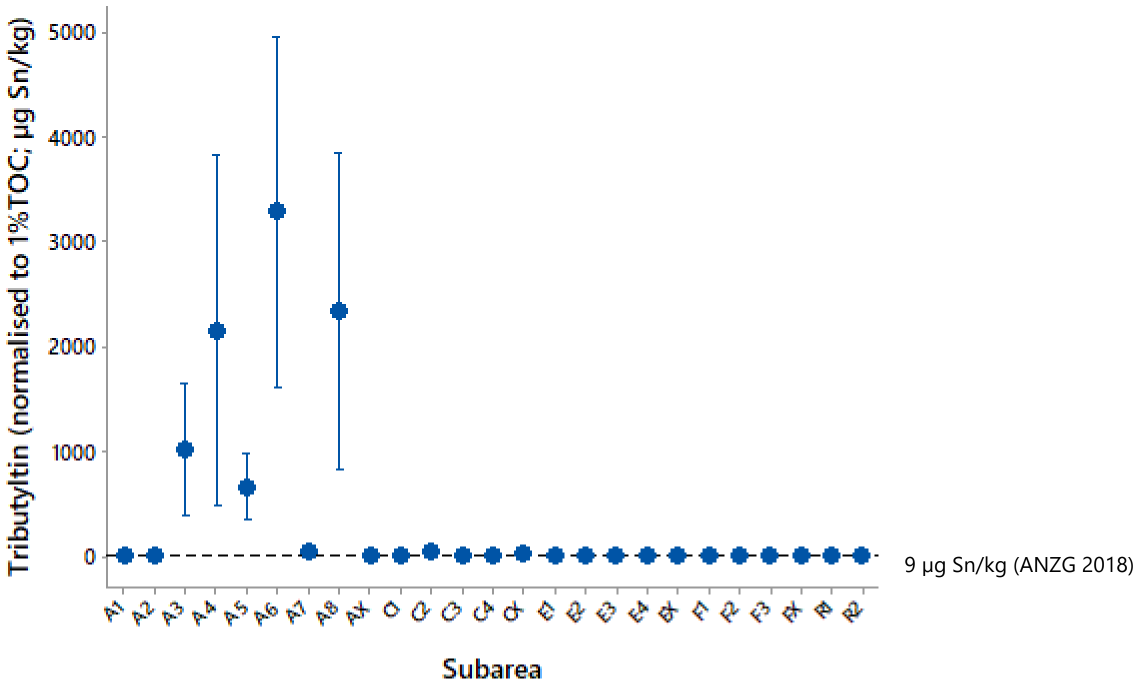


Figure 3-31: Mean concentrations of TBT (normalised to 1% TOC) (µg Sn/kg) by sub-area with the NAGD (2009) guideline level of 9 µg Sn/kg

3.1.4 Elutriate

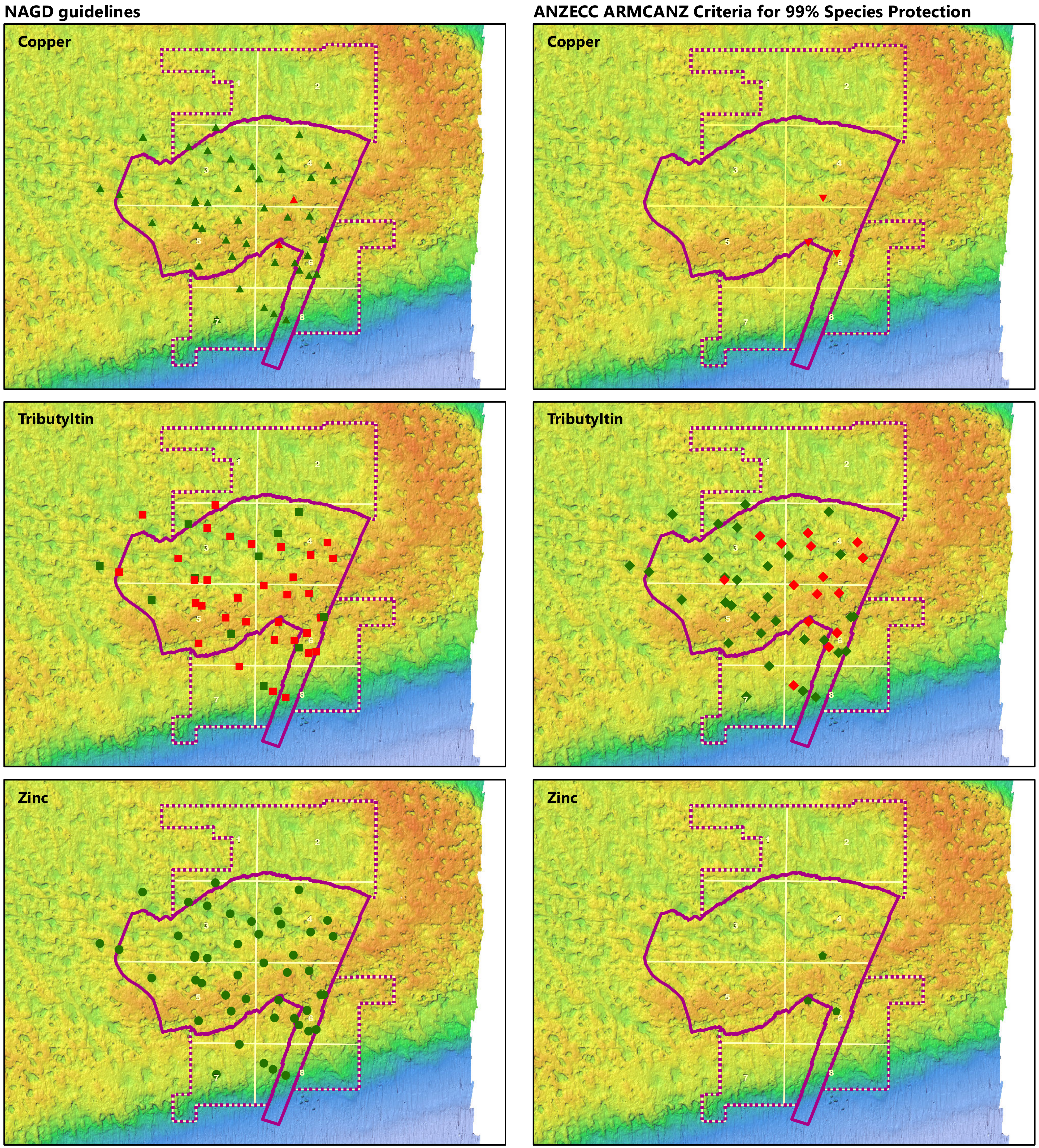
Where sediment concentrations of total or bioavailable metals and metalloids and normalised TBT were near or above the NADG (2009) guidelines, the samples were flagged for Phase III elutriate testing and results compared to the ANZG (2018) 99% species protection guideline level. The primary laboratory was able to lower the LORs for zinc and copper to meet these guidelines; however, the LOR for elutriate TBT analysis could not be achieved by the primary laboratory or several other laboratories contacted during the planning stage. As a result, all TBT concentrations in elutriate water were above the 99% species protection guideline prior to the application of a dilution factor to the results.

Elutriate testing is discussed in detail in the NAGD (2009, pp. 59) and the guidelines were followed in laboratory analysis and reporting. The results for all Priority Areas are provided in the Laboratory Analysis Report (Advisian 2019e). As stated in the NAGD (2009), elutriate tests use a four-times dilution factor of sediment to seawater. This gives a concentration that overestimates the water quality impacts as it is more likely that 100-times dilutions or more would be expected in practice. A dilution factor of 20-times the laboratory test results was used in elutriate analysis to replicate this conservative approach (80x dilution in total).

Elutriate testing was completed for select samples from all Priority Areas (Table 2-2), however samples from Priority Areas E and F had no detectable concentrations of copper, zinc or TBT once eluted, and Priority Area C has no detectable concentrations of copper or zinc once eluted. The results for Priority Areas A and C are shown in Figure 3-32 and Figure 3-33 respectively as a comparison to Phase II testing results. The results show that:

- Priority Area A has 3 sampling sites with copper (µg/L) concentrations above the ANZG (2018) 99% species protection guideline, one in sub-area A4 and two in sub-area A6 (Figure 3-32). Priority Area A has no zinc (µg/L) concentrations above the guideline.
- Priority Area A has 15 sampling sites with TBT concentrations (ng Sn/L) above the ANZG (2018) species protection guideline (Figure 3-32).
- Priority Area C, sub-area C3 contains one sampling site with a TBT concentration (ng Sn/L) above the ANZG (2018) 99% species protection guideline (Figure 3-33).

Douglas Shoal Remediation Planning
Sediment Characterisation Report
Figure 3-32
Elutriate Concentrations at Sediment Sampling Sites in Priority Area A



NAGD GUIDELINES

TOTAL Copper mg/kg
- <= 65 mg/kg
- > 65 mg/kg

Tributyltin (normalised to PC TOC) µg Sn/kg
- <= 9 µg Sn/kg
- > 9 µg Sn/kg

TOTAL Zinc mg/kg
- <= 200 mg/kg

ANZECC ARMCANZ CRITERIA FOR 99% SPECIES PROTECTION

Copper (80 times dilution) µg/L
- <= 0.3 µg/L

Tributyltin (80 times dilution) ng Sn/L
- <= 0.4 ng Sn/L
- > 0.4 ng Sn/L

Zinc (20 times dilution) µg/L
- <= 7 µg/L

Note: TOC = Total Organic Carbon

Priority Area
- A
- A - outside grounding footprint

Priority Area A Sub-area

Bathymetry

-23.0m -9.0m

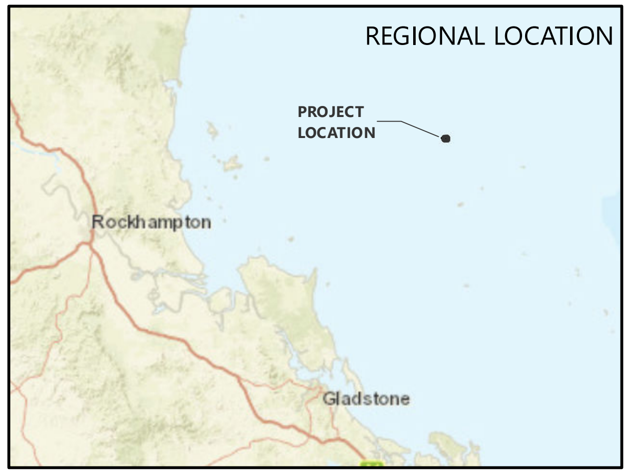
0 50 100 150 200
Metres

Scale at A3 - 1:7,500

N

Coordinate System: GCS GDA 1994
Datum: GDA 1994

Source Information:
Grounding footprint, Priority areas
Cardno 2017
2010 AFP sampling
Costen et al 2017
Sampling locations and contaminant concentration
Advisian - March 2019
Bathymetry (50cm LAT)
Acoustic Imaging 2019



Advisian
Worley Group

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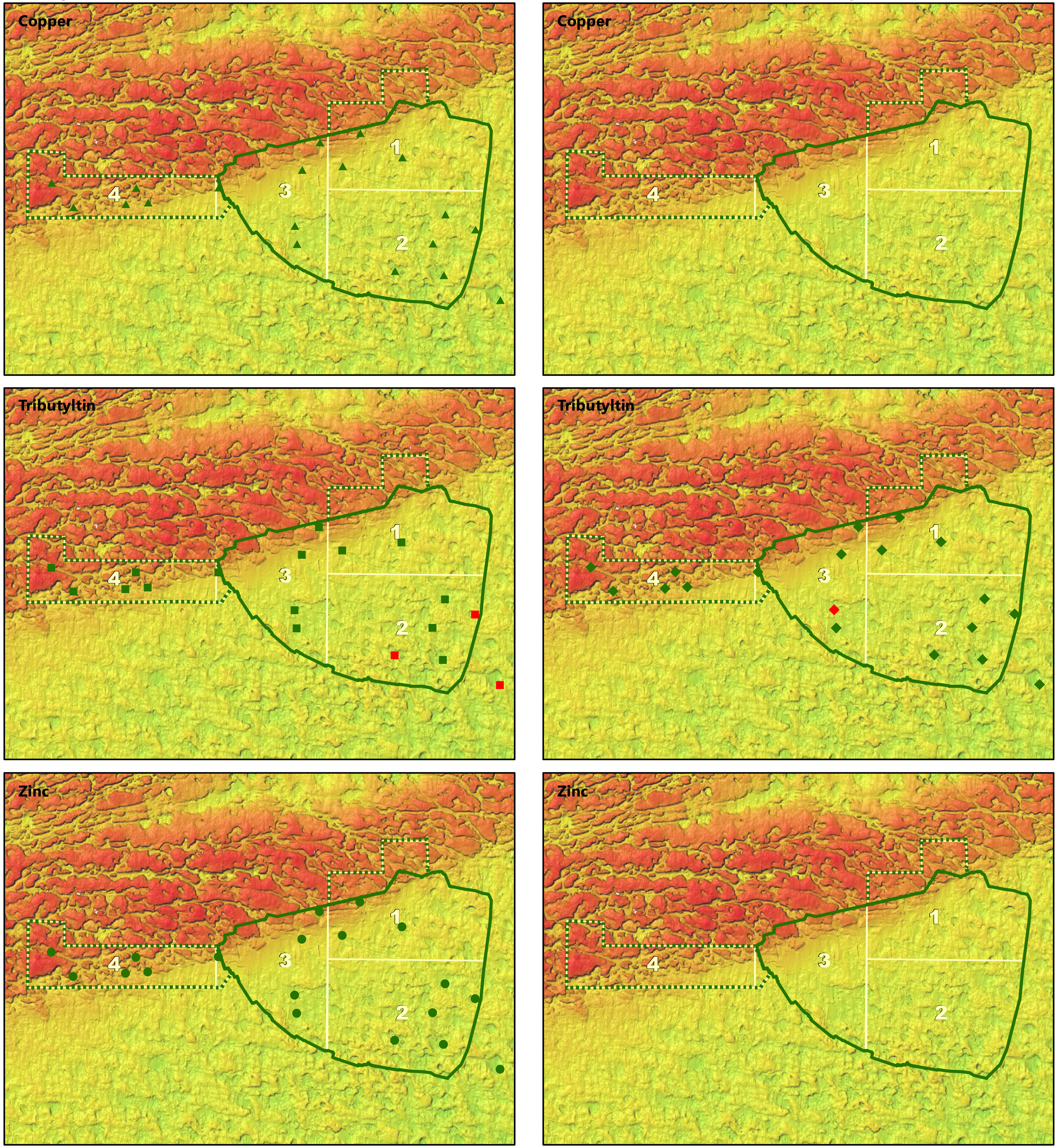
19/08/2019 Rev: B ISSUED FOR INFORMATION Org: KM Chk: SN

Douglas Shoal Remediation Planning
Sediment Characterisation Report
Figure 3-33
Elutriate Concentrations at Sediment Sampling Sites in Priority Area C

NAGD guidelines

ANZECC ARMCANZ Criteria for 99% Species Protection



NAGD GUIDELINES

TOTAL Copper mg/kg
- ▲ <= 65 mg/kg

Tributyltin (normalised to PC TOC) µg Sn/kg
- ■ <= 9 µg Sn/kg
- ■ > 9 µg Sn/kg

TOTAL Zinc mg/kg
- ● <= 200 mg/kg

ANZECC ARMCANZ CRITERIA FOR 99% SPECIES PROTECTION

Tributyltin (80 times dilution) ng Sn/L
- ◆ <= 0.4 ng Sn/L
- ◆ > 0.4 ng Sn/L

Priority Area
- C
- C - outside grounding footprint

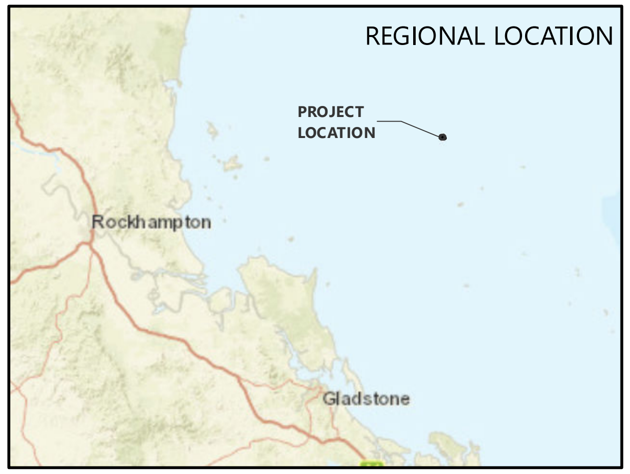
Priority Area C Sub-area

Bathymetry

-23.0m — -9.0m

Note: TOC = Total Organic Carbon

Source Information:
Grounding footprint, Priority areas
Cardno 2017
2010 AFP sampling
Costen et al 2017
Sampling locations and contaminant concentration
Advisian - March 2019
Bathymetry (50cm LAT)
Acoustic Imaging 2019



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

0 50 100 150 200
Metres

N

Scale at A3 - 1:5,000

Coordinate System: GCS GDA 1994
Datum: GDA 1994

Advisian
Worley Group

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19/08/2019 Rev: B ISSUED FOR INFORMATION Org: KM Chk: SN

3.1.5 Zineb

A total of 72 samples were tested for the presence of the biocide zineb, which is a constituent of the AFP applied to the Shen Neng 1. All samples were tested using the Phase III elutriate methods from NAGD (2009) because the proposed Phase III method outlined in the SAP (Advisian 2019a) was decided against due to the explosive nature of the calcium carbonate sample when the original methods were applied (See Section 2.1).

None of the sediment samples had zineb concentrations above the LOR (<2µg/L).

3.1.6 nMDS plots

Non-metric multidimensional scaling (nMDS) plots were completed to identify the priority areas and sub-areas that are different in terms of their contamination profile and the specific contaminants that are driving that difference. The plots are found in Figure 3-34 and Figure 3-35 and show the following results:

- There are three main groups / clusters of priority areas that show contamination due to organotins (Figure 3-34). These groups or clusters are comprised predominantly of sub-areas from Priority Area A.
- Priority Area A is most different from the other priority areas due to samples with elevated concentrations of organotins as well as (to a lesser extent) bioavailable copper and bioavailable zinc (Figure 3-34).
- Sub-areas A3, A4, A5 and A6 are the most different from other sub-areas, again due to samples with elevated concentrations of organotins as well as (to a lesser extent) bioavailable copper and bioavailable zinc (Figure 3-35).
- There was one sampling site within each of sub-areas C2, CX and EX which were different from other Priority Area C and E sub-areas due to bioavailable aluminium and bioavailable iron contamination (Figure 3-35).
- There were two sampling sites within sub-area F3 which were different due to higher concentrations of total arsenic, cadmium, cobalt, lead and nickel (Figure 3-35).

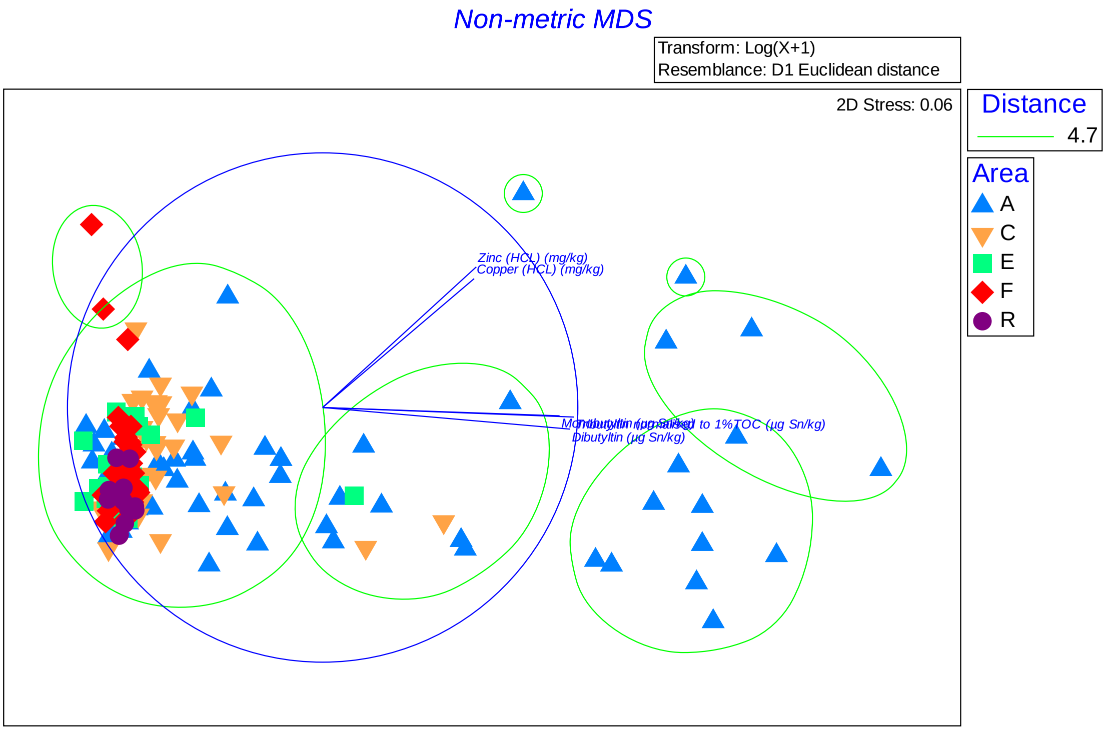

Figure 3-34: nMDS plot of the contaminant data matrix overlaid with the factor of area (sub-areas which are clustered together and most similar are circled)

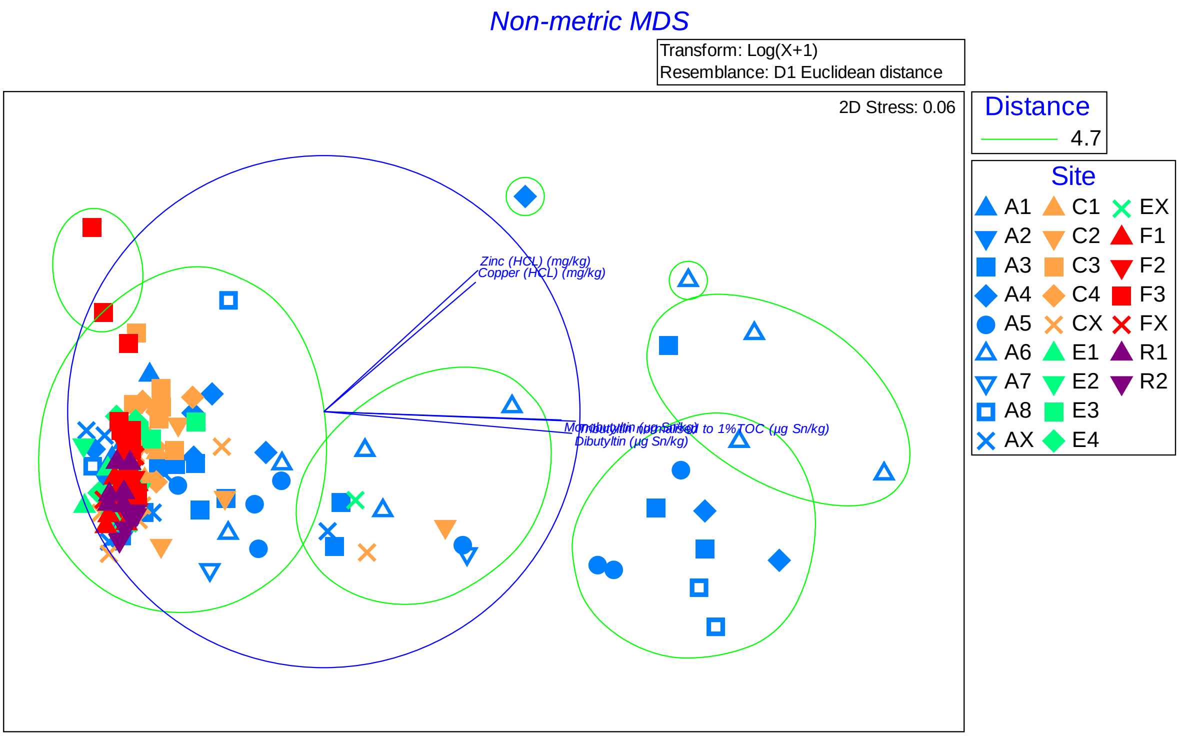

Figure 3-35: nMDS plot of the contaminant data matrix overlaid with the factor of sampling site (sampling sites which are clustered together and most similar are circled)

3.1.7 PERMANOVA

Permutation Analysis of Variance (PERMANOVA) was undertaken to determine significant differences or interactions between sub-areas in the multivariate profile of contaminants (Table 3-1). There was a significant difference between sub-areas based on this profile (p=0.001) and therefore planned pairwise comparisons between sub-areas within the priority areas and reference areas was undertaken (Table 3-2). This analysis showed that;

- Sub-areas A1, A3, A4, A5, A6 and A8 are significantly different (p<0.01) to reference area sub-areas
- Sub-areas C2, C3 and C4 are significantly different (p<0.01) to reference area sub-areas
- Sub-areas E3 is significantly different (p<0.01) to reference area sub-areas
- Sub-areas F2 and F3 are significantly different (p<0.01) to reference area sub-areas.

The results from the nMDS analysis can be used to indicate why sub-areas are significantly different. The nMDS showed that differences for sites in Priority Areas C, E and F were driven by elevated concentrations of metals in one or two samples in sub-areas within the priority area (Section 3.1.6). For sub-areas within Priority Area A, the nMDS analysis (Section 3.1.6) indicated that differences are due to samples with elevated organotin, copper and zinc concentrations, all of which are a component of AFP.

Table 3-1: Summary of PERMANOVA output (significant differences (p<0.01) are emboldened)

Factor	df	SS	MS	Pseudo-F	p	Unique permutations
Site	23	1147.7	49.9	5.09	**0.001**	996
Residuals	205	2008.2	9.79			
Total	228	3155.9				

Table 3-2: Summary of PERMANOVA planned pairwise comparisons between sites and reference sites (significant differences (p<0.01) are emboldened)

Pairwise comparisons of sites to reference sites	t	P(perm)	Unique permutations	Difference
A1, Ref	1.8641	**0.010**	998	
A2, Ref	1.9056	0.020	973	--
A3, Ref	3.0629	**0.001**	997	
A4, Ref	2.4754	**0.001**	999	
A5, Ref	3.1335	**0.001**	998	
A6, Ref	4.1661	**0.001**	998	
A7, Ref	1.6108	0.025	995	--

Pairwise comparisons of sites to reference sites	t	P(perm)	Unique permutations	Difference
A8, Ref	2.057	**0.003**	988	
AX, Ref	1.6866	0.011	998	--
C1, Ref	2.0325	0.023	979	--
C2, Ref	1.8537	**0.004**	999	
C3, Ref	4.4255	**0.001**	965	
C4, Ref	3.8808	**0.001**	992	
CX, Ref	1.2192	0.182	997	--
E1, Ref	1.7305	0.046	989	--
E2, Ref	1.6741	0.045	975	--
E3, Ref	2.3561	**0.005**	989	
E4, Ref	1.6999	0.049	968	--
EX, Ref	1.063	0.293	996	--
F1, Ref	1.3385	0.144	994	--
F2, Ref	3.1675	**0.001**	999	
F3, Ref	2.6869	**0.001**	999	
FX, Ref	1.156	0.247	997	--

3.1.8 Area A hotspot

The contamination levels and locations of organotins, total copper and total zinc (all AFP components) within Priority Area A were examined in greater detail in response to the outcomes of the nMDS plots (Section 3.1.6) and PERMANOVA analyses (Section 3.1.7). Bubble plots developed to visualize contamination concentrations in Priority Area A are shown in Figure 3-36. The plots show that:

- There were many exceedances of the NAGD (2009) guideline for TBT (Figure 3-36). The highest concentrations (normalised to 1% TOC) were seen in sub-area A4 (19,800 µg Sn/kg), followed by sub-area A6 (17,905 µg Sn/kg), A8 (8,750 µg Sn/kg), A3 (7,350 µg Sn/kg) and A5 (2,845 µg Sn/kg).
- Similar patterns to that of TBT were observed for concentrations of DBT (µg Sn/kg) (highest concentration in sub-area A6, followed by A4, A3, A8 and A5) (Figure 3-37) and MBT (µg Sn/kg) (highest concentration in sub-area A6, followed by A4, A5, A8 and A3) (Figure 3-38).
- Concentrations of total copper (mg/kg) were most elevated in two sub-areas (A4 and A6) due to only one sampling site in each sub-area exceeding the NAGD (2009) guideline of 65 mg/kg (Figure 3-39). These sample concentrations were 365 mg/kg in sub-area A4 and 175 mg/kg in sub-area A6.

- Similar patterns to that of copper were observed for total zinc (mg/kg) concentrations which were elevated in two sub-areas (A4 and A6) due to one sampling site in each (Figure 3-40). No values exceed the NAGD (2009) guideline level of 200 mg/kg for zinc.

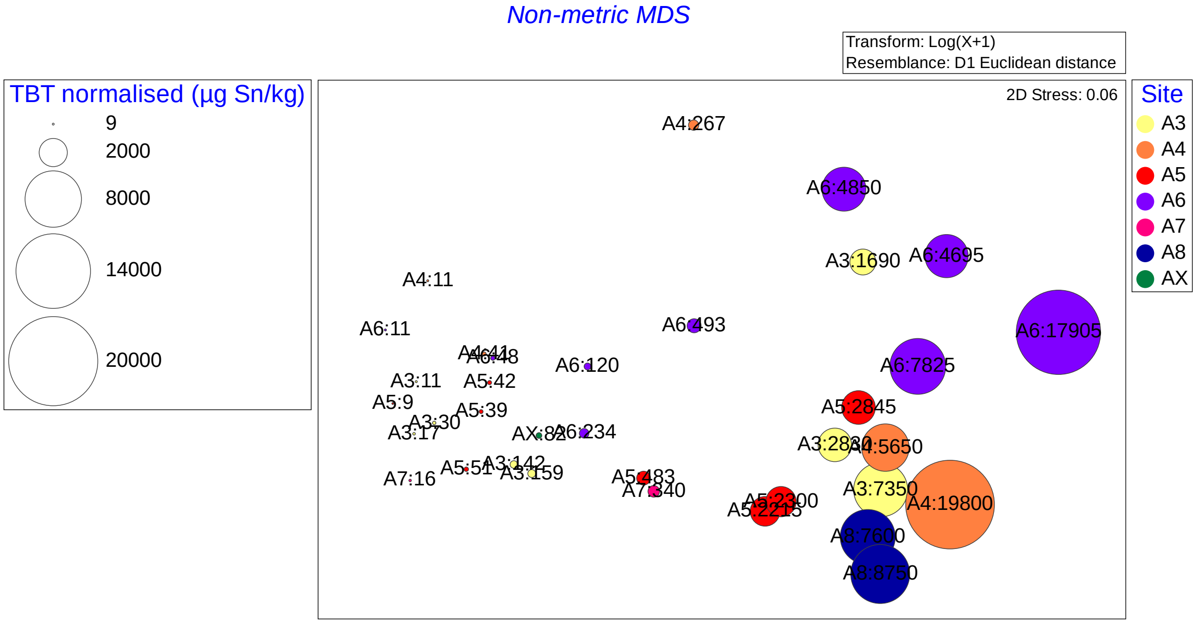

Figure 3-36: Concentrations of TBT (normalised to 1% TOC) which exceeded the NAGD (2009) guideline of 9 µg Sn/kg within Priority Area A

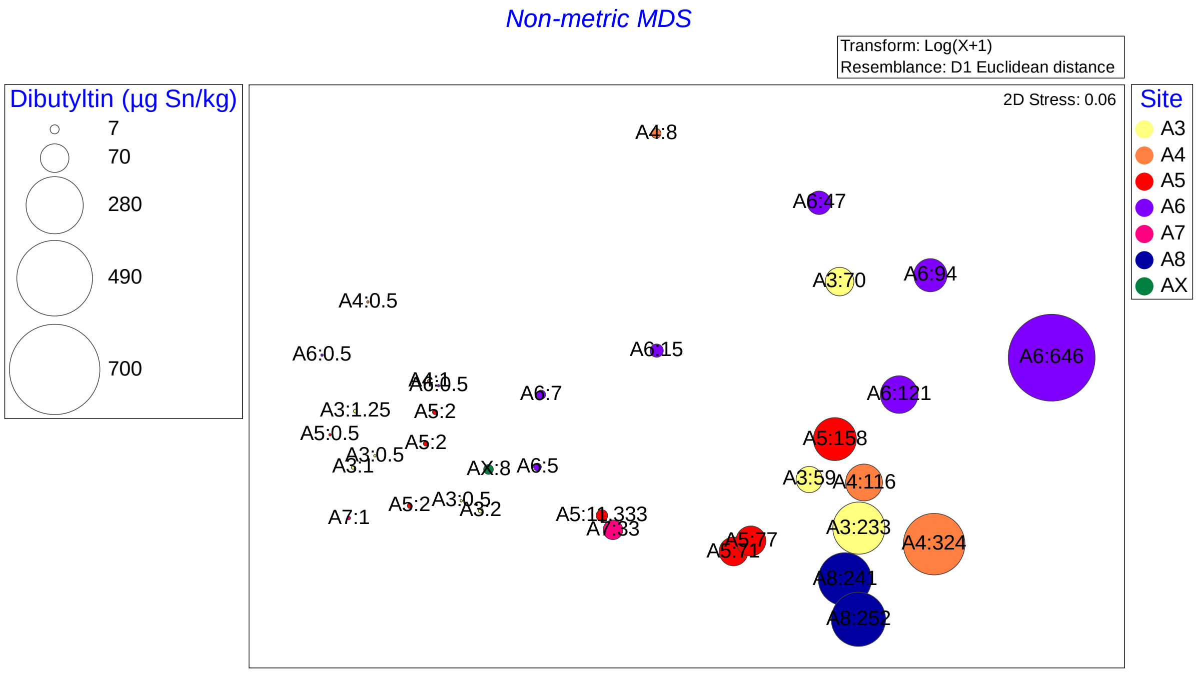

Figure 3-37: Concentrations of DBT within Priority Area A

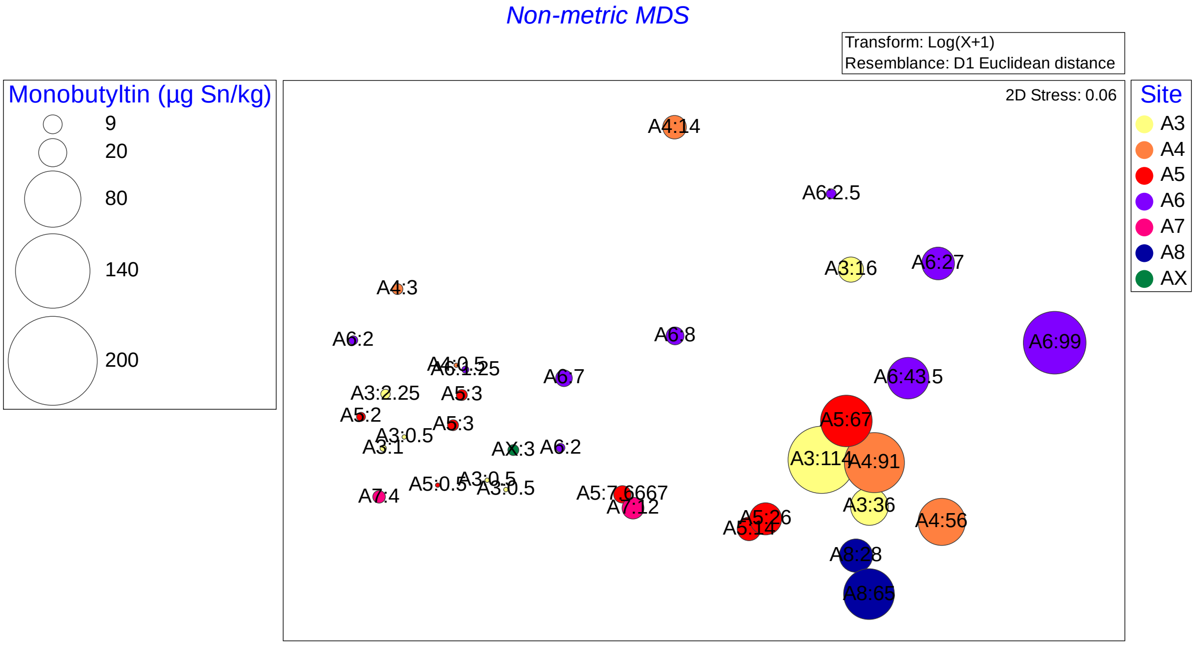

Figure 3-38: Concentrations of MBT within Priority Area A

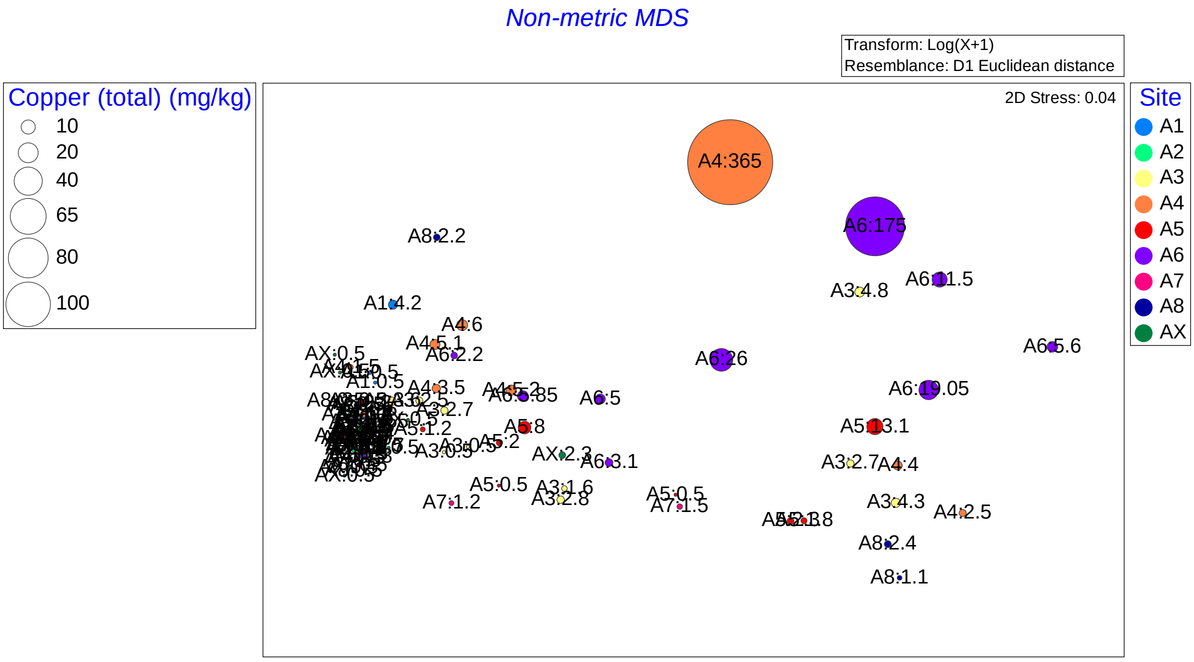

Figure 3-39: Concentrations of copper within Priority Area A (note that the NAGD (2009) guideline level is 65 mg/kg

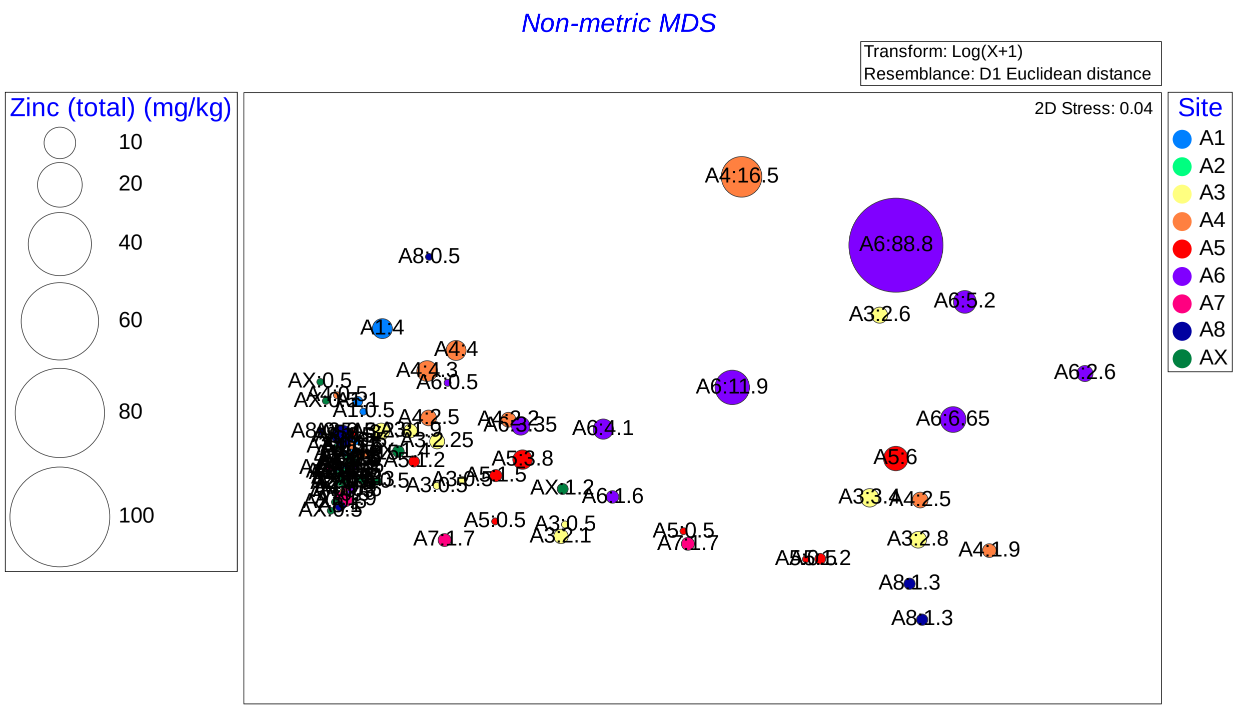

Figure 3-40: Concentrations of zinc within Priority Area A

3.1.9 Summary

There was a significant difference between sub-areas in the multivariate profile of contaminants, and this was evident in pairwise comparisons between sub-areas within the priority areas and reference areas. There was a significant difference for many sites in Priority Area A, and a few from Priority Areas C, E and F:

- Sub-areas A1, A3, A4, A5, A6 and A8 were significantly different ($p<0.01$) to reference areas due to elevated levels of organotins and (to a lesser extent) copper and zinc.
- Sub-areas C2, C3 and C4 were significantly different ($p<0.01$) to reference areas due to some elevated concentrations of total aluminium, total iron, bioavailable aluminium and bioavailable iron in several sampling sites.
- Sub-area E2 was significantly different ($p<0.01$) to reference areas due to elevated concentrations of organotins in one sampling site only.
- Sub-area F3 was significantly different ($p<0.01$) to reference areas. This result was driven by two to three sampling sites which had higher concentrations of either total arsenic, cadmium, cobalt, lead and nickel. There were two sampling sites in sub-area F3 which had total arsenic concentrations exceeding the NAGD (2009) guideline of 2mg/kg. There were also two sampling sites that had total cadmium concentrations exceeding the NAGD (2009) guideline of 1.5mg/kg.

Phase III elutriate results showed that contaminants that may become bioavailable during removal activities were in Priority Area A and to a much lesser extent Priority Area C.

3.2 Physical characteristics

3.2.1 Physical characteristics

Physical characteristics were determined using PSD, TOC, full range PSD (range specified by the primary laboratory, ALS, scale), soil particle density, moisture content, and settleability. These parameters were graphed to compare across priority areas, reference areas and sub-areas as shown in Figure 3-41 to Figure 3-50. The following patterns were observed:

- PSD varied considerably between priority areas and between sub-areas within priority areas for percent (%) clay, silt, sand and gravel (Figure 3-41) and percent (%) full range PSD (Figure 3-42):
  - The proportion of clay was highest in sub-area C2 (16.7%), and the mean proportions within sub-areas ranged from 1.0%-16.7%
  - The proportion of silt was highest at sub-areas A6 (4.7%), F3 (4.3%) and R2 (4.0%) and the mean proportions within sub-areas ranged from 0%-4.7%
  - The proportion of gravel was highest at sub-area C4 (74.1%), and the mean proportions within sub-areas ranged from 61.0%-83.0%
  - The proportion of very fine sediment fractions (<75µm) were highest at sub-areas C2 (18.5%), F2 (15.7%), A6 (13.6%), F3 (11.5%) and C4 (11.2%).
- Overall, there were higher proportions of the larger sediment sizes (1180 µm +) within the grounding area compared to outside of it; however, the finest sediment fraction (<75µm) was also higher within the grounding area (Figure 3-43). The following further differences were found within the grounding footprint in comparison to outside:
  - Lower proportions of the sediment fraction +425µm
  - Lower proportions of sediment fraction +600µm
  - Higher proportions of sediment fraction +2.36mm
  - Higher proportions of sediment fraction +4.75mm
  - Higher proportions of sediment fraction +9.5mm.
- TOC (%) also varied considerably within priority areas and between all sub-areas ranging from 0.1%-0.3% (Figure 3-44). The areas with the highest TOC were R1 (0.3%), A1 (0.3%), E4 (0.2%) and R2 (0.2%).
- Soil particle density (g/cm^3) ranged from 2.31 g/cm^3 – 2.69 g/cm^3 and was similar throughout all sub-areas (Figure 3-45).
- Moisture content (%) was lowest at sub-areas C1 (12.4%) and C4 (12.4%) and highest at areas A7 (35.1%) and R1 (34.8%) (Figure 3-46).
- Underflow solids (%) had similar patterns between sub-areas for 10% settleability (10% S) and 20% settleability (20% S) rates tested (Figure 3-47). Percentages ranged from 48.5%-66.3% for 10% S and 51.0%-66.6% for 20% S. The largest difference between 10% S and 20% S was for sub-area E1.
- Underflow density (g/cm^3) varied between sub-areas and there were minimal differences between the 10% S and 20% S rates tested (Figure 3-48). Percentages ranged from 1.37 g/cm3-1.99 g/cm3 for 10% S and 1.37 g/cm3-1.96 g/cm3 for 20% S. The largest difference between 10% S and 20% S was for sub-area A4.

- Settling rate at 10% S (mm/min) ranged from 54.2%-57.3% (Figure 3-49). Results were the same for settling rates of 50% and 90%.
- Settling rate at 20% S (mm/min) ranged from 19.6%-23.0% (Figure 3-50). Results were the same for settling rates of 50% and 90%.

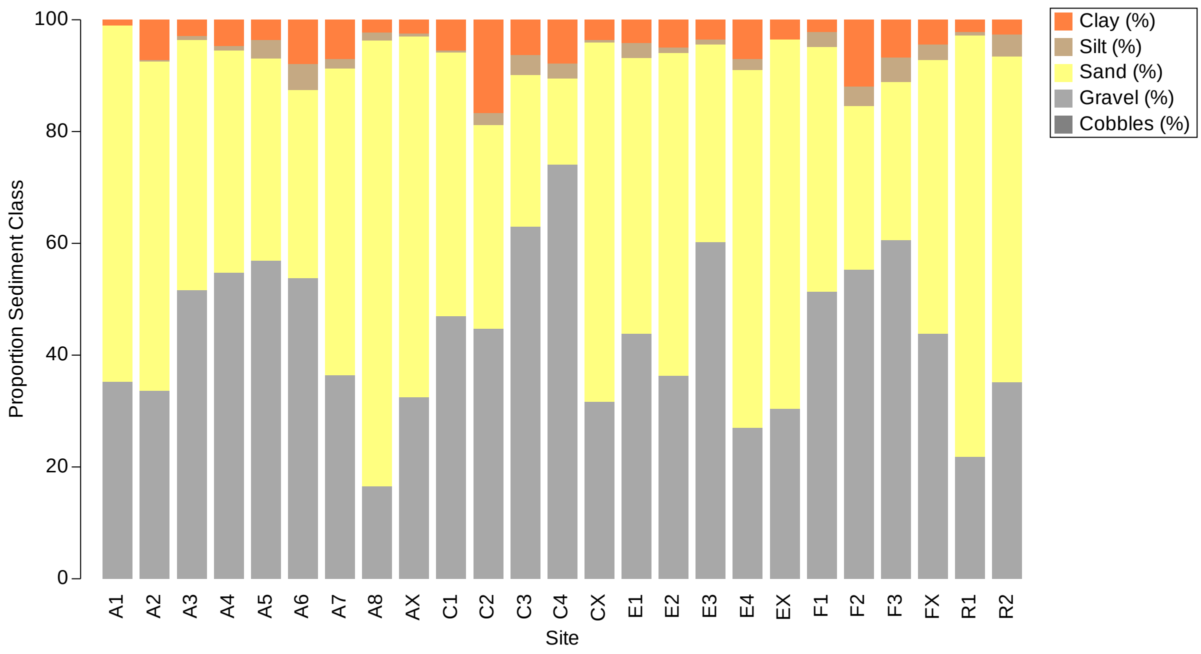

Figure 3-41: Proportion of PSD (%) shown by sub-area

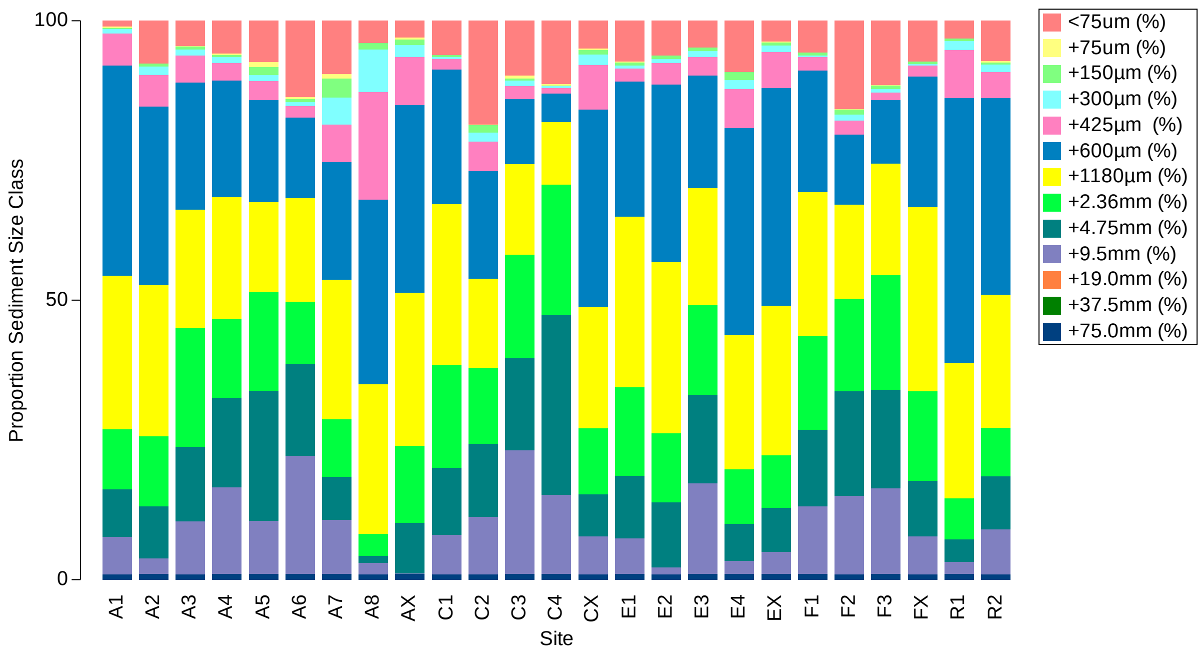

Figure 3-42: Proportion of full range PSD (%) as categorised by ALS shown by sub-area

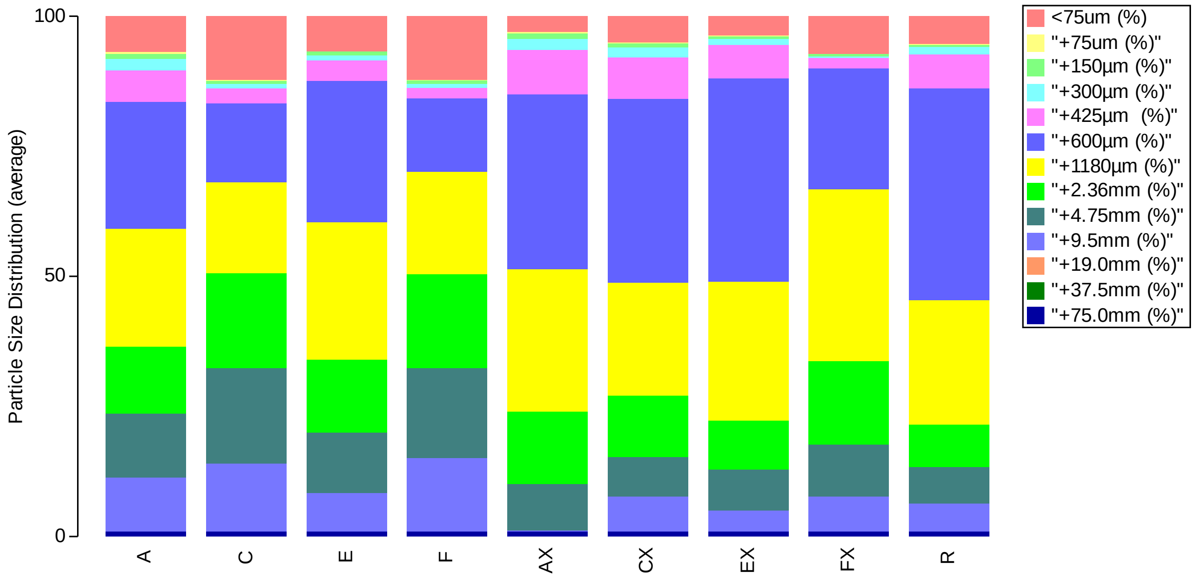

Figure 3-43: Mean full range PSD (%) as categorised by ALS shown by priority area

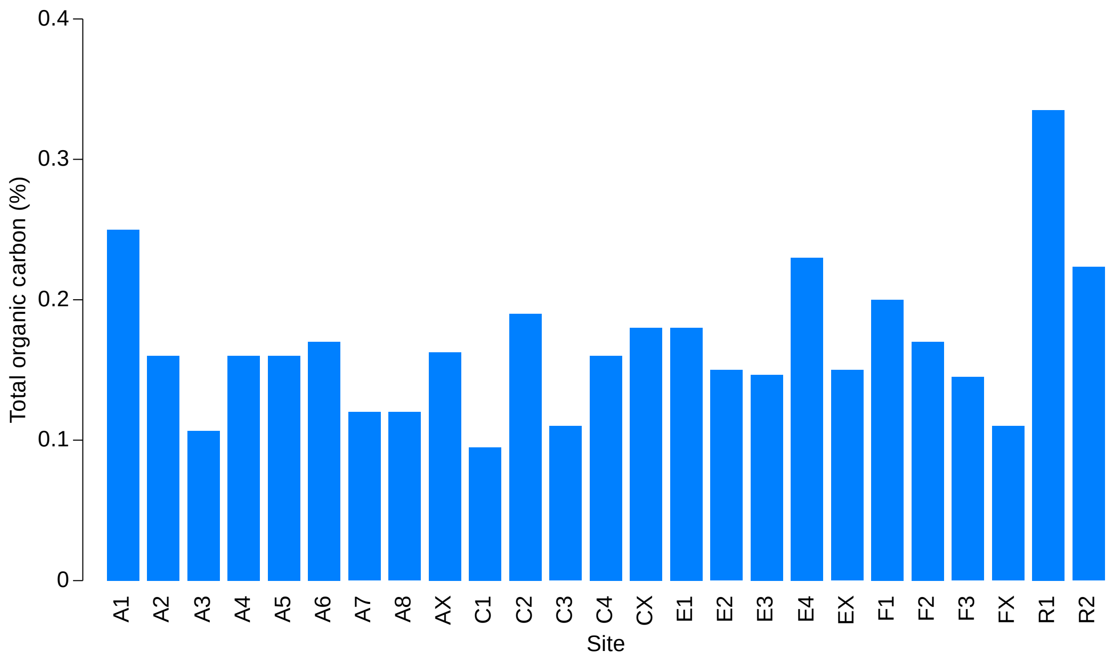

Figure 3-44: Mean TOC (%) shown by sub-area

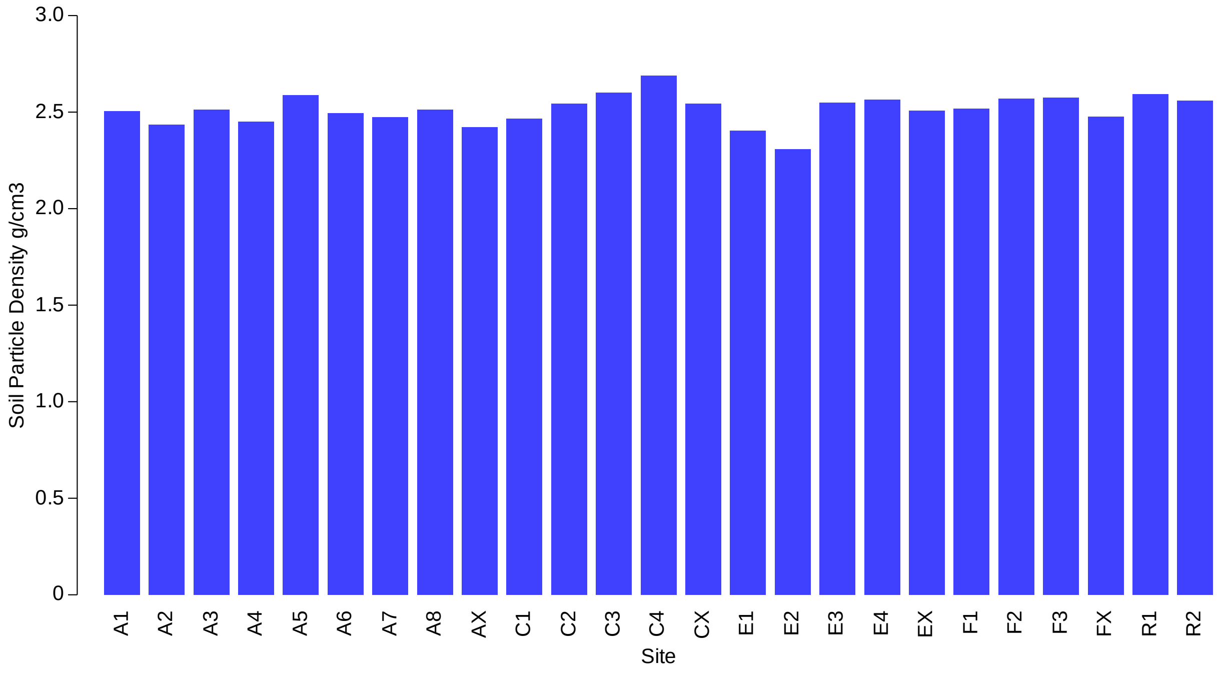

Figure 3-45: Mean soil particle density (g/cm^3) shown by sub-area

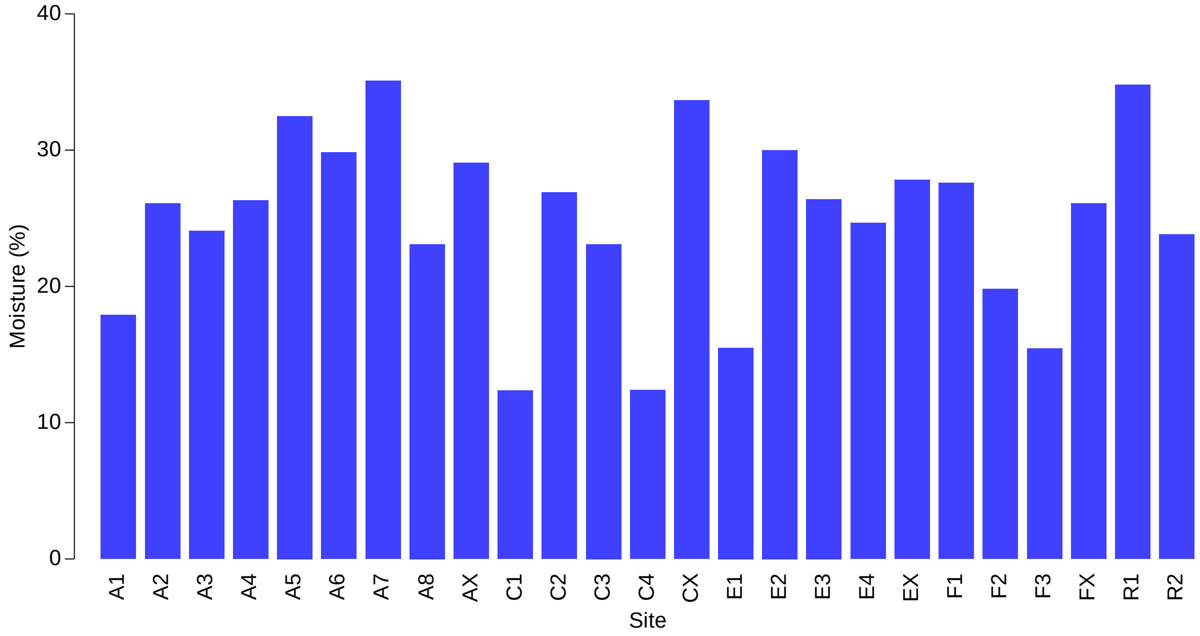

Figure 3-46: Mean moisture (%) shown by sub-area

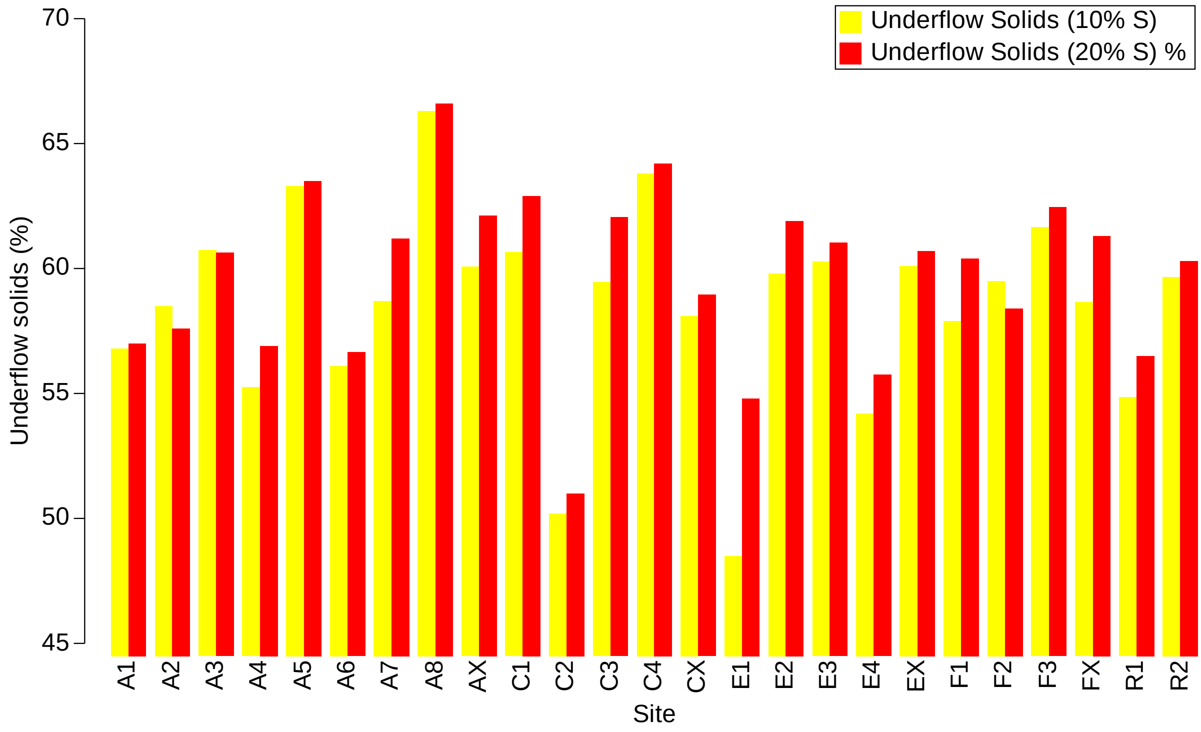

Figure 3-47: Mean underflow solids (%) for 10% and 20% settleability shown by sub-area based on 50%ile and 90%ile (no difference between 50%ile and 90%ile)

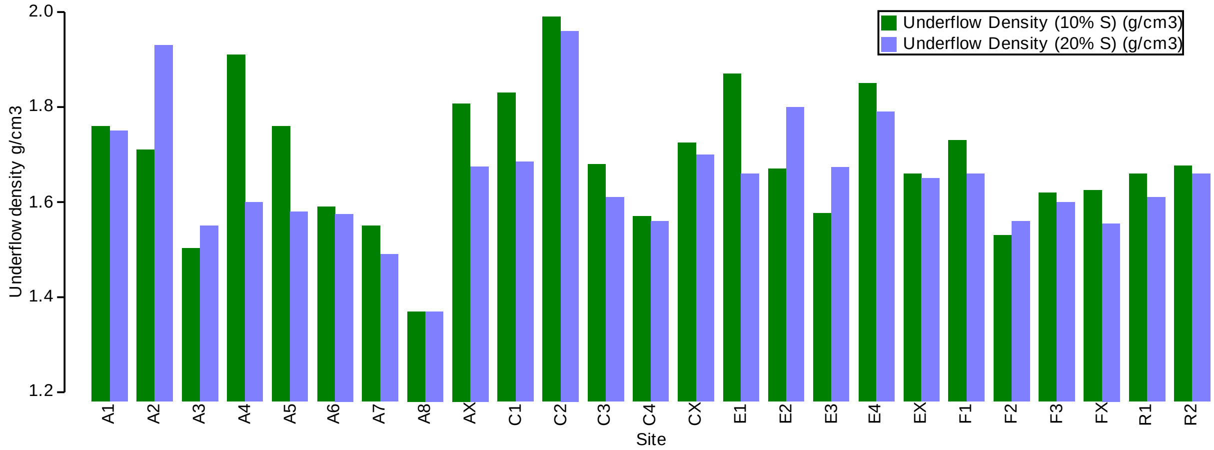

Figure 3-48: Mean underflow density (g/ cm^3) for 10% and 20% settleability shown by sub-area

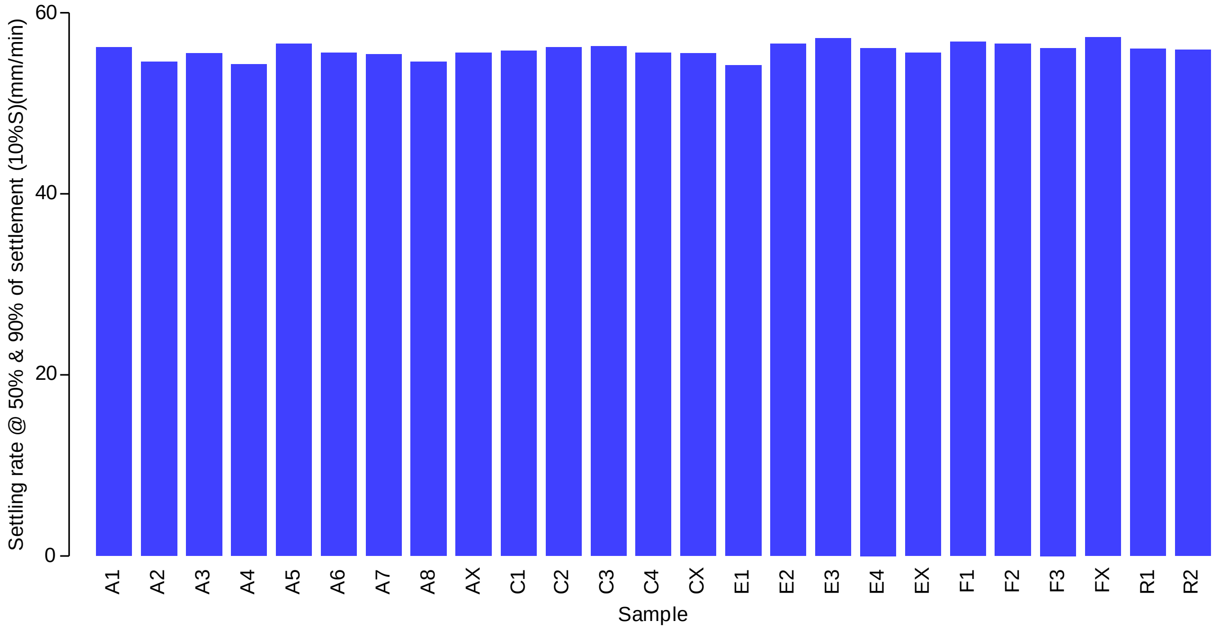

Figure 3-49: Mean settling rate at 50% and 90% of settlement (10% S) (mm/min) shown by sub-area

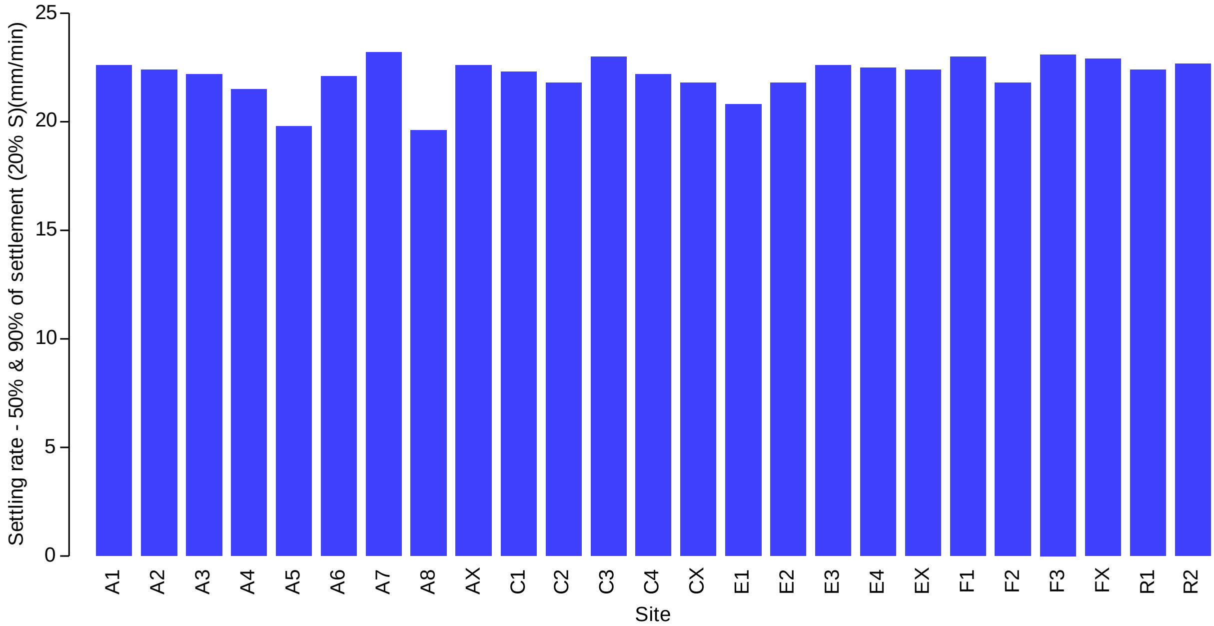

Figure 3-50: Mean settling rate at 50% and 90% of settlement (20% S) (mm/min) shown by sub-area

3.2.2 nMDS plots

Non-metric MDS plots were completed to identify the differences in terms of PSD of sites within the grounding area in comparison to outside of it. The plots are found in Figure 3-51 and Figure 3-52 and show the following results:

- There were more sub-areas with a higher proportion of the finest sediment size, <75µm, in Priority Areas A, C and F, in comparison to other priority areas (seen by sites spread to the left of the nMDS) (Figure 3-51).
- There were more sub-areas with higher proportions of the finest sediment sizes, <75µm (and to a lesser extent +75µm) in the grounding footprint in comparison to sub-areas outside of the grounding footprint (Figure 3-52).
- There is a higher variation of particle size within sub-areas in the grounding footprint compared to outside or within the reference area sub-areas (seen by sites spread to the right of the nMDS). In other words, there were many sub-areas which also had similar sediment size profiles to those outside the grounding footprint or inside the reference areas (Figure 3-52).

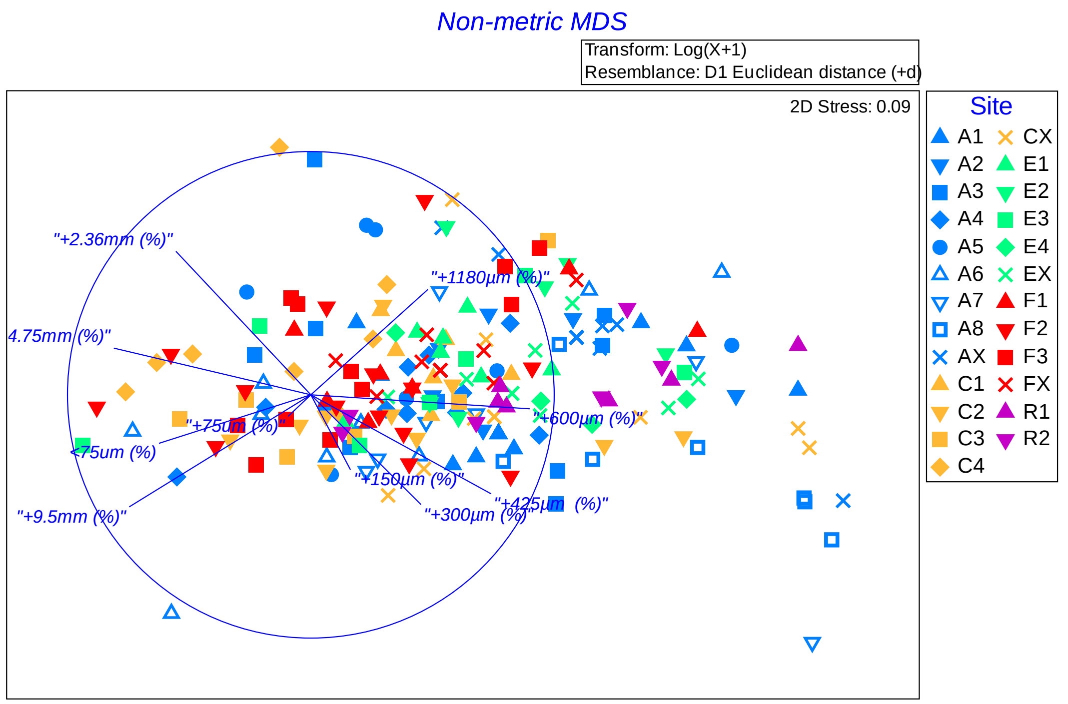

Figure 3-51: nMDS plot of the particle size distribution data matrix overlaid with the factor of site

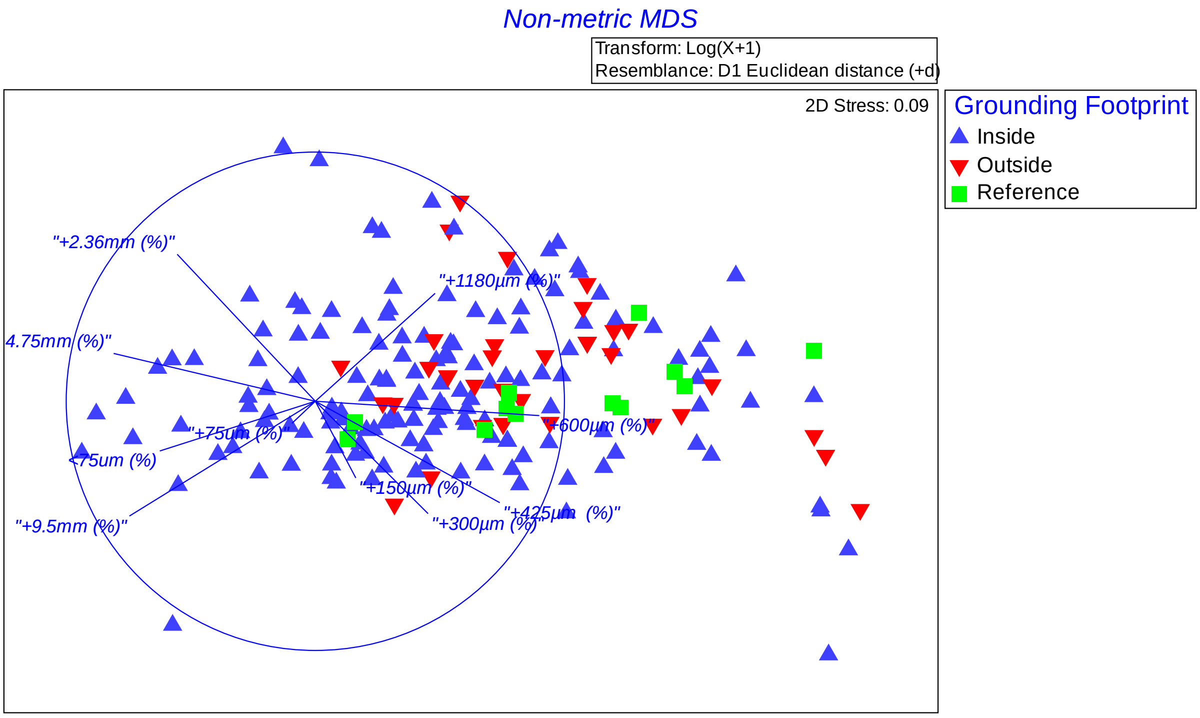

Figure 3-52: nMDS plot of the particle size distribution data matrix overlaid with the factor of grounding footprint

3.2.3 DistLM and dbRDA

DistLM was completed to identify which factors are important in driving variability and to determine if there is a significant difference between sites after accounting for key sediment characteristics that influence chemical concentrations. The final model (Table 3-3) that explained the most variability in the chemical dataset contained the following factors, listed in order of their contribution to the model:

- TOC (%)
- Sub-area
- PSD (%) (full size ranges from <75µm to +19mm)
- Underflow (g/cm^3)
- Moisture (%)
- Soil particle density (g/cm^3)
- Settling rate (mm/min)

The model shows that there is more variability within the grounding area than outside or in reference areas. This is a reflection that not all sub-areas within the grounding area show contamination and that it is confined to a subset of sub-areas, likely those with higher proportions of the finest sediment fraction, <75µm, and higher TOC concentrations.

Spatial factors (such as priority area or sub-site) were included last as recommended by Anderson *et al.* (2008) in order to determine if there are spatial impacts after accounting for environmental and temporal variability. In DistLM models, there is a set amount of variability and a proportion which will be shared among some factors. The shared variability is assigned to the factor listed first in the model.

The results of the final model in Table 3-3 and a dbRDA plot by sub-area of the factors influencing the dataset is shown in Figure 3-53 and Figure 3-54. Key points from the analysis include:

- The factor of sediment depth (mm) was not a significant factor suggested in any of the solutions by the BEST procedure which demonstrated this factor was not an important contributor to overall variability. This factor was therefore removed from the model.
- Most of the variability in the model can be explained by TOC (%) (10.4%) and PSD (%) (16.9%) (Table 3-3).
- Within the group of PSD (using full range PSD), it is the finer fractions which explained more variability: <75µm (5.22%), +75µm (1.73%) and +150µm (0.68%) and +300µm (0.59%). The proportion of variability explained by sediment fractions decreased with size with +425 µm (0.38%), +600µm (0.24%), +1180µm (0.11%), +2.36mm (0.07%), +4.75mm (0.04%) and +9.5mm (0.02%).
- Other factors (underflow, sediment moisture, soil particle density and settling rate) are significant contributors of the model but explain very small amounts of variability after accounting for factors of TOC (%) and PSD (%) (Table 3-3).
- Sub-area) was also a significant contributor of the model but explained a very small amount of variability after accounting for factors of TOC (%) and PSD (%). This doesn't mean that sub-area is not important, but shows that within contaminated sub-areas, samples with higher proportions of the finest sediment fraction <75µm and high TOC are likely to have higher concentrations of contaminants.
- The analysis showed that the factors in the final model explained 48.6% of the variability in the dataset, which should be considered a high amount of explained variability in an environmental sediment dataset. There is a proportion of variability that is unidentified and driven by unknown factors, but this is typical of field-based monitoring programs and especially for contaminants such as TBT which are highly variable in nature due to fate and breakdown.
- The model shows that the contamination profile of Priority Area A is different from the other priority areas. In particular that higher contamination within Priority Area A is associated more with particle size (mainly <75µm and +75µm, and to a far lesser extent 4.75mm and 9.5mm) and TOC (Figure 3-53).
- The model shows that there is more variability within the grounding area than outside or in reference areas. This is a reflection that not all sub-areas within the grounding area show contamination and that it is confined to a subset of sub-areas, likely those with higher proportions of the finest sediment fraction, <75µm, and higher TOC concentrations (Figure 3-54).

Table 3-3: Results of the DistLM analysis of the contaminant multivariate profile (significant factors have p<0.05)

Factor	SS	Pseudo-F	P	Prop	% variation explained by factor
Total Organic Carbon (%)	248.65	9.94	0.001	0.042	10.42%
Particle Size Distribution	699.48	3.25	0.001	0.118	16.90%
Underflow	468.29	4.80	0.001	0.078	0.18%
Sediment moisture (%)	162.43	6.40	0.001	0.027	0.02%
Soil Particle Density (g/cm3)	124.51	4.87	0.002	0.021	<0.01%
Settling Rate	211.84	4.19	0.001	0.036	<0.01%
Sub-area	214.70	8.53	0.001	0.036	<0.01%

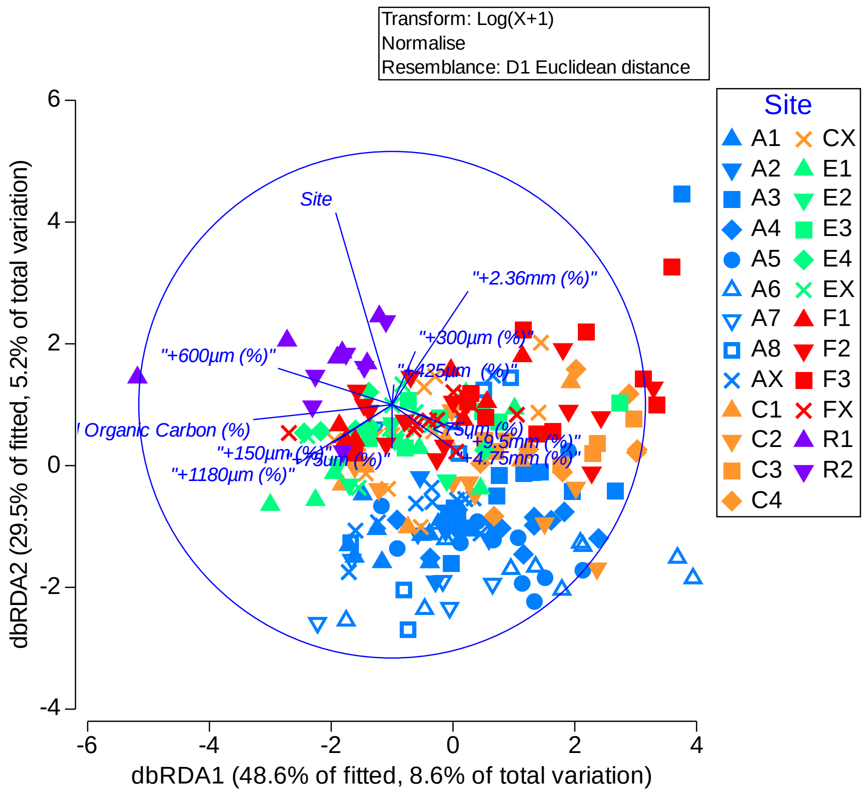

Figure 3-53: dbRDA plot of the contaminant matrix overlaid with the factor of sub-area

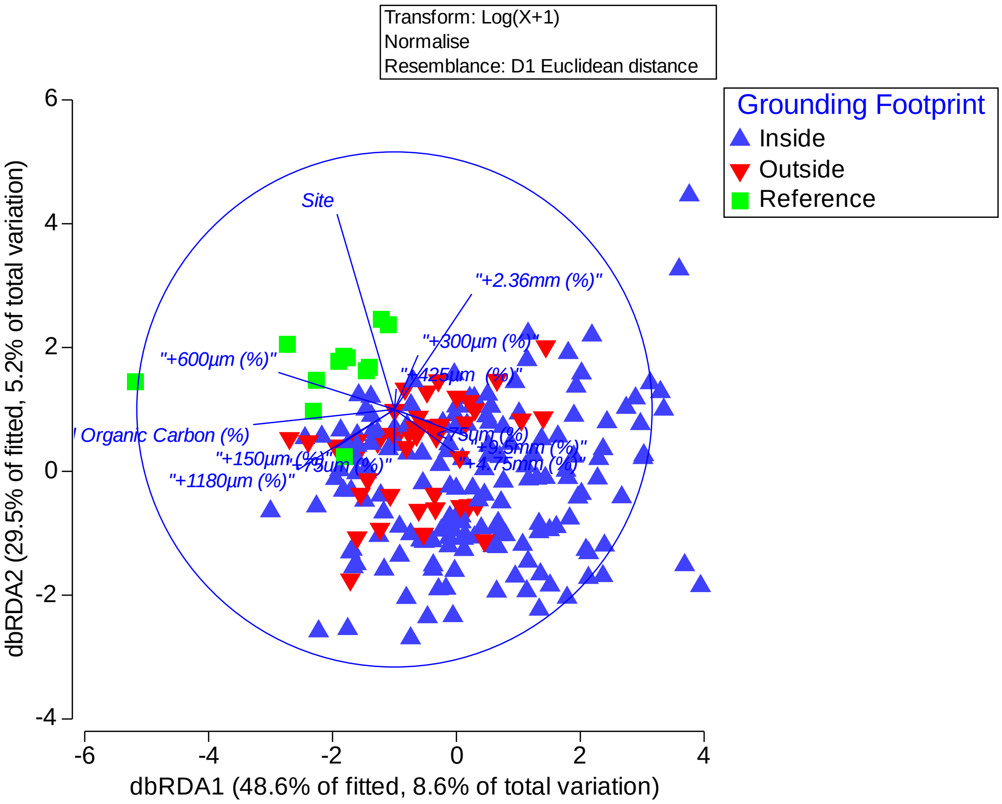

Figure 3-54: dbRDA plot of the contaminant matrix overlaid with the factor of grounding footprint

3.2.4 Summary

Most of the variability in the contaminant multivariate dataset can be explained by TOC (10.4%) and PSD (16.9%), with sub-area accounting for <0.01% of variation. Within the factor of PSD (using full range PSD), more variability is described by the smaller fractions (< +300µm) compared to the larger (> +425µm). Inside the grounding footprint there was a higher proportion of larger particles compared to outside, and there was also the highest amount of the finest sediments within.

Sub-area was a significant contributor of the DistLM model but explained a very small amount of variability after accounting for factors of TOC (%) and PSD (%). This shows that within the contaminated sub-areas, in particular those in Priority Area A, contamination is strongly associated with the finest sediment fraction (<75µm in particular) and TOC. As is well established in the literature (ANZG 2018), sediment samples with higher proportions of the sediment fraction <75µm or higher TOC are more likely to have higher concentrations of contaminants.

3.3 Data validation

This section examines the validity of the analytical data reported for this study by reviewing the confidence and accuracy of the field and laboratory QA/QC results.

3.3.1 Field QA/QC

3.3.1.1 Field triplicates

Field triplicates were collected during sampling to assess the validity, confidence and accuracy of the results. A total of seven field triplicates were collected (refer Table 2-3) and the results are shown in Table 3-4.

As stated in the NAGD (2009), field triplicates should have a relative standard deviation (RSD) of ± 50%; however, it also states that this may not always be the case 'where the sediments are very heterogenous or greatly differing in grain size'.

For sampling sites E2-11, C4-11, R2-7 and A5-8 all parameters are within the NAGD (2009) acceptable RSD range; however, TBT concentrations exceed the RSD range for sampling sites A6-4, A5-9 and CX-9. This is likely due to the intrinsic nature of organotins being heterogenous in samples. Sampling site CX-9 also has RSD exceedances for total aluminum (54%) and total iron (58%) due to the higher concentrations in sampling site CX-9 (T3). As there are no laboratory Method Blanks (MB) or Laboratory Control Samples (LCS) outliers therefore there is no reason for reduced data quality. This RSD result indicates there is some variability of these parameters even within the small distance between the replicate samples.

Despite this difference in total aluminium and iron concentrations, there is little variation in aluminium, and iron concentrations detected in sampling site CX-9 using the 1M HCl method. This suggests the RSD and relative percent difference (RPD) exceedances may be associated with the method of analysis. The 1M HCl method generally yields smaller values as it is a dilute acid extraction (DAE) method, while the total metals (ICP-AES) method is more aggressive and therefore liberates more contaminants.

Sampling site A6-4 has RSD exceedances for total chromium, total copper, total zinc, 1M HCl copper and 1M HCl zinc. These RSD exceedances occurred as these metal concentrations were higher in sampling site A6-4 (T2) compared to sampling site A6-4 (T1) and A6-4 (T3). As there are no laboratory MB, Matrix Spikes (MS) or LCS outliers therefore there is no reason for reduced data quality. This RSD result indicates there is some variability in metals even within the small distance between the replicate samples.

Table 3-4: Field QA/QC field triplicate results

Work Order No.	Date Sampled	Sample Description	Moisture Content	Total Organic Carbon	Total Metals and Metalloids																1ML HCL Total Metals and Metalloids																Organotins		
					Aluminium	Antimony	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc	Aluminium	Antimony	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc	Monobutyltin	Dibutyltin	Tributyltin
			%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg Sn/kg	µgSn/kg	µg Sn/kg
Field Triplicate																																							
EB1906960004	10/03/2019	A6-4 (T1)	18.3	0.1	160	<0.50	<1.00	<0.2	2.4	<0.5	1.9	150	<1.0	<10	<0.01	<1.0	<0.2	<0.2	<2.0	<1.0	60	<2.0	<1.0	<0.12	2.3	<0.5	2.8	50	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	3.9
EB1906960005	10/03/2019	A6-4 (T2)	20.6	0.16	330	<0.50	<1.00	<0.2	7.8	<0.5	647	190	1.5	<10	<0.01	1.5	<0.2	<0.2	<2.0	150	70	<2.0	<1.0	<0.12	2.9	<0.5	14.9	80	<1.0	10	<0.10	<1.0	<0.5	<1.0	<2.0	5.4	2	<1	2
EB1906960006	10/03/2019	A6-4 (T3)	40.3	0.14	160	<0.50	<1.00	<0.2	2.7	<0.5	6.2	150	<1.0	<10	<0.01	1.2	<0.2	<0.2	<2.0	2.7	60	<2.0	<1.0	<0.12	2.3	<0.5	1.6	60	<1.0	10	<0.10	<1.0	<0.5	<1.0	<2.0	1.5	1	2	17.1
		RSD	**46%**	**23%**	**45%**	**ND**	**ND**	**ND**	**71%**	**ND**	**170%**	**14%**	**ND**	**ND**	**ND**	**16%**	**ND**	**ND**	**ND**	**136%**	**9%**	**ND**	**ND**	**ND**	**14%**	**ND**	**114%**	**24%**	**ND**	**0%**	**ND**	**ND**	**ND**	**ND**	**ND**	**80%**	**47%**	**ND**	**107%**
EB1906964018	12/03/2019	E2-11 (T1)	37.2	0.14	120	<0.50	<1.00	<0.2	1.6	<0.5	<1.0	100	<1.0	<10	<0.01	<1.0	<0.2	<0.2	2.1	<1.0	140	<2.0	1.0	<0.12	2.5	<0.5	<1.0	120	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
EB1906964019	12/03/2019	E2-11 (T2)	35.5	0.13	230	<0.50	1.60	<0.3	3.1	<0.5	1.2	200	<1.0	12	<0.01	1.5	<0.3	<0.3	2.9	<1.0	160	<2.0	1.2	<0.12	3.1	<0.5	<1.0	130	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
EB1906964020	12/03/2019	E2-11 (T3)	33.5	0.17	250	<0.50	<1.00	<0.2	2.4	<0.5	1.0	190	<1.0	<10	<0.01	1.1	<0.2	<0.2	2.2	<1.0	60	<2.0	<1.0	<0.12	2.4	<0.5	<1.0	70	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
		RSD	**5%**	**14%**	**35%**	**ND**	**ND**	**ND**	**32%**	**ND**	**13%**	**34%**	**ND**	**ND**	**ND**	**22%**	**ND**	**ND**	**18%**	**ND**	**44%**	**ND**	**13%**	**ND**	**14%**	**ND**	**ND**	**30%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
EB1906974005	14/03/2019	A5-9 (T1)	17.6	0.22	400	<0.50	1.41	<0.2	3.7	<0.5	<1.0	330	<1.0	13	<0.01	1.2	<0.2	<0.2	<2.0	<1.0	60	<2.0	<1.0	<0.12	2.0	<0.5	<1.0	60	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	0.5
EB1906974006	14/03/2019	A5-9 (T2)	29.9	0.26	260	<0.50	1.19	<0.2	3.4	<0.5	<1.0	240	<1.0	14	<0.01	1.1	<0.2	<0.2	<2.0	<1.0	60	<2.0	<1.0	<0.12	2.7	<0.5	1.2	80	<1.0	11	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	22	33	375
EB1906974007	14/03/2019	A5-9 (T3)	20.1	0.27	240	<0.50	<1.00	<0.2	3.2	<0.5	<1.0	210	<1.0	12	<0.01	1	<0.2	<0.2	<2.0	<1.0	60	<2.0	<1.0	<0.12	2.4	<0.5	1.1	60	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	0.9
		RSD	**29%**	**11%**	**29%**	**ND**	**12%**	**ND**	**7%**	**ND**	**ND**	**24%**	**ND**	**8%**	**ND**	**9%**	**ND**	**ND**	**ND**	**ND**	**0%**	**ND**	**ND**	**ND**	**15%**	**ND**	**6%**	**17%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**172%**
EB1907617025	15/03/2019	C4-11 (T1)	37.2	0.14	120	<0.50	<1.00	<0.2	1.6	<0.5	<1.0	100	<1.0	<10	<0.01	<1.0	<0.2	<0.2	2.1	<1.0	140	<2.0	1.0	<0.12	2.5	<0.5	<1.0	120	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
EB1907617026	15/03/2019	C4-11 (T2)	35.5	0.13	230	<0.50	1.60	<0.3	3.1	<0.5	1.2	200	<1.0	12	<0.01	1.5	<0.3	<0.3	2.9	<1.0	160	<2.0	1.2	<0.12	3.1	<0.5	<1.0	130	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
EB1907617027	15/03/2019	C4-11 (T3)	33.5	0.17	250	<0.50	<1.00	<0.2	2.4	<0.5	1.0	190	<1.0	<10	<0.01	1.1	<0.2	<0.2	2.2	<1.0	60	<2.0	<1.0	<0.12	2.4	<0.5	<1.0	70	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
		RSD	**5%**	**14%**	**35%**	**ND**	**ND**	**ND**	**32%**	**ND**	**13%**	**34%**	**ND**	**ND**	**ND**	**22%**	**ND**	**ND**	**18%**	**ND**	**44%**	**ND**	**13%**	**ND**	**14%**	**ND**	**ND**	**30%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
EB1907620033	17/03/2019	CX-9 (T1)	32.1	0.22	130	<0.50	2.05	<0.2	3.1	<0.5	<1.0	100	<1.0	<10	<0.01	1.3	<0.2	<0.2	2.0	2.4	<50	<2.0	1.6	<0.12	2.0	<0.5	<1.0	60	<1.0	<10	<0.10	<1.0	<0.5	<1.0	2	<1.0	1	<1	0.8
EB1907620034	17/03/2019	CX-9 (T2)	34.3	0.18	180	<0.50	1.07	<0.2	2.7	<0.5	<1.0	210	<1.0	<10	<0.01	<1.0	<0.2	<0.2	<2.0	<1.0	<60	<2.0	1.0	<0.12	3.0	<0.5	<1.0	100	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	0.5
EB1907620035	17/03/2019	CX-9 (T3)	33.5	0.15	360	<0.50	1.32	<0.2	4.3	<0.5	<1.0	360	<1.0	12	<0.01	1.2	<0.2	<0.2	<2.0	3.0	<60	<2.0	1.1	<0.12	2.2	<0.5	<1.0	80	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<2	10	137
		RSD	**3%**	**19%**	**54%**	**ND**	**34%**	**ND**	**25%**	**ND**	**ND**	**58%**	**ND**	**ND**	**ND**	**6%**	**ND**	**ND**	**ND**	**16%**	**ND**	**ND**	**26%**	**ND**	**22%**	**ND**	**ND**	**25%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**171%**
EB1907620024	17/03/2019	R2-7 (T1)	22.2	0.17	400	<0.50	1.3	<0.2	4.3	<0.5	<1.0	320	<1.0	13	<0.01	1.7	<0.2	<0.2	<2.0	<1.0	<50	<2.0	1.5	<0.12	2.2	<0.5	<1.0	70	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
EB1907620025	17/03/2019	R2-7 (T2)	26.9	0.15	250	<0.50	1.21	<0.2	3.0	<0.5	<1.0	220	<1.0	12	<0.01	1.3	<0.2	<0.2	2.00	<1.0	<50	<2.0	1.7	<0.12	2.2	<0.5	<1.0	70	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
EB1907620026	17/03/2019	R2-7 (T3)	22.7	0.18	290	<0.50	1.49	<0.2	3.4	<0.5	<1.0	240	<1.0	12	<0.01	1.5	<0.2	<0.2	<2.0	<1.0	<50	<2.0	1.5	<0.12	1.9	<0.5	<1.0	60	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
		RSD	**11%**	**9%**	**25%**	**ND**	**11%**	**ND**	**19%**	**ND**	**ND**	**20%**	**ND**	**5%**	**ND**	**13%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**7%**	**ND**	**8%**	**ND**	**ND**	**9%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
EB1907623027	20/03/2019	A5-8 (T1)	14.8	0.13	200	<0.50	1.47	<0.2	2.5	<0.5	<1.0	180	<1.0	11	<0.01	<1.0	<0.2	<0.2	<2.0	<1.0	<120	<2.0	1.5	<0.12	2.7	<0.5	<1.0	110	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
EB1907623028	20/03/2019	A5-8 (T2)	14.2	0.12	330	<0.50	1.21	<0.2	3.5	<0.5	<1.0	320	<1.0	19	<0.01	1.2	<0.2	<0.2	<2.0	<1.0	<120	<2.0	1.3	<0.12	2.3	<0.5	<1.0	90	<1.0	12	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
EB1907623029	20/03/2019	A5-8 (T3)	13.6	0.18	390	<0.50	1.25	<0.2	4.1	<0.5	<1.0	360	<1.0	15	<0.01	1.2	<0.2	<0.2	2	<1.0	<120	<2.0	1.3	<0.12	2	<0.5	<1.0	110	<1.0	13	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
		RSD	**4%**	**22%**	**32%**	**ND**	**11%**	**ND**	**24%**	**ND**	**ND**	**33%**	**ND**	**27%**	**ND**	**0%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**8%**	**ND**	**15%**	**ND**	**ND**	**11%**	**ND**	**6%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**

Notes

(shaded)	Relative percent difference (RPD) or relative standard deviation (RSD) outside suggested NAGD data validation level.
ND	Not Determinable
NT	Not Tested

3.3.1.2 Field split replicates

A total of eight split replicates were collected (refer Table 2-3) and the results are shown in Table 3-5. The NAGD (2009) states that split replicates (field duplicates) should have an RPD of ± 30%. If RPD's are outside of this range, concentrations should be noted as estimates. Table 3-6 identifies situations where the NAGD (2009) RPD acceptance criteria is exceeded and provides an explanation in terms of data quality. Note that laboratory criteria applied to RPD results reported in Section 3.3.2 may also be applicable in some cases below, specifically where concentrations are less than 10 times the LOR, i.e. close to the LOR, RPD criteria may not be applicable and therefore not considered an exceedance.

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Table 3-5: Field QA/QC split replicate results

Work Order No.	Date Sampled	Sample Description			Total Metals and Metalloids																1ML HCL Total Metals and Metalloids																Organotins		
			Moisture Content	Total Organic Carbon	Aluminium	Antimony	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc	Aluminium	Antimony	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc	Monobutyltin	Dibutyltin	Tributyltin
			%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg Sn/kg	µgSn/kg	µg Sn/kg
ALS (Primary laboratory)		10 x LOR	10.00	0.20	500.00	5.00	10.00	1.00	10.00	5.00	10.00	500.00	10.00	100.00	0.10	10.00	1.00	1.00	20.00	10.00	500.00	20.00	10.00	1.00	10.00	5.00	10.00	500.00	10.00	100.00	1.00	10.00	5.00	10.00	20.00	10.00	10.00	10.00	5.00
NMI (Secondary laboratory)		10 x LOR			10.00	5.00	5.00	5.00	5.00	5.00	5.00	10.00	5.00	5.00	2.00	5.00	5.00	5.00	5.00	5.00	10.00	5.00	5.00	5.00	5.00	5.00	5.00	10.00	5.00	5.00	2.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Split replicate																																							
EB1906960018	10/03/2019	A3-3	21.5	0.11	350	<0.50	1.27	<0.2	4.6	<0.5	4.3	330	<1.0	13	<0.01	1.5	<0.2	<0.2	<2.0	2.8	70	<2.0	<1.0	<0.12	2.5	<0.5	2.0	70	<1.0	12	<0.10	<1.0	<0.5	<1.0	<2.0	1.6	36	233	1470
EB1906960021	10/03/2019	D1	30.6	0.12	530	<0.50	1.48	<0.2	5.0	<0.5	12.2	430	<1.0	18	<0.01	1.3	<0.2	0.3	<2.0	5.7	80	<2.0	<1.0	<0.12	3.4	<0.5	2.7	80	<1.0	14	<0.10	<1.0	<0.5	<1.0	<2.0	2.0	13	66	369
		RPD	**35%**	**9%**	41%	**ND**	**15%**	**ND**	**8%**	**ND**	96%	**26%**	**ND**	**32%**	**ND**	**14%**	**ND**	**ND**	**ND**	68%	**13%**	**ND**	**ND**	**ND**	**31%**	**ND**	**30%**	**13%**	**ND**	**15%**	**ND**	**ND**	**ND**	**ND**	**ND**	**22%**	94%	112%	120%
ADVI02-190321	10/03/2019	D2	NT	0.36	450	<0.5	1.10	<0.5	4.5	<0.5	7.1	400	<0.5	13	<0.2	1.4	<0.5	<0.5	1.3	2.9	110	<0.5	0.7	<0.5	3.2	<0.5	5.6	130	<0.5	13	<0.2	1.0	<0.5	<0.5	0.6	2.6	4.2	0.7	3.6
		RPD	**ND**	106%	**25%**	**ND**	**14%**	**ND**	**2%**	**ND**	49%	**19%**	**ND**	**0%**	**ND**	**7%**	**ND**	**ND**	**ND**	**4%**	44%	**ND**	**ND**	**ND**	**25%**	**ND**	95%	60%	**ND**	**8%**	**ND**	**ND**	**ND**	**ND**	**ND**	48%	158%	199%	199%
EB1906964009	11/03/2019	A4-5	18.4	0.11	980	<0.50	1.49	<0.2	5.2	<0.5	6.0	610	<1.0	16	<0.01	1.6	<0.2	<0.2	2.9	4.0	350	<2.0	1.1	<0.12	2.4	<0.5	4.0	240	<1.0	13	<0.10	<1.0	<0.5	<1.0	<2.0	3.0	3.0	<1	2.1
EB1906960022	11/03/2019	D3	21.2	0.10	380	<0.50	<1.00	<0.2	3.7	<0.5	4.1	310	<1.0	13	<0.01	1.0	<0.2	<0.2	<2.0	3.3	90	<2.0	<1.0	<0.12	3.9	<0.5	5.2	100	<1.0	14	<0.10	<1.0	<0.5	<1.0	<2.0	3.1	<1	<1	1.4
		RPD	**14%**	**10%**	88%	**ND**	**ND**	**ND**	**34%**	**ND**	38%	65%	**ND**	**21%**	**ND**	46%	**ND**	**ND**	**ND**	**19%**	118%	**ND**	**ND**	**ND**	**48%**	**ND**	**26%**	82%	**ND**	**7%**	**ND**	**ND**	**ND**	**ND**	**ND**	**3%**	**ND**	**ND**	40%
ADVI02-190321	11/03/2019	D4	NT	0.27	660	<0.5	0.97	<0.5	5.4	<0.5	7.9	510	<0.5	14	<0.2	2.2	<0.5	<0.5	1.5	5.2	95	<0.5	0.6	<0.5	3.4	<0.5	4.2	110	<0.5	15	<0.2	1.0	<0.5	<0.5	0.6	3.1	3.0	0.5	1.1
		RPD	**ND**	84%	39%	**ND**	42%	**ND**	**4%**	**ND**	**27%**	**18%**	**ND**	**13%**	**ND**	**32%**	**ND**	**ND**	64%	**26%**	115%	**ND**	57%	**ND**	**34%**	**ND**	**5%**	74%	**ND**	**14%**	**ND**	**ND**	**ND**	**ND**	**ND**	**3%**	**0%**	**ND**	63%
EB1906964023	12/03/2019	EX-5	32.7	0.14	330	<0.50	1.83	<0.2	4.6	<0.5	2.5	350	<1.0	11	<0.01	1.6	<0.2	<0.2	3.1	<1.0	70	<2.0	1.3	<0.12	2.6	<0.5	<1.0	80	<1.0	10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
EB1906974001	12/03/2019	D5	34.9	0.19	220	<0.50	1.07	<0.2	3.5	<0.5	<1.0	200	<1.0	11	<0.01	1.2	<0.2	<0.2	<2.0	<1.0	90	<2.0	1.4	<0.12	3.6	<0.5	<1.0	90	<1.0	12	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
		RPD	**7%**	**30%**	40%	**ND**	52%	**ND**	**27%**	**ND**	**ND**	55%	**ND**	**0%**	**ND**	**29%**	**ND**	**ND**	**ND**	**ND**	**25%**	**ND**	**7%**	**ND**	**32%**	**ND**	**ND**	**12%**	**ND**	**18%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
ADVI02-190321	12/03/2019	D6	NT	0.37	360	<0.5	0.99	<0.5	3.4	<0.5	<0.5	290.0	<0.5	9.6	<0.2	1.2	<0.5	<0.5	1.0	1.8	97	<0.5	0.8	<0.5	2.9	<0.5	<0.5	110.0	<0.5	11	<0.2	0.9	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5
		RPD	**ND**	90%	**9%**	**ND**	60%	**ND**	**30%**	**ND**	**ND**	**19%**	**ND**	**14%**	**ND**	**29%**	**ND**	**ND**	106%	**ND**	**32%**	**ND**	50%	**ND**	**11%**	**ND**	**ND**	**32%**	**ND**	**10%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
EB1906974014	14/03/2019	AX-11	30.6	0.14	110	<0.50	1.24	<0.1	2.9	<0.5	<1.0	180	<1.0	10	<0.01	<1.0	<0.1	<0.1	<2.0	<1.0	80	<2.0	<1.0	<0.12	2.6	<0.5	<1.0	70	<1.0	13	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
EB1906974002	12/03/2019	D7	26.8	0.18	160	<0.50	<1.00	<0.2	2.7	<0.5	<1.0	170	<1.0	11	<0.01	<1.0	<0.2	<0.2	<2.0	<1.0	60	<2.0	<1.0	<0.12	2.5	<0.5	<1.0	60	<1.0	12	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
		RPD	**13%**	**25%**	37%	**ND**	**ND**	**ND**	**7%**	**ND**	**ND**	**6%**	**ND**	**10%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**29%**	**ND**	**ND**	**ND**	**4%**	**ND**	**ND**	**15%**	**ND**	**8%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
ADVI02-190321	14/03/2019	D8	NT	0.49	280	<0.5	1.10	<0.5	2.8	<0.5	<0.5	230	<0.5	12	<0.2	1.1	<0.5	<0.5	0.9	1.6	100	<0.5	0.8	<0.5	3.1	<0.5	<0.5	94	<0.5	15	<0.2	0.8	<0.5	<0.5	0.6	0.7	<0.5	<0.5	<0.5
		RPD	**ND**	111%	87%	**ND**	**12%**	**ND**	**4%**	**ND**	**ND**	**24%**	**ND**	**18%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**22%**	**ND**	**ND**	**ND**	**18%**	**ND**	**ND**	**29%**	**ND**	**14%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
EB1907617006	15/03/2019	R1-5	24.7	0.20	210	<0.50	1.50	<0.2	3.2	<0.5	3.0	230	<1.0	11	<0.01	<1.0	<0.2	<0.2	<2.0	1.2	100	<2.0	1.4	<0.12	2.3	<0.5	<1.0	110	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
ADVI02-190328	15/03/2019	D9	NT	0.50	350	<0.5	1.20	<0.5	3.1	<0.5	<0.5	270	<0.5	9	<0.2	1.0	<0.5	<0.5	1.0	0.8	84	<0.5	0.8	<0.5	2.2	<0.5	<0.5	81	<0.5	10	<0.2	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
		RPD	**ND**	86%	50%	**ND**	**22%**	**ND**	**3%**	**ND**	**ND**	**16%**	**ND**	**20%**	**ND**	**ND**	**ND**	**ND**	**ND**	36%	**17%**	**ND**	50%	**ND**	**4%**	**ND**	**ND**	**30%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
EB1907617010	15/03/2019	D10	21.5	0.22	210	<0.50	1.34	<0.2	3.8	<0.5	3.4	250	<1.0	12	<0.01	<1.0	<0.2	<0.2	<2.0	1.2	70	<2.0	1.2	<0.13	1.8	<0.5	<1.0	90	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
		RPD	**14%**	**10%**	**0%**	**ND**	**11%**	**ND**	**17%**	**ND**	**13%**	**8%**	**ND**	**9%**	**ND**	**ND**	**ND**	**ND**	**ND**	**0%**	35%	**ND**	**15%**	**ND**	**24%**	**ND**	**ND**	**20%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
EB1907617024	15/03/2019	C4-9	16	0.18	1080	<0.50	1.18	<0.2	6.5	<0.5	<1.0	640	<1.0	13	<0.01	1.6	<0.2	<0.2	<2.0	1.8	180	<2.0	1.5	<0.12	4.2	<0.5	<1.0	200	<1.0	20	<0.10	1.2	<0.5	<1.0	<2.0	<1.0	<1	<1	0.6
ADVI02-190328	15/03/2019	D11	NT	0.33	610	<0.5	1.20	<0.5	4.6	<0.5	1.7	470	<0.5	12	<0.2	1.8	<0.5	<0.5	1.6	2.8	130	<0.5	0.7	<0.5	3.1	<0.5	1.1	130	<0.5	10	<0.2	1.0	<0.5	<0.5	0.6	0.9	1.2	<0.5	1.2
		RPD	**ND**	59%	56%	**ND**	**2%**	**ND**	**34%**	**ND**	**ND**	**31%**	**ND**	**8%**	**ND**	**12%**	**ND**	**ND**	**ND**	43%	**32%**	**ND**	74%	**ND**	**30%**	**ND**	**ND**	42%	**ND**	67%	**ND**	**18%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	67%
EB1907617011	15/03/2019	D12	32	0.13	1330	<0.50	1.64	<0.2	5.7	<0.5	5.0	820	<1.0	25	<0.01	2.0	<0.2	<0.2	2.4	2.8	170	<2.0	1.4	<0.12	2.9	<0.5	<1.0	170	<1.0	<10	<0.10	1.0	<0.5	<1.0	<2.0	1.2	1	<1	1.2
		RPD	67%	**32%**	**21%**	**ND**	**33%**	**ND**	**13%**	**ND**	**ND**	**25%**	**ND**	63%	**ND**	**22%**	**ND**	**ND**	**ND**	43%	**6%**	**ND**	**7%**	**ND**	37%	**ND**	**ND**	**16%**	**ND**	**ND**	**ND**	**18%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	67%
EB1907620003	15/03/2019	F1-7	21.5	0.15	260	<0.50	<1.00	<0.2	3.3	<0.5	<1.0	220	<1.0	<10	<0.01	<1.0	<0.2	<0.2	<2.0	<1.0	130	<2.0	1.4	<0.12	2.5	<0.5	<1.0	140	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
ADVI02-190328	15/03/2019	D13	NT	0.93	240	<0.5	0.77	<0.5	2.5	<0.5	<0.5	200	<0.5	6.7	<0.2	1.3	<0.5	<0.5	0.7	1.0	94	<0.5	0.8	<0.5	2.5	<0.5	<0.5	100	<0.5	15	<0.2	0.8	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5
		RPD	**ND**	144%	**8%**	**ND**	**ND**	**ND**	**28%**	**ND**	**ND**	**10%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**32%**	**ND**	51%	**ND**	**0%**	**ND**	**ND**	**33%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
EB1907617012	15/03/2019	D14	16.4	0.18	190	<0.50	1.02	<0.2	3.8	<0.5	3.0	190	<1.0	11	<0.01	<1.0	<0.2	<0.2	<2.0	<1.0	90	<2.0	1.2	<0.12	3.0	<0.5	<1.0	100	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
		RPD	**27%**	**18%**	**31%**	**ND**	**ND**	**ND**	**14%**	**ND**	**ND**	**15%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	36%	**ND**	**15%**	**ND**	**18%**	**ND**	**ND**	**33%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
EB1907624012	20/03/2019	A1-12	15.1	0.15	820	<0.50	1.66	<0.2	4.6	<0.5	4.2	590	<1.0	14	<0.01	1.3	<0.2	<0.2	2.1	4	90	<2.0	<1.0	<0.12	3.2	<0.5	14.4	120	<1.0	13	<0.10	<1.0	<0.5	<1.0	<2.0	8.5	1	<1	<0.5
ADVI02-190328	20/03/2019	D15	NT	0.60	300	<0.5	1.00	<0.5	3.3	<0.5	0.85	250	<0.5	11	<0.2	1.3	<0.5	<0.5	0.9	1.1	120	<0.5	0.9	<0.5	3.30	<0.5	0.8	120	<0.5	16	<0.2	0.8	<0.5	<0.5	0.7	0.8	0.8	<0.5	0.7
		RPD	**ND**	120%	93%	**ND**	50%	**ND**	**33%**	**ND**	133%	81%	**ND**	**24%**	**ND**	**0%**	**ND**	**ND**	78%	114%	**29%**	**ND**	**ND**	**ND**	**3%**	**ND**	179%	**0%**	**ND**	**21%**	**ND**	**ND**	**ND**	**ND**	**ND**	164%	**19%**	**ND**	**ND**
EB1907617013	15/03/2019	D16	28.2	0.25	180	<0.50	<1.00	<0.2	3.1	<0.5	4.0	210	<1.0	14	<0.01	<1.0	<0.2	<0.2	<2.0	<1.0	110	<2.0	1.2	<0.12	2.9	<0.5	<1.0	120	<1.0	<10	<0.10	<1.0	<0.5	<1.0	<2.0	<1.0	<1	<1	<0.5
		RPD	61%	50%	128%	**ND**	**ND**	**ND**	39%	**ND**	**5%**	95%	**ND**	**0%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**20%**	**ND**	**ND**	**ND**	**10%**	**ND**	**ND**	**0%**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**

Notes

	Relative percent difference (RPD) or relative standard deviation (RSD) outside suggested NAGD data validation level.
	Values that exceed the NAGD criteria but have concentrations that are less than 10 times the LOR therefore no longer considered as an RPD exceedance. I.e. these values are close to the LOR therefore small changes in the concentration can result in an RPD exceedance.
ND	Not Determinable
NT	Not Tested

Table 3-6: Split replicate RPD exceedances

RPD exceedance	Comparisons	Explanation
Moisture content	C4-9 / D12 A1-12 / D16	Analysis for moisture content is standard and it is uncertain why there is variation between split samples; however, less moisture in samples typically improves the accuracy of the analysis. Moisture content in split sample D12 and D16 are consistent with values throughout the project area, while moisture content in split samples C4-9 and A1-12 are lower. This RPD result is not considered to impact data quality.
TOC	R1-5 / D9	As the concentrations that resulted in this RPD exceedance are within the same low magnitude that is consistent throughout most samples and as there is no NAGD guideline level for this parameter, this RPD exceedance is not considered to impact data quality.
Total aluminium	A4-5 / D4 C4-9 / D11	The RPD exceedances may be attributed to variability of sample textures, i.e. the high percentage of gravels and/or rubble contributing to sample heterogeneity. As there is no NAGD guideline level for this metal and it is not a target contaminant, these RPD exceedances are not considered to impact data quality.
Total iron	A1-12 / D16	The RPD exceedances may be attributed to variability of sample textures, i.e. the high percentage of gravels and/or rubble contributing to sample heterogeneity. As there is no NAGD guideline level for this metal and it is not a target contaminant, these RPD exceedances are not considered to impact data quality
MBT	A3-3 / D1	This RPD exceedance occurrence is attributed to the inherent heterogeneous nature of organotin contamination, i.e. often associated with physical pieces of material such as paint flecks that are not evenly distributed throughout a sample. There is also no NAGD guideline level for this contaminant. As such, this RPD exceedance is not considered to impact data quality.
DBT	A3-3 / D1	Similar to MBT above, this RPD exceedance is not considered to impact data quality.

RPD exceedance	Comparisons	Explanation
TBT	A3-3 / D1	Similar to MBT and DBT above, this RPD exceedance is not considered to impact data quality.

3.3.1.3 Rinsate blank

A rinsate blank sample was taken during each day of sampling to confirm there was no cross contamination between samples. Total zinc was detected in Rinsate #6, Rinsate #7 and Rinsate #10, while total manganese was detected in Rinsate #9. As these metals were below the respective NAGD (2009) guideline for samples collected during the corresponding sampling day these detections in rinsate water indicate that cross contamination is not a concern and not considered to impact data quality. The results of rinsate analysis is present in Table 3-7.

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Table 3-7: Rinsate results

Work Order No.	Units	PQL	EB1906974015	EB1906974016	EB1906974017	EB1906974018	EB1906974019	EB1907624013	EB1907624014	EB1907624015	EB1907624016	EB1907624017	EB1907624018	EB1907624019
Sample ID			Rinsate #1	Rinsate #2	Rinsate #3	Rinsate #4	Rinsate #5	Rinsate #6	Rinsate #7	Rinsate #8	Rinsate #9	Rinsate #10	Rinsate #11	Rinsate #12
Date Sampled			8/03/2019	9/03/2019	10/03/2019	11/03/2019	12/03/2019	14/03/2019	15/03/2019	16/03/2019	17/03/2019	18/03/2019	19/03/2019	20/03/2019
Total Metals and Metalloids														
Arsenic, As	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium, Cd	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium, Cr	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt, Co	mg/L	0.001	-	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper, Cu	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead, Pb	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese, Mn	mg/L	0.001	-	-	-	-	-	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
Mercury, Hg	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel, Ni	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium, Se	mg/L	0.01	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium, V	mg/L	0.01	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc, Zn	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.016	0.012	<0.005	<0.005	0.009	<0.005	<0.005

Notes

PQL	Practical Quantitation Limit
Sample ID	Sample number
-	No analysis undertaken for a given sample
(green shading)	Value exceeds PQL detection level
Note	In all cases where the PQL detection level is exceeded, the NAGD or agreed screening level is not exceeded (for the corresponding metal on the corresponding day)

3.3.2 Laboratory QA/QC

Both the primary and secondary laboratory QA/QC analyses outliers are reported and summarised in Appendix A.

It should be noted that Work Orders for PSD and settleability analysis (EB1906982, EB190686, EB1906987, EB1906993, EB1907628, EB1907630, EB907633, EB1907638, EB1907639, EB1907813) are not included as they do not have a laboratory QA/QC component. MB, Laboratory Duplicates (DUP), LCS and MS are not required to be reported and Quality Control (QC) Frequency is not available.

A review of the laboratory QA/QC data indicated that the data quality has not been impacted and is therefore considered suitable for use in this report. This review is found in Appendix A.

3.3.3 Re-analysis

During preliminary data evaluation various samples were re-analysed either in triplicate, duplicate or as a single repeat when concern around the accuracy of the reported concentration were identified.

Sub-areas A3-5, A6-3, A6-8, A6-9, A8-1 and F3-6 were re-analysed as the primary results showed that the concentrations for both copper and zinc was higher using the 1M HCl method compared to the total metals method. Repeat and repeat duplicates were completed, and in most cases, the primary results were supported and therefore retained in the dataset.

Sub-areas A8-9, AX-2, C2-4, C2-10, CX-8, CX-9 (T3) and EX-7 were re-analysed for MBT, DBT and TBT as they had TBT concentrations (normalised to % TOC) above the NAGD (2009) guideline and in some cases were in broader sites without other organotin exceedances. The primary sample was re-analysed in triplicate. In most cases, the variation between the triplicates and primary and within the triplicates was high. This can be attributed to the nature of organotins in sediment described as an expectation that concentrations be heterogenous in samples. The use of an average result from this reanalysis would be inappropriate as it is possible that similar variety would be found in all organotin samples if they were to be re-analysed in triplicate. Therefore, the primary results were used for further analysis.

Split replicate samples D2, D4, D11 and D15 from the secondary laboratory (NMI) were re-analysed for TOC as a single repeat. This was undertaken as the reported TOC concentrations were significantly higher than those reported in all other samples. The repeat concentrations were lower than the initial results and more accurate in the context of TOC throughout the entire Project area. The laboratory indicated that the primary analysis had interferences caused by the sample matrix and further processing was required prior to analysis. As such, the results from the repeat analysis was retained for use within the dataset.

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4 References

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Appendix A
Laboratory QA/QC compliance assessments

Work Order	Raised LORs	Method Blank (MB)	Laboratory Duplicates (DUP)	Laboratory Control Samples (LCS)	Matrix Spikes (MS)	Surrogates	Holding Times	Quality Control (QC) Frequency	Comments
EB1906947	×	✓	✓	✓	✓	✓	✓	×	**Raised LORs** – The LOR was raised for some total and 1M HCl metals in some samples due to matrix interference. In each sample where the LOR was raised, the concentrations do not exceed the NAGD guideline level and no MS outliers were reported. Therefore, the raised LORs are not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS for 1M HCl extractable metals. This outlier pertains to Al and Fe which are not present in the MS. The laboratory excludes Al and Fe from the MS as these metals are typically high in soil and sediment and therefore would likely cause MS recoveries to always exceed the spike concentration. These frequency outliers therefore do not impact data quality.
EB1906960	×	×	×	✓	×	×	×	×	**Raised LORs** – The LOR was raised for some total and 1M HCl metals in some samples due to matrix interference, and for DBT for sample A3-9 due to spectral interference. For each sample where the LOR was raised the concentrations do not exceed the NAGD guideline level where it applies. Therefore, this is not considered to impact data quality. **Method Blank** – A MB outlier occurred for total silver but does not impact data quality as all samples for this work order had concentrations of silver below LOR and NAGD guideline level. **Laboratory Duplicates** – Laboratory duplicates exceed the RPD criteria for total copper (samples A6-1, D1 and A6-9), total zinc (sample A6-1), MBT (sample A6-9), and DBT and TBT (samples A6-1, D1 and A6-9) due to sample heterogeneity. The concentrations of the total metals are below the NAGD guideline level, and concentrations of organotins (MBT, DBT, TBT) are generally expected to be heterogenous (as described in Table 3-6). Therefore, laboratory duplicate RPD exceedance are not considered to impact data quality. **Matrix Spikes** – Organotins for samples A6-2 and D3 have MS recoveries above or below data quality objectives due to sample heterogeneity associated with sample textures and the nature of organotin contamination. As there are no LCS or MB outliers for organotins these MS exceedances are not considered to impact data quality. **Surrogates –** The organotin surrogate, Tripropyltin, for sample A6-10 was lower than the data quality objective due to matrix interference, likely arising from sample heterogeneity and indicating a bias to detect lower concentrations in samples. However, as the TBT concentration in A6-10 is above the NAGD guideline level, a low bias is considered not to impact data quality.

Work Order	Raised LORs	Method Blank (MB)	Laboratory Duplicates (DUP)	Laboratory Control Samples (LCS)	Matrix Spikes (MS)	Surrogates	Holding Times	Quality Control (QC) Frequency	Comments
									Holding Times – The holding time for SOPH-1 was exceeded. SOPH-1 is a Certified Reference Material (CRM) used to assess the procedures used in determining the concentration of organotins in sediment. The contamination levels in this case were all within upper / lower CRM limits as specified in the CRM Certificates of Analysis from the National Research Council Canada. Therefore, this is not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for DUP and MS in some cases. These outliers occurred where Advisian requested analysis to be repeated, i.e. where initial results were suspect and required validation. As the analysis was repeated, the total number of analysis increased therefore the original QAQC testing was insufficient. However, as the number of samples did not change, the original QAQC testing is still valid and adequate for the number of samples submitted. Therefore, these DUP and MS frequency outliers do not impact data quality.
EB1906964	✗	✓	✗	✓	✓	✗	✓	✗	**Raised LORs** – The LOR was raised for some total and 1M HCl metals in some samples due to matrix interference. For each sample where the LOR was raised the concentrations do not exceed the NAGD guideline level where it applies. As there were also no MB, LCS and MS outliers, the raised LORs are not considered to impact data quality. **Laboratory Duplicates** – Laboratory duplicates exceed the RPD criteria for DBT and TBT for sample A4-9 due to sample heterogeneity. This is expected, however as there are no MB, LCS or MS outliers, DUP exceedances are not considered to impact data quality. **Surrogates** – The organotin surrogate, tripropyltin, for sample E1-7 was greater than the upper data quality objective indicating a bias to detect higher concentrations in samples. However, as the primary sample concentration is below the LOR and there are no MB, LCS or MS outliers, this surrogate exceedance is not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for DUP and MS in some cases. These outliers occurred where Advisian requested analysis to be repeated, i.e. where initial results were suspect and required validation. As the analysis was repeated, the total number of analysis increased therefore the original QAQC testing was insufficient. However, as the number of samples did not change, the original QAQC testing is still valid and adequate for the number of samples submitted. Therefore, these DUP and MS frequency outliers do not impact data quality.
EB1906974	✗	✗	✗	✓	✗	✓	✓	✗	**Raised LORs** – The LOR was raised for some total and 1M HCl metals in some samples due to matrix interference. For each sample where the LOR was raised the

Work Order	Raised LORs	Method Blank (MB)	Laboratory Duplicates (DUP)	Laboratory Control Samples (LCS)	Matrix Spikes (MS)	Surrogates	Holding Times	Quality Control (QC) Frequency	Comments
									concentrations do not exceed the NAGD guideline level where it applies. As there were also no LCS outliers, the raised LORs are not considered to impact data quality. **Method Blank** – A MB outlier occurred for silver but does not impact data quality as all samples for this work order had concentrations of silver below LOR and NAGD guideline level. **Laboratory Duplicates** – Laboratory duplicates exceed the RPD criteria for DBT, TBT and total copper for an anonymous sample due to sample heterogeneity. The concentrations of the copper are below the NAGD guideline level, and concentrations of organotins (DBT, TBT) are generally expected to be heterogenous (as described in Table 3-6). Therefore, laboratory duplicate RPD exceedance are not considered to impact data quality. **Matrix Spike** – Organotins for AX-5 and an anonymous sample, and 1M HCl manganese and mercury for AX-5 have MS recoveries above or below the data quality objectives due to matrix interference and sample heterogeneity associated with sample textures and organotins. As there are no LCS or MB outliers for organotins, manganese and mercury, these MS exceedances are not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS for 1M HCl extractable metals. This outlier pertains to Al and Fe which are not present in the MS. The laboratory excludes Al and Fe from the MS as these metals are typically high in soil and sediment and therefore would likely cause MS recoveries to always exceed the spike concentration. These frequency outliers therefore do not impact data quality.
EB1907617	×	✓	×	✓	✓	✓	✓	×	**Raised LORs** – The LOR was raised for some total and 1M HCl metals in some samples due to matrix interference. For each sample where the LOR was raised the concentrations do not exceed the NAGD guideline level where it applies. As there were also no LCS outliers, the raised LORs are not considered to impact data quality. **Laboratory Duplicates** – Laboratory duplicates exceed the RPD criteria for total aluminium and iron for sample C4-3 due to sample heterogeneity. As there are no NAGD guideline level for these parameters and there are no MB, LCS or MS outliers, DUP exceedances are not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS for 1M HCl extractable metals. This outlier pertains to Al and Fe which are not present in the MS. The laboratory excludes Al and Fe from the MS as these metals are typically high in soil and sediment and therefore would likely cause MS recoveries to always exceed the spike concentration. These frequency outliers therefore do not impact data quality.

Work Order	Raised LORs	Method Blank (MB)	Laboratory Duplicates (DUP)	Laboratory Control Samples (LCS)	Matrix Spikes (MS)	Surrogates	Holding Times	Quality Control (QC) Frequency	Comments
EB1907620	×	✓	×	✓	×	✓	×	×	**Raised LORs** – The LOR was raised for some total and 1M HCl metals in some samples due to matrix interference. For each sample where the LOR was raised the concentrations do not exceed the NAGD guideline level where it applies. As there were also no MB or LCS outliers, the raised LORs are not considered to impact data quality. **Laboratory Duplicates** – Laboratory duplicates exceed the RPD criteria for TBT in sample A7-7 and total aluminium and iron in an anonymous sample due to sample heterogeneity. As there are no NAGD guideline level for these parameters, concentrations of organotins (DBT, TBT) are generally expected to be heterogenous (as described in Table 3-6) and there are no MB or LCS outliers, DUP exceedances are not considered to impact data quality. **Matrix Spikes** – MS recovery was not determined for sample CX-9 (T3) for TBT due to the presence of a high background level of contaminants. As there are no MB or LCS outliers this is not considered to impact data quality. **Holding Times** – Moisture content analysis holding times were 2-3 days overdue. However, as there were no MB or LCS outliers and all samples are stored appropriately in the laboratory this moisture content exceedance is not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS for 1M HCl extractable metals. This outlier pertains to Al and Fe which are not present in the MS. The laboratory excludes Al and Fe from the MS as these metals are typically high in soil and sediment and therefore would likely cause MS recoveries to always exceed the spike concentration. These frequency outliers therefore do not impact data quality.
EB1907622	×	✓	✓	✓	×	✓	×	×	**Raised LORs** – The LOR was raised for some total and 1M HCl metals in some samples due to matrix interference. For each sample where the LOR was raised the concentrations do not exceed the NAGD guideline level where it applies. As there were also no MB or LCS outliers, the raised LORs are not considered to impact data quality. **Matrix Spike** – MS recovery was not determined for an anonymous sample for TBT due to the presence of a high background level of contaminants. As there are no MB or LCS outliers this is not considered to impact data quality. **Holding Times** – Moisture content analysis holding times were 1-2 days overdue and total organic carbon analysis holding times were 1 day overdue. As there are no MB or LCS outliers and all samples are stored appropriately in the laboratory, this is not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS for 1M HCl extractable metals. This outlier pertains to Al and Fe which are

Work Order	Raised LORs	Method Blank (MB)	Laboratory Duplicates (DUP)	Laboratory Control Samples (LCS)	Matrix Spikes (MS)	Surrogates	Holding Times	Quality Control (QC) Frequency	Comments
									not present in the MS. The laboratory excludes Al and Fe from the MS as these metals are typically high in soil and sediment and therefore would likely cause MS recoveries to always exceed the spike concentration. These frequency outliers therefore do not impact data quality.
EB1907623	✗	✓	✓	✓	✓	✓	✓	✗	**Raised LORs** – The LOR was raised for total metals and 1M HCl metals in some samples due to matrix interference. For each sample where the LOR was raised the concentrations do not exceed the NAGD guideline level where it applies. As there were also no MB, MS or LCS outliers, the raised LORs are not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS for 1M HCl extractable metals. This outlier pertains to Al and Fe which are not present in the MS. The laboratory excludes Al and Fe from the MS as these metals are typically high in soil and sediment and therefore would likely cause MS recoveries to always exceed the spike concentration. These frequency outliers therefore do not impact data quality.
EB1907624	✗	✓	✓	✗	✗	✓	✗	✗	**Raised LORs** – The LOR was raised for some total metals due to matrix interference and for MBT in samples A3-12 and A1-6 due to spectral interference. For each sample where the LOR was raised the concentrations do not exceed the NAGD guideline level where it applies. As there were also no MB outliers, the raised LORs are not considered to impact data quality. **Laboratory Control Samples** – Total mercury has an LCS greater than the upper control limit for both sediment and rinsate (water). As all total mercury results (sediment and rinsate) are below LOR and there are no MB outliers this LCS exceedance is not considered to impact data quality. **Matrix Spikes** – MS recovery was not determined for sample A3-4 for TBT due to the presence of a high background level of contaminants. As there are no MB outliers this is not considered to impact data quality. **Holding Times** – Total mercury analysis holding times for Rinsate #6 were 1 day overdue. As all concentration are below LOR and there is no cross contamination (see Section 3.3.1.3) this is not considered to impact data quality **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS for 1M HCl extractable metals. This outlier pertains to Al and Fe which are not present in the MS. The laboratory excludes Al and Fe from the MS as these metals are typically high in soil and sediment and therefore would likely cause MS recoveries to always exceed the spike concentration. These frequency outliers therefore do not impact data quality.

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Work Order	Raised LORs	Method Blank (MB)	Laboratory Duplicates (DUP)	Laboratory Control Samples (LCS)	Matrix Spikes (MS)	Surrogates	Holding Times	Quality Control (QC) Frequency	Comments
EB1907810	✗	✓	✓	✗	✗	✓	✗	✗	**Raised LORs** – The LOR was raised for some total metals and organotins in some samples due to matrix interference and spectral interference respectively. For each sample where the LOR was raised the concentrations do not exceed the NAGD guideline level where it applies. As there were also no MB outliers, the raised LORs are not considered to impact data quality. **Laboratory Control Samples** – Total mercury has an LCS greater than the upper control limit. As all total mercury results are below the LOR and there are no MB outliers this LCS exceedance is not considered to impact data quality. **Matrix Spikes** – MS recovery was not determined for an anonymous sample for TBT due to the presence of a high background level of contaminants. As there are no MB outliers this is not considered to impact data quality. **Holding Times** – Moisture content analysis holding times were 2 days overdue and total organic carbon analysis holding times were 15 days overdue. As there are no MB outliers and all samples are stored appropriately in the laboratory this is not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS for 1M HCl extractable metals. This outlier pertains to Al and Fe which are not present in the MS. The laboratory excludes Al and Fe from the MS as these metals are typically high in soil and sediment and therefore would likely cause MS recoveries to always exceed the spike concentration. These frequency outliers therefore do not impact data quality.
EB1908498	✗	✓	✓	✓	✓	✓	✓	✗	**Raised LORs** – The LOR was raised for TBT in some samples due to spectral interference. As the 100 times dilution concentration for TBT was below the ANZG (2018) 99% species protection guideline these raised LORs are not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS and DUP for organotins. These outliers occurred as because the laboratory reserved the volume of elutriate water for the primary analysis, and if required, additional analysis. TBT in elutriate analysis requires significant quantities of the seawater collected from the sampling area. This quantity was sufficient for the primary analysis and some QAQC, however, if all QAQC test were undertaken there would be insufficient volume for the requested analysis. As the remaining QAQC tests completed returned acceptable results these QC Frequency outliers do not impact data quality.
EB1909443	✗	✓	✓	✓	✗	✓	✓	✗	**Raised LORs** – The LOR was raised for TBT in some samples due to possible laboratory contamination. As the 100 times dilution concentration for TBT was below the ANZG

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Work Order	Raised LORs	Method Blank (MB)	Laboratory Duplicates (DUP)	Laboratory Control Samples (LCS)	Matrix Spikes (MS)	Surrogates	Holding Times	Quality Control (QC) Frequency	Comments
									(2018) 99% species protection guideline these raised LORs are not considered to impact data quality. **Matrix Spikes** - MS recovery was not determined for sample A6-7 for total copper due to the presence of a high background level of contaminants. However, as there are no MB or LCS outliers this is not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS and DUP for organotins. These outliers occurred as because the laboratory reserved the volume of elutriate water for the primary analysis, and if required, additional analysis. TBT in elutriate analysis requires significant quantities of the seawater collected from the sampling area. This quantity was sufficient for the primary analysis and some QAQC, however, if all QAQC test were undertaken there would be insufficient volume for the requested analysis. As the remaining QAQC tests completed returned acceptable results these QC Frequency outliers do not impact data quality.
EB1909703	✓	✓	✓	✓	✓	✓	✓	×	**Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS and DUP for organotins. These outliers occurred as because the laboratory reserved the volume of elutriate water for the primary analysis, and if required, additional analysis. TBT in elutriate analysis requires significant quantities of the seawater collected from the sampling area. This quantity was sufficient for the primary analysis and some QAQC, however, if all QAQC test were undertaken there would be insufficient volume for the requested analysis. As the remaining QAQC tests completed returned acceptable results these QC Frequency outliers do not impact data quality.
EB1910331	×	✓	✓	✓	✓	×	✓	×	**Raised LORs** – The LOR was raised for TBT in samples due to spectral interference. As the 100 times dilution concentration for TBT was below the ANZG (2018) 99% species protection guideline these raised LORs are not considered to impact data quality. **Surrogates** – The TBT surrogate, tripropyltin, for sample A5-2 was greater than the upper data quality objective indicating a bias to detect higher concentrations in samples. However, as the 100 times dilution concentration for TBT was below the ANZG (2018) 99% species protection guideline this surrogate outlier is not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS and DUP for organotins. These outliers occurred as because the laboratory reserved the volume of elutriate water for the primary analysis, and if required, additional analysis. TBT in elutriate analysis requires significant quantities of the seawater collected from the sampling area. This quantity was sufficient for the primary analysis and some QAQC, however, if all QAQC test were undertaken there would be insufficient volume for the requested analysis. As the remaining QAQC tests

Work Order	Raised LORs	Method Blank (MB)	Laboratory Duplicates (DUP)	Laboratory Control Samples (LCS)	Matrix Spikes (MS)	Surrogates	Holding Times	Quality Control (QC) Frequency	Comments
									completed returned acceptable results these QC Frequency outliers do not impact data quality.
EB1910617	×	✓	✓	✓	✓	✓	✓	×	**Raised LORs** – The LOR was raised for TBT in some samples due to spectral interference. If the 100 times dilution was applied to the samples with concentrations below the LOR, the concentrations would not exceed the ANZG (2018) 99% species protection guideline, therefore these raised LORs are not considered to impact data quality. **Quality Control Frequency** – The actual QC Frequency was lower than the expected value for MS and DUP for organotins. These outliers occurred as because the laboratory reserved the volume of elutriate water for the primary analysis, and if required, additional analysis. TBT in elutriate analysis requires significant quantities of the seawater collected from the sampling area. This quantity was sufficient for the primary analysis and some QAQC, however, if all QAQC test were undertaken there would be insufficient volume for the requested analysis. As the remaining QAQC tests completed returned acceptable results these QC Frequency outliers do not impact data quality.
ADVI02_ 190321	Not reported	✓	✓	✓	Not tested	✓	Not reported	Not reported	
ADVI02_ 190328	Not reported	✓	Not tested	✓	Not tested	✓	Not reported	Not reported	
Legend:									
×	Outliers / exceedances have occurred								
✓	No outliers / exceedances								

Appendix B
Sediment logs

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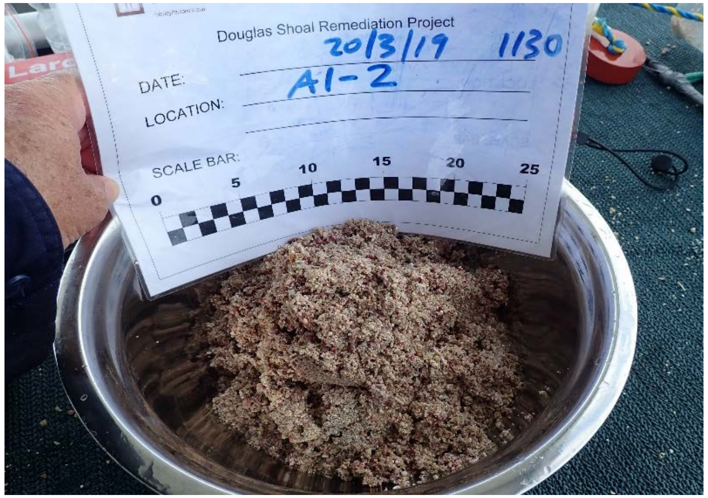
Location of Sampling	Douglas Shoal	
Sample ID	**A1-1**	
Sample Date	11/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	20 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
PSD (%)		
Silt & Clay	Sand	Gravel
1	90	9

Location of Sampling	Douglas Shoal
Sample ID	**A1-2**
Sample Date	20/03/2019
Sampling Depth	13.9 m
Average Sediment Depth	150 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS
Coralline Algae Presence	No
PSD (%)	
Not tested	



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Location of Sampling		Douglas Shoal
Sample ID		**A1-3**
Sample Date		11/03/2019
Sampling Depth		15.9 m
Average Sediment Depth		80 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
1	83	16

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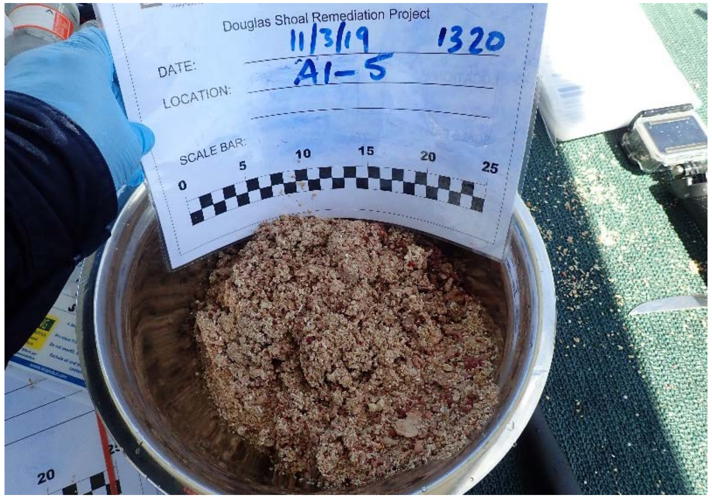
Location of Sampling	Douglas Shoal
Sample ID	**A1-4**
Sample Date	20/03/2019
Sampling Depth	15.1 m
Average Sediment Depth	19 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	-
Coralline Algae Presence	No
PSD (%)	
Not tested	

Location of Sampling	Douglas Shoal	
Sample ID	**A1-5**	
Sample Date	11/03/2019	
Sampling Depth	15.7	
Average Sediment Depth	40 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
1	45	54



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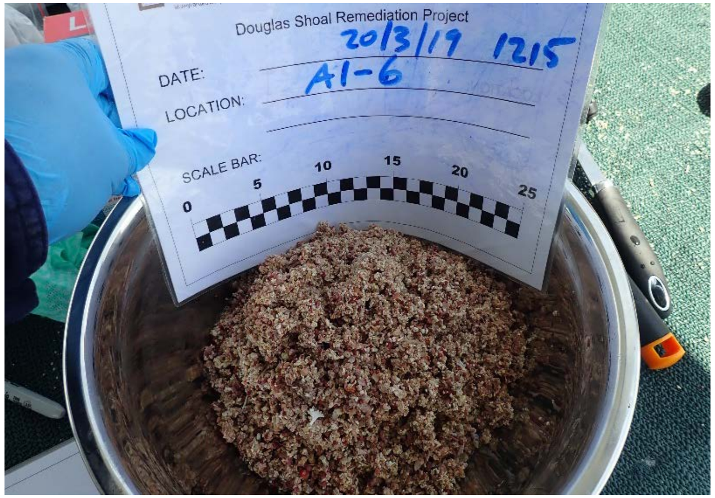
Location of Sampling	Douglas Shoal
Sample ID	**A1-6**
Sample Date	20/03/2019
Sampling Depth	13.8 m
Average Sediment Depth	17 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS
Coralline Algae Presence	Yes
PSD (%)	
Not tested	



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Location of Sampling	Douglas Shoal	
Sample ID	**A1-7**	
Sample Date	11/03/2019	
Sampling Depth	16 m	
Average Sediment Depth	82 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
1	55	44

Location of Sampling	Douglas Shoal
Sample ID	**A1-8**
Sample Date	20/03/2019
Sampling Depth	14.7 m
Average Sediment Depth	80 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<1%)
Coralline Algae Presence	Yes
PSD (%)	
Not tested	

Location of Sampling		Douglas Shoal
Sample ID		**A1-9**
Sample Date		11/03/2019
Sampling Depth		15.9 m
Average Sediment Depth		16 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		R / CS
Coralline Algae Presence		Yes
PSD (%)		
Silt & Clay	Sand	Gravel
1	34	65

Location of Sampling	Douglas Shoal
Sample ID	**A1-10**
Sample Date	20/03/2019
Sampling Depth	13.6 m
Average Sediment Depth	10 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS
Coralline Algae Presence	No
PSD (%)	
Not tested	

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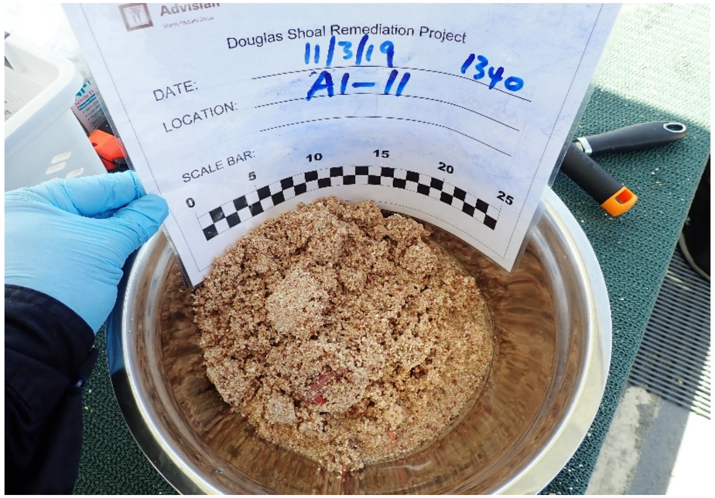
Location of Sampling	Douglas Shoal	
Sample ID	**A1-11**	
Sample Date	11/03/2019	
Sampling Depth	16.5 m	
Average Sediment Depth	20 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
1	75	24



Location of Sampling	Douglas Shoal
Sample ID	**A1-12 (plus D15 and D16)**
Sample Date	20/03/2019
Sampling Depth	14 m
Average Sediment Depth	25 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<1%)
Coralline Algae Presence	No
PSD (%)	
Not tested	

Location of Sampling	Douglas Shoal	
Sample ID	**A2-1**	
Sample Date	12/03/2019	
Sampling Depth	15.7 m	
Average Sediment Depth	25 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
5	67	28

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Location of Sampling	Douglas Shoal	
Sample ID	**A2-3**	
Sample Date	12/03/2019	
Sampling Depth	15.8 m	
Average Sediment Depth	45 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (small)	
Coralline Algae Presence		
PSD (%)		
Silt & Clay	Sand	Gravel
10	47	43

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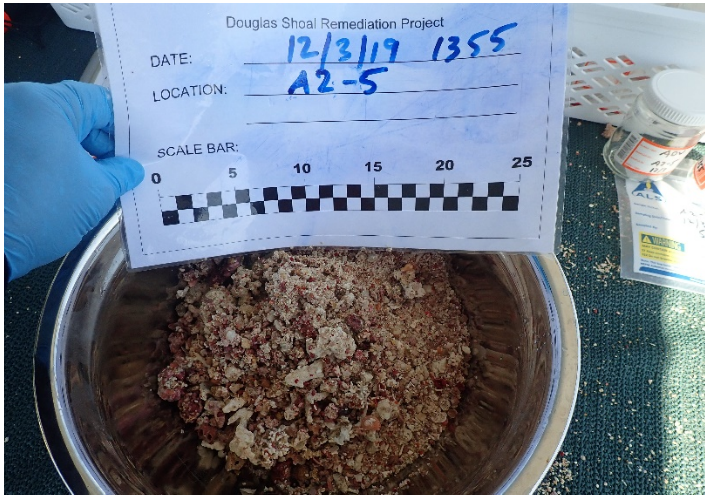
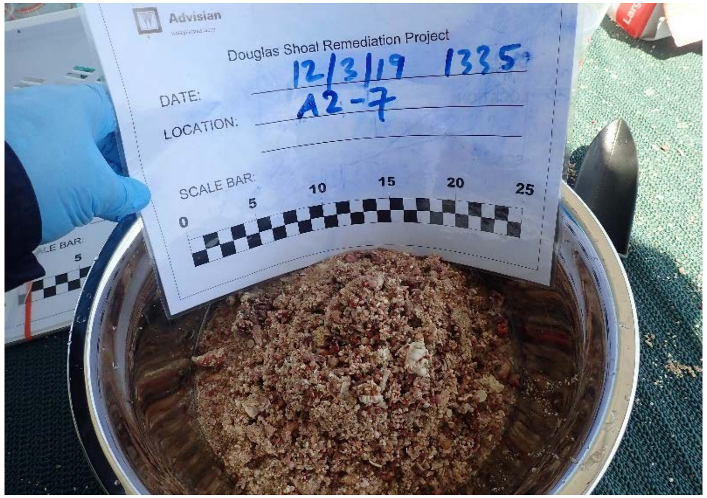
Location of Sampling	Douglas Shoal	
Sample ID	**A2-5**	
Sample Date	12/03/2019	
Sampling Depth	15.5 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (small)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
10	54	36



Location of Sampling	Douglas Shoal
Sample ID	**A2-7**
Sample Date	12/03/2019
Sampling Depth	14.5 m
Average Sediment Depth	30 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (small) (<2%)
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
8	46	46



Location of Sampling	Douglas Shoal	
Sample ID	**A2-9**	
Sample Date	12/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	45 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
8	52	40

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Location of Sampling	Douglas Shoal	
Sample ID	**A2-11**	
Sample Date	12/03/2019	
Sampling Depth	15.2 m	
Average Sediment Depth	21 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / S	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	87	9

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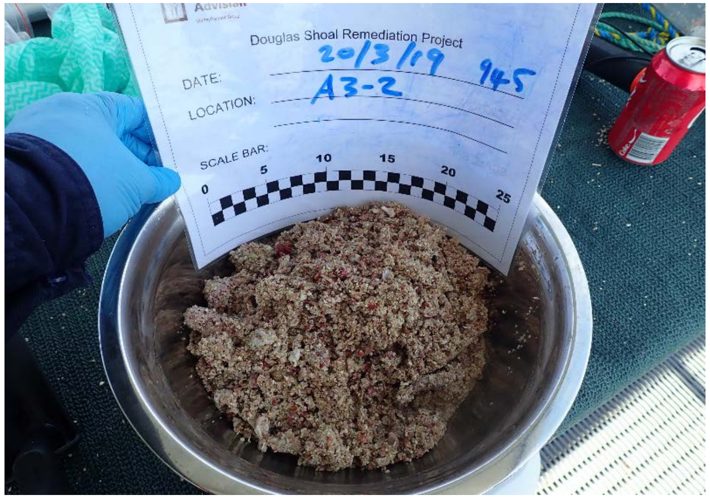
Location of Sampling	Douglas Shoal	
Sample ID	**A3-1**	
Sample Date	10/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	20 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	FS / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	69	27

Location of Sampling	Douglas Shoal
Sample ID	**A3-2**
Sample Date	20/03/2019
Sampling Depth	17 m
Average Sediment Depth	22 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS
Coralline Algae Presence	No
PSD (%)	
Not tested	



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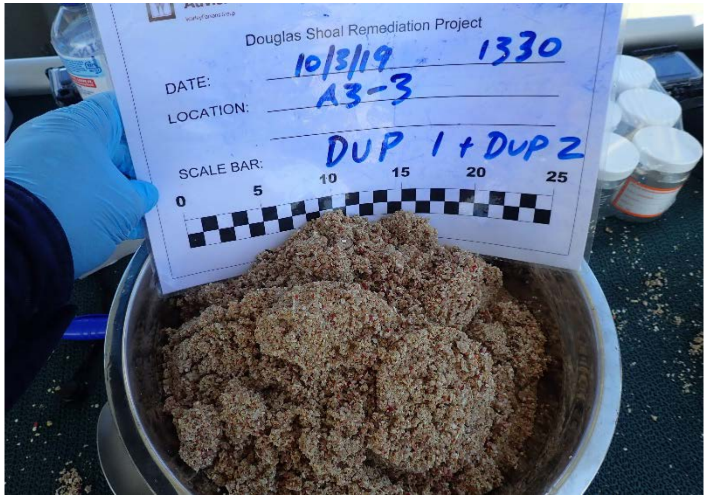
Location of Sampling		Douglas Shoal
Sample ID		**A3-3 (plus D1 and D2)**
Sample Date		10/03/2019
Sampling Depth		15.9 m
Average Sediment Depth		25 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
3	72	25



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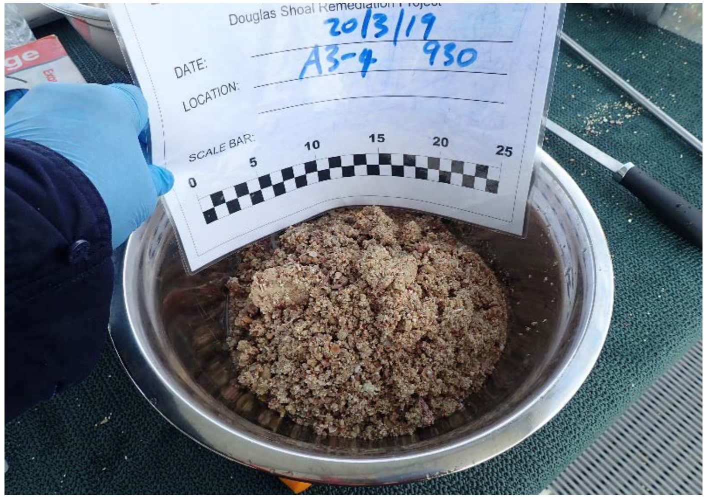
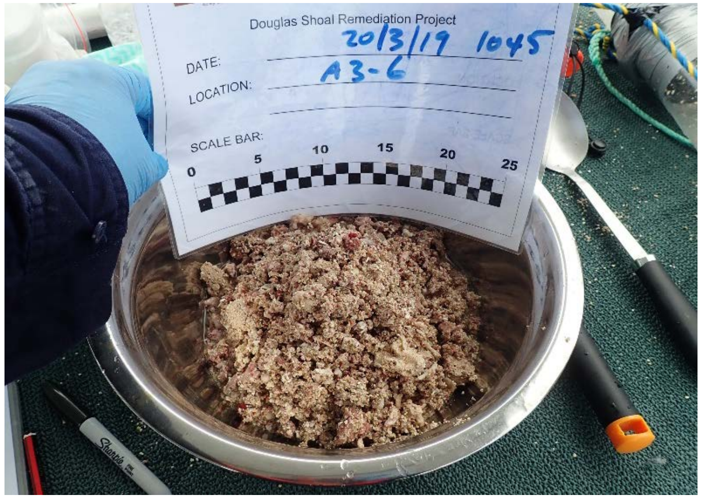
Location of Sampling	Douglas Shoal
Sample ID	**A3-4**
Sample Date	20/03/2019
Sampling Depth	15.5 m
Average Sediment Depth	22 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS
Coralline Algae Presence	No
PSD (%)	
Not tested	



Location of Sampling	Douglas Shoal	
Sample ID	**A3-5**	
Sample Date	10/03/2019	
Sampling Depth	16.7 m	
Average Sediment Depth	25 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	69	27

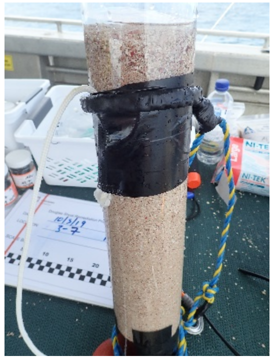
Location of Sampling	Douglas Shoal
Sample ID	**A3-6**
Sample Date	20/03/2019
Sampling Depth	16.5 m
Average Sediment Depth	50 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<2%)
Coralline Algae Presence	Yes
PSD (%)	
Not tested	

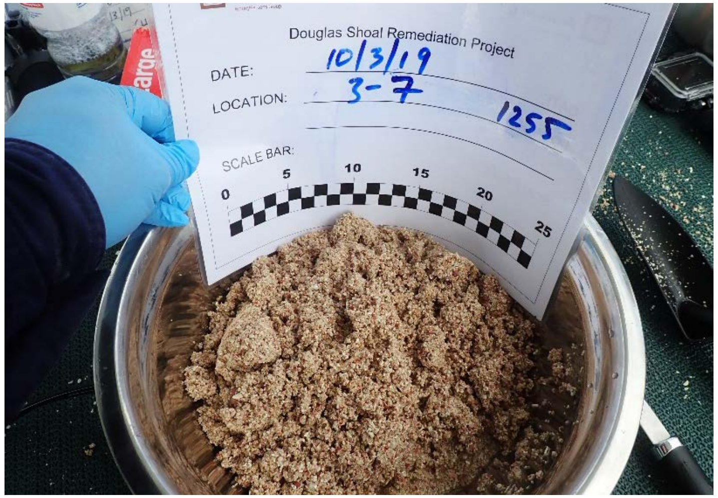


Location of Sampling	Douglas Shoal
Sample ID	**A3-7**
Sample Date	10/03/2019
Sampling Depth	15.7 m
Average Sediment Depth	36 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
2	70	28





Location of Sampling	Douglas Shoal
Sample ID	**A3-8**
Sample Date	20/03/2019
Sampling Depth	15.5 m
Average Sediment Depth	30 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS
Coralline Algae Presence	No
PSD (%)	
Not tested	

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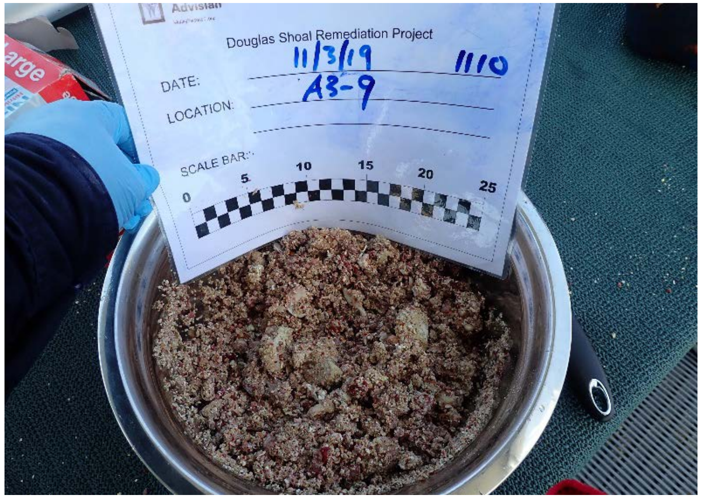
Location of Sampling		Douglas Shoal
Sample ID		**A3-9**
Sample Date		11/03/2019
Sampling Depth		16.8 m
Average Sediment Depth		34 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS / R
Coralline Algae Presence		Yes
PSD (%)		
Silt & Clay	Sand	Gravel
4	29	67



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Location of Sampling		Douglas Shoal
Sample ID		**A3-10**
Sample Date		18/03/2019
Sampling Depth		14.5 m
Average Sediment Depth		60 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS / R
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
12	13	75

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Location of Sampling	Douglas Shoal	
Sample ID	**A3-10a**	
Sample Date	20/03/2019	
Sampling Depth	15.6 m	
Average Sediment Depth	110 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / P / R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
2	20	78

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Location of Sampling		Douglas Shoal
Sample ID		**A3-11**
Sample Date		11/03/2019
Sampling Depth		16.2
Average Sediment Depth		50 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS / R (small)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
3	20	77

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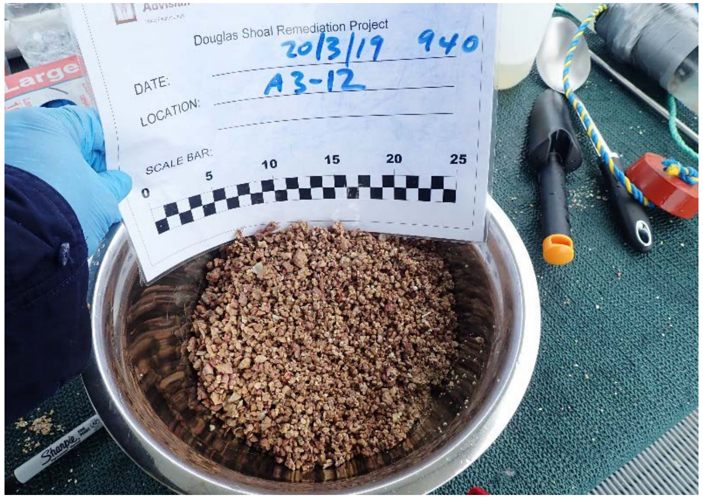
Location of Sampling	Douglas Shoal	
Sample ID	A3-12	
Sample Date	20/03/2019	
Sampling Depth	15.9 m	
Average Sediment Depth	25 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	P / CS (<2%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
2	12	86



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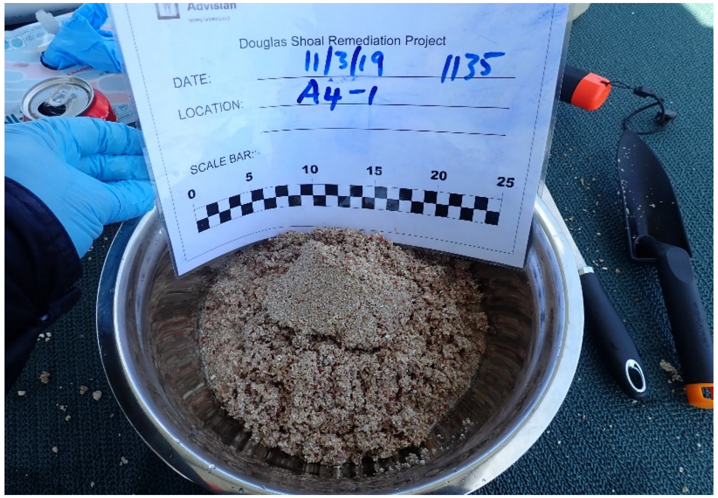
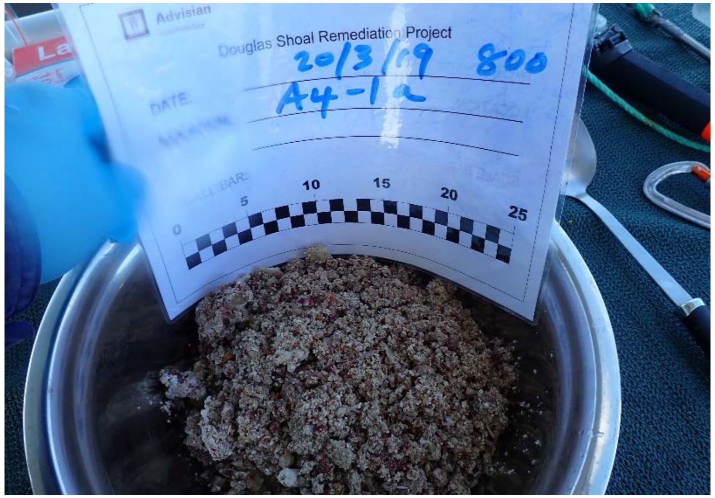
Location of Sampling	Douglas Shoal	
Sample ID	**A4-1**	
Sample Date	11/03/2019	
Sampling Depth	15.5 m	
Average Sediment Depth	36 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	69	27



Location of Sampling		Douglas Shoal
Sample ID		**A4-1a**
Sample Date		20/03/2019
Sampling Depth		16.8 m
Average Sediment Depth		32 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS / R (<5%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
1	41	58



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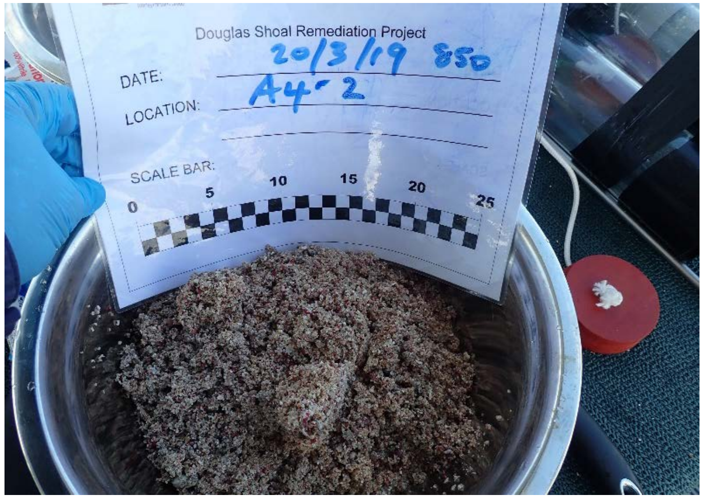
Location of Sampling	Douglas Shoal
Sample ID	**A4-2**
Sample Date	20/03/2019
Sampling Depth	18.8 m
Average Sediment Depth	150 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS
Coralline Algae Presence	No
PSD (%)	
Not tested	



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Location of Sampling		Douglas Shoal
Sample ID		**A4-3**
Sample Date		11/03/2019
Sampling Depth		16.2 m
Average Sediment Depth		50 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		R / CS
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
7	45	48

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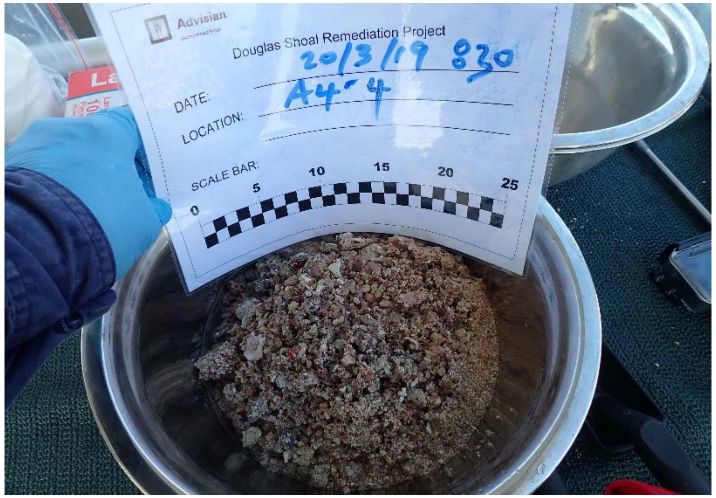
Worley Group

Location of Sampling	Douglas Shoal
Sample ID	**A4-4**
Sample Date	20/03/2019
Sampling Depth	17.8 m
Average Sediment Depth	115 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<2%)
Coralline Algae Presence	No
PSD (%)	
Not tested	



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Location of Sampling	Douglas Shoal	
Sample ID	**A4-5 (plus D3 and D4)**	
Sample Date	11/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	190 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
5	36	59

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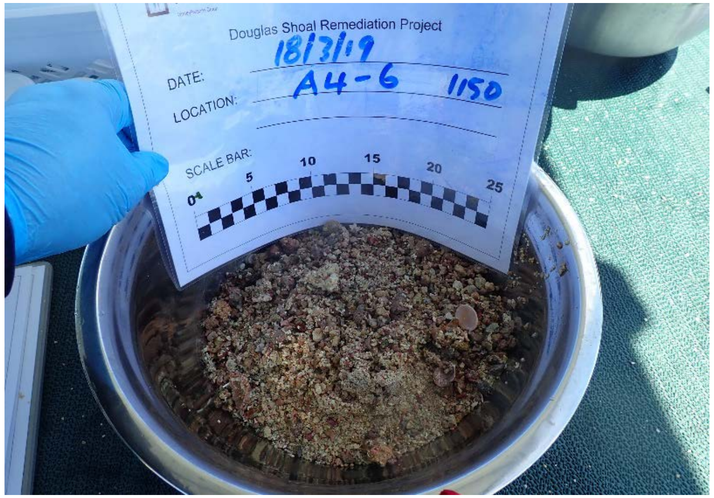
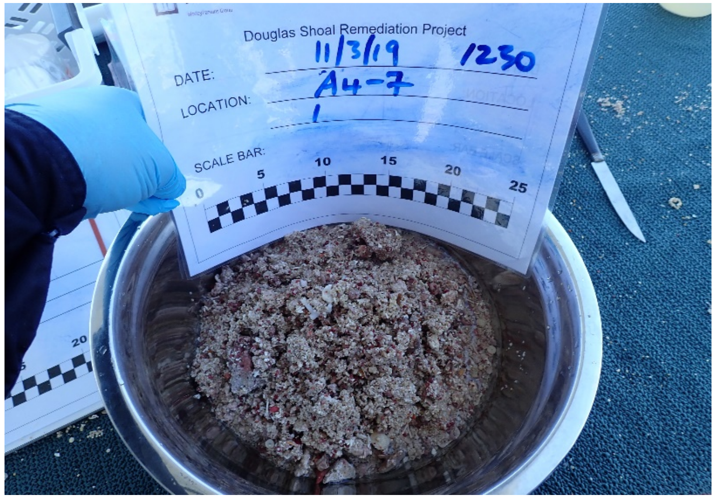
Location of Sampling	Douglas Shoal	
Sample ID	**A4-6**	
Sample Date	18/03/2019	
Sampling Depth	14.4 m	
Average Sediment Depth	10 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<2%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
9	41	50



Location of Sampling	Douglas Shoal	
Sample ID	**A4-7**	
Sample Date	11/03/2019	
Sampling Depth	16 m	
Average Sediment Depth	46 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
6	53	41



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Location of Sampling	Douglas Shoal	
Sample ID	**A4-8**	
Sample Date	20/03/2019	
Sampling Depth	17.3 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R / CS (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	5	91

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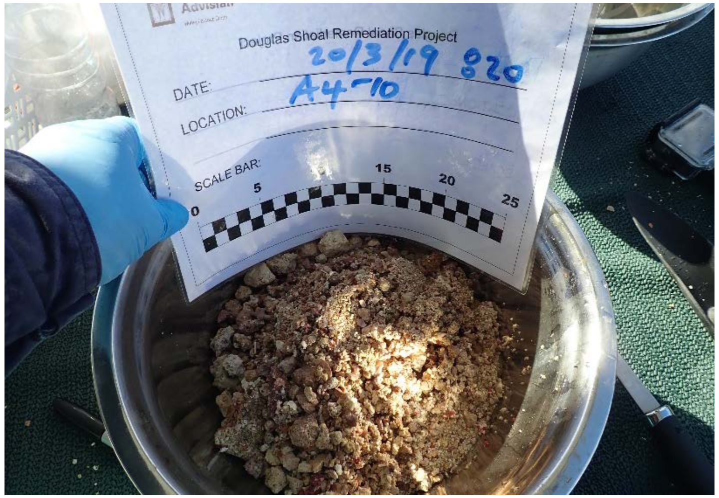
Location of Sampling	Douglas Shoal	
Sample ID	**A4-9**	
Sample Date	11/03/2019	
Sampling Depth	16 m	
Average Sediment Depth	54 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
5	53	42

Location of Sampling	Douglas Shoal
Sample ID	**A4-10**
Sample Date	20/03/2019
Sampling Depth	16.8 mm
Average Sediment Depth	100 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<5%)
Coralline Algae Presence	No
PSD (%)	
Not tested	



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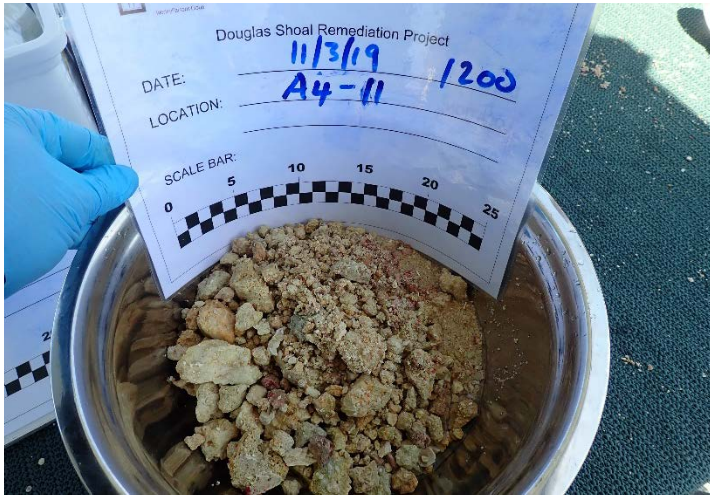
Location of Sampling	Douglas Shoal	
Sample ID	**A4-11**	
Sample Date	11/03/2019	
Sampling Depth	16 m	
Average Sediment Depth	130 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
10	12	78



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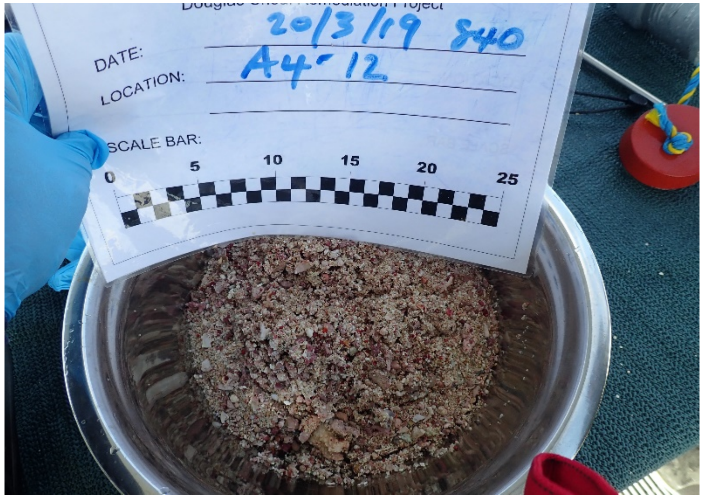
Location of Sampling	Douglas Shoal	
Sample ID	**A4-12**	
Sample Date	11/03/2019	
Sampling Depth	16 m	
Average Sediment Depth	81.25 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
1	57	42



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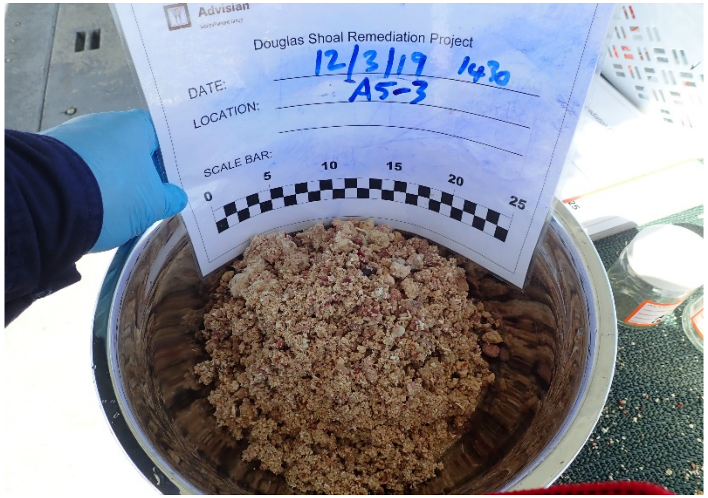
Location of Sampling	Douglas Shoal	
Sample ID	**A5-1**	
Sample Date	12/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	10 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
3	87	10

Location of Sampling	Douglas Shoal
Sample ID	**A5-2**
Sample Date	19/03/2019
Sampling Depth	13.6 m
Average Sediment Depth	100 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<1%)
Coralline Algae Presence	No
PSD (%)	
Not tested	

Location of Sampling	Douglas Shoal	
Sample ID	**A5-3**	
Sample Date	12/03/2019	
Sampling Depth	14.9 m	
Average Sediment Depth	80 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
11	24	65



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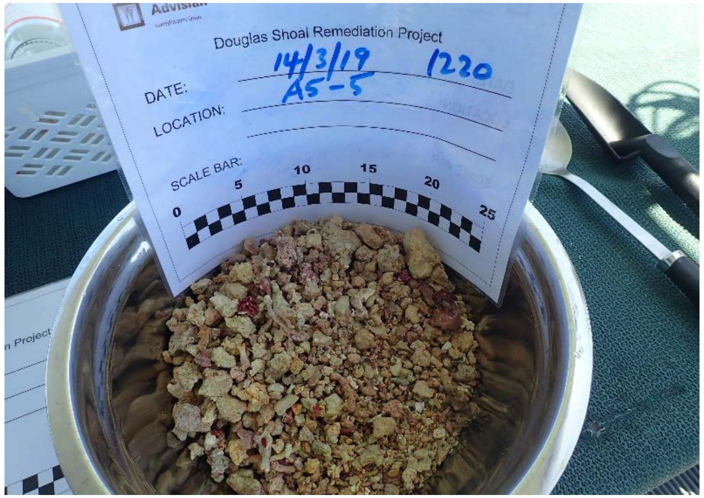
Location of Sampling	Douglas Shoal	
Sample ID	**A5-4**	
Sample Date	18/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	80 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<20%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
15	23	62

Location of Sampling	Douglas Shoal		
Sample ID	**A5-5**		
Sample Date	14/03/2019		
Sampling Depth	14.2 m		
Average Sediment Depth	81 mm		
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS (<2%)		
Coralline Algae Presence	No		
PSD (%)			
Silt & Clay	Sand	Gravel	
9	24	67	



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Location of Sampling	Douglas Shoal
Sample ID	**A5-6**
Sample Date	19/03/2019
Sampling Depth	13 m
Average Sediment Depth	50 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<2%)
Coralline Algae Presence	No
PSD (%)	
Not tested	

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Location of Sampling	Douglas Shoal	
Sample ID	**A5-7**	
Sample Date	14/03/2019	
Sampling Depth	14.7 m	
Average Sediment Depth	52 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R (large)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
8	23	69

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Location of Sampling	Douglas Shoal	
Sample ID	**A5-8 (T1)**	
Sample Date	20/03/2019	
Sampling Depth	16.2 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
1	17	82

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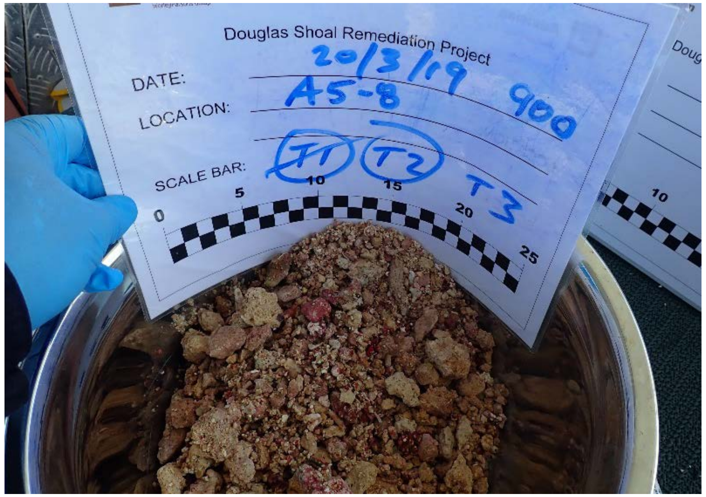
Location of Sampling		Douglas Shoal
Sample ID		**A5-8 (T2)**
Sample Date		20/03/2019
Sampling Depth		16.2 m
Average Sediment Depth		100 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS / R
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
2	11	87



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Location of Sampling		Douglas Shoal
Sample ID		**A5-8 (T3)**
Sample Date		20/03/2019
Sampling Depth		16.2 m
Average Sediment Depth		100 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS / R
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
2	10	88

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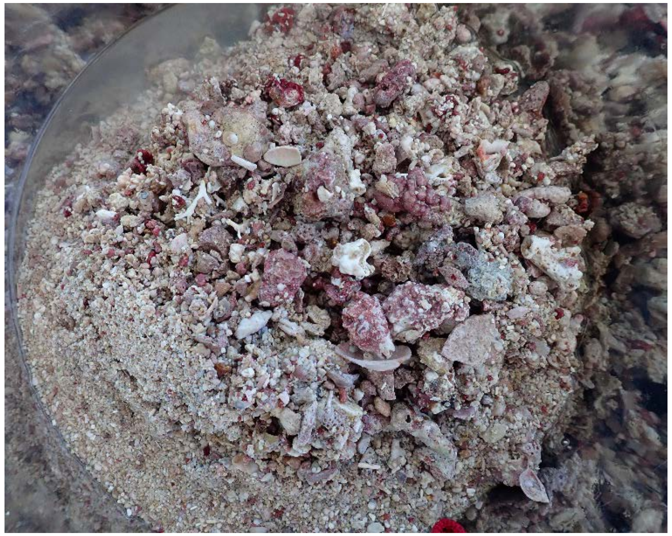
Location of Sampling	Douglas Shoal
Sample ID	**A5-9 (T1)**
Sample Date	14/03/2019
Sampling Depth	14.5 m
Average Sediment Depth	172 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS
Coralline Algae Presence	No
PSD (%)	
Not tested	



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Location of Sampling	Douglas Shoal
Sample ID	**A5-9 (T2)**
Sample Date	14/03/2019
Sampling Depth	14.5 m
Average Sediment Depth	172 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS
Coralline Algae Presence	No
PSD (%)	
Not tested	

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Location of Sampling	Douglas Shoal
Sample ID	**A5-9 (T3)**
Sample Date	14/03/2019
Sampling Depth	14.5 m
Average Sediment Depth	172 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS
Coralline Algae Presence	No
PSD (%)	
Not tested	

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Location of Sampling	Douglas Shoal
Sample ID	**A5-10**
Sample Date	20/03/2019
Sampling Depth	16.8 m
Average Sediment Depth	150 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<5%)
Coralline Algae Presence	No
PSD (%)	
Not tested	

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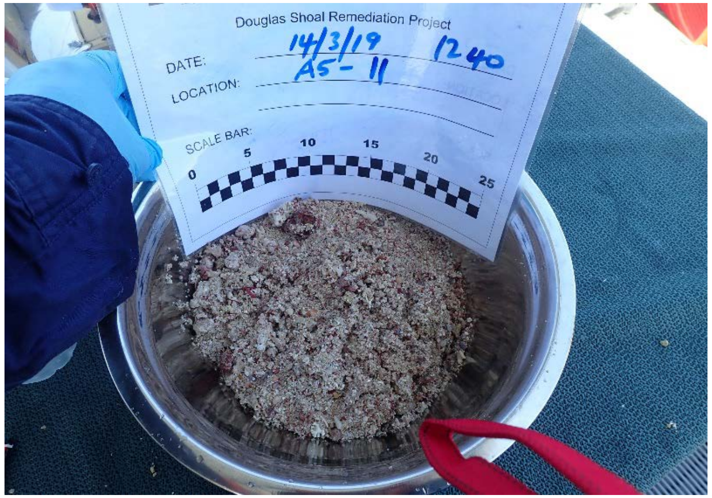
Location of Sampling	Douglas Shoal	
Sample ID	**A5-11**	
Sample Date	14/03/2019	
Sampling Depth	25 m	
Average Sediment Depth	212 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
1	59	40



Location of Sampling	Douglas Shoal
Sample ID	**A5-12**
Sample Date	20/03/2019
Sampling Depth	16 m
Average Sediment Depth	10 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS
Coralline Algae Presence	No
PSD (%)	
Not tested	

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Location of Sampling	Douglas Shoal	
Sample ID	**A6-1**	
Sample Date	10/03/2019	
Sampling Depth	13.2 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R / CS (<10%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
5	12	83

Location of Sampling	Douglas Shoal	
Sample ID	**A6-2**	
Sample Date	10/03/2019	
Sampling Depth	13.3 m	
Average Sediment Depth	80 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
21	3	76

Location of Sampling	Douglas Shoal	
Sample ID	**A6-3**	
Sample Date	10/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	79 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS (<10%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
32	6	62

Location of Sampling	Douglas Shoal	
Sample ID	**A6-4 (T1)**	
Sample Date	10/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	30 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	80	16

Location of Sampling		Douglas Shoal
Sample ID		**A6-4 (T2)**
Sample Date		10/03/2019
Sampling Depth		15 m
Average Sediment Depth		30 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
9	30	61

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Location of Sampling	Douglas Shoal	
Sample ID	**A6-4 (T3)**	
Sample Date	10/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	30 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
PSD (%)		
Silt & Clay	Sand	Gravel
15	32	53

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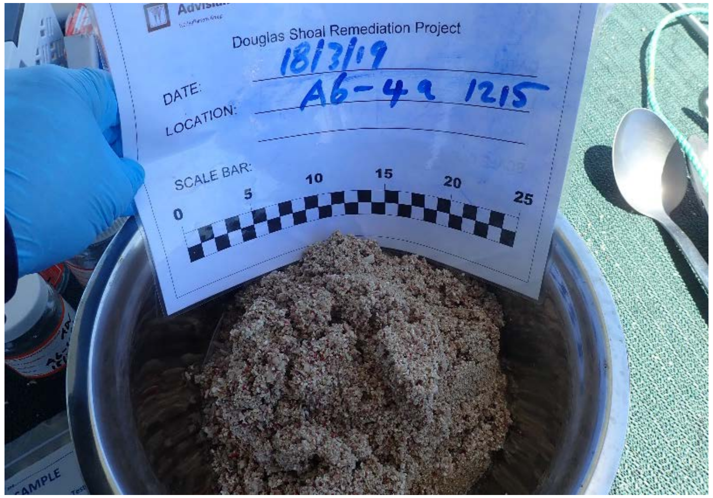
Location of Sampling	Douglas Shoal	
Sample ID	**A6-4a**	
Sample Date	18/03/2019	
Sampling Depth	14 m	
Average Sediment Depth	70 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<1%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
5	70	25



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Location of Sampling	Douglas Shoal
Sample ID	**A6-5**
Sample Date	10/03/2019
Sampling Depth	15 m
Average Sediment Depth	50 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
3	81	16

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Location of Sampling	Douglas Shoal
Sample ID	**A6-6**
Sample Date	10/03/2019
Sampling Depth	15 m
Average Sediment Depth	50 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<1%)
Coralline Algae Presence	No
PSD (%)	
Not tested	

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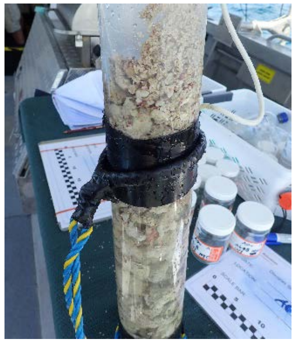
Location of Sampling	Douglas Shoal
Sample ID	**A6-7**
Sample Date	10/03/2019
Sampling Depth	15.2 m
Average Sediment Depth	70 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS
Coralline Algae Presence	No

PSD (%)

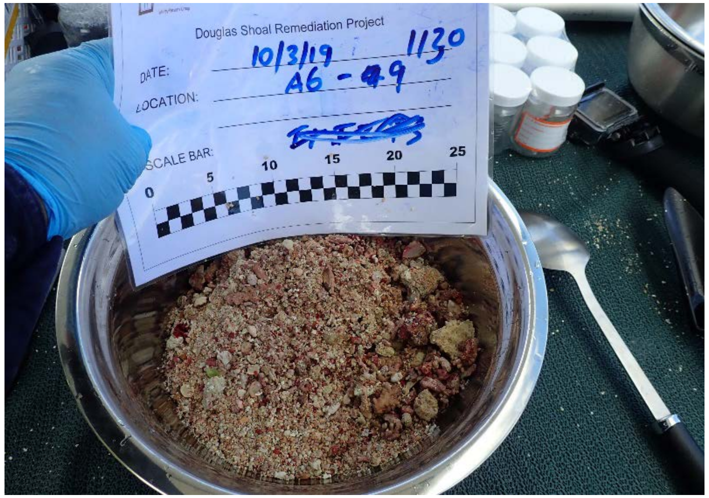
Not tested

Location of Sampling		Douglas Shoal
Sample ID		**A6-8**
Sample Date		10/03/2019
Sampling Depth		15.7 m
Average Sediment Depth		38 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		R / CS (<10%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
16	22	62



Location of Sampling		Douglas Shoal
Sample ID		**A6-8a**
Sample Date		18/03/2019
Sampling Depth		13.6 m
Average Sediment Depth		85 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		R (gravel) / CS (<5%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
17	12	71

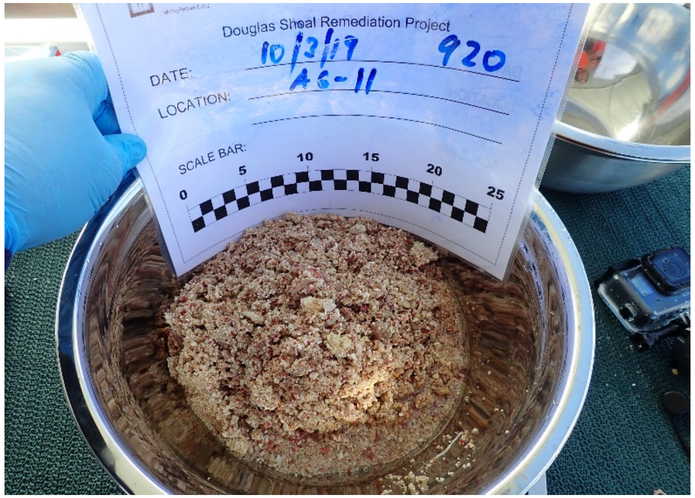
Location of Sampling	Douglas Shoal	
Sample ID	**A6-9**	
Sample Date	10/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
12	35	53



Location of Sampling	Douglas Shoal		
Sample ID	**A6-10**		
Sample Date	10/03/2019		
Sampling Depth	15 m		
Average Sediment Depth	25 mm		
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS (50%) / R (50%)		
Coralline Algae Presence	No		
PSD (%)			
Silt & Clay	Sand	Gravel	
17	13	70	

Location of Sampling	Douglas Shoal	
Sample ID	**A6-10a**	
Sample Date	18/03/2019	
Sampling Depth	13.1 m	
Average Sediment Depth	25 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
5	66	29

Location of Sampling	Douglas Shoal	
Sample ID	**A6-11**	
Sample Date	10/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	59 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<1%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	64	32



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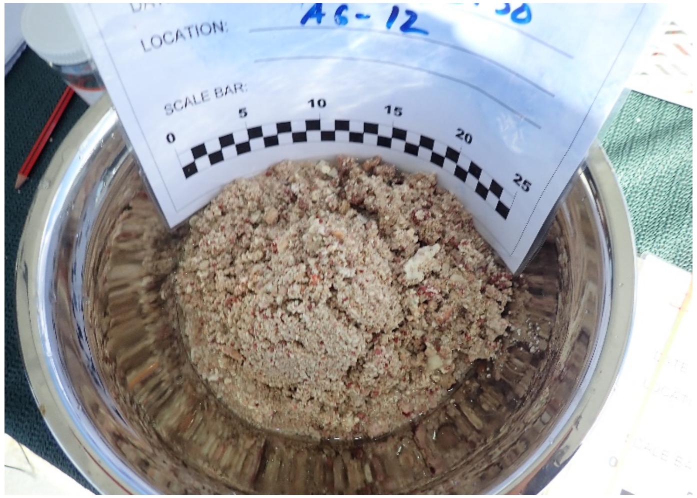
Location of Sampling	Douglas Shoal	
Sample ID	**A6-12**	
Sample Date	10/03/2019	
Sampling Depth	16.5 m	
Average Sediment Depth	60 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<10%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
9	45	46



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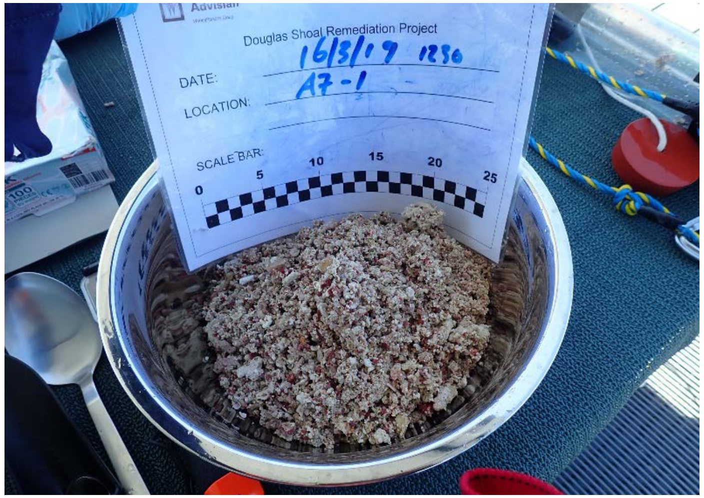
Location of Sampling	Douglas Shoal	
Sample ID	**A7-1**	
Sample Date	16/03/2019	
Sampling Depth	13.2 m	
Average Sediment Depth	180 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
13	36	51



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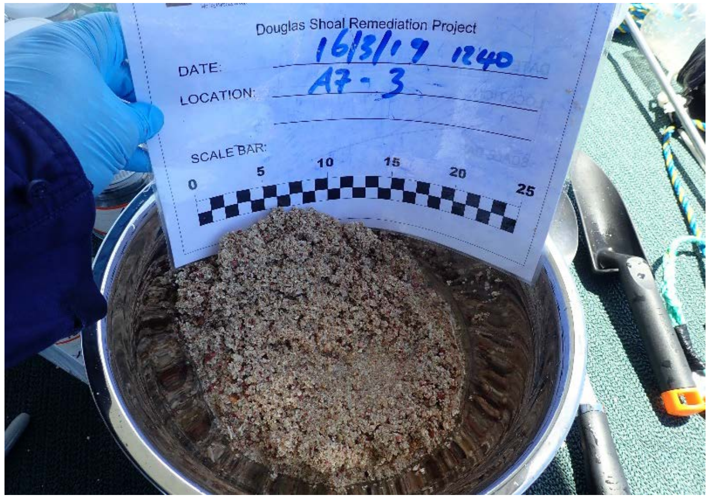
Location of Sampling	Douglas Shoal	
Sample ID	**A7-3**	
Sample Date	16/03/2019	
Sampling Depth	14.4 m	
Average Sediment Depth	24 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
5	77	18



Location of Sampling	Douglas Shoal	
Sample ID	**A7-4**	
Sample Date	18/03/2019	
Sampling Depth	13.5 m	
Average Sediment Depth	55 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
9	48	43

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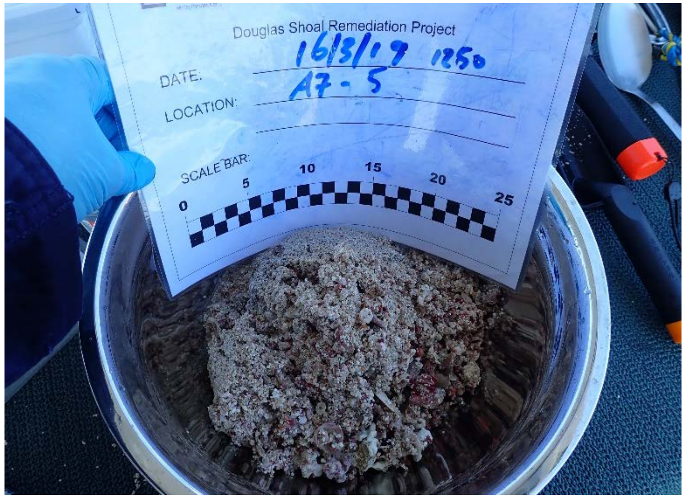
Location of Sampling	Douglas Shoal	
Sample ID	**A7-5**	
Sample Date	16/03/2019	
Sampling Depth	14.3 m	
Average Sediment Depth	70 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
12	37	51



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Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	**A7-7**	
Sample Date	16/03/2019	
Sampling Depth	14.6 m	
Average Sediment Depth	30 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	S / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
14	55	31

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Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	**A7-9**	
Sample Date	16/03/2019	
Sampling Depth	14.2 m	
Average Sediment Depth	27 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	S / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	40	56

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Location of Sampling	Douglas Shoal	
Sample ID	**A7-11**	
Sample Date	16/03/2019	
Sampling Depth	17.9 m	
Average Sediment Depth	30 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	FS / S	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	91	5

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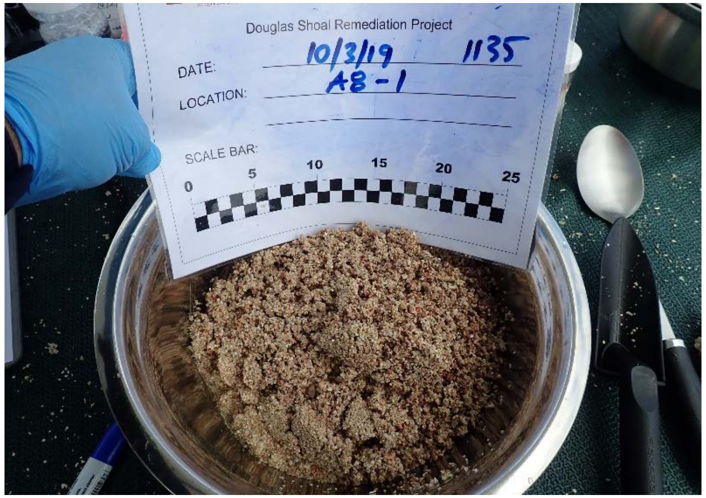
Location of Sampling	Douglas Shoal	
Sample ID	**A8-1**	
Sample Date	10/03/2019	
Sampling Depth	15.2 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	61	35



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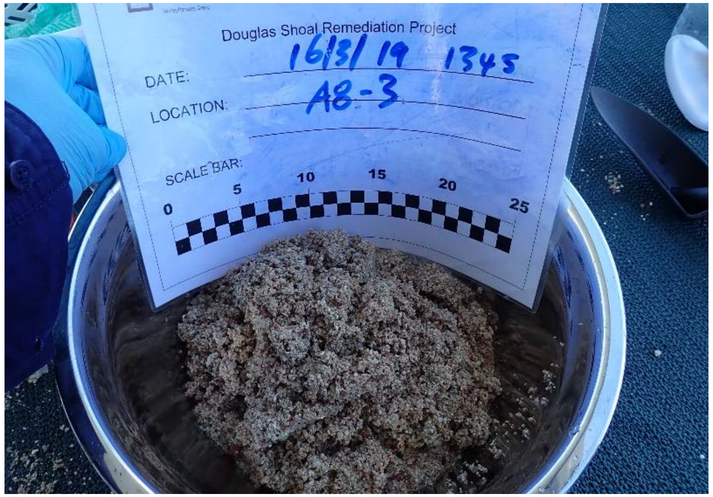
Location of Sampling	Douglas Shoal	
Sample ID	**A8-3**	
Sample Date	16/03/2019	
Sampling Depth	15.6 m	
Average Sediment Depth	25 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
3	82	15



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Location of Sampling	Douglas Shoal	
Sample ID	**A8-5**	
Sample Date	10/03/2019	
Sampling Depth	19 m	
Average Sediment Depth	37 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	FS / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
3	90	7

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Location of Sampling		Douglas Shoal
Sample ID		**A8-6**
Sample Date		18/03/2019
Sampling Depth		14.5 m
Average Sediment Depth		75 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
5	67	28

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Location of Sampling	Douglas Shoal	
Sample ID	**A8-7**	
Sample Date	16/03/2019	
Sampling Depth	15.7 m	
Average Sediment Depth	41 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	S / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
3	91	6

Location of Sampling	Douglas Shoal	
Sample ID	**A8-9**	
Sample Date	16/03/2019	
Sampling Depth	17.6 m	
Average Sediment Depth	55 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	73	23

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Location of Sampling	Douglas Shoal	
Sample ID	**A8-11**	
Sample Date	16/03/2019	
Sampling Depth	19.6 m	
Average Sediment Depth	72 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	FS / S	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	94	2

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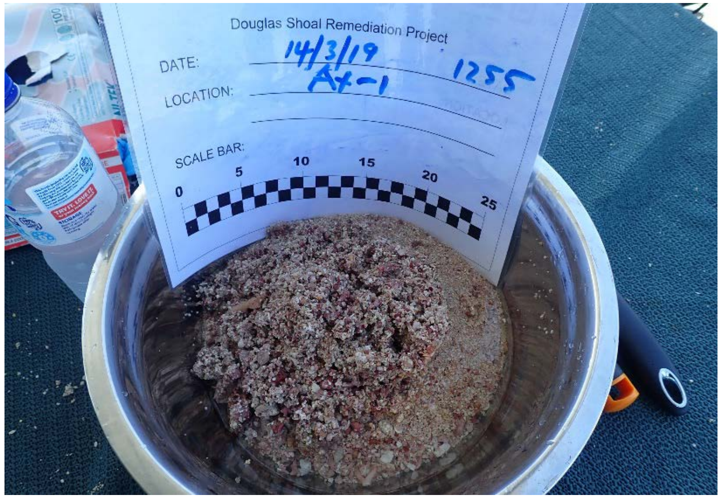
Location of Sampling		Douglas Shoal
Sample ID		**AX-1**
Sample Date		14/03/2019
Sampling Depth		14.2 m
Average Sediment Depth		26 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
3	69	28



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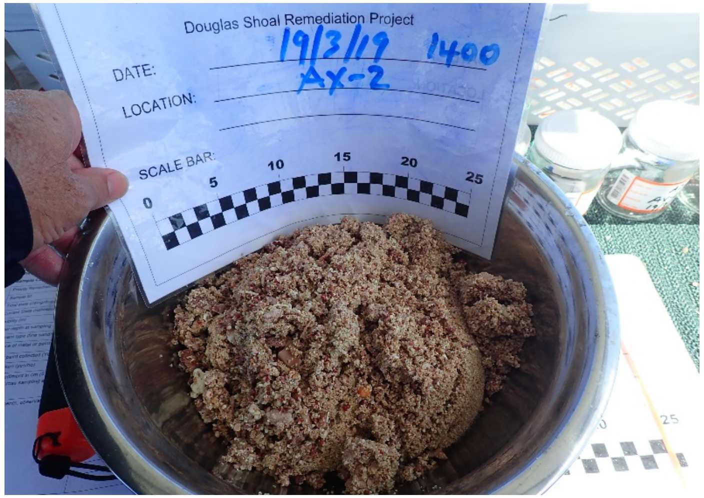
Location of Sampling	Douglas Shoal
Sample ID	**AX-2**
Sample Date	19/03/2019
Sampling Depth	14.1 m
Average Sediment Depth	50 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<5%)
Coralline Algae Presence	Yes
PSD (%)	
Not tested	



Location of Sampling	Douglas Shoal	
Sample ID	**AX-3**	
Sample Date	14/03/2019	
Sampling Depth	14.7 m	
Average Sediment Depth	162 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
7	29	64

Location of Sampling	Douglas Shoal	
Sample ID	**AX-4**	
Sample Date	19/03/2019	
Sampling Depth	13.2 m	
Average Sediment Depth	70 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
1	73	26

Location of Sampling	Douglas Shoal	
Sample ID	**AX-5**	
Sample Date	14/03/2019	
Sampling Depth	14.9 m	
Average Sediment Depth	112 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
1	75	24

Location of Sampling	Douglas Shoal
Sample ID	**AX-6**
Sample Date	19/03/2019
Sampling Depth	13.8 m
Average Sediment Depth	110 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<2%)
Coralline Algae Presence	Yes
PSD (%)	
Not tested	

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Location of Sampling	Douglas Shoal
Sample ID	**AX-7**
Sample Date	14/03/2019
Sampling Depth	15 m
Average Sediment Depth	144 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
4	46	50

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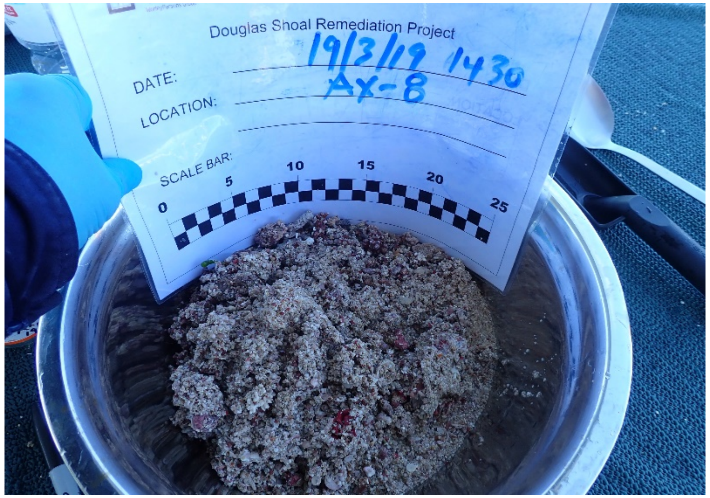
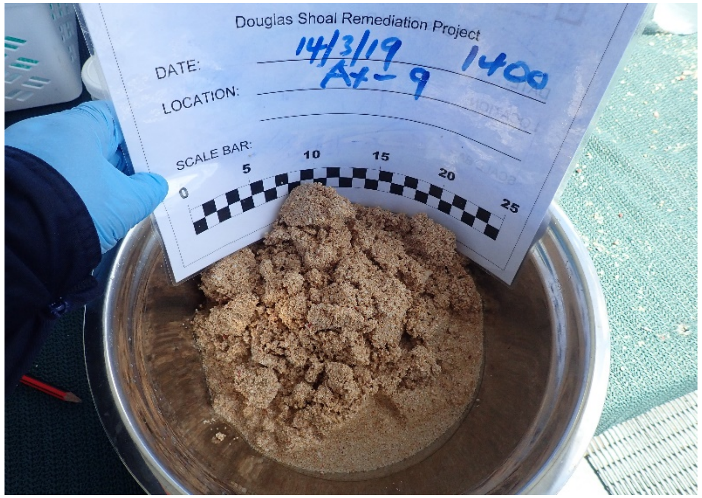
Location of Sampling	Douglas Shoal
Sample ID	**AX-8**
Sample Date	19/03/2019
Sampling Depth	14.5 m
Average Sediment Depth	90 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R
Coralline Algae Presence	No
PSD (%)	
Not tested	



Location of Sampling	Douglas Shoal	
Sample ID	**AX-9**	
Sample Date	14/03/2019	
Sampling Depth	20.8 m	
Average Sediment Depth	170 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	F / S	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
2	95	3



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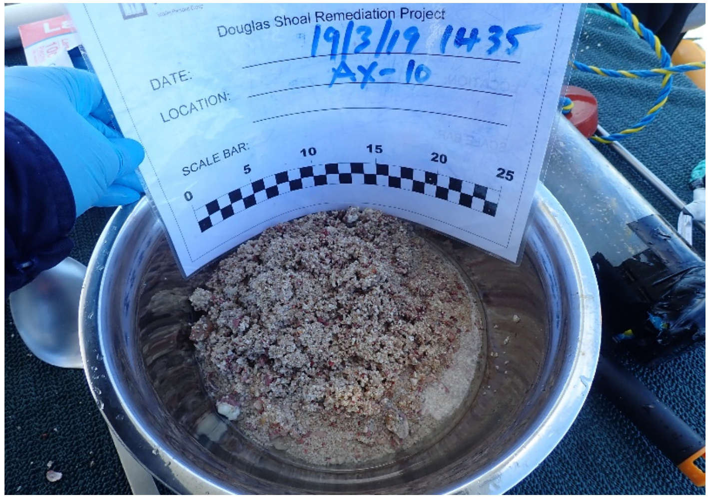
Location of Sampling	Douglas Shoal
Sample ID	**AX-10**
Sample Date	19/03/2019
Sampling Depth	14.5 m
Average Sediment Depth	30 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<8%)
Coralline Algae Presence	Yes
PSD (%)	
Not tested	



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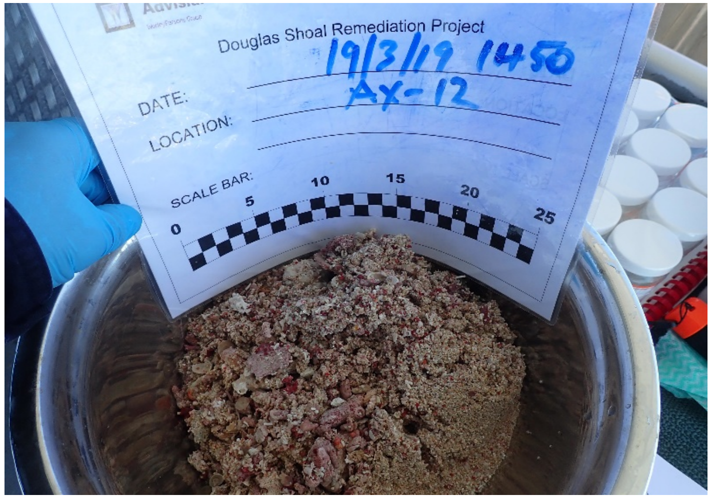
Location of Sampling	Douglas Shoal
Sample ID	**AX-11 (plus D7 and D8)**
Sample Date	14/03/2019
Sampling Depth	13.4 m
Average Sediment Depth	140 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	S / CS
Coralline Algae Presence	No
PSD (%)	
Not tested	

Location of Sampling	Douglas Shoal
Sample ID	**AX-12**
Sample Date	19/03/2019
Sampling Depth	14.2 m
Average Sediment Depth	90 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<5%)
Coralline Algae Presence	Yes
PSD (%)	
Not tested	



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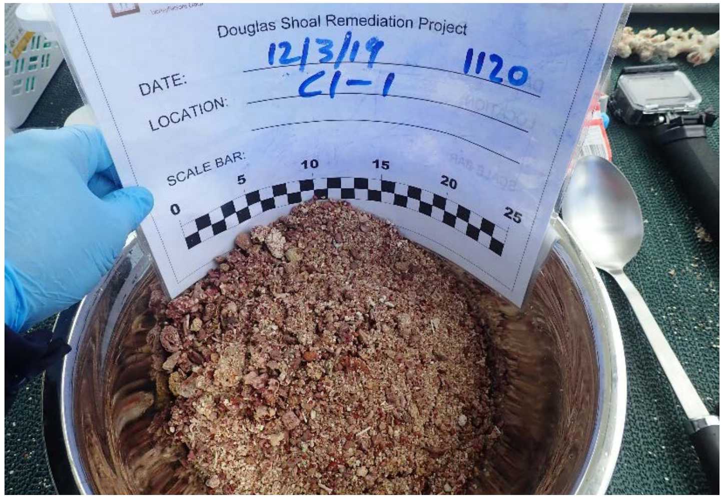
Location of Sampling	Douglas Shoal	
Sample ID	**C1-1**	
Sample Date	12/03/2019	
Sampling Depth	14.5 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
7	49	44



Location of Sampling	Douglas Shoal		
Sample ID		**C1-3**	
Sample Date		12/03/2019	
Sampling Depth		15 m	
Average Sediment Depth		210 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		R / CS (<5%)	
Coralline Algae Presence		No	
PSD (%)			
Silt & Clay	Sand	Gravel	
6	28	66	

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Location of Sampling	Douglas Shoal	
Sample ID	**C1-5**	
Sample Date	12/03/2019	
Sampling Depth	14.8 m	
Average Sediment Depth	200mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	67	29

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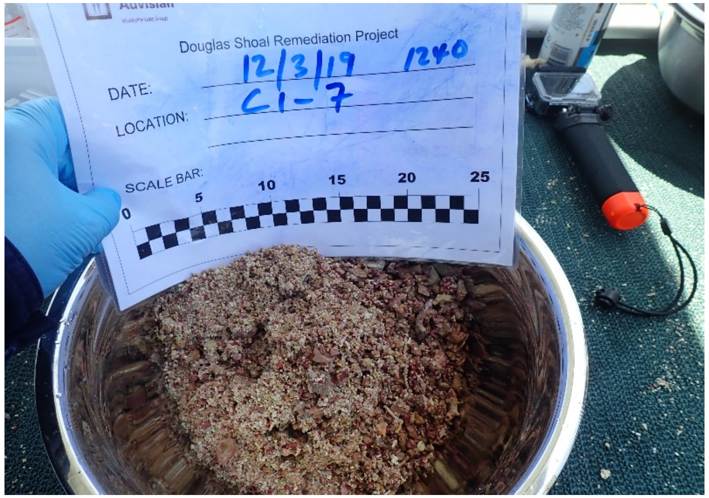
Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	**C1-7**	
Sample Date	12/03/2019	
Sampling Depth	14.5 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
6	40	53



Location of Sampling	Douglas Shoal	
Sample ID	**C1-9**	
Sample Date	12/03/2019	
Sampling Depth	14.8 m	
Average Sediment Depth	45.8 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
5	51	44

Location of Sampling	Douglas Shoal	
Sample ID	**C1-11**	
Sample Date	12/03/2019	
Sampling Depth	14 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	Not recorded	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
6	48	46

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Location of Sampling	Douglas Shoal	
Sample ID	**C2-1**	
Sample Date	9/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
20	23	57

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Location of Sampling	Douglas Shoal	
Sample ID	**C2-2**	
Sample Date	9/03/2019	
Sampling Depth	16 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (15%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
16	34	50

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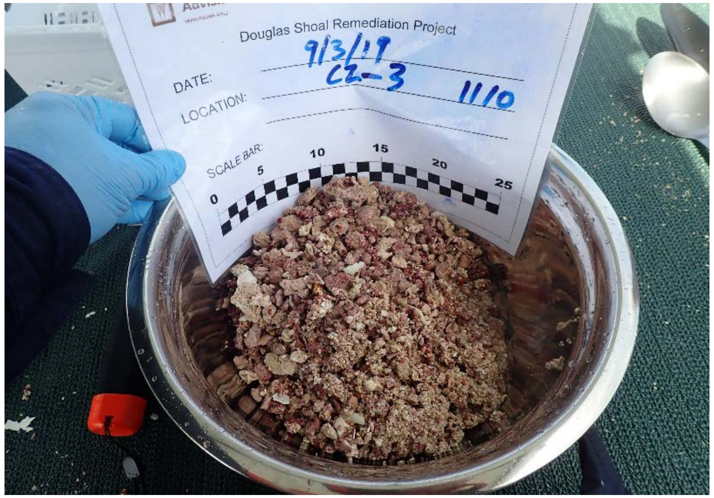
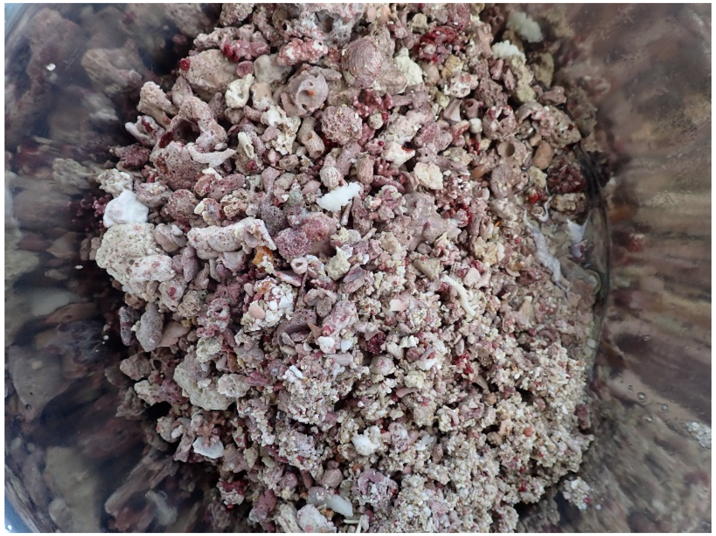
Location of Sampling	Douglas Shoal	
Sample ID	**C2-3**	
Sample Date	9/03/2019	
Sampling Depth	16 m	
Average Sediment Depth	80 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	Not recorded	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
30	21	49





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Location of Sampling	Douglas Shoal
Sample ID	**C2-4**
Sample Date	9/03/2019
Sampling Depth	15.3 m
Average Sediment Depth	40 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	Not recorded
Coralline Algae Presence	No
PSD (%)	
Not tested	

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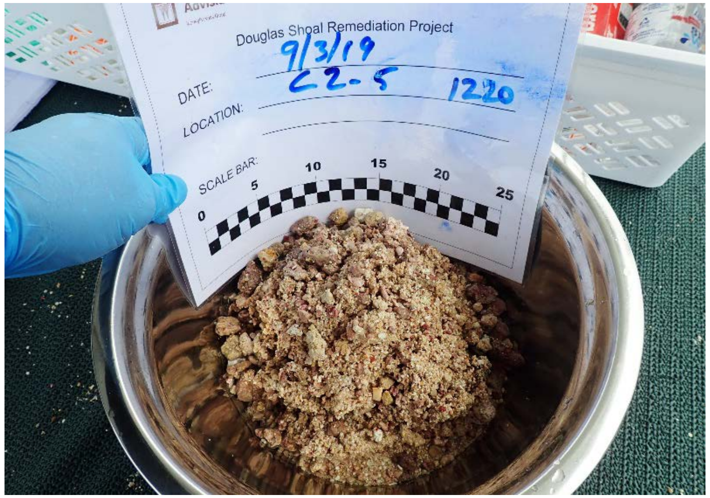
Location of Sampling	Douglas Shoal	
Sample ID	**C2-5**	
Sample Date	9/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	37 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (10%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
23	19	58



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Location of Sampling		Douglas Shoal
Sample ID		**C2-6**
Sample Date		9/03/2019
Sampling Depth		16 m
Average Sediment Depth		10 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		R (large) / CS (<5%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
43	9	48

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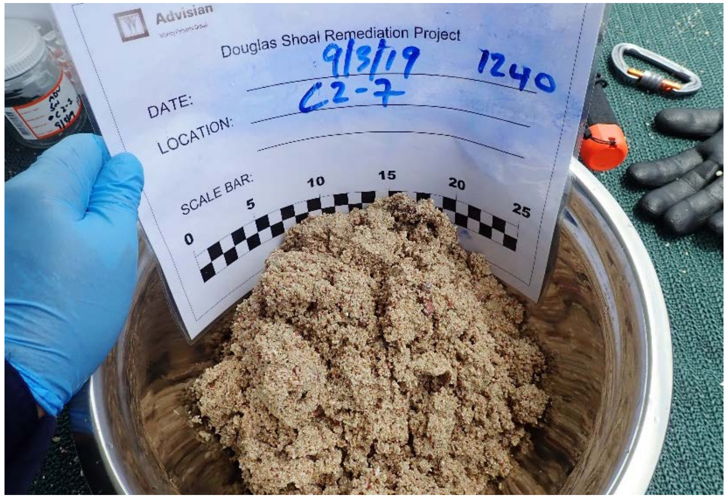
Location of Sampling	Douglas Shoal	
Sample ID	C2-7	
Sample Date	9/03/2019	
Sampling Depth	15.7 m	
Average Sediment Depth	35 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	Not recorded	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
5	79	16



Location of Sampling		Douglas Shoal
Sample ID		**C2-8**
Sample Date		9/03/2019
Sampling Depth		16 m
Average Sediment Depth		44 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS / R (<1%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
4	83	13

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Location of Sampling	Douglas Shoal
Sample ID	**C2-8b**
Sample Date	18/03/2019
Sampling Depth	15.5 m
Average Sediment Depth	50 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
9	42	49

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Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	**C2-9**	
Sample Date	9/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	25 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	Not recorded	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
16	28	56

Location of Sampling	Douglas Shoal
Sample ID	**C2-10**
Sample Date	9/03/2019
Sampling Depth	16 m
Average Sediment Depth	65 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<5%)
Coralline Algae Presence	No
PSD (%)	
Not tested	

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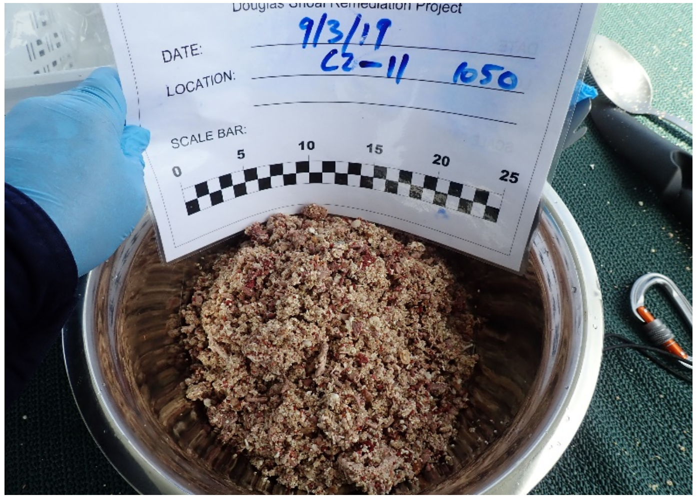
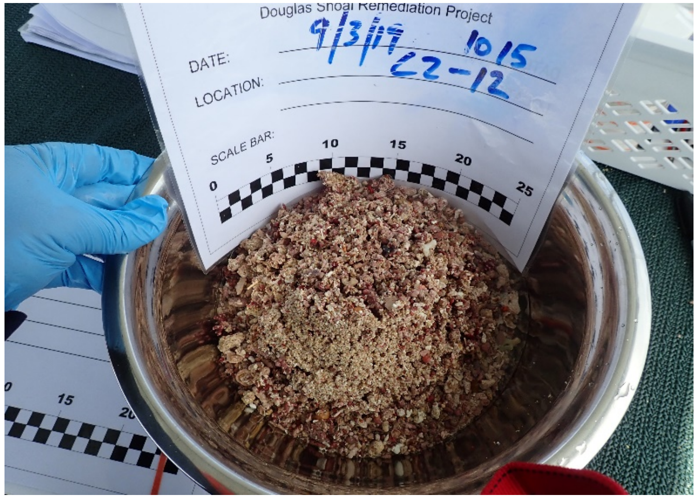
Location of Sampling	Douglas Shoal
Sample ID	**C2-11**
Sample Date	9/03/2019
Sampling Depth	16 m
Average Sediment Depth	80 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	Not recorded
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
10	52	38



Location of Sampling	Douglas Shoal
Sample ID	**C2-12**
Sample Date	9/03/2019
Sampling Depth	16 m
Average Sediment Depth	24 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<5%)
Coralline Algae Presence	No
PSD (%)	
Not tested	



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Location of Sampling	Douglas Shoal	
Sample ID	**C3-1**	
Sample Date	15/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (~30%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	50	46

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Worley Group

Location of Sampling	Douglas Shoal
Sample ID	**C3-3**
Sample Date	15/03/2019
Sampling Depth	13.8 m
Average Sediment Depth	50 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R / CS
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
15	13	72

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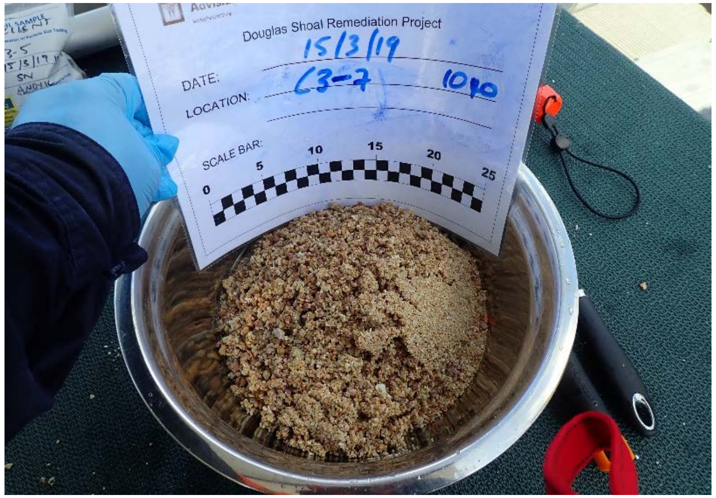
Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	C3-5	
Sample Date	15/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	25 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R (small) / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
11	28	61

Location of Sampling	Douglas Shoal	
Sample ID	**C3-7**	
Sample Date	15/03/2019	
Sampling Depth	13.5 m	
Average Sediment Depth	200 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	52	44



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Location of Sampling	Douglas Shoal	
Sample ID	**C3-9**	
Sample Date	15/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	150 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
13	15	72

Location of Sampling	Douglas Shoal	
Sample ID	**C3-11**	
Sample Date	15/03/2019	
Sampling Depth	13.5 m	
Average Sediment Depth	60 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
12	5	83

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Location of Sampling	Douglas Shoal
Sample ID	**C4-1**
Sample Date	15/03/2019
Sampling Depth	13.2 m
Average Sediment Depth	25 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS
Coralline Algae Presence	No

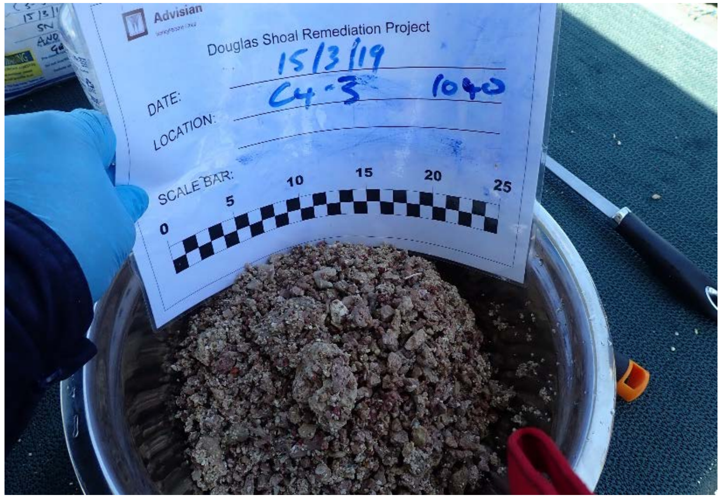
PSD (%)

Not tested

Location of Sampling	Douglas Shoal
Sample ID	**C4-3**
Sample Date	15/03/2019
Sampling Depth	13.8 m
Average Sediment Depth	45 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
9	25	66



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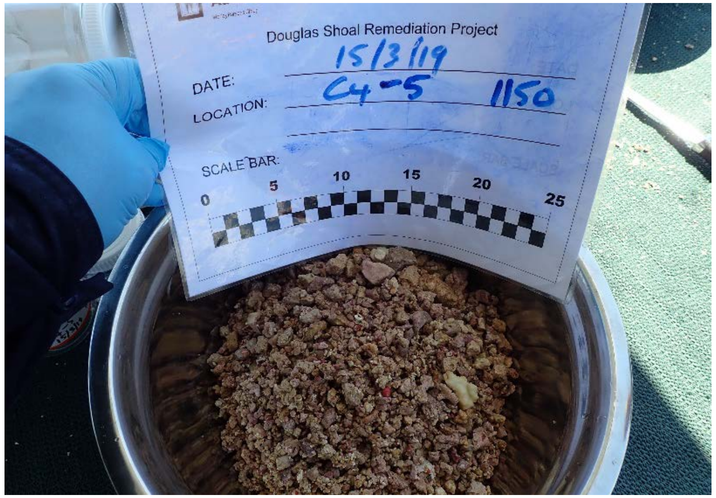
Location of Sampling	Douglas Shoal	
Sample ID	**C4-5**	
Sample Date	15/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	36 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
11	8	81



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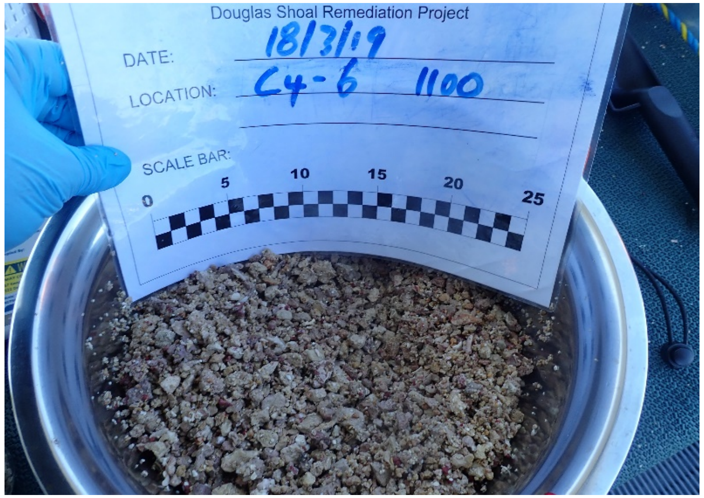
Location of Sampling		Douglas Shoal
Sample ID		**C4-6**
Sample Date		18/03/2019
Sampling Depth		15.5 m
Average Sediment Depth		210 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		R (small pebbles) / CS (<2%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
13	5	82



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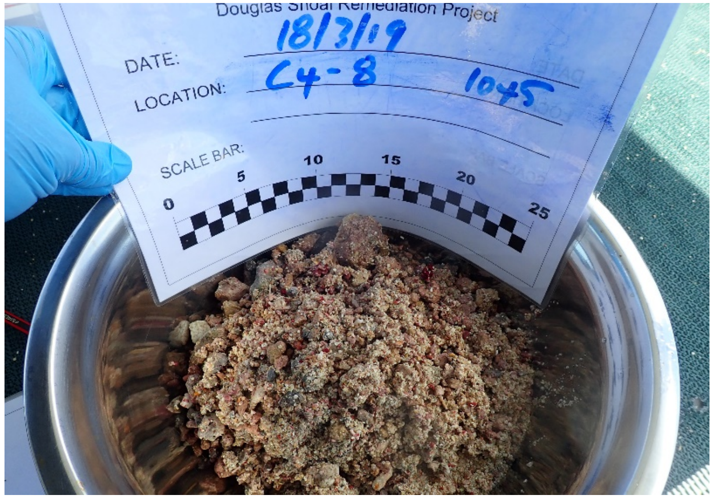
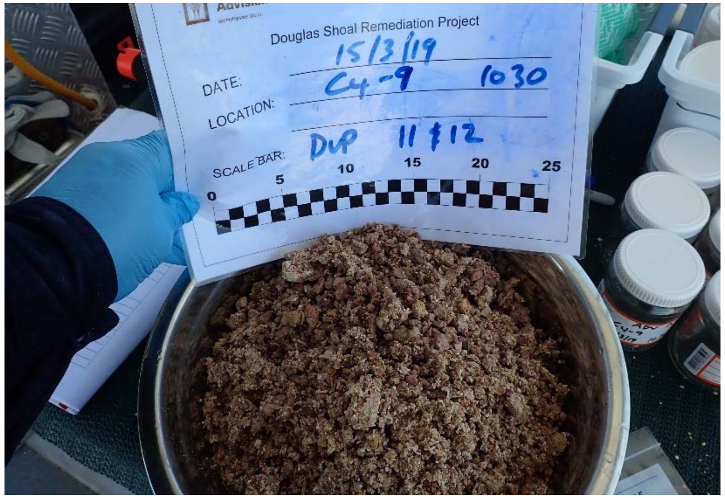
Location of Sampling		Douglas Shoal
Sample ID		**C4-7**
Sample Date		15/03/2019
Sampling Depth		13.5 m
Average Sediment Depth		49 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		R / CS (<5%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
10	7	83

Location of Sampling	Douglas Shoal	
Sample ID	**C4-8**	
Sample Date	18/03/2019	
Sampling Depth	Not recorded	
Average Sediment Depth	25 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
12	22	66



Location of Sampling		Douglas Shoal
Sample ID		**C4-9 (plus D11 and D12)**
Sample Date		15/03/2019
Sampling Depth		13.1 m
Average Sediment Depth		30 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS / R
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
7	32	61



Location of Sampling	Douglas Shoal
Sample ID	**C4-11 (T1)**
Sample Date	15/03/2019
Sampling Depth	13.2 m
Average Sediment Depth	320 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
15	4	81

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Location of Sampling	Douglas Shoal	
Sample ID	**C4-11 (T2)**	
Sample Date	15/03/2019	
Sampling Depth	13.2 m	
Average Sediment Depth	320 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
11	10	79

Location of Sampling	Douglas Shoal	
Sample ID	**C4-11 (T3)**	
Sample Date	15/03/2019	
Sampling Depth	13.2 m	
Average Sediment Depth	320 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
9	12	79

Location of Sampling	Douglas Shoal	
Sample ID	**CX-1**	
Sample Date	17/03/2019	
Sampling Depth	12.4 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R (small) / CS	
PSD (%)		
Silt & Clay	Sand	Gravel
6	31	63

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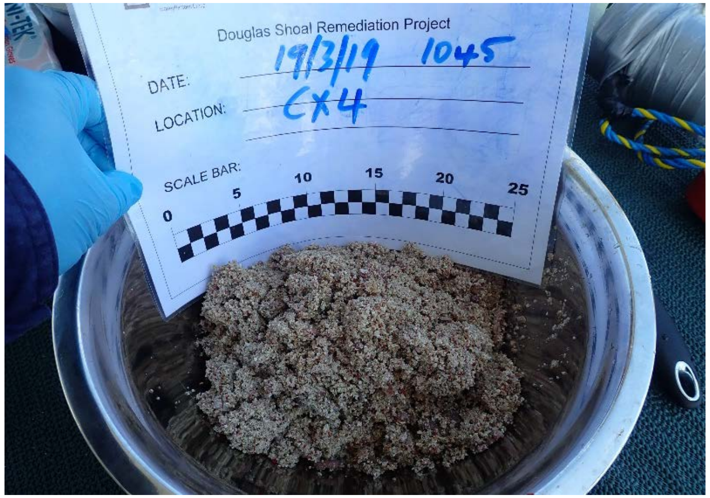
Location of Sampling	Douglas Shoal	
Sample ID	**CX-2**	
Sample Date	19/03/2019	
Sampling Depth	15.2 m	
Average Sediment Depth	170 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
2	42	56

Location of Sampling	Douglas Shoal	
Sample ID	**CX-3**	
Sample Date	17/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	70 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	S / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
3	91	6

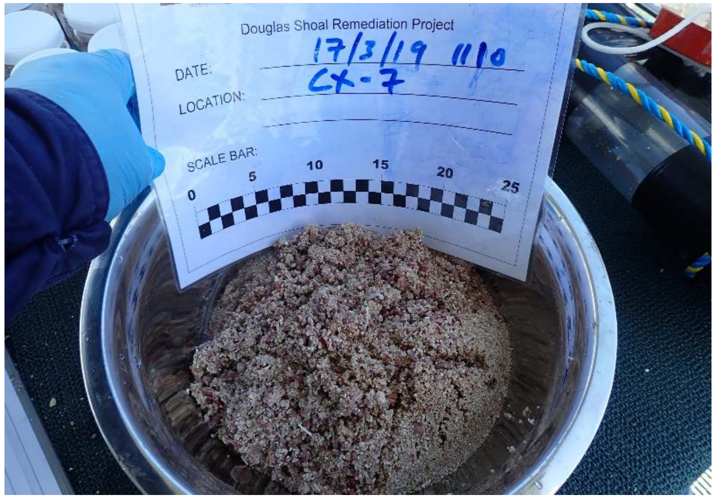
Location of Sampling	Douglas Shoal
Sample ID	**CX-4**
Sample Date	19/03/2019
Sampling Depth	15.5 m
Average Sediment Depth	20 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	S / CS
Coralline Algae Presence	No
PSD (%)	
Not tested	



Location of Sampling	Douglas Shoal	
Sample ID	**CX-5**	
Sample Date	17/03/2019	
Sampling Depth	14.2 m	
Average Sediment Depth	36 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	S / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
3	93	4

Location of Sampling	Douglas Shoal		
Sample ID	**CX-6**		
Sample Date	19/03/2019		
Sampling Depth	15 m		
Average Sediment Depth	25 mm		
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	S / CS		
Coralline Algae Presence	No		
PSD (%)			
Silt & Clay	Sand	Gravel	
1	84	15	

Location of Sampling	Douglas Shoal	
Sample ID	**CX-7**	
Sample Date	17/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
6	58	36



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Location of Sampling	Douglas Shoal
Sample ID	**CX-8**
Sample Date	19/03/2019
Sampling Depth	15.7 m
Average Sediment Depth	50 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R (gravel) / CS
Coralline Algae Presence	No
PSD (%)	
Not tested	

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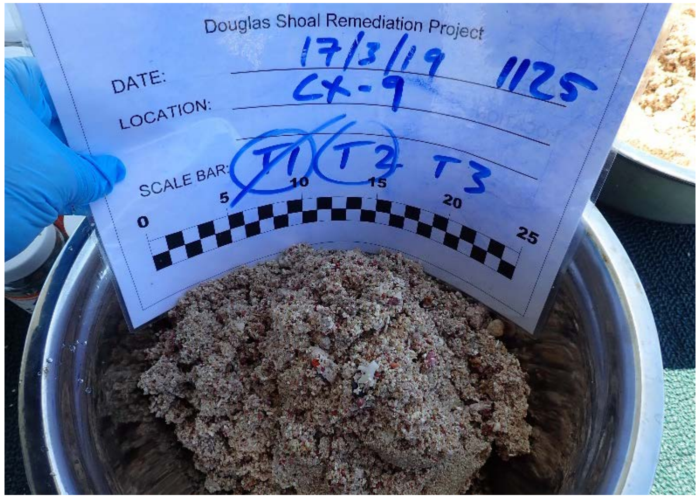
Location of Sampling		Douglas Shoal
Sample ID		**CX-9 (T1)**
Sample Date		17/03/2019
Sampling Depth		14.8 m
Average Sediment Depth		100 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS / R (10%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
16	38	46

Location of Sampling	Douglas Shoal	
Sample ID	**CX-9 (T2)**	
Sample Date	17/03/2019	
Sampling Depth	14.8 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (10%)	
PSD (%)		
Silt & Clay	Sand	Gravel
5	74	21



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Location of Sampling	Douglas Shoal	
Sample ID	**CX-9 (T3)**	
Sample Date	17/03/2019	
Sampling Depth	14.8 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (10%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	75	21

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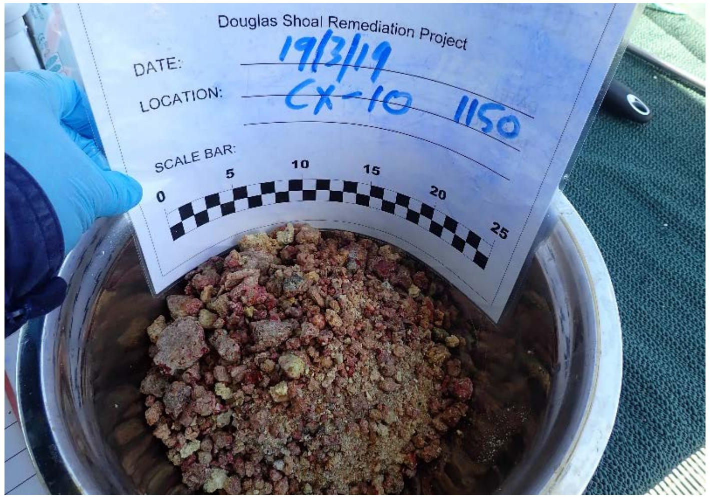
Location of Sampling	Douglas Shoal
Sample ID	**CX-10**
Sample Date	19/03/2019
Sampling Depth	14.1 m
Average Sediment Depth	30 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / P / CS
Coralline Algae Presence	No
PSD (%)	
Not tested	



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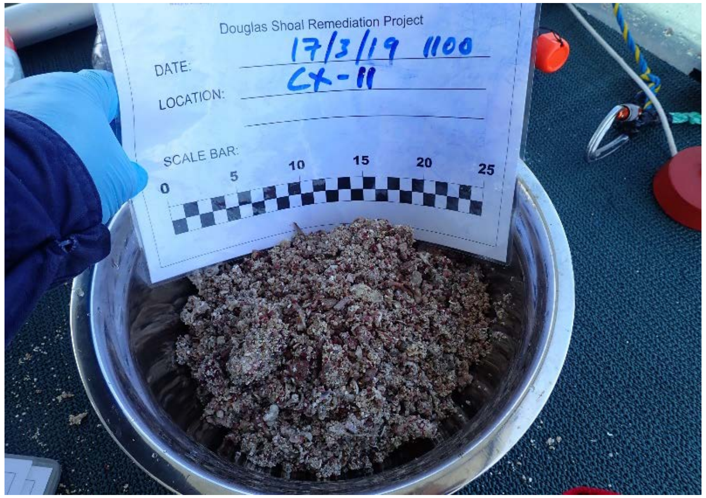
Location of Sampling	Douglas Shoal	
Sample ID	**CX-11**	
Sample Date	17/03/2019	
Sampling Depth	14.7 m	
Average Sediment Depth	110 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
3	53	44



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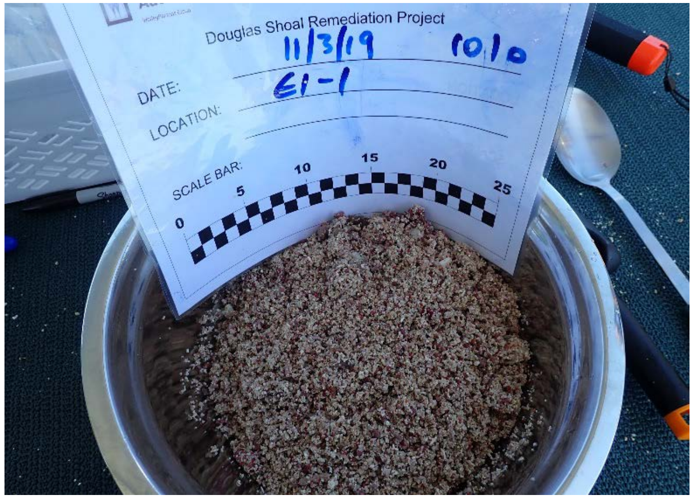
Location of Sampling	Douglas Shoal
Sample ID	**CX-12**
Sample Date	19/03/2019
Sampling Depth	15.3 m
Average Sediment Depth	70 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (small)
Coralline Algae Presence	Yes
PSD (%)	
Not tested	

Location of Sampling	Douglas Shoal	
Sample ID	**E1-1**	
Sample Date	11/03/2019	
Sampling Depth	15.1 m	
Average Sediment Depth	160 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (small)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
5	54	41



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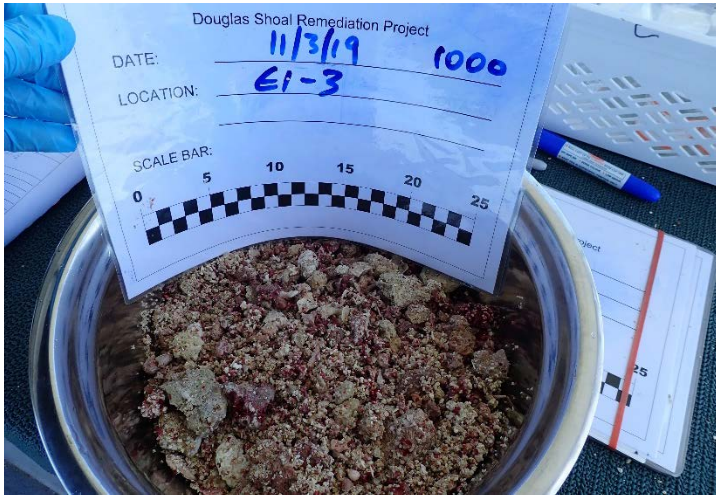
Location of Sampling	Douglas Shoal	
Sample ID	**E1-3**	
Sample Date	11/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	140 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	Not recorded	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
11	28	61



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Location of Sampling	Douglas Shoal
Sample ID	**E1-5**
Sample Date	11/03/2019
Sampling Depth	15.2 m
Average Sediment Depth	40 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (small)
Coralline Algae Presence	Yes

PSD (%)

Silt & Clay	Sand	Gravel
3	62	35

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Location of Sampling	Douglas Shoal	
Sample ID	**E1-6**	
Sample Date	18/03/2019	
Sampling Depth	15.2 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<5%)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
11	42	47

Location of Sampling	Douglas Shoal	
Sample ID	**E1-7**	
Sample Date	11/03/03/2019	
Sampling Depth	15.9 m	
Average Sediment Depth	110 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (small)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
5	51	44

Location of Sampling	Douglas Shoal	
Sample ID	**E1-9**	
Sample Date	11/03/2019	
Sampling Depth	15.8 m	
Average Sediment Depth	70 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
8	39	53

Location of Sampling	Douglas Shoal	
Sample ID	**E1-11**	
Sample Date	11/03/2019	
Sampling Depth	16.8 m	
Average Sediment Depth	23 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
5	69	26

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Location of Sampling		Douglas Shoal
Sample ID		**E2-1**
Sample Date		12/03/2019
Sampling Depth		14.7 m
Average Sediment Depth		70 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS / R
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
9	34	57

Location of Sampling		Douglas Shoal
Sample ID		**E2-3**
Sample Date		12/03/2019
Sampling Depth		14.9 m
Average Sediment Depth		60 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
4	63	33

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Location of Sampling	Douglas Shoal
Sample ID	**E2-5**
Sample Date	12/03/2019
Sampling Depth	14.8 m
Average Sediment Depth	110 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R
Coralline Algae Presence	No
PSD (%)	
Not tested	

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Location of Sampling		Douglas Shoal
Sample ID		**E2-7**
Sample Date		12/03/2019
Sampling Depth		14.9 m
Average Sediment Depth		25 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
5	62	33

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Location of Sampling		Douglas Shoal
Sample ID		**E2-9**
Sample Date		12/03/2019
Sampling Depth		15.2 m
Average Sediment Depth		50 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS / R (5%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
8	52	40

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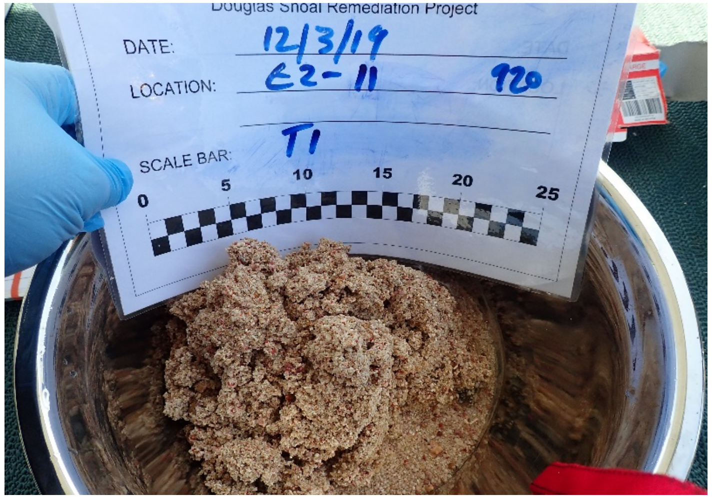
Location of Sampling	Douglas Shoal	
Sample ID	**E2-11 (T1)**	
Sample Date	12/03/2019	
Sampling Depth	15.2 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	81	15



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Location of Sampling		Douglas Shoal
Sample ID		**E2-11 (T2)**
Sample Date		12/03/2019
Sampling Depth		15.2 m
Average Sediment Depth		50 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
3	75	22

Location of Sampling	Douglas Shoal	
Sample ID	**E2-11 (T3)**	
Sample Date	12/03/2019	
Sampling Depth	15.2 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	77	19

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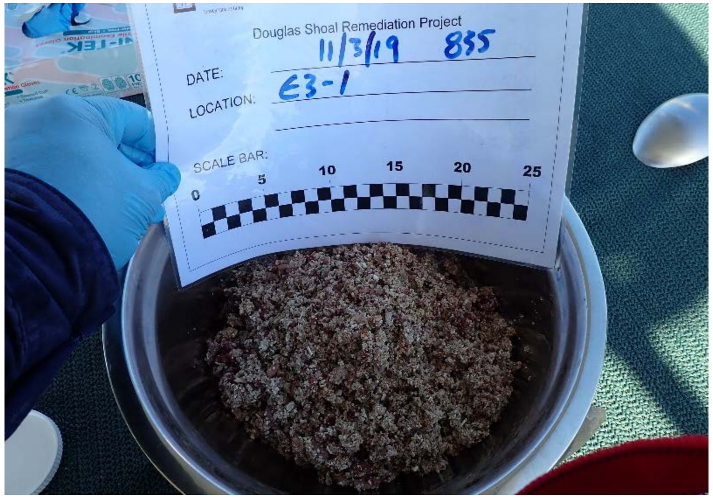
Location of Sampling	Douglas Shoal	
Sample ID	**E3-1**	
Sample Date	11/03/2019	
Sampling Depth	14.8 m	
Average Sediment Depth	85 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (small)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
4	14	82



Location of Sampling	Douglas Shoal	
Sample ID	**E3-3**	
Sample Date	11/03/2019	
Sampling Depth	14.9 m	
Average Sediment Depth	55 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (small)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
4	15	81

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Location of Sampling	Douglas Shoal	
Sample ID	**E3-5**	
Sample Date	11/03/2019	
Sampling Depth	14.5 m	
Average Sediment Depth	80 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	S / CS / R (small)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
2	54	44

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Location of Sampling	Douglas Shoal	
Sample ID	**E3-7**	
Sample Date	11/03/2019	
Sampling Depth	15.3 m	
Average Sediment Depth	65 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
2	84	14

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Location of Sampling	Douglas Shoal	
Sample ID	**E3-9**	
Sample Date	11/03/2019	
Sampling Depth	15.3 m	
Average Sediment Depth	90 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
6	2	92

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Location of Sampling	Douglas Shoal	
Sample ID	**E3-10**	
Sample Date	18/03/2019	
Sampling Depth	14.9 m	
Average Sediment Depth	80 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R (large) / CS (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
10	29	61

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Location of Sampling		Douglas Shoal
Sample ID		**E3-11**
Sample Date		11/03/2019
Sampling Depth		15m
Average Sediment Depth		100 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		P
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
3	49	48

Location of Sampling	Douglas Shoal
Sample ID	**E4-1**
Sample Date	9/03/2019
Sampling Depth	15 m
Average Sediment Depth	5 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<1%)
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
8	58	34

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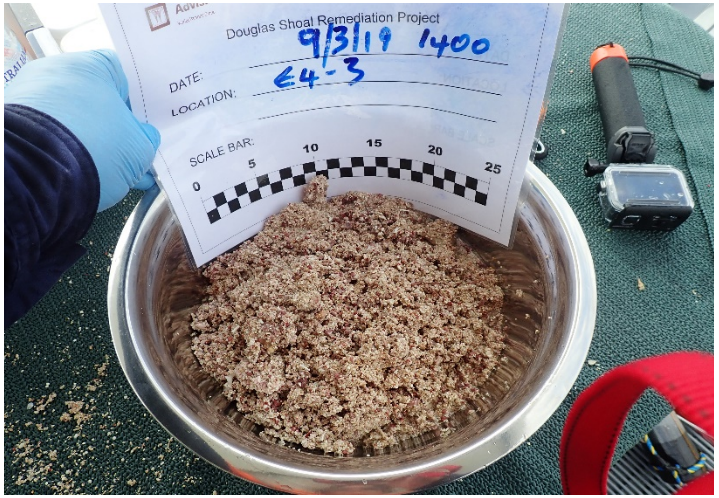
Worley Group

Location of Sampling		Douglas Shoal
Sample ID		**E4-3**
Sample Date		9/03/2019
Sampling Depth		13.7 m
Average Sediment Depth		20 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
7	70	23



Advisian
Worley Group

Location of Sampling	Douglas Shoal
Sample ID	**E4-5**
Sample Date	9/03/2019
Sampling Depth	14 m
Average Sediment Depth	50 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R / CS (<5%)
Coralline Algae Presence	No
PSD (%)	
Not tested	

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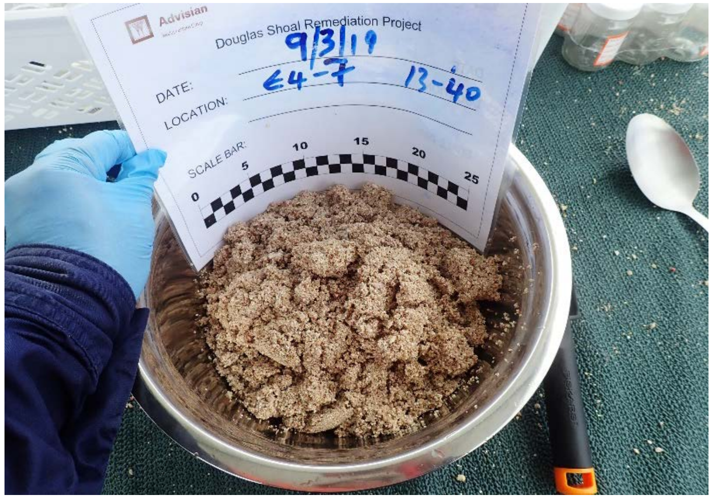
Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	**E4-7**	
Sample Date	9/03/2019	
Sampling Depth	14 m	
Average Sediment Depth	42 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
5	85	10



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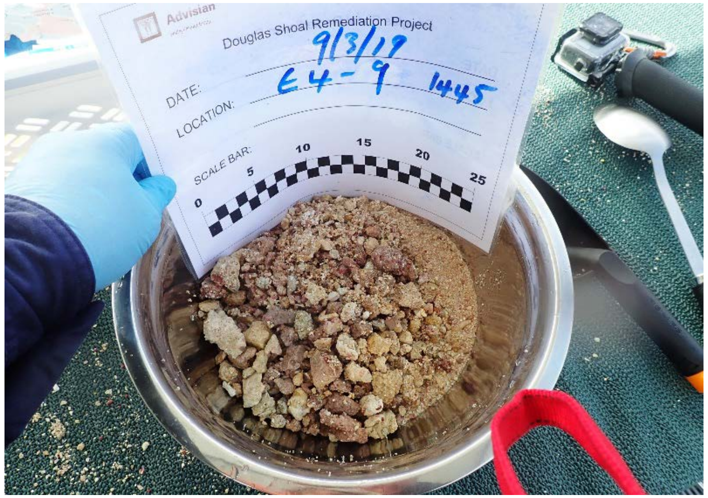
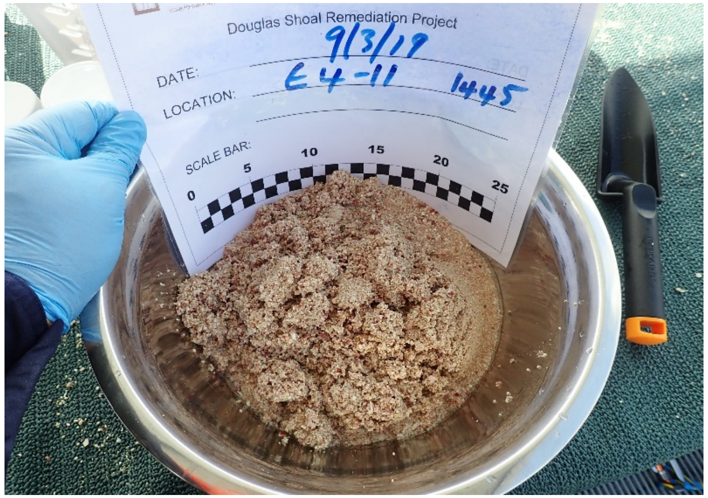
Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	**E4-9**	
Sample Date	9/03/2019	
Sampling Depth	14.3 m	
Average Sediment Depth	25 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R / CS (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
18	34	48



Location of Sampling	Douglas Shoal	
Sample ID	**E4-11**	
Sample Date	9/03/2019	
Sampling Depth	14 m	
Average Sediment Depth	44 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
PSD (%)		
Silt & Clay	Sand	Gravel
7	73	20



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Worley Group

Location of Sampling	Douglas Shoal
Sample ID	**EX-1**
Sample Date	12/03/2019
Sampling Depth	15.4 m
Average Sediment Depth	170 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
5	67	28

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Worley Group

Location of Sampling	Douglas Shoal
Sample ID	**EX-2**
Sample Date	19/03/2019
Sampling Depth	13.9 m
Average Sediment Depth	90 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (small)
Coralline Algae Presence	Yes
PSD (%)	
Not tested	

Advisian
Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	**EX-3**	
Sample Date	12/03/2019	
Sampling Depth	15.6 m	
Average Sediment Depth	25 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
5	64	31

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Location of Sampling	Douglas Shoal	
Sample ID	**EX-4**	
Sample Date	19/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	S / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
1	82	17

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Worley Group

Location of Sampling	Douglas Shoal
Sample ID	**EX-5 (plus D5 and D6)**
Sample Date	12/03/2019
Sampling Depth	14.7 m
Average Sediment Depth	100 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	Not recorded
Coralline Algae Presence	No
PSD (%)	
Not tested	

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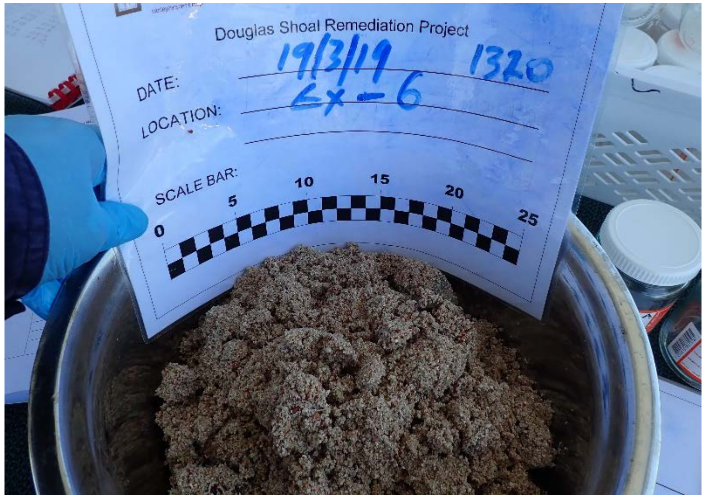
Worley Group

Location of Sampling	Douglas Shoal
Sample ID	**EX-6**
Sample Date	19/03/2019
Sampling Depth	13.2 m
Average Sediment Depth	30 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	S / CS
Coralline Algae Presence	No
PSD (%)	
Not tested	



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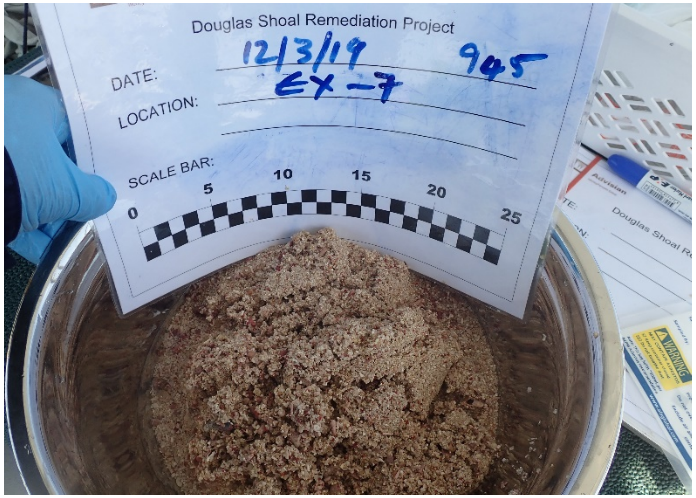
Location of Sampling	Douglas Shoal
Sample ID	**EX-7**
Sample Date	12/03/2019
Sampling Depth	15.4 m
Average Sediment Depth	50 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
3	72	25



Location of Sampling	Douglas Shoal
Sample ID	**EX-8**
Sample Date	19/03/2019
Sampling Depth	13.5 m
Average Sediment Depth	80 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<2%)
Coralline Algae Presence	Yes
PSD (%)	
Not tested	

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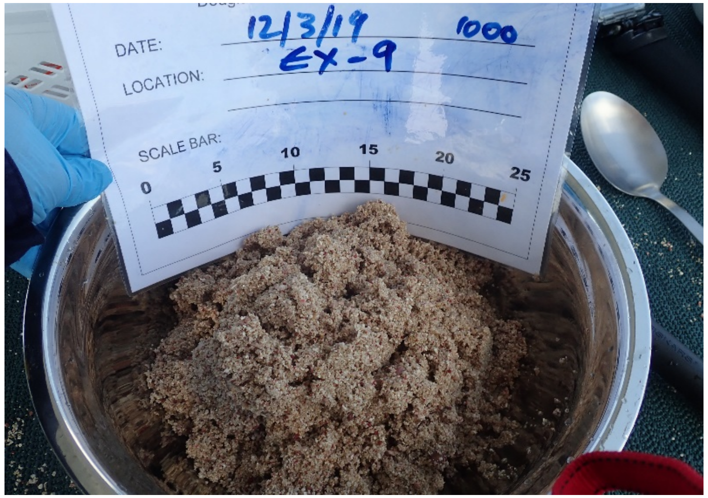
Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	**EX-9**	
Sample Date	12/03/2019	
Sampling Depth	15.5 m	
Average Sediment Depth	25 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
3	85	12



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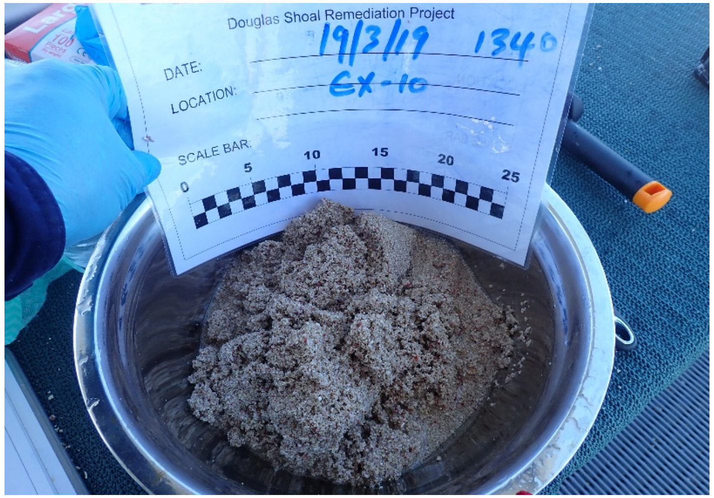
Location of Sampling	Douglas Shoal
Sample ID	**EX-10**
Sample Date	19/03/2019
Sampling Depth	13.5 m
Average Sediment Depth	25 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	S / CS
Coralline Algae Presence	No
PSD (%)	
Not tested	



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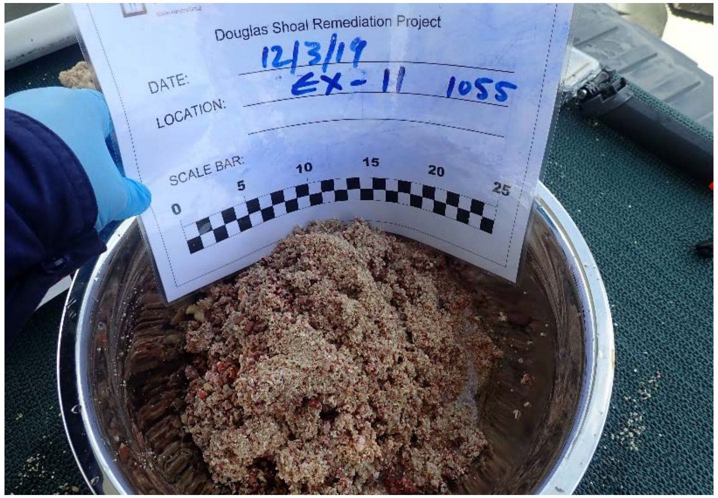
Location of Sampling		Douglas Shoal
Sample ID		**EX-11**
Sample Date		12/03/2019
Sampling Depth		14.9 m
Average Sediment Depth		60 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS / R (<5%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
6	55	39



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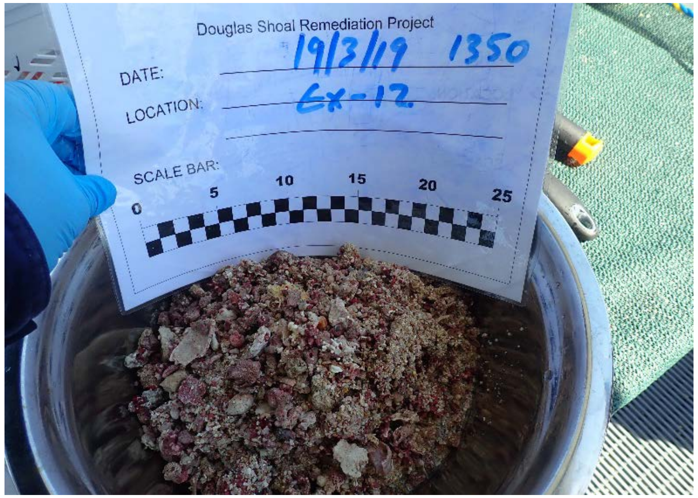
Location of Sampling	Douglas Shoal	
Sample ID	**EX-12**	
Sample Date	19/03/2019	
Sampling Depth	13.5 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<2%)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
2	37	61



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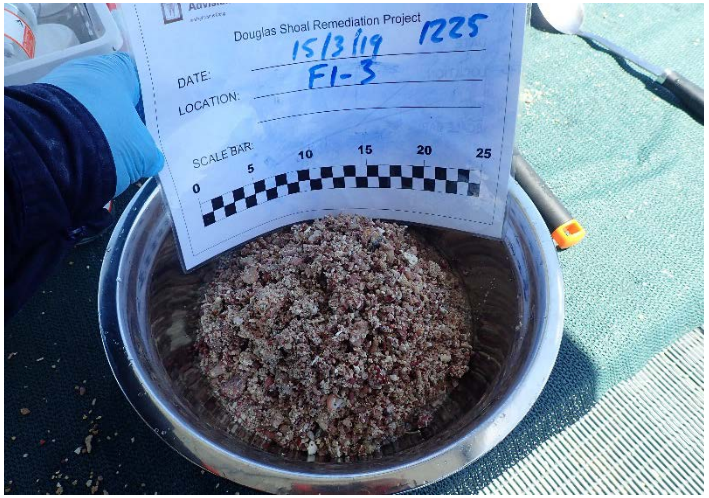
Location of Sampling	Douglas Shoal		
Sample ID	**F1-1**		
Sample Date	11/03/2019		
Sampling Depth	15.6 m		
Average Sediment Depth	95 mm		
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R		
Coralline Algae Presence	Yes		
PSD (%)			
Silt & Clay	Sand	Gravel	
4	25	71	

Location of Sampling	Douglas Shoal	
Sample ID	**F1-3**	
Sample Date	15/03/2019	
Sampling Depth	13.2 m	
Average Sediment Depth	120 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<10%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	37	59



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Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	**F1-5**	
Sample Date	15/03/2019	
Sampling Depth	13.9 m	
Average Sediment Depth	130 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS /R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
8	18	74

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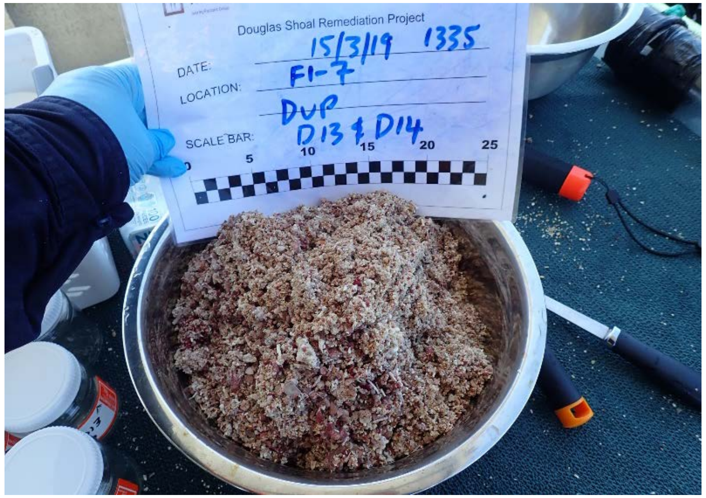
Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	**F1-7 (plus D13 and D14)**	
Sample Date	15/03/2019	
Sampling Depth	14.1 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
2	65	33



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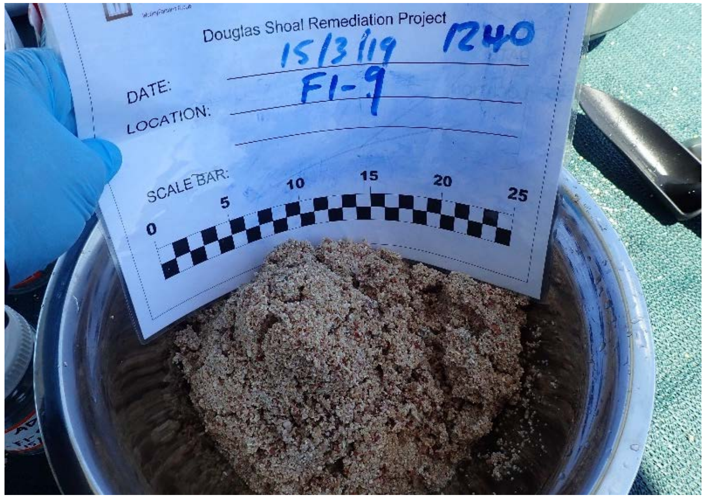
Location of Sampling	Douglas Shoal	
Sample ID	**F1-9**	
Sample Date	15/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	140 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
1	84	15



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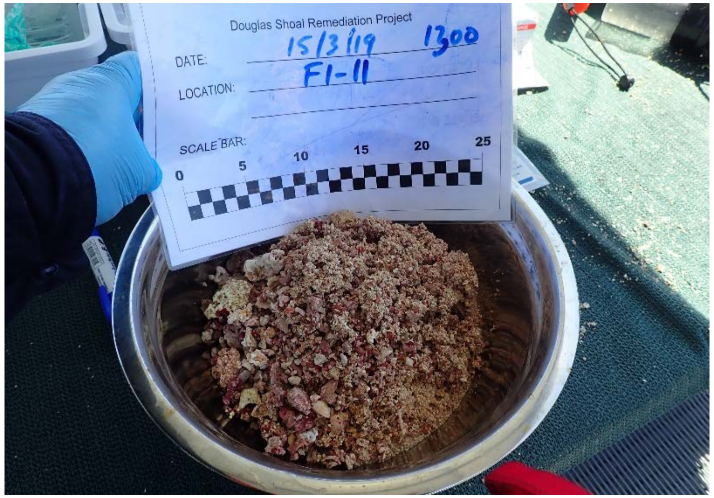
Location of Sampling	Douglas Shoal	
Sample ID	**F1-11**	
Sample Date	15/03/2019	
Sampling Depth	13.4 m	
Average Sediment Depth	70 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	Not recorded	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
10	34	56



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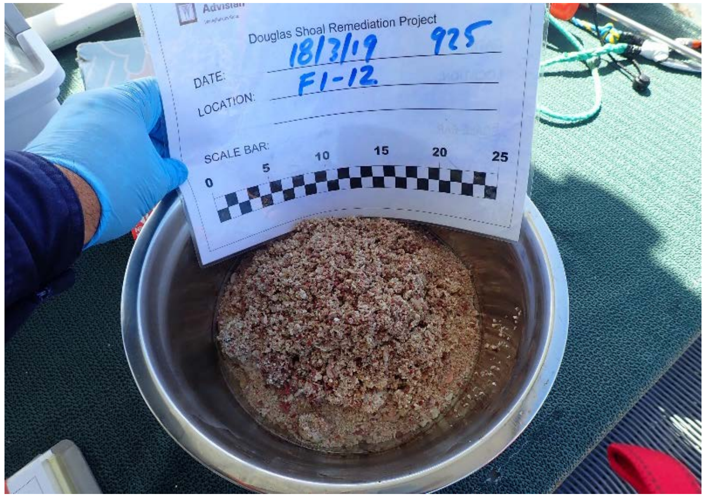
Location of Sampling	Douglas Shoal
Sample ID	**F1-12**
Sample Date	18/03/2019
Sampling Depth	15.4 m
Average Sediment Depth	42 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<1%)
Coralline Algae Presence	No
PSD (%)	
Not tested	



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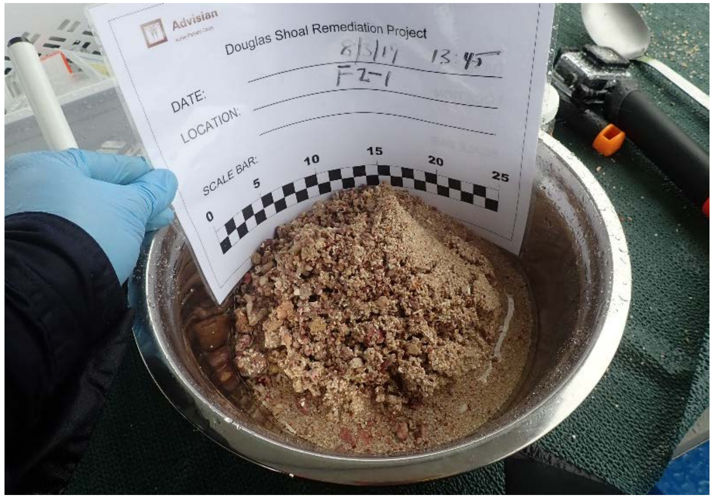
Location of Sampling		Douglas Shoal
Sample ID		**F2-1**
Sample Date		8/03/2019
Sampling Depth		14 m
Average Sediment Depth		22 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS / R (<10%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
17	36	47



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Location of Sampling	Douglas Shoal
Sample ID	**F2-2**
Sample Date	8/03/2019
Sampling Depth	14.2 m
Average Sediment Depth	80 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R / CS
Coralline Algae Presence	No
PSD (%)	
Not tested	

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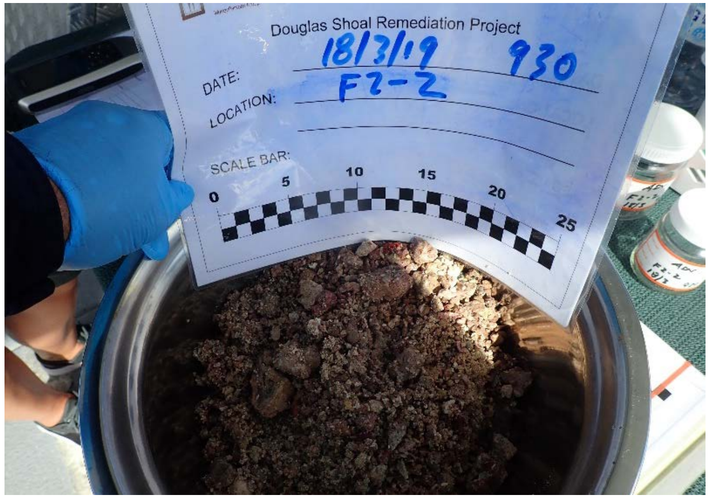
Location of Sampling	Douglas Shoal	
Sample ID	**F2-2a**	
Sample Date	18/03/2019	
Sampling Depth	15.1 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
16	11	73



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Location of Sampling	Douglas Shoal	
Sample ID	**F2-3**	
Sample Date	8/03/2019	
Sampling Depth	13 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
20	26	54

Location of Sampling	Douglas Shoal
Sample ID	**F2-4**
Sample Date	8/02/2019
Sampling Depth	13 m
Average Sediment Depth	84 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R
Coralline Algae Presence	No
PSD (%)	
Not tested	

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Worley Group

Location of Sampling		Douglas Shoal
Sample ID		**F2-5**
Sample Date		8/03/2019
Sampling Depth		14 m
Average Sediment Depth		190 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		CS / R (<5%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
14	32	54

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Worley Group

Location of Sampling		Douglas Shoal
Sample ID		**F2-6**
Sample Date		8/03/2019
Sampling Depth		14 m
Average Sediment Depth		130 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS / R
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
16	41	43

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Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	**F2-7**	
Sample Date	8/03/2019	
Sampling Depth	14 m	
Average Sediment Depth	17 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<10%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
10	57	33

Location of Sampling		Douglas Shoal
Sample ID		**F2-8**
Sample Date		8/03/2019
Sampling Depth		14 m
Average Sediment Depth		26 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		R / CS (<5%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
23	5	72

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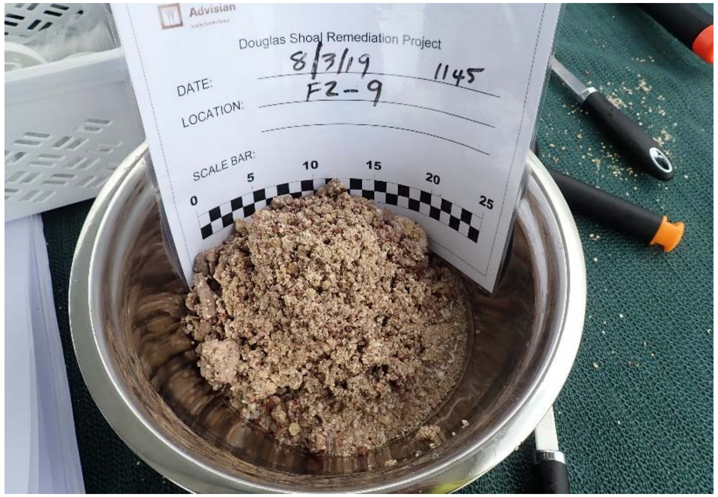
Location of Sampling	Douglas Shoal	
Sample ID	**F2-9**	
Sample Date	8/03/2019	
Sampling Depth	14 m	
Average Sediment Depth	11 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<10%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
10	40	50



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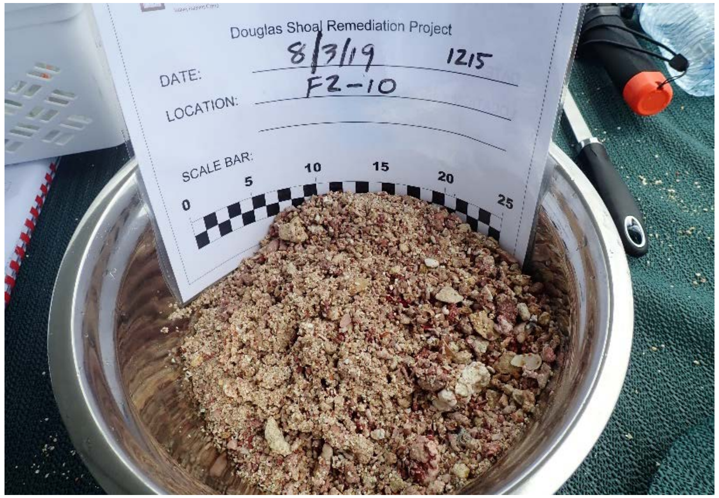
Location of Sampling	Douglas Shoal	
Sample ID	**F2-10**	
Sample Date	8/03/2019	
Sampling Depth	14 m	
Average Sediment Depth	24 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
14	33	53



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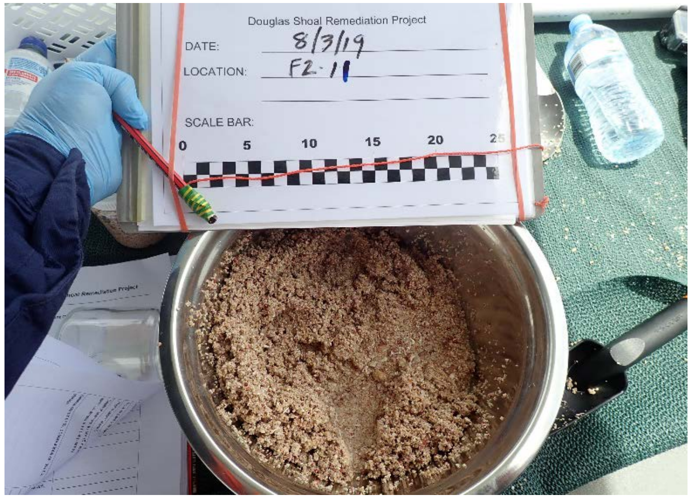
Location of Sampling	Douglas Shoal	
Sample ID	**F2-11**	
Sample Date	8/03/2019	
Sampling Depth	14 m	
Average Sediment Depth	68 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (small) (<5%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
6	66	28



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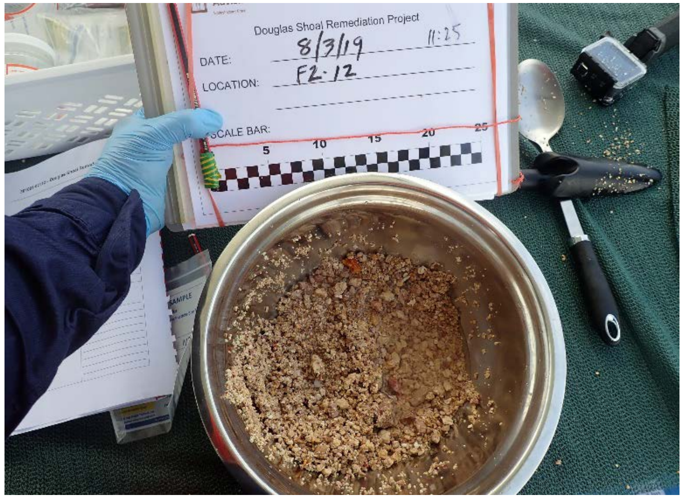
Location of Sampling	Douglas Shoal	
Sample ID	**F2-12**	
Sample Date	8/03/2019	
Sampling Depth	14 m	
Average Sediment Depth	34 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
12	21	67



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Location of Sampling		Douglas Shoal
Sample ID		**F2-13**
Sample Date		18/03/2019
Sampling Depth		12.5 m
Average Sediment Depth		135.7 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		R / CS (<5%)
Coralline Algae Presence		No
PSD (%)		
Silt & Clay	Sand	Gravel
22	10	68

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Worley Group

Location of Sampling	Douglas Shoal	
Sample ID	**F2-14**	
Sample Date	18/03/2019	
Sampling Depth	12.5 m	
Average Sediment Depth	140 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
21	2	77

No image

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Location of Sampling	Douglas Shoal	
Sample ID	**F3-1**	
Sample Date	15/03/2019	
Sampling Depth	15 m	
Average Sediment Depth	90 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	Not recorded	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
5	59	36

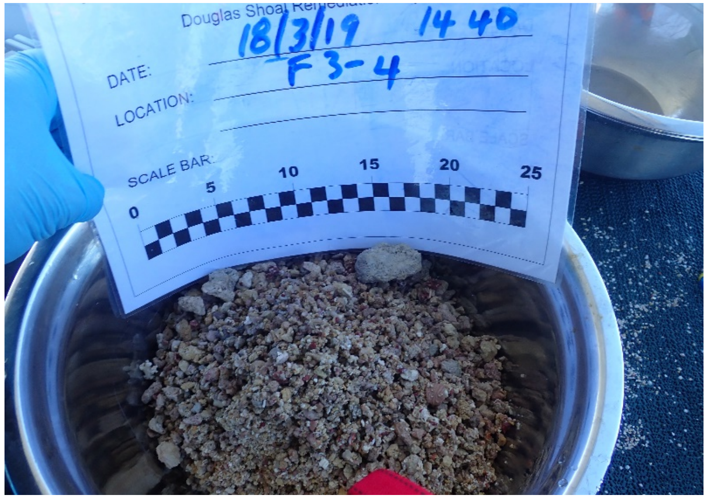
Location of Sampling	Douglas Shoal	
Sample ID	**F3-2**	
Sample Date	18/03/2019	
Sampling Depth	14.5 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<10%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
6	43	51

Location of Sampling	Douglas Shoal	
Sample ID	**F3-3**	
Sample Date	15/03/2019	
Sampling Depth	14.1 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
21	16	63

Location of Sampling	Douglas Shoal
Sample ID	**F3-4**
Sample Date	18/03/2019
Sampling Depth	12.5 m
Average Sediment Depth	120 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	P / R / CS
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
11	18	71



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Location of Sampling	Douglas Shoal	
Sample ID	**F3-5**	
Sample Date	15/03/2019	
Sampling Depth	14.2 m	
Average Sediment Depth	40 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	Not recorded	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
9	13	78

Location of Sampling	Douglas Shoal
Sample ID	**F3-6**
Sample Date	18/03/2019
Sampling Depth	15.1 m
Average Sediment Depth	70 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS (<10%)
Coralline Algae Presence	No

PSD (%)

Silt & Clay	Sand	Gravel
20	10	70

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Location of Sampling	Douglas Shoal	
Sample ID	**F3-7**	
Sample Date	17/03/2019	
Sampling Depth	12.1 m	
Average Sediment Depth	170 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R (small)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
8	17	75

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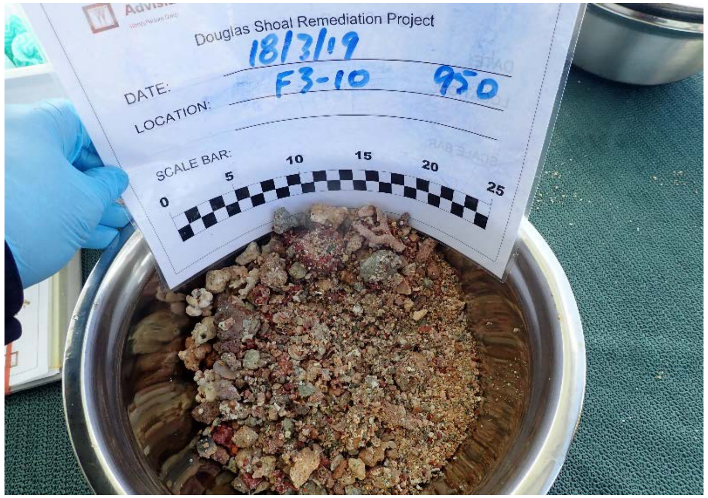
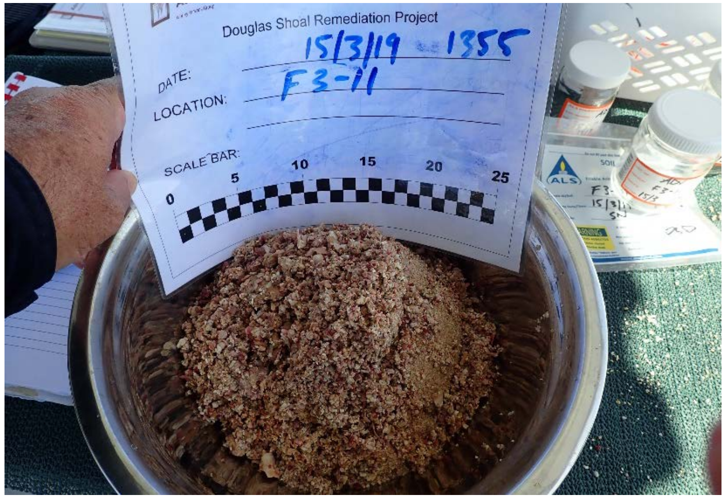
Location of Sampling	Douglas Shoal
Sample ID	**F3-8**
Sample Date	18/03/2019
Sampling Depth	13.8 m
Average Sediment Depth	102 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	R / CS (<2%)
Coralline Algae Presence	No
PSD (%)	
Not tested	

Location of Sampling	Douglas Shoal	
Sample ID	**F3-9**	
Sample Date	15/03/2019	
Sampling Depth	14.1 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
11	27	62

Location of Sampling	Douglas Shoal	
Sample ID	**F3-10**	
Sample Date	18/03/2019	
Sampling Depth	15.5 m	
Average Sediment Depth	90 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<20%)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
14	23	63



Location of Sampling	Douglas Shoal		
Sample ID		**F3-11**	
Sample Date		15/03/2019	
Sampling Depth		14.8 m	
Average Sediment Depth		100 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS	
Coralline Algae Presence		No	
PSD (%)			
Silt & Clay	Sand	Gravel	
6	57	37	



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Location of Sampling	Douglas Shoal	
Sample ID	**FX-1**	
Sample Date	17/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	90 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<2%)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
6	45	49

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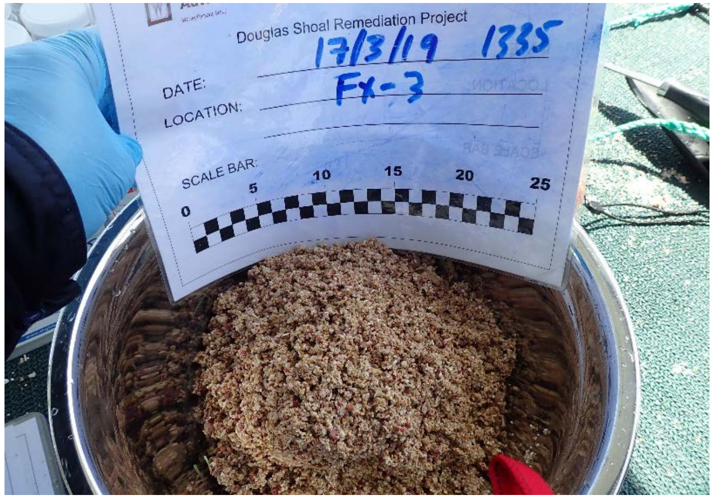
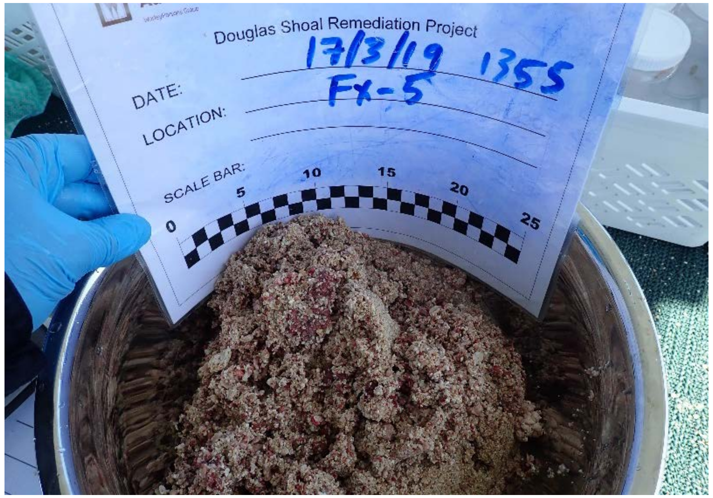
Location of Sampling	Douglas Shoal
Sample ID	**FX-2**
Sample Date	18/03/2019
Sampling Depth	13.5 m
Average Sediment Depth	180 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS
Coralline Algae Presence	No
PSD (%)	
Not tested	

Location of Sampling	Douglas Shoal	
Sample ID	**FX-3**	
Sample Date	17/03/2019	
Sampling Depth	13.5 m	
Average Sediment Depth	180 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<2%)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
6	46	48

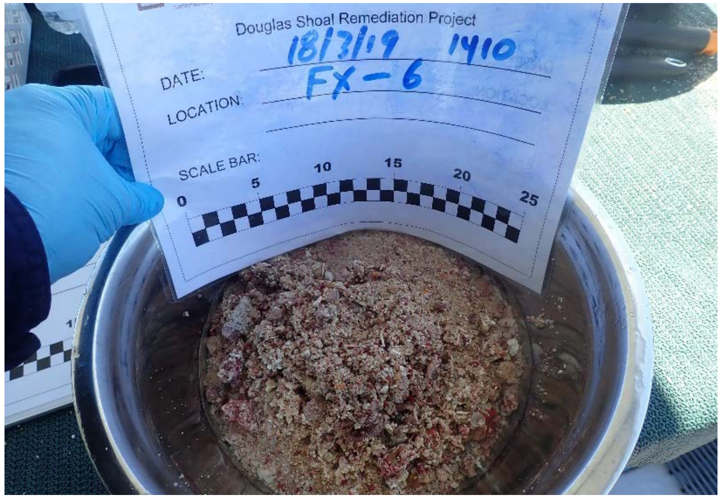


Location of Sampling	Douglas Shoal
Sample ID	**FX-4**
Sample Date	18/03/2019
Sampling Depth	13.4 m
Average Sediment Depth	90 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS
Coralline Algae Presence	Yes
PSD (%)	
Not tested	

Location of Sampling	Douglas Shoal	
Sample ID	**FX-5**	
Sample Date	17/03/2019	
Sampling Depth	14.2 m	
Average Sediment Depth	110 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (<2%)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
5	63	32



Location of Sampling	Douglas Shoal
Sample ID	**FX-6**
Sample Date	18/03/2017
Sampling Depth	13.7 m
Average Sediment Depth	44 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS
Coralline Algae Presence	Yes
PSD (%)	
Not tested	



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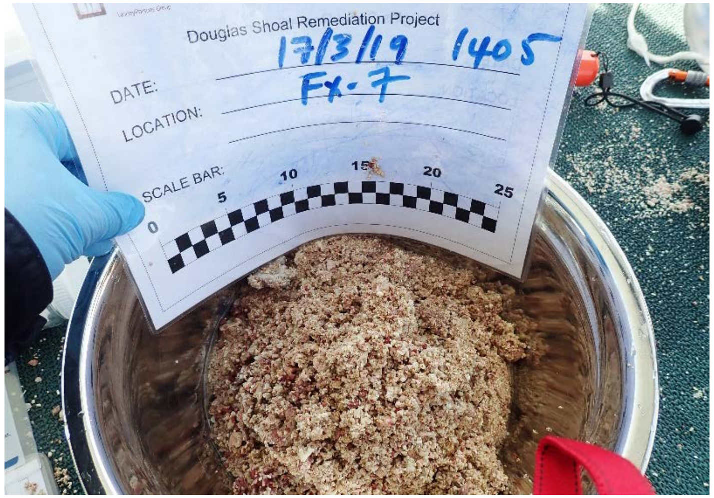
Location of Sampling	Douglas Shoal	
Sample ID	**FX-7**	
Sample Date	17/03/2019	
Sampling Depth	13.2 m	
Average Sediment Depth	45 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
4	58	38



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Location of Sampling		Douglas Shoal
Sample ID		**FX-8**
Sample Date		18/03/2019
Sampling Depth		13.4 m
Average Sediment Depth		88 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**		CS / R (<5%)
Coralline Algae Presence		Yes
PSD (%)		
Silt & Clay	Sand	Gravel
13	27	60

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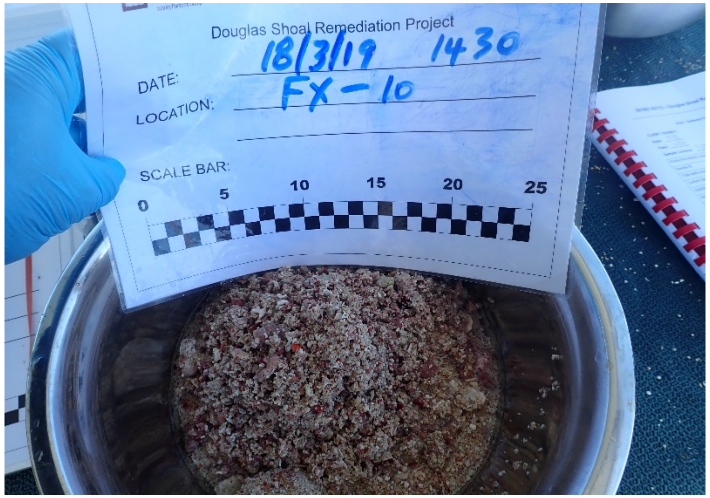
Location of Sampling	Douglas Shoal	
Sample ID	**FX-9**	
Sample Date	17/03/2019	
Sampling Depth	13.5 m	
Average Sediment Depth	110 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
12	35	53

Location of Sampling	Douglas Shoal
Sample ID	**FX-10**
Sample Date	18/03/2019
Sampling Depth	Not recorded
Average Sediment Depth	170 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS
Coralline Algae Presence	No
PSD (%)	
Not tested	



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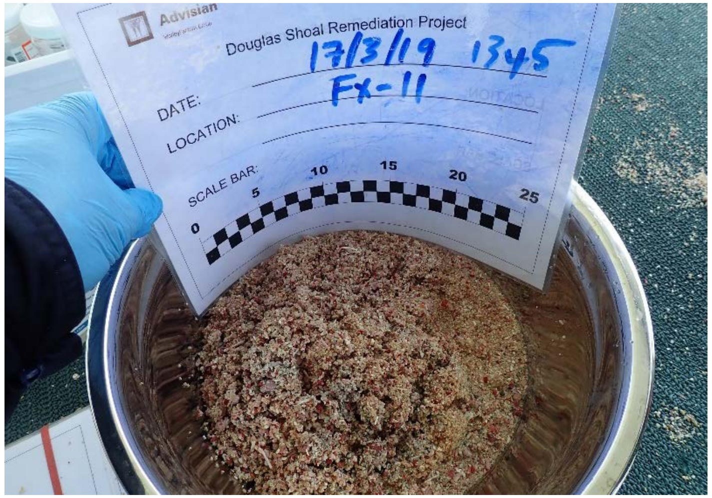
Location of Sampling	Douglas Shoal
Sample ID	**FX-11**
Sample Date	17/03/2019
Sampling Depth	13.8 m
Average Sediment Depth	125 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R
Coralline Algae Presence	Yes

PSD (%)

Silt & Clay	Sand	Gravel
4	69	27



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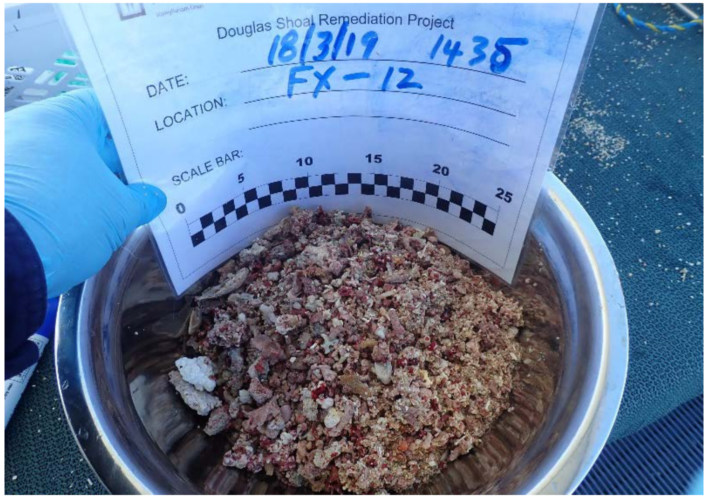
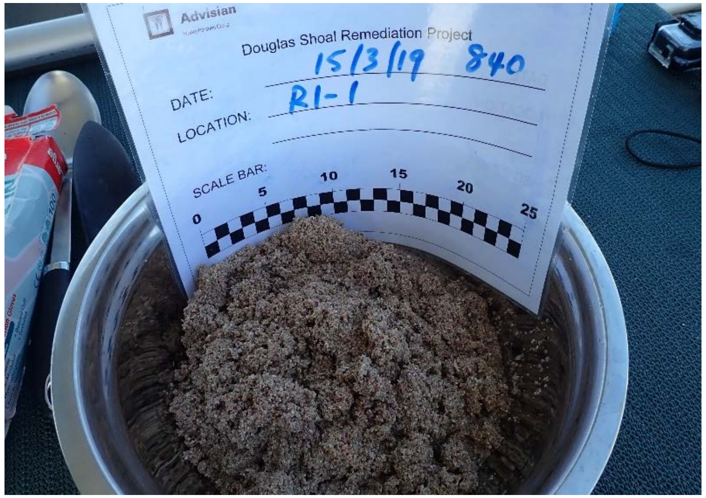
Location of Sampling	Douglas Shoal
Sample ID	**FX-12**
Sample Date	18/03/2019
Sampling Depth	13.5 m
Average Sediment Depth	160 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<5%)
Coralline Algae Presence	Yes
PSD (%)	
Not tested	



Location of Sampling	Douglas Shoal		
Sample ID	**R1-1**		
Sample Date	15/03/2019		
Sampling Depth	13.2 m		
Average Sediment Depth	100 mm		
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	S / CS		
Coralline Algae Presence	No		
PSD (%)			
Silt & Clay	Sand	Gravel	
1	92	7	



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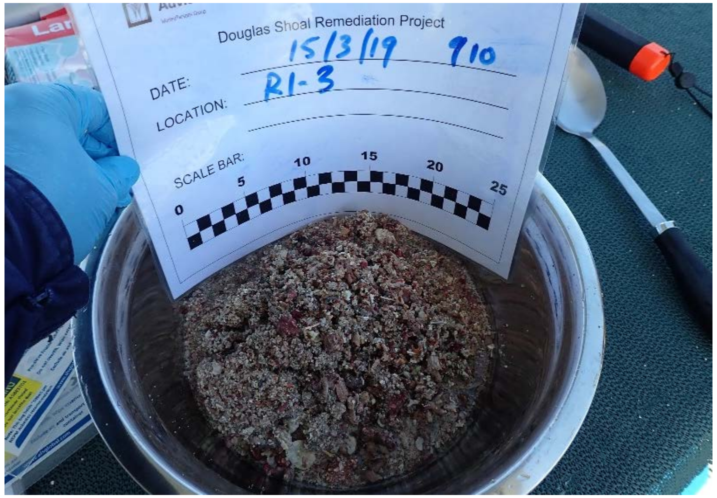
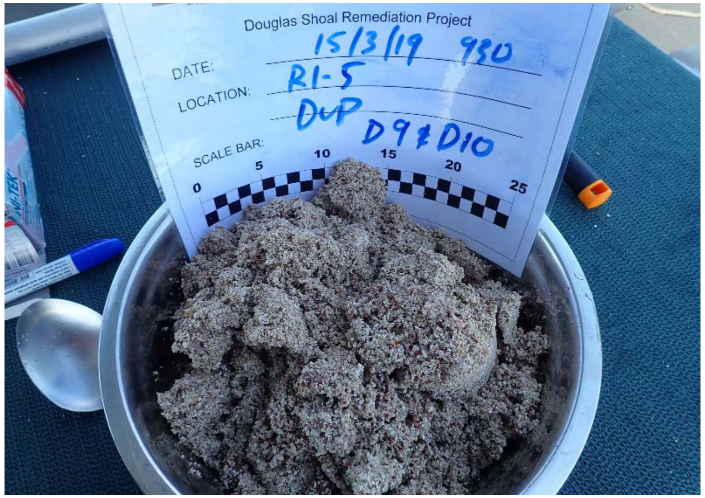
Location of Sampling	Douglas Shoal	
Sample ID	**R1-3**	
Sample Date	15/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	42 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (small)	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	62	34

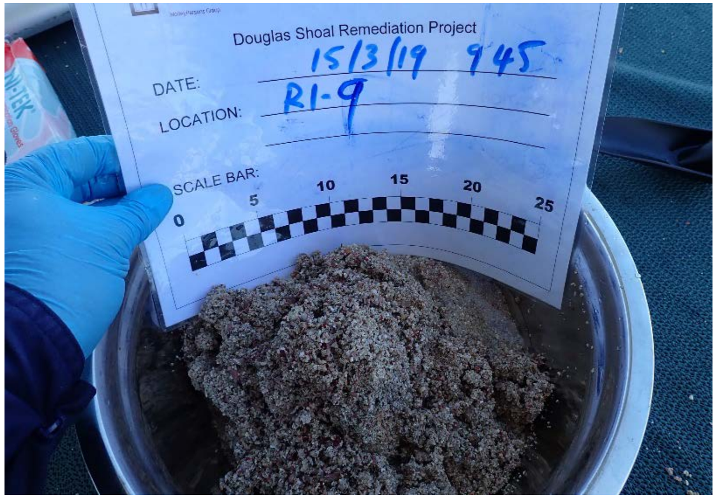


Location of Sampling	Douglas Shoal
Sample ID	**R1-5 (plus D9 and D10)**
Sample Date	15/03/2019
Sampling Depth	13.5 m
Average Sediment Depth	25 mm
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / R (<1%)
Coralline Algae Presence	No
PSD (%)	
Not tested	



Location of Sampling	Douglas Shoal	
Sample ID	**R1-7**	
Sample Date	15/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	150 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
4	60	36

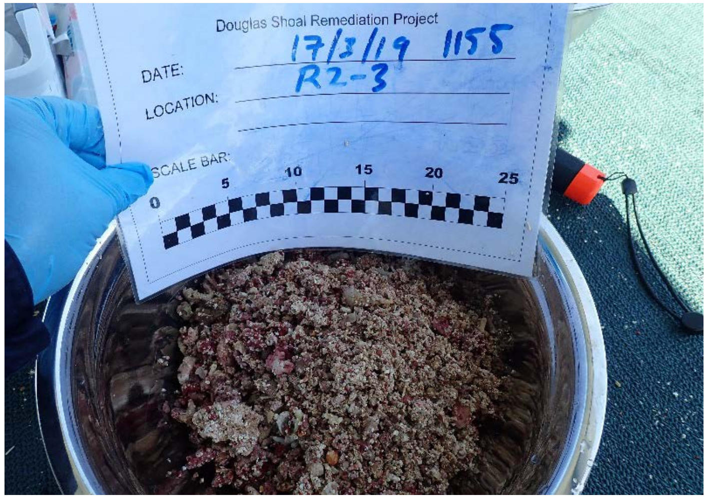
Location of Sampling	Douglas Shoal	
Sample ID	**R1-9**	
Sample Date	15/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
3	78	19



Location of Sampling	Douglas Shoal	
Sample ID	**R1-11**	
Sample Date	15/03/2019	
Sampling Depth	13.8 m	
Average Sediment Depth	75 mm	
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	CS / S	
Coralline Algae Presence	No	
PSD (%)		
Silt & Clay	Sand	Gravel
2	85	13

Location of Sampling	Douglas Shoal		
Sample ID	**R2-1**		
Sample Date	17/03/2019		
Sampling Depth	15.1 m		
Average Sediment Depth	50 mm		
Sediment Type and Percentage **(Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)**	S / CS		
Coralline Algae Presence	Yes		
PSD (%)			
Silt & Clay	Sand	Gravel	
3	77	20	

Location of Sampling	Douglas Shoal	
Sample ID	**R2-3**	
Sample Date	17/03/2019	
Sampling Depth	13.5 m	
Average Sediment Depth	100 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R / CS (<5%)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
14	27	59



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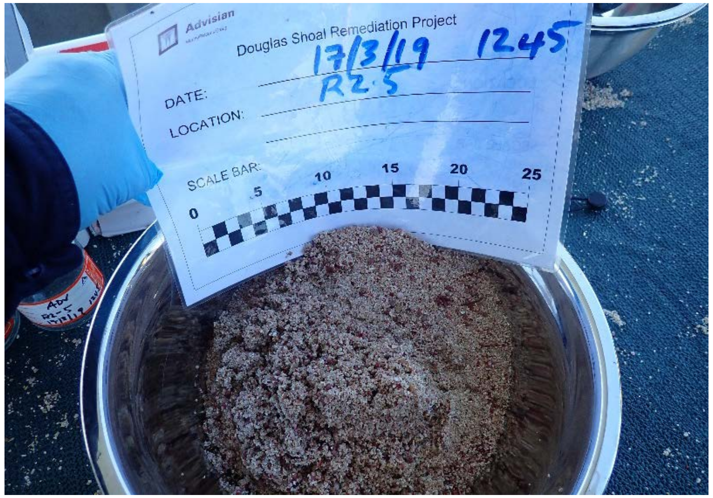
Location of Sampling		Douglas Shoal
Sample ID		**R2-5**
Sample Date		17/03/2019
Sampling Depth		13.5 m
Average Sediment Depth		50 mm
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)		S / CS
Coralline Algae Presence		Yes
PSD (%)		
Silt & Clay	Sand	Gravel
3	78	19



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Location of Sampling	Douglas Shoal	
Sample ID	**R2-7 (T1)**	
Sample Date	17/03/2019	
Sampling Depth	14.2 m	
Average Sediment Depth	65 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
3	84	13

Location of Sampling	Douglas Shoal	
Sample ID	**R2-7 (T2)**	
Sample Date	17/03/2019	
Sampling Depth	14.2 m	
Average Sediment Depth	65 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
2	78	20

Location of Sampling	Douglas Shoal	
Sample ID	**R2-7 (T3)**	
Sample Date	17/03/2019	
Sampling Depth	14.2 m	
Average Sediment Depth	65 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
3	79	18

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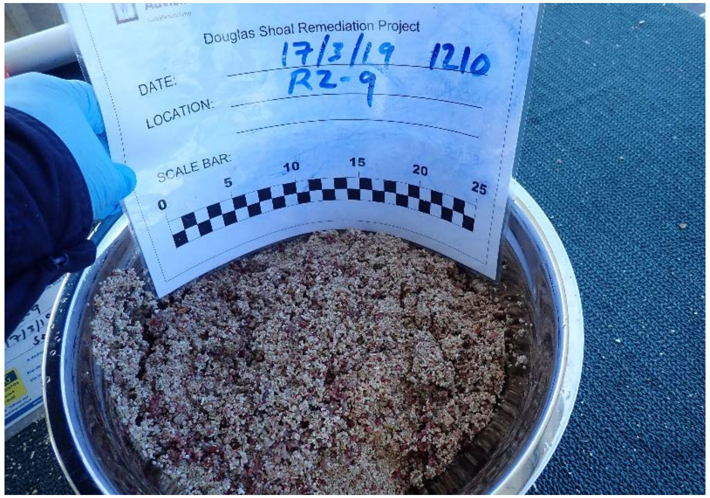
Location of Sampling	Douglas Shoal	
Sample ID	**R2-9**	
Sample Date	17/03/2019	
Sampling Depth	14.8 m	
Average Sediment Depth	50 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	CS / R (small) (<2%)	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
4	60	36



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Location of Sampling	Douglas Shoal	
Sample ID	**R2-11**	
Sample Date	17/03/2019	
Sampling Depth	14 m	
Average Sediment Depth	130 mm	
Sediment Type and Percentage (Fine Sand – FS, Sand – S, Coarse Sand – CS, Rubble – R, Pebble – P)	R / CS	
Coralline Algae Presence	Yes	
PSD (%)		
Silt & Clay	Sand	Gravel
13	27	60