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environment in which
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PORT OF GERALDTON MAINTENANCE DREDGE PROJECT 2021: Baseline Sediment Assessment



Prepared by

Purpose

In accordance with the National Assessment Guidelines for Dredging (NAGD) 2009, MWPA engaged O2 Marine to conduct an assessment of the sediments within the Geraldton commercial harbour and shipping channel. This report provides a summary of the associated field sampling program and investigation of sediments which have accumulated over time. The sediment quality at each site was compared with guidelines values as set out in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018)*.

Linkages

The assessment characterised the following aspects of the sediment:

- Particle Size;
- Presence of Acid Sulfate Soils;
- Metals and Metalloid content; and
- Nutrient levels.

The assessment was a key input to the following studies and plans:

- Beneficial Re-Use Options Assessment;
- Environmental Impact Assessment;
- Dredging and Dredge Plume Hydro-graphic Modelling; and
- Dredged Environmental Management Plans.

Importance

The assessment classified sediments as:

- 'Probably Clean' being channel sediments;
- 'Probably Contaminated' being berth pocket sediments; and
- 'Suspect' sediments which was applied to the remaining harbour sediments.

These classifications then informed MWPA's decisions for managing and placing dredge material to ensure that any contamination was appropriately managed.

Outcomes

The assessment resulted in the following recommendations:

- Harbour sediments were suitable for placement onshore within the Berth 7 Reclamation area, and
- Clean channel sediments were appropriate for beneficial uses such as nearshore placement within the marine environment.

These recommendations were considered in the Beneficial Use Assessment and shaped the design of the maintenance dredge program.

Geraldton Port Baseline Sediment Assessment - 2019-2021

SAP Implementation Report



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WA Marine Pty Ltd t/as O2 Marine

ACN 168 014 819

Originating Office – Southwest

Suite 5, 18 Griffin Drive, Dunsborough WA 6281

T 1300 739 447 | info@o2marine.com.au



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Name	Email Address
Kylie Reynolds	Kylie.reynolds@midwestports.com.au
Caitlin Monti	Caitlin.monti@midwestports.com.au

Executive Summary

The Port of Geraldton is situated on the central coast of Western Australia, approximately 430 km north of Perth. The Port consists of seven bulk loading berths (commercial harbour), tug basin and jetties as well as a fishing boat harbour. Facilities are managed by the Midwest Ports Authority (MWPA) and have been servicing the Midwest as the major seaport of the region since 1840. The Port is responsible for the handling and loading of a range of materials including, but not limited to, a variety of metal ores and concentrates that may contain potential environmental contaminants.

Recent hydrographic surveys undertaken at Geraldton Port indicated ~82,385 m³ of surficial sediment have accumulated within the inner harbour and navigation channel. Accumulated sediments are beginning to reduce available draft and require removal to continue safe navigation for vessels entering, loading and exiting the harbour. The early phase of planning by the MWPA involves investigating options to carry out maintenance dredging works to return the channel and harbour to the original designed depths, thus ensuring the safe navigability and continued use of the Port.

A Sampling and Analysis Plan (SAP, O2M 2019) has been developed in accordance with the National Assessment Guidelines for Dredging (NAGD) 2009. This report provides a summary of the associated field sampling program and investigation of sediments which have accumulated within the harbour and navigational channel. The concentration of potential contaminants in sediments detected at each site were compared to the sediment Default Guidelines Values (DGV), and waters were compared to the water DGVs for the 90%, 95% and 99% Species Protection Levels (SPL) published in ANZG (2018). In accordance with the decision tree framework for applying the DGV values for toxicants in ANZG (2018), further analysis of contaminants that exceed the sediment DGV were compared against background concentrations, and laboratory analysis of elutriate and bioavailable concentrations was conducted. The potential for acid sulphate soils was also assessed using the chromium reducible sulfur suite and compared against the Action Criteria published by the Department of Environmental Regulation (DER 2015). Acid-based accounting (ABA) was applied to determine the residual acid-producing and acid-neutralizing potential of the sediments.

Assessment of the sediments accumulated in within navigable water was divided into three categories in accordance with the NAGD (2009):

1. 'Probably Clean' channel sediments;
2. 'Probably Contaminated' harbour sediments associated with the Berths 3, 4 and 5 pockets based on historical monitoring; and
3. 'Suspect' sediments within the remaining harbour sediments.

In addition, sampling at the proposed Nearshore Material Placement Area (MAP) was also undertaken, though these are anticipated to be clean, and not assigned under the NAGD as they are not being dredged.

Physical Characteristics

'Probably Clean' and Nearshore MPA sediments were characterised by fine-medium grained, yellow to grey or light brown sands of natural origins such as coastal silicate sands transported to the channel via localised northern longshore drift, or marine carbonate sediments transported via oceanic currents

and swell. No contaminants of potential concern (COPC) were identified for Nearshore MPA or probably clean sediments, which is consistent with previous assessments of channel sediments.

'Suspect' and 'Probably Contaminated' sediments occurring within the harbour were typically comprised of consistently finer material than channel sediments with the exception of sites near the channel entrance which were physically similar to those within the channel. The sediments occurring in Berths 3-7 were comprised of slightly coarser material, described as medium/fine silty sands, than the south-eastern corner of the harbour characterised by fine silty sands. Appearance ranged from grey to dark grey and brown throughout the berth pockets and the south-eastern corner.

Metals and Metalloids

Total copper, zinc and mercury at 'Suspect' sediment sites were detected above DGV levels, with the 95% UCL of the mean for copper and zinc exceeding the DGV. Total cadmium, copper, lead and zinc in 'Probably Contaminated' sediment sites were detected above the DGV screening levels, with the 95% UCL of the mean for copper and zinc exceeding the DGV. Terrestrial based ecological and health-based investigation levels were also referenced within this report with the aim of providing a generalised comparison with soil guidelines to consider an option for onshore placement of dredge material. The terrestrial investigation levels indicate contaminants would not exceed soil Environmental Investigation Levels (EILs).

Comparison of total metals to ambient background was undertaken through normalising raw results using aluminum as a normalising element to represent differences in metal concentrations based on particle size between samples for total metals cadmium, copper, lead, iron, manganese, mercury, vanadium and zinc. All metals display a strong linear correlation with aluminum. Normalised 'Suspect' sediments indicated 'Minor' to 'Moderate' enrichment for copper, 'Moderately Severe' to 'Severe' enrichment for zinc and 'No Enrichment' for mercury. Metals manganese, iron and vanadium, with no screening guideline values, recorded 'No Enrichment' to 'Minor'. Normalised 'Probably Contaminated' sediments indicated 'Minor' to 'Moderately Severe' enrichment for cadmium, copper and lead, with 'Severe' to 'Extremely Severe' zinc enrichment. Metals manganese, iron and vanadium, with no screening guideline values, recorded 'No Enrichment' to 'Minor'.

Except for mercury, all samples of total metals that exceeded DGV screening levels were tested using elutriate (dissolved metals) and bioavailable (dilute acid extraction) techniques. Dissolved metal concentrations from 'Suspect' sediments for copper were below the laboratory limit of reporting (LoR) and zinc concentrations from two samples exceed the 90% ecosystem protection guideline. Dissolved metal concentrations from 'Probably Contaminated' sediments for cadmium, copper and lead were below the LoR, with zinc concentrations exceeding the 95% ecosystem protection guideline at one site and 90% at two sites. The dilute acid extraction (DAE) assessment returned results below the LoR for all cadmium and lead samples, whilst copper was only detected at two sites. Zinc ranged between 2-8 mg/kg for all sites within the harbour. All DAE test results were below DGV levels and recorded levels considered acceptable for ocean placement or onshore placement/reuse.

Tributyltin

Tributyltin (TBT) was assessed for all 'Suspect' sites and three 'Probably Contaminated' sites. TBTs normalised to 1% total organic carbon are below the SQG of 9.0 µgSn/kg at all 'Suspect' sites, while the 95% UCL of the means and two sites from the 'Probably Contaminated' sites exceed this level.

Subsequent assessment undertaken on three samples from the 'Probably Contaminated' sites CH4, CH5 and CH6 were analysed for elutriate TBTs. All results were reported below the laboratory LoR and the 95% recommended for moderately disturbed ecosystems (ANZG 2018).

Nutrients

Nutrients were analysed from all 'Probably Contaminated' inner harbour locations and Berth 6 within the 'Suspect' area. The results from this investigation were comparable with historical investigations. Total nitrogen concentrations were typically highest at Berths 3, 4 and 6, with total phosphorous highest at Berth 3 which is commensurate with handling activities for import and export of fertilisers which occurs at these Berths. Nitrogen and phosphorous concentrations and spatial distribution results are comparable with historical investigations. Nitrogen within sediments were identified as almost entirely in organic forms, with no detections of nitrite/nitrate above LoRs.

Nitrogen and phosphorous concentrations within porewater are considerably lower than sediment concentrations, however all detections exceeded the DGV applied. However, the DGV applied is not considered appropriate for a modified Port environment, rather being applicable to natural to slightly disturbed environments. These results are comparable with hierarchical investigations, whilst also being within the range of existing groundwater concentrations measured at the Berth 7 reclamation area.

The proportionately lower results for inorganic nitrogen and reactive phosphorous in porewater compared to organic nitrogen forms and total phosphorous in sediments identify nutrients within the marine environment occurring in particulate forms, rather than dissolved forms which are likely explained by import and export of fertilisers across these berths. Furthermore, this demonstrates that either the breakdown of particulate nutrients are occurring slowly within the sediments, or dilution factors are sufficiently large, so that porewaters concentrations, and therefore likely the water column concentrations, are considerably lower.

Based upon the nutrient flux study conducted at the Berth 7 reclaim which determined that existing soil and groundwater nutrients are not impacting marine environmental quality, it is highly unlikely that the relocation of inner harbour sediments into the reclaim will have any adverse impacts on marine environmental quality.

Acid sulfate soils

Acid Sulfate Soil (ASS) Action level criteria were exceeded at all inner harbour sites and at one 'Probably Clean' site. Acid based accounting results indicate that the potential acidity of these sediments are effectively buffered from the acid neutralising capacity (ANC), and therefore there would be a negative net acidity following disturbance of these sediments. However, as the DER (2015) action criteria was exceeded an Acid Sulfate Soils Management Plan will need to be developed, submitted and approved by the Department of Water and Environmental Regulation (DWER) during the environmental referral process.

Based upon this assessment dredge material placement options MWPA may consider include:

- > Beneficial re-use for sustainable relocation for coastal erosion management
 - Channel sediments only
- > Placement within the Berth 7 reclaim pond

- All dredge material
- > Sea Dumping
 - All dredge material – management consideration required for elutriate TBTs from ‘Probably Contaminated’ sediments due to insufficient data to assess impacts for 99% SPL required at sea dumping locations.

Acronyms and Abbreviations

Acronyms/Abbreviation	Description
°C	Degrees Celsius
ADAS	Australian Diver Accreditation Scheme
Ag	Silver
Al	Aluminium
As	Arsenic
ASS	Acid Sulphate Soils
AS/NZS	Australian Standard / New Zealand Standard
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
Cd	Cadmium
CGG	City of Greater Geraldton
cm	Centimeter
CoC	Chain of Custody
Cu	Copper
EIL	Ecological Investigation Levels
FBH	Fishing Boat Harbour
Fe	Iron
FRP	Filterable reactive phosphorous
g	Grams
GPS	Global Positioning System
Hg	Mercury
HIL	Health Investigation Levels
HSE	Health, Safety and Environment
ID	Identification
DGV	Default Guideline Value
JSEA	Job Safety and Environmental Analysis
km	Kilometers
KML	Karara Mining Limited
L	Litres
m	Meters
m ²	Square meters
m ³	Cubic meters
Mg	Magnesium
mg/kg	Milligrams per kilogram
Mn	Manganese
MWPA	Midwest Ports Authority
NO _x	Nitrite/Nitrate combined
NAGD	National Assessment Guidelines for Dredging 2009
NATA	National Association of Testing Authorities
Ni	Nickel

Acronyms/Abbreviation	Description
O2M	O2 Marine
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PEP	Port Enhancement Project
PSD	Particle Size Distribution
PVC	Polyvinyl chloride
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SCR	Inorganic Sulphur Content
TBT	Tributyltin
TKN	Total kjedahl nitrogen
TN	Total nitrogen
TOC	Total Organic Carbon
TP	Total phosphorous
TRH	Total Recoverable Hydrocarbons
UCL	Upper Confidence Limit
µg/L	Micrograms per Litre
V	Vanadium
QA/QC	Quality Assurance and Quality Control
Zn	Zinc

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1. Introduction

1.1. Project Location

The Port of Geraldton is located approximately 430 km north of Perth in the Mid-West region of Western Australia (**Figure 1-1**). The Port is administered by the Midwest Ports Authority (MWPA) and presently consists of a shipping channel, a seven berth Commercial Harbour (CH), a large fishing boat harbour (FBH), a tug pen and associated land-based infrastructure. The layout of Geraldton Port has undergone many alterations over the years including moving from its primary location and timber jetty to a single concrete reinforced berth (now referred to as Berth 1), to its current seven berth configuration (**Figure 1-1**). The town of Geraldton has grown around the Port and the shelter of Point Moore, with other major industries of the region including farming and fishing. The waters around Geraldton are one of the State's major western rock lobster fishing grounds and support some 150 fishing vessels each year.



Figure 1-1 Location and Layout of Geraldton Port

1.2. Project Description

Recent hydrographic surveys undertaken at Geraldton Port have indicated that since the completion of the 2012 maintenance dredging campaign, ~82,385 m³ of surficial sediment has accumulated within the inner harbour (~13,451 m³) and navigation channel (~70,634 m³).

The most recent hydrographic survey undertaken during February and March 2021 indicate sedimentation occurring in several locations within the inner harbour and navigation channel. Accumulated sediments are beginning to reduce available draft clearance and will require removal to continue safe navigation for vessels entering, loading and exiting the harbour. **Figure 1-2** and **Figure 1-3** displays the spatial extent of sediment accumulation with **Table 1-1** presenting the associated areas of each distinct zone and estimated sedimentation volumes for each.

The majority of channel sedimentation has accumulated along the western edge between Beacons 13 and 19, with smaller amounts also occurring between Beacons 9 and 11 (southern side of the bend) and Beacons 20 to 22 (eastern side of channel entrance). Within the harbour, sedimentation typically occurs within berth pockets from Berth 3 to Berth 7, along the eastern breakwater from the slipway to the channel entrance, with shoaling north of Berth 1/2 and east of Berth 6.

The Midwest Ports Authority (MWPA) is entering into an early phase of planning, which includes investigating options to carry out maintenance dredging works to return the channel and harbour to the original design depths, thus ensuring the safe navigability and continued use of the Port.

Table 1-1 Identified zones of sediment accumulation, the area and total estimated sediment volume above design.

Zone	Area (m ²)	Volume above Design (m ³)	Lower Forecast Dredge Volume	Upper Forecast Dredge Volume
Channel (12.8m)	61,861	1,299	5,040	6,183
Channel (13.1m)	39,932	7,127	11,435	12,690
Channel (13.5m)	208,161	48,997	79,263	88,196
Channel (14.0m)	628,427	13,211	45,870	56,271
Siltation Allowance	-	-	14,865	22,820
Chanell Total	-	70,634	156,472	186,161
Turning Basin	303,964	5,718	14,018	21,928
Berth 1/2	10,595	0	-	-
Berth 3	10,230	1,700	3,043	4,542
Berth 4	9,742	1,548	2,384	3,521
Berth 5	10,066	1,856	2,740	4,065
Berth 6	9,615	1,128	2,538	3,819
Berth 7	15,317	1,501	3,000	4,422
Siltation Allowance	-	-	3,340	7,080
Inner Harbour Total	-	13,451	31,063	49,378
Project Total	1,424,612	82,385	187,535	235,539

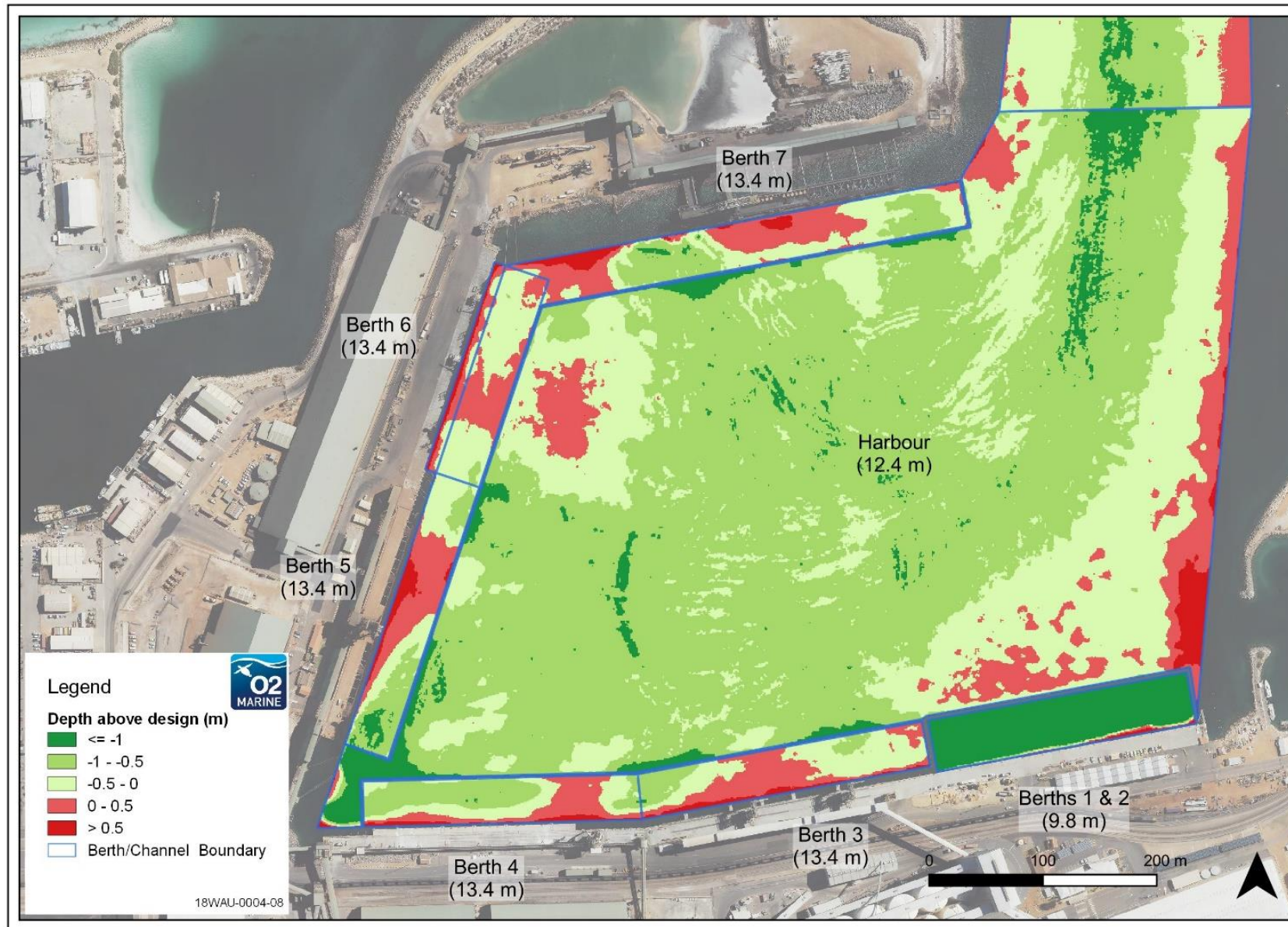


Figure 1-2 Spatial extent of sediment accumulation within the Inner Harbour



Figure 1-3 Spatial extent of sediment accumulation within the Navigation Channel

1.3. Scope

The MWPA require an assessment of the potential impacts of proposed dredge material loading and placement activities in accordance with relevant guidelines to support project planning and environmental approvals. O2 Marine (O2M) developed a sediment baseline characterisation Sampling and Analysis Plan (the SAP) (O2M 2019) in accordance with the National Assessment Guidelines for Dredging (NAGD 2009) for the proposed dredging and placement activities at Geraldton Port. The SAP details the dredging proposal (volumes and areas), then sets out the study objectives and the proposed sampling, analysis and quality assurance/quality control procedures required to adequately characterise the sediments to be dredged. This scope entails implementation of the SAP and development of a report detailing the sampling and analysis carried out, as well as presentation and assessment of the results.

1.4. Objectives

The broad objective is to implement the requirements of the SAP to assess, characterise and provide sediment quality data to inform the suitability, acceptability or unacceptability of material placement options to advise environmental planning and approvals for future dredging activities. This document details the specific methodology undertaken, presents the data collected, provides an assessment of the results against relevant industry guidelines and provides recommendations for dredge material placement options.

Specific objectives of this document are as follows:

- > Outline the sampling program carried out with detail on the number, type and location of samples collected (including replicates and QA samples);
- > Detail field logs and descriptions of sediments and any problems encountered or deviations from the procedures set out in the SAP (including justifications for deviations);
- > Presentation and review of the results, including QA/QC assessment of both field and laboratory data, comparison to data quality objectives, and data validation;
- > Assessment of the results in accordance with NAGD (2009);

2. Sampling and Analysis Methods

The sampling and analysis methods are described in detail in the SAP (O2M 2019).

2.1. Field Sampling

Field investigations to implement the SAP were undertaken by three qualified Marine Scientists between 16-18 June 2019. All 28 nominated sample locations (14 channel and 14 harbour) were sampled in accordance with the SAP. However, core refusal occurred at a depth of <0.5 m at sites NC2, NC3, NC4, NC5, NC6 and NC7, which were all nominated for two sampling horizons (<0.5, 0.5-1 m) in the SAP with the objective to assess samples to the full depth of dredging. This resulted in a total of 31 samples as opposed to 37 identified in the SAP.

A subsequent sampling program was conducted in parallel with the annual compliance sediment sampling program between 18-20 February 2020, 23 and 24 March 2021 and 12 May 2021. These subsequent investigations were required to supplement the preliminary investigations including:

- > Inclusion of additional sample sites for increased dredge volumes estimates;
- > Assessment of elutriate TBT at 'Probably Contaminated' sites CH1, CH4, and CH6;
- > Assessment of nutrients at 'Probably Contaminated' sites within the shipping pockets at Berths 3- 6; and
- > Assessment of sediments at the proposed Nearshore Material Placement Area (MPA).

The date, coordinates, sample depth (proposed and actual) and proposed dredge depth of the sediment sampling locations nominated from the SAP are presented in **Table 2-1** and displayed in **Figure 2-1**.

Sample locations presented within the SAP for the Nearshore MPA were preliminary and the final locations were collected from the sites presented within **Figure 2-2** and **Table 2-1**



Figure 2-1 Final site locations sampled during the SAP implementation program for the Chanell and Inner Harbour2019.



Figure 2-2 Final site locations sampled during the SAP implementation program for the Nearshore MPA

Table 2-1 Sample location details from the 2019 SAP implementation program including coordinates, nominated and actual sampling depths, and laboratory analysis. Sites denoted with an asterisk (*) identify sites shared with the routine compliance monitoring program.

Site	Easting	Northing	Approx Dredge Depth (m)	Proposed Sample Depth (m)	Core Refusal Depth (m)	Date (s)
Probably Clean Sediments						
NC1	265846.5	6815204.3	0.3	0-0.5	-	17-Jun 2019
NC2	265658.7	6815445.8	1.0	0-0.5 0.5-1.0	0.4	17-Jun 2019
NC3	265680.5	6815565.3	0.79	0-0.5 0.5-1.0	0.4	17-Jun 2019
NC4	265681.8	6815650.9	0.76	0-0.5 0.5-1.0	0.4	17-Jun 2019
NC5	265655.5	6815763.8	1.0	0-0.5 0.5-1.0	0.5	17-Jun 2019
NC6	265638.5	6815918.4	0.96	0-0.5 0.5-1.0	0.4	16-Jun 2019
NC7	265621.4	6815978.8	0.78	0-0.5 0.5-1.0	0.5	16-Jun 2019
NC8	265581.6	6816178.1	0.43	0-0.5	-	16-Jun 2019
NC9	265561.0	6816204.9	0.52	0-0.5	-	16-Jun 2019
NC10	265390.4	6816450.5	0.51	0-0.5	-	16-Jun 2019
NC11	265356.6	6816498.7	0.34	0-0.5	-	16-Jun 2019
NC12	264702.2	6816880.9	0.25	0-0.5	-	16-Jun 2019
NC13	264679.3	6816898.3	0.28	0-0.5	-	16-Jun 2019
NC14	264581.7	6816902.8	0.51	0-0.5	-	16-Jun 2019
NC15	264728.2	6817096.6	0.34	0-0.5	-	24-Mar 2021
NC16	265328.4	6816817.2	0.44	0-0.5	-	24-Mar 2021
NC17	265547.8	6816563.1	0.46	0-0.5	-	24-Mar 2021
NC18	265593.1	6816091.3	0.76	0-0.5 0.5-1.0	0.5	24-Mar 2021
NC19	265655.3	6815863.7	0.81	0-0.5 0.5-1.0	0.5	24-Mar 2021
Suspect Sediments						
CH7*	265172.7	6814768.3	0.23	0-0.5	-	17-Jun 2021 24-Mar 2021
CH8*	265266.3	6814884.6	0.77	0-0.5 0.5-1.0	-	17-Jun 2021 24-Mar 2021
CH10*	265662	6814999	0.21	0-0.5	-	17-Jun 2021
CH11	265629.7	6814973.8	0.19	0-0.5	-	18-Jun 2021
CH12	265252.7	6814754.7	0.66	0-0.5	-	17-Jun 2021

Site	Easting	Northing	Approx Dredge Depth (m)	Proposed Sample Depth (m)	Core Refusal Depth (m)	Date (s)
0.5-1.0						
CH13	265440.4	6814916.7	0.15	0-0.5	-	17-Jun 2021
CH14	265822.7	6814751.5	0.88	0-0.5 0.5-1.0	-	18-Jun 2021
CH15	265805.9	6814580.4	0.17	0-0.5	-	18-Jun 2021
CH16	265692.4	6814534.2	0.24	0-0.5	-	24-May 2021
CH17	265794.8	6814623.5	0.18	0-0.5	-	23-May 2021
CH18	265189.9	6814746.7	0.21	0-0.5	-	23-May 2021
CH19	265241.4	6814871.1	0.32	0-0.5	-	23-May 2021
Probably Contaminated Sediments						
CH1*	265465.0	6814441.0	0.04	0-0.5	-	18-Jun 2019 24-Mar 2021
CH2*	265402.3	6814420.0	0.18	0-0.5	-	18-Jun 2019 24-Mar 2021
CH3*	265271.0	6814425.0	0.03	0-0.5	-	18-Jun 2019 20-Feb 2020 24-Mar 2021
CH4*	265133.0	6814394.0	0.16	0-0.5	-	18-Jun 2019 20-Feb 2020 24-Mar 2021
CH5*	265091.0	6814535.0	0.29	0-0.5	-	17-Jun 2019 24-Mar 2021
CH6*	265123.0	6814630.0	0.39	0-0.5	-	17-Jun 2019 18-Feb 2020 24-Mar 2021
Nearshore Placement Area						
NPA1	265975.7	6819411.6	-	0-0.2	-	12-May 2021
NPA2	266087.3	6819333.0	-	0-0.2	-	12-May 2021
NPA3	266165.9	6819145.4	-	0-0.2	-	12-May 2021
NPA4	265960.6	6818616.1	-	0-0.2	-	12-May 2021
NPA5	266003.5	6818284.8	-	0-0.2	-	12-May 2021

2.1.1. Sample Collection

Sediment samples were collected by Marine Scientists commercially trained in SCUBA in accordance with Australian Standard AS2815.1 and AS2299.2:2002 and the SAP. With the exception of core refusal at several sites described within **Section 2.1**, the sampling process was adhered to at all sampling locations.

Sample collection from the Nearshore MPAs were collected using a sediment grab, collected from each site using the MWPA Vessel 'MV Jorgenson'.

2.1.2. Laboratory Testing

Sediment Samples

Sample storage and transport was undertaken in accordance with the SAP. This included the development of Chain of Custody (CoC) forms which accompanied the samples transported to the NATA-accredited laboratory for analysis. Copies of the CoC are provided in **Appendix A**.

The primary NATA accredited laboratory was Analytical Reference Laboratories (WA) Pty Ltd for total metals, dilute acid extraction metals, total organic carbon (TOC) and the sulfur reducible chromium suite. ARL also subcontracted the following testing:

- MPL Laboratories: elutriate metals, tributyltin (TBT); and
- MicroAnalysis: particle size distribution (PSD).

ALS was the secondary laboratory used for interlaboratory field split analysis.

During subsequent testing conducted in 2020 for elutriate TBTs, ALS was selected as the primary laboratory.

Laboratory analytical reports are presented in the Appendixes as follows:

- > ARL (including subcontracted services) – **Appendix B**
- > ALS – **Appendix C**
- > ALS Elutriate TBTs – **Appendix C**

During subsequent testing conducted in 2020 for elutriate TBTs, ALS was selected as the primary laboratory.

QA/QC Samples

As per the SAP, the following QA/QC samples were collected:

- > Triplicate samples, that is three separate samples taken at the same location, to determine the variability of the sediment physical and chemical characteristics, taken at a minimum of three (3) sites; and
- > Field split samples, that is three samples taken from a thoroughly mixed and homogenised sample with one sample sent to a secondary laboratory to assess inter-laboratory variation, collected from a minimum of two sites.

During implementation the following QA/QC samples were collected as per the NAGD (**Table 2-1**):

- > Four triplicate samples were collected from:
 - CH1;
 - CH5;
 - CH10; and
 - NC17.

- > Three field split samples were collected from:
 - CH2;
 - CH3; and
 - CH8.

All QA/QC samples were taken from the 0-0.5 m layer.

A sampling error for TOC and TBT resulted in only two split samples, rather than three, collected for the field splits with one sample analysed by each laboratory. No QA/QC samples were collected for chromium suite analysis.

Laboratory QA/QC

The analytical procedures are presented within laboratory QA/QC reports included within **Appendix D**.

Analytical Suite

Sediment samples were analysed in accordance with the SAP.

A full summary of the sediment samples that were analysed and preserved is provided in **Table 2-2**.

Table 2-2 Analysed analytical suite for each site and sample layer. C means collected and analysed, P collected and preserved, and N proposed but not collected.

Site	Proposed Sample Depth (m)	Core Refusal Depth (m)	Total Metals	Elutriate Metals	DAE Metals	TOC TBT	PSD	ASS	Elutriate TBT	Field Triplicate	Field Split
Probably Clean – Channel											
NC1	0-0.5	-	C	-	-	-	C	C	-	-	-
NC2	0-0.5	0.4	P	-	-	-	P	P	-	-	-
	0.5-1.0		N				N	N			
NC3	0-0.5	0.4	C	-	-	-	C	C	-	-	-
	0.5-1.0		N				N	N			
NC4	0-0.5	0.4	P	-	-	-	P	P	-	-	-
	0.5-1.0		N				N	N			
NC5	0-0.5	0.5	C	-	-	-	C	C	-	-	-
	0.5-1.0		N				N	N			
NC6	0-0.5	0.4	P	-	-	-	P	P	-	-	-
	0.5-1.0		N				N	N			
NC7	0-0.5	0.5	C	-	-	-	C	C	-	-	-
	0.5-1.0		N				N	N			
NC8	0-0.5	-	P	-	-	-	P	P	-	-	-
NC9	0-0.5	-	C	-	-	-	C	C	-	-	-
NC10	0-0.5	-	P	-	-	-	P	P	-	-	-
NC11	0-0.5	-	C	-	-	-	C	C	-	-	-
NC12	0-0.5	-	P	-	-	-	P	P	-	-	-
NC13	0-0.5	-	C	-	-	-	C	C	-	-	-
NC14	0-0.5	-	P	-	-	-	P	P	-	-	-
NC15	0-0.5	-	P	-	-	-	P	P	-	-	-
NC16	0-0.5	-	P	-	-	-	P	P	-	-	-
NC17	0-0.5	-	C	-	-	-	C	P	-	C ³	-

Site	Proposed Sample Depth (m)	Core Refusal Depth (m)	Total Metals	Elutriate Metals	DAE Metals	TOC TBT	PSD	ASS	Elutriate TBT	Field Triplicate	Field Split
NC18	0-0.5 0.5-1.0	0.5	C	-	-	-	C	P	-	-	-
NC19	0-0.5 0.5-1.0	0.45	C	-	-	-	C	P	-	-	-
Suspect – Inner Harbour											
CH7	0-0.5	-	C	C	C			C	-	-	-
CH8-S	0-0.5	-	C	C	C	C	C	C	-	-	C ²
CH8-D	0.5-1.0			P	P	C	C	C			
CH10	0-0.5	-	C	Composite 1	Composite 1			C	-	C ³	-
CH11	0-0.5	-	C			C	C	C	-	-	-
CH12-S	0-0.5	-	C			C	C	C	-	-	-
CH12-D	0.5-1.0		C			C	C	C			
CH13	0-0.5	-	C	Composite 2	Composite 2	C	C	C	-	-	-
CH14-S	0-0.5	-	C			C	C	C	-	-	-
CH14-D	0.5-1.0		C			C	C	C			
CH15	0-0.5	-	C			C	C	C	-	-	-
CH16	0-0.5	-	C	-	-	C	C	-	-	-	-
CH17	0-0.5	-	C	-	-	C	C	-	-	-	-
CH18	0-0.5	-	C	-	-	C	C	-	-	-	-
CH19	0-0.5	-	C	-	-	C	C	-	-	-	-
Probably Contaminated – Inner Harbour											
CH1	0-0.5	-	C	C	C	C	C	C	-	C ³	-
CH2	0-0.5	-	C	C	C		C	C	-	-	C ²
CH3	0-0.5	-	C	C	C	C	C	C	-	-	C ²
CH4	0-0.5	-	C	C	C		C	C	C	-	-
CH5	0-0.5	-	C	C	C	C	C	C	C	C ³	-

Site	Proposed Sample Depth (m)	Core Refusal Depth (m)	Total Metals	Elutriate Metals	DAE Metals	TOC TBT	PSD	ASS	Elutriate TBT	Field Triplicate	Field Split
CH6	0-0.5	-	C	C	C	C	C	C	C	-	-
Nearshore Material Placement Area											
NPA1	0-0.2	-	C	-	-	C	C	-	-	C ³	-
NPA2	0-0.2	-	C	-	-	C	C	-	-	-	-
NPA3	0-0.2	-	C	-	-	C	C	-	-	-	C ²
NPA4	0-0.2	-	C	-	-	C	C	-	-	-	-
NPA5	0-0.2	-	C	-	-	C	C	-	-	-	-

2.2. Sediment Data Assessment

Sediment data assessment was undertaken in accordance with the SAP with the following described deviations.

2.2.1. Pooled Data Sets

The SAP recommended that data from the 0-0.5 m and 0.5-1.0 m layers be assessed against screening levels separately for the 'Probably Clean' and 'suspect' sample sites. However, the implementation program differed from the SAP in the following manner:

- > No 0.5-1.0 m samples were collected from 'Probably Clean' sites due to core refusal occurring before 0.5 m. Therefore only 0-0.5 m samples were collected; and
- > Three samples were collected as proposed within the SAP from 'Suspect' sample sites from the 0.5-1.0 m horizon. Due to the low number it was considered that these three samples should be pooled with the 0.0-0.5 m horizon samples for the purposes of assessment.

2.2.2. Elutriate and Bioavailability Assessment

In this investigation elutriate and bioavailability tests were conducted for each metal and TBT, from each sample that exceeded screening levels. For 'Suspect' sediments, metals tests were undertaken from both samples CH7 and CH8-S, along with two composite samples, incorporating homogenised sediments from the following sites under laboratory conditions:

1. CH10, CH11, CH12-S and CH12-D.
2. CH13, CH14-S, CH14-D and CH15.

These composite samples were grouped according to their CH locations and associated PSD characteristics as described in **Section 3.1.1**.

This regime of testing for elutriate metals is consistent and above minimum requirements stipulated within the NAGD (2009), whilst taking into consideration the nature of the dredge sediments which are not entirely uniform, or consistent (i.e. within one discreet location particularly 'Suspect' dredge sediments).

2.2.3. Nutrient analysis

The current ANZG (2018) guideline does not include updated investigation levels for nutrients in marine water. Therefore, the ANZECC/ARMCANZ (2000) default trigger values physical and chemical stressors for South-west Australia for Marine (inshore) have been used as a guide to assess sediment nutrient concentrations for porewater. No guidelines are applicable to sediment concentrations as there are no established guidelines for terrestrial soil (i.e. NEPM and DEC environmental investigation levels).

3. Results

3.1. Sediment Properties

3.1.1. Field Observations

Probably Clean Sediments - Navigation Channel

A summary of the sediment characteristics of the samples collected from the channel 'Probably Clean' sites is presented in **Appendix E**. Channel sediments are quite consistent across the 17 sites sampled, predominately comprising medium to fine 'beach' sands of natural origins. Very little organic matter is present, typically confined to the surface 1 cm. Surface sediments are typically a yellow-light brown colour, becoming progressively greyer with depth. Most cores were quite densely packed but soft once removed and placed into the sampling container. Living biota (infauna) are typically present within sediments, dominated by echinoderms and small crustaceans.

Suspect Sediments

A summary of the sediment characteristics of the samples collected from the CH 'Suspect' sites is presented in **Appendix E**. Suspect sediments varied depending on their location within the inner harbour. Locations near the channel entrance (CH10, CH12, CH13 CH18 and CH19) comprised medium to fine 'beach' sands, fine silty sands composed samples collected at sites near the tug pen entrance (CH14-CH17) and inner harbour samples (CH7, CH8, CH11,) comprised medium fine silty sands. Sediments are typically grey in colour varying to brown or dark grey at some locations. Shell grit/fragments are quite common, though living biota was not observed. Organic matter, typically sea-wrack, is common throughout 'Suspect' sediment samples.

Probably Contaminated Sediments

A summary of the sediment characteristics of the samples collected from the CH 'Probably Contaminated' sites is presented in **Appendix E**. Samples typically comprised a variety of sands ranging from fine to medium grained. Sediments are generally grey to dark grey, with CH1 recording a grey/brown colour. Foreign material is present in most sediments as sea-wrack. High or medium levels of foreign material were recorded from CH1, CH2 and CH3, likely to be decomposing grain matter resulting from windblown dust or spillages from adjacent loading operations. All samples recorded levels of shell grit or fragments with CH5 recording medium levels. No odours other than standard organic smell was noted.

Nearshore Placement Area

A summary of the sediment characteristics of the samples collected from the nearshore placement area is presented in **Appendix E**. Nearshore placement area sediments are quite consistent across the five sites sampled, predominately comprising medium to fine 'beach' sands of natural origins. Very little organic matter is present and sediments are typically a yellow-light brown colour. Most cores were quite densely packed but soft once removed and placed into the sampling container. Living biota (infauna) were not observed from the collected sediments.

3.1.2. Particle Size Distribution

Channel ‘Probably Clean’ Sediments

Sediment classifications based on the PSD from each sample are shown in **Figure 3-1** and descriptive statistics provided in **Table 3-1**. Raw laboratory results for PSD are provided in **Appendix B**.

PSD analysis for the channel samples indicate sediments are predominately composed of sand sized particles (\bar{x} = 89.7%). The proportion of sand fraction within samples are predominantly fine sand ranging from 54.1% to 78.2%, whilst medium sand ranged between 5.3% to 41.6%. The proportion of gravel, coarse sand and clay was low, typically <4%.

The PSD across sites NC1-NC11 and NC18-NC19 are typically comparable, dominated by fine sand with low silt/coarse sand and moderate medium sand content. NC13 contains a relatively higher proportion of medium sands (41.6%) and less coarse sand (0.45%). NC17 had a higher proportion of finer sediment (clay, silt + fine sand) and a much lower proportion of medium (0.83%) and coarse (0.59%) sands when compared to most other sites.

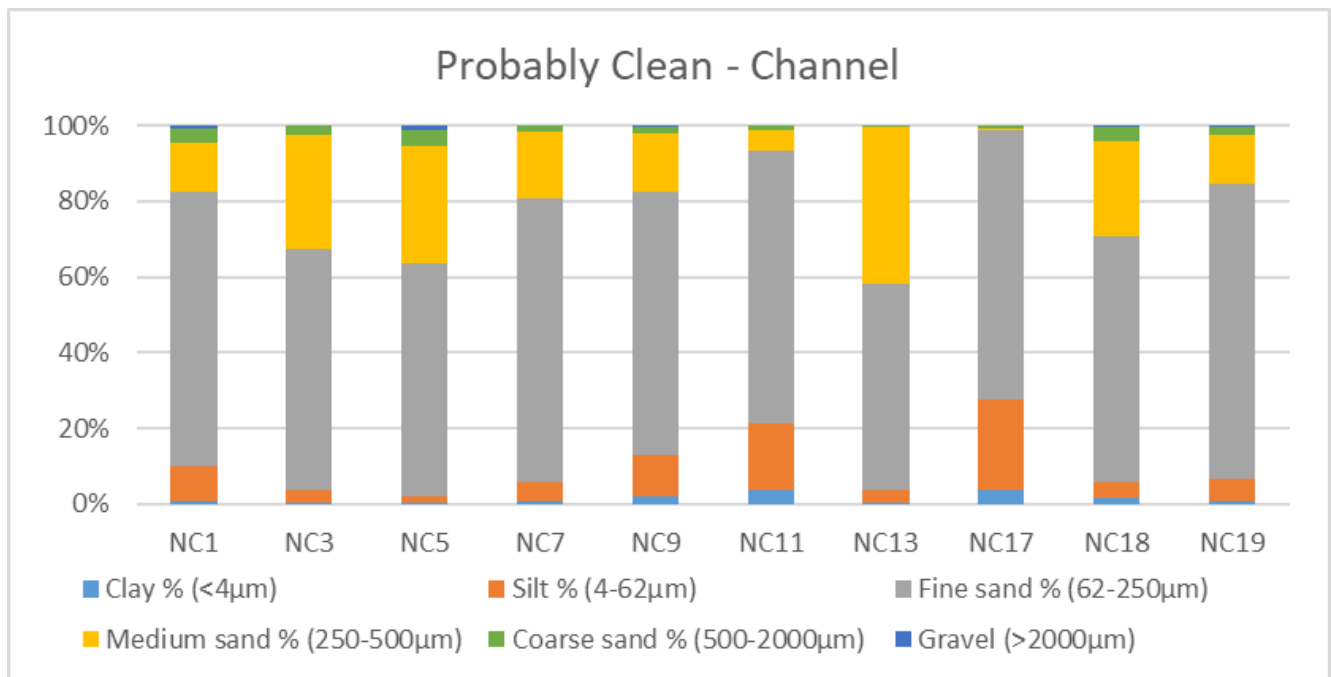


Figure 3-1 Sediment classification based on particle size for samples collected from the ‘Probably Clean’ channel dredge area.

Inner Harbour ‘Suspect’

Sediment classifications based on the particle size distributions from each sample are shown in **Figure 3-2** and descriptive statistics provided in **Table 3-1**. Further details of the laboratory analysis results for PSD are provided in **Appendix B**.

PSD analysis for the suspect samples indicate sediments are predominately composed of silt and sand sized particles (\bar{x} = 49.4 % & 38.7%, respectively). The silt fraction within samples range from 34.3% to

62.8%. Sand fractions are typically comprised of fine sand (\bar{x} = 28.7%) and some medium sand (\bar{x} = 6.57%). Clays range between 4.5% to 14.6%, whilst gravel is either in low proportion or non-existent.

Two distinct PSDs are observed across sites relative to their location within the inner harbour; the NW inner harbour (CH8-D, CH11, and CH12) and the SW and W inner harbour (CH13, CH14, CH15, CH16, CH17, CH18, CH19). The SW and W inner harbour sites typically comprise a higher proportion of silt particles and lower proportion of larger fractions. Deeper samples (0.5-1 m) collected from sites CH12 and CH14 indicate little variation in PSD compared to surficial samples from the same sites.

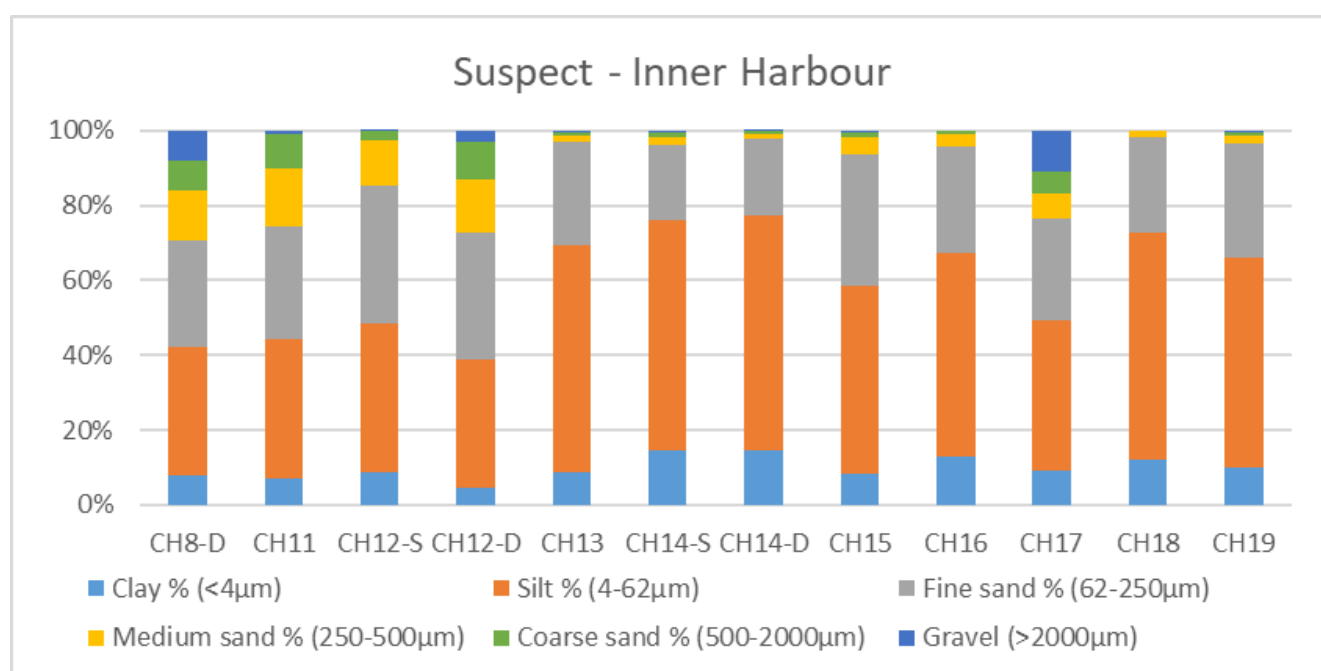


Figure 3-2 Sediment classification based on particle size for samples collected from the ‘Suspect’ inner harbour dredge area.

Inner Harbour ‘Probably Contaminated’

Sediment classifications based on the particle size distributions from each sample are shown in **Figure 3-3** and descriptive statistics provided in **Table 3-1**. Further details of the laboratory analysis results for PSD are provided in **Appendix B**.

PSD analysis for the probably contaminated samples indicate sediments are predominately composed of clay, silt and fine sand sized particles (\bar{x} = 17.0%, 17.4% & 34.4%, respectively). The clay fraction within sediments ranges from 14.0% to 21%, the silt fraction ranges from 11.0% to 27.0%, whilst fine sand range between 25% to 48%. Medium and coarse sands and gravels account for a maximum combined particle size distribution of 39% at CH5. There is no discernible spatial pattern in particle size distribution and all samples are generally comparable.

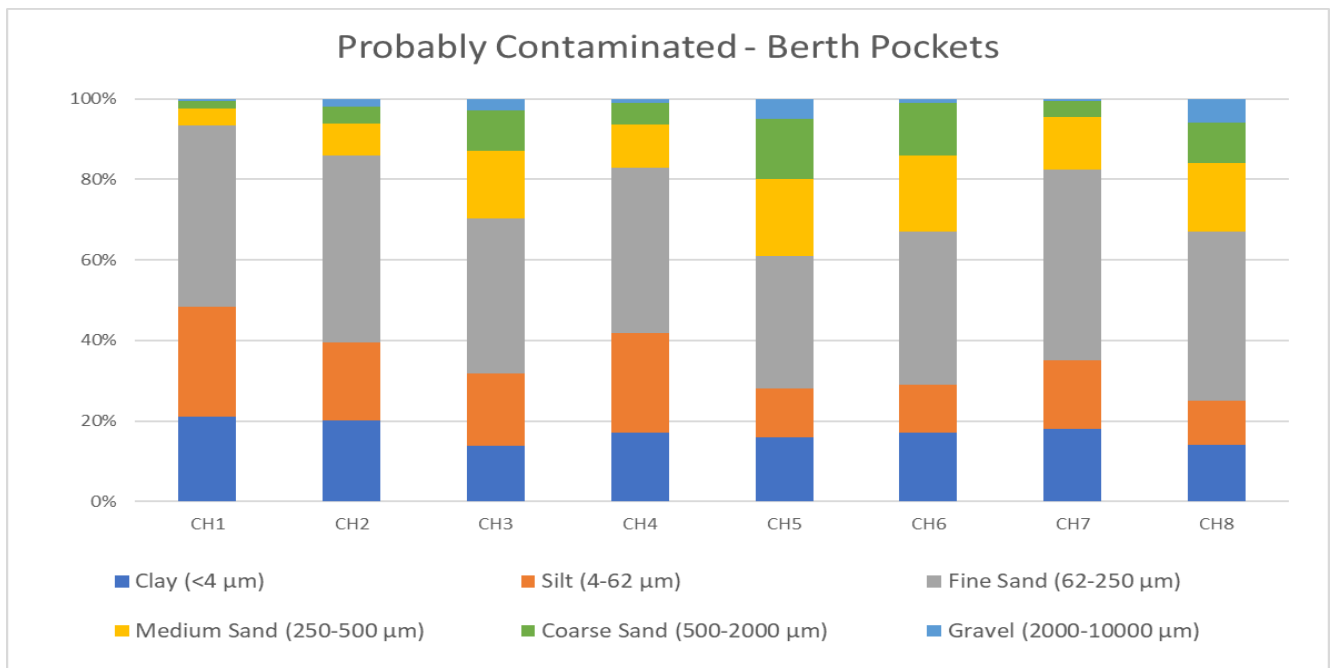


Figure 3-3 Sediment classification based on particle size for samples collected from the ‘Probably Contaminated’ inner harbour dredge area.

Nearshore Material Placement Area

Sediment classifications based on the particle size distributions from each sample are shown in **Figure 3-4** and descriptive statistics provided in **Table 3-1**. Further details of the laboratory analysis results for PSD are provided in **Appendix B**.

Nearshore MPA sediments are almost entirely comprised of sand sized particles ($\bar{x} = 98.5\%$). Medium sands comprise the highest distribution ($\bar{x} = 56.4\%$) with fine sands second ($\bar{x} = 31.1\%$). Mud sized particles are very low ($\bar{x} = 0.04\%$), as well as gravels ($\bar{x} = 1.44\%$).

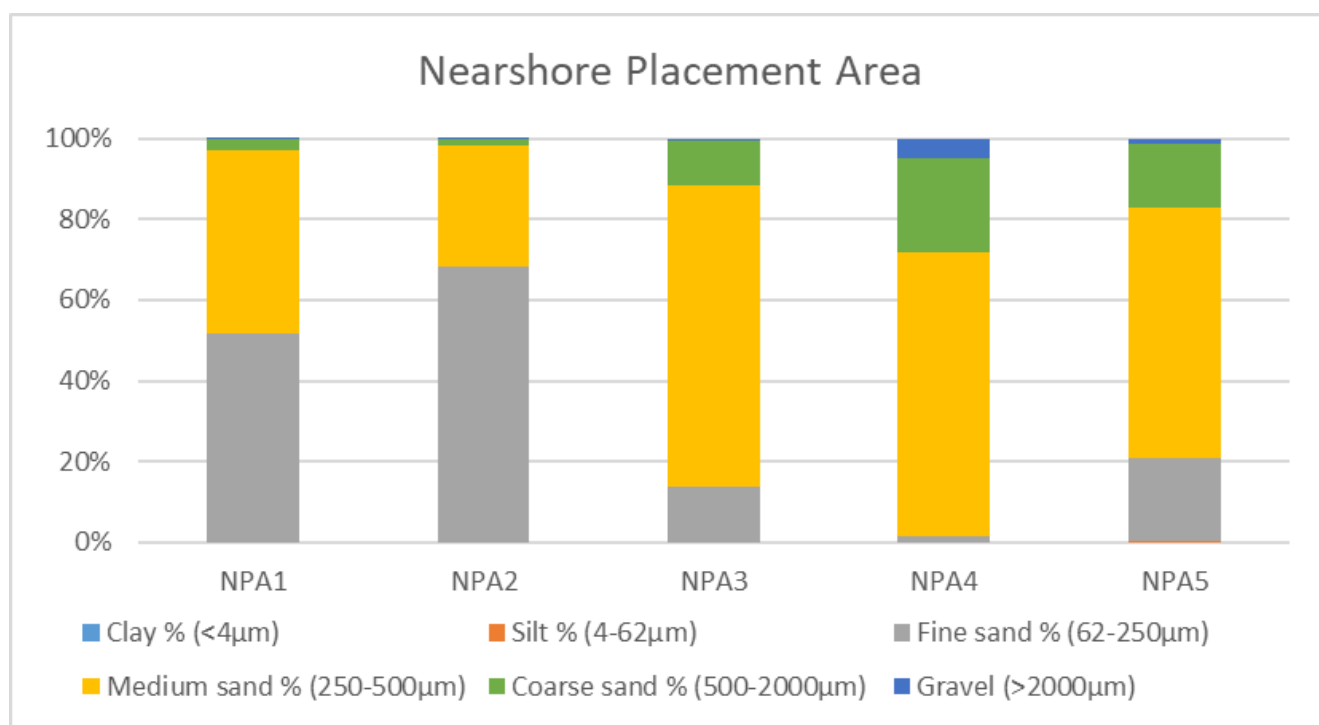


Figure 3-4 Sediment classification based on particle size for samples collected from the nearshore placement area.

Table 3-1 Descriptive statistics of sediment particle size distribution from the ‘Probably Clean’ and ‘Suspect’ dredge areas

Statistic	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
Probably Clean - Channel				
Min	0.2	1.9	72.2	0.0
Max	3.8	24.0	96.6	1.3
Mean	1.5	8.5	89.7	0.3
SD	1.3	7.2	8.2	0.4
n	10	10	10	10
Suspect Inner Harbour				
Min	4.5	34.3	22.5	0.0
Max	14.6	62.8	58.2	11.1
Mean	9.8	49.4	38.7	2.0
SD	3.1	11.3	12.4	3.6
n	12	12	12	12
Probably Contaminated Inner Harbour				
Min	14.0	11.0	51.0	0.5
Max	21.1	27.0	70.0	6.0
Mean	17.0	17.4	62.3	2.4
SD	2.6	5.7	7.3	2.1
n	8	8	8	8
Nearshore Placement Area				
Min	0.0	0.0	94.9	0.06
Max	0.0	0.42	99.94	5.10
Mean	0.0	0.08	98.5	1.44
SD	-	0.19	2.10	2.10
n	5	5	5	5

3.1.3. Total Organic Carbon, Moisture Content and Tributyltin

The TOC, moisture content and TBT levels for sediment samples from the ‘Suspect’ and ‘Probably Contaminated’ dredge areas are presented in **Table 3-2** and raw laboratory results presented in **Appendix B**.

Sediment samples from the ‘Suspect’ dredge area are composed of relatively low TOC results that range between 1.1-3.0%. TOC for samples with two depth profiles (CH12 and CH14) indicate little variation with TOC and depth, although this observation is based upon a limited sample size (n=2). Moisture content is moderate ranging from 39.2-60.8%. Normalised TBT concentrations are below the SQG for all sites. The corresponding 95% UCL of the means for ‘Suspect’ dredge areas is 3.9 ugSn/kg, which is lower than the SQG of 9.0 ugSn/kg.

Sediment samples from the 'Probably Contaminated' dredge area range between 0.5 – 1.9% for TOC, whilst the corresponding moisture content is moderate, ranging between 31.4-50.6%. Normalised TBT concentrations are above the SQG at CH1 and CH5, and below the SQG at CH3. The corresponding 95% UCL of the means for 'Probably Contaminated' dredge area is 13.5 ugSn/kg, which is higher than the SQG of 9.0 ugSn/kg.

Sediment samples comprised very low TOC from all five samples collected at the Nearshore MPA.

Figure 3-6 spatially displays the sites which exceeded the SQG for TBTs.

Table 3-2 Total organic carbon, moisture content and tributyltin for sediment samples from 'Probably Contaminated' and 'Suspect' dredging areas. Red bold text identifies concentrations in excess of the SQG values.

Location	Total Organic Carbon (%)	Moisture Content (%)	Tributyltin (ugSn/kg) ¹
SQG	-	-	9.0
Suspect – Inner Harbour			
CH8-D	1.2	40.1	2.3
CH11	1.4	46.3	5.4
CH12-S	1.3	39.2	6.9
CH12-D	1.1	-	2.6
CH13	3.0	60.8	1.3
CH14-S	2.4	43.6	3.4
CH14-D	2.0	-	5.5
CH15	2.6	54.3	2.8
CH16	2.8	53.6	2
CH17	1.5	46.6	2
CH18	2.4	55.4	1
CH19	2.4	54.6	1
95% UCL	-	-	3.9
Probably Contaminated – Inner Harbour			
CH1	1.3	39.4	13.1
CH3	1.9	50.6	6.3
CH5	0.5	31.4	12.8
95% UCL	-	-	13.5
Nearshore Material Placement Area			
NPA1	0.2	-	-
NPA2	0.2	-	-
NPA3	0.2	-	-
NPA4	0.2	-	-
NPA5	0.2	-	-

¹ Normalised to 1 per cent TOC.

3.1.4. Elutriate Tributyltin

Elutriate TBTs were collected from the 'Probably Contaminated' sediments and analysed in accordance with the SAP (O2M 2019) and the NAGD, with results presented in **Table 3-3** and raw data provided in **Appendix C**.

The LoR for elutriate TBT was insufficiently low to provide comparison with the 99% SPL. However, ANZG (2018) guidelines classify port areas as *slightly to moderately disturbed* ecosystems, indicating the 99% SPL is not required to be met within inner harbour sites.

Elutriate TBT concentrations for all three sites tested are below the laboratory LoR (0.002 µgSn/L) for all analysed samples. This is significantly lower than the 95 SPL which is set as 0.006 µgSn/L.

Table 3-3 Elutriate TBT results for ‘Probably Contaminated Sites’

Species Protection Level Level	TBT
99% SPL	0.0004
95% SPL	0.006
90% SPL	0.02
LoR	0.002
Probably Contaminated – Inner Harbour	
CH3-1	<0.002
CH4-1	<0.002
CH6-1	<0.002

3.2. Acid Sulfate Soils

The chromium reducible sulfur suite results from the ‘Probably Clean’, ‘Suspect’ and ‘Probably Contaminated’ dredge areas are presented in **Table 3-4**. Raw results are presented in full in **Appendix B**.

The pH_{KCl} in all the sediment samples is greater than 6.5 and therefore Actual ASS are not present. One sample from the ‘Probably Clean’ and all samples from the inner harbour (‘Probably Contaminated’ and ‘Suspect’) recorded sulfur values (%S (S_{Cr})) which exceed the Action Criteria. These sediments are therefore considered Potential Acid Sulfate Soils (PASS). **Figure 3-5** displays the spatial extent of sites which exceeded the Action Criteria.

To determine the net acidity of the PASS sediment samples, Acid-base accounting (ABA) was conducted and the findings are presented in **Table 3-4**. The results indicate the potential acidity of sediments are effectively buffered from the acid neutralising capacity (ANC), and therefore there would be a negative net acidity following disturbance of these sediments.

Table 3-4 Chromium reducible sulfur suite results for sediment samples tested from 'Probably Clean', 'Suspect' and 'Probably Contaminated' dredge areas. Values in red font exceed the Action Criteria for disturbance of >1000 tonnes of soils (DER 2015).

Location	pHKCL	TAA (mol H+/t)	%S (SCr)	Potential acidity (mol H+/t)	ANCBT (%CaCO3)2	ANC (mol H+/t)	FF	Net acidity (mol H+/t)3
Action criteria (%S)			0.03	18				
Probably Clean – Channel								
NC1	9.5	<2	0.02	12	---	---	---	---
NC3	9.7	<2	0.02	12	---	---	---	---
NC5	9.8	<2	0.01	<8	---	---	---	---
NC7	9.7	<2	0.02	12	---	---	---	---
NC9	9.7	<2	<0.01	<8	---	---	---	---
NC11	9.6	<2	0.04	25	97	19,000	1.5	-12642
NC13	9	<2	0.02	12	---	---	---	
Suspect – Inner Harbour								
CH7	8.9	<2	0.46	290	74	15,000	1.5	-9710
CH8-S	9.3	<2	0.31	190	63	13,000	1.5	-8477
CH8-D	9.2	<2	0.18	110	67	13,000	1.5	-8557
CH10	9.1	<2	0.17	110	55	11,000	1.5	-7223
CH11	9.1	<2	0.26	160	78	16,000	1.5	-10507
CH12-S	9.2	<2	0.32	200	74	15,000	1.5	-9800
CH13	8.6	<2	0.23	140	80	16,000	1.5	-10527
CH14-S	8.9	<2	0.74	460	81	16,000	1.5	-10207
CH15	8.8	<2	0.58	360	77	15,000	1.5	-9,640
Probably Contaminated – Inner Harbour								
CH1	9.2	<2	0.26	160	62	12,000	1.5	-7840
CH2	8.9	<2	0.39	240	77	15,000	1.5	-9760
CH3	9	<2	0.62	390	78	16,000	1.5	-10277
CH4	8.9	<2	0.72	450	72	14,000	1.5	-8883
CH5	9.3	<2	0.24	150	88	18,000	1.5	-11850
CH6	9.1	<2	0.42	260	71	14,000	1.5	-9073



Figure 3-5 Spatial extent of Acid Sulfate Soil Action Criteria Exceedances

3.3. Metals and Metalloids

The total metal concentrations in sediment samples from the CH and navigational channel are presented in **Table 3-5** and raw laboratory results are presented in **Appendix B**.

3.3.1. Comparison of Data to Screening Levels

A comparison of metal concentrations and the 95% UCLs to the screening levels described in the SAP (O2M 2019) are presented in **Table 3-5**. Where a value is reported below the LoR, a value of 50% of the LoR is applied to determine the 95% UCL of the mean.

Figure 3-6 spatially displays the sites where DGV exceedances are recorded.

Probably Clean - Channel Sediments

Screening levels are not exceeded for any metals in any samples from navigational channel sites. Therefore, the 95% UCLs of the means are also below screening levels. Cadmium, nickel and vanadium recorded values below LoRs at some sites, whilst silver and mercury are below the LoRs at all sites.

Suspect - Inner Harbour Sediments

Concentrations in exceedance of the DGV screening levels for copper (14 sites), zinc (12 sites) and mercury (one site) are present in 'Suspect' sediments. The 95% UCLs of the means exceed the DGV screening level for copper and zinc. No default EILs are exceeded, however the zinc concentration exceeds the low-level EIL at CH7, but not the high level EIL.

Probably Contaminated - Inner Harbour Sediments

Concentrations in exceedance of the DGV screening levels for cadmium (two sites), copper (all sites), lead (one site) and zinc (five sites) are present in 'Probably Contaminated' sediments. The 95% UCLs of the means exceed the DGV screening level for copper and zinc. 95% UCLs of the means for the remaining metals are below their relevant DGV screening level. No default EILs are exceeded, however zinc concentrations exceed the low-level EIL at CH3 and CH4 and the 95% UCL of the means. The high-level zinc EIL is not exceeded at any sites. No concentrations exceed the HILs for any contaminant at any site or their respective 95% UCLs.

Nearshore Placement Area

All metals from sediments at the Nearshore MPA are below the assigned DGVs.

3.3.2. Metals Normalisation

Results for the linear regression analysis of concentrations of Aluminium is shown in **Figure 3-7**. Linear regression shows a positive correlation between Aluminium and:

- > The proportion of mud (clay and silt) fractions ($r^2=0.61$);
- > Cadmium ($r^2=0.88$);
- > Copper ($r^2=0.91$);
- > Lead ($r^2=0.90$);
- > Iron ($r^2=0.94$);

- > Manganese ($r^2=0.86$);
- > Vanadium ($r^2=0.94$) and
- > Zinc ($r^2=0.89$).

Table 3-5 Total metal concentrations (mg/kg) for the 'Probably Clean', 'Probably Contaminated' and 'Suspect' sediment samples from the channel and inner harbour dredging areas. Red bold text identifies concentrations in excess of the DGV values (where provided).

Total Metals (mg/kg)	Al	As	Cd	Cr	Cu	Pb	Mn	Ni	Zn	Ag	Fe	V	Hg
LoR	1	0.1	0.1	1	1	1	1	1	1	1	1	2	0.02
DGV	-	20	1.5	80	65	50	-	21	200	1	-	-	0.15
EILs	-	170	-	310	1208	1,800	-	55	363-2003	-	-	-	-
HILs (D)	-	3,000	800	(VI) 3,000	250,000	1,500	40,000	4,000	400,000	-	-	-	4,000
Probably Clean - Channel													
NC1	800.0	1.9	0.10	11.0	18.0	3.0	28.0	1.0	15.0	<0.1	1300.0	4.0	<0.02
NC3	220.0	1.4	<0.1	12.0	14.0	2.0	14.0	<0.1	5.0	<0.1	540.0	<2.0	<0.02
NC5	240.0	1.3	<0.1	13.0	13.0	2.0	17.0	<0.1	3.0	<0.1	520.0	<2.0	<0.02
NC7	290.0	1.1	<0.1	12.0	15.0	2.0	17.0	<0.1	6.0	<0.1	650.0	2.0	<0.02
NC9	310.0	1.5	0.10	11.0	14.0	1.0	16.0	<0.1	6.0	<0.1	700.0	2.0	<0.02
NC11	340.0	1.7	<0.1	11.0	14.0	2.0	21.0	<0.1	7.0	<0.1	780.0	3.0	<0.02
NC13	300.0	2.0	<0.1	15.0	12.0	1.0	21.0	<0.1	3.0	<0.1	820.0	3.0	<0.02
NC17-1	420.0	2.8	0.1	11.0	12.0	1.0	25.0	0.5	15.0	0.05	1100.0	3.0	0.005
NC18	250	1.4	0.05	13	10	0.5	17	0.5	5	0.05	650	2	0.005
NC19	320	1.5	0.05	13	11	0.5	15	0.5	8	0.05	720	2	0.005
95% UCL	446.4	1.9	0.08	13.0	14.6	2.0	21.7	0.6	9.8	0.5	920.4	2.9	0.01
Median	305.0	1.5	0.1	12.0	13.5	1.5	17.0	0.5	6.0	0.5	710.0	2.0	0.0
Mean	349.0	1.7	0.1	12.2	13.3	1.5	19.1	0.6	7.3	0.4	778.0	2.3	0.0
Std Deviation	168.4	0.5	0.0	1.3	2.3	0.8	4.6	0.2	4.3	0.2	245.7	0.9	0.0
Suspect – Inner Harbour													
CH7	2800.0	6.0	1.10	19.0	230.0	33.0	46.0	4.0	370.0	<0.1	9100.0	17.0	0.13

Total Metals (mg/kg)	Al	As	Cd	Cr	Cu	Pb	Mn	Ni	Zn	Ag	Fe	V	Hg
CH8-S	1900.0	3.9	0.60	15.0	110.0	17.0	34.0	3.0	170.0	<0.1	5200.0	12.0	0.06
CH8-D	1800.0	4.0	0.70	17.0	140.0	20.0	41.0	4.0	230.0	<0.1	5400.0	12.0	0.09
CH10	1500.0	4.1	0.40	19.0	53.0	8.0	30.0	3.0	83.0	<0.1	4500.0	9.0	0.03
CH11	2000.0	4.7	0.90	20.0	170.0	27.0	70.0	4.0	310.0	<0.1	7400.0	17.0	0.08
CH12-S	2200.0	4.5	0.50	19.0	150.0	22.0	49.0	4.0	240.0	<0.1	12000.0	14.0	0.06
CH12-D	1900.0	4.4	0.70	18.0	140.0	20.0	49.0	3.0	240.0	<0.1	7100.0	13.0	0.08
CH13	2200.0	6.4	0.80	20.0	150.0	23.0	42.0	4.0	250.0	<0.1	7900.0	16.0	0.07
CH14-S	5300.0	8.6	1.10	26.0	150.0	38.0	77.0	5.0	300.0	<0.1	9100.0	24.0	0.12
CH14-D	4300.0	7.0	0.80	23.0	150.0	32.0	72.0	5.0	280.0	<0.1	8000.0	21.0	0.25
CH15	2300.0	6.2	1.00	22.0	200.0	31.0	52.0	4.0	320.0	<0.1	8800.0	18.0	0.07
CH16	2,700	6.9	0.8	25.0	250.0	33.0	54.0	5.0	370.0	0.3	11000.0	21.0	0.06
CH17	1,600	4.1	0.4	19.0	120.0	17.0	34.0	3.0	170.0	0.1	5700.0	12.0	0.03
CH18	2,300	6.2	0.7	23.0	170.0	22.0	43.0	4.0	260.0	0.2	8200.0	16.0	0.04
CH19	2,000	5.9	0.6	20.0	150.0	19.0	38.0	3.0	240.0	0.2	7200.0	14.0	0.05
95% UCL	2923.0	6.2	0.84	21.7	177.1	27.8	55.3	4.2	290.3	0.48	8725.0	17.6	0.11
Median	2200.0	5.9	0.7	20.0	150.0	22.0	46.0	4.0	250.0	0.5	7900.0	16.0	0.07
Mean	2453.3	5.5	0.7	20.3	155.5	24.1	48.7	3.9	255.5	0.4	7773.3	15.7	0.1
Std Deviation	1033.6	1.4	0.2	3.0	47.3	8.0	14.3	0.7	76.4	0.1	2092.3	4.1	0.1
Probably Contaminated – Inner Harbour													
CH1	2000.0	6.3	0.80	18.0	99.0	16.0	59.0	3.0	180.0	<0.1	5400.0	14.0	0.07
CH2	2400.0	6.0	1.10	18.0	200.0	31.0	47.0	4.0	360.0	<0.1	8100.0	18.0	0.08
CH3	2800.0	7.1	3.40	22.0	340.0	65.0	59.0	5.0	950.0	1.0	9600.0	19.0	0.11
CH4	2600.0	8.0	2.10	26.0	280.0	48.0	51.0	6.0	580.0	<0.1	9300.0	17.0	0.09
CH5	1200.0	4.1	0.60	13.0	81.0	15.0	35.0	2.0	210.0	<0.1	4900.0	10.0	0.04

Total Metals (mg/kg)	Al	As	Cd	Cr	Cu	Pb	Mn	Ni	Zn	Ag	Fe	V	Hg
CH6	2400.0	5.9	1.10	20.0	190.0	29.0	50.0	4.0	350.0	<0.1	9000.0	16.0	0.07
95% UCL	2707.0	7.3	2.4	23.1	281.0	49.9	57.5	5.2	675.2	0.75	9409.0	18.4	0.10
Median	2400.0	6.2	1.1	19.0	195.0	30.0	50.5	4.0	355.0	0.50	8550.0	16.5	0.08
Mean	2233.3	6.2	1.5	19.5	198.3	34.0	50.2	4.0	438.3	0.58	7716.7	15.7	0.08
Std Deviation	571.5	1.3	1.1	4.4	100.4	19.4	8.9	1.4	288.0	0.20	2057.0	3.3	0.02
Nearshore Placement Area													
NPA1	480	2	<0.1	12	6	1	25	<1	3	<0.1	600	3	<0.01
NPA2	440	2.4	<0.1	11	7	1	24	<1	2	<0.1	520	2	<0.01
NPA3	400	2.3	<0.1	10	5	1	25	<1	2	<0.1	510	3	<0.01
NPA4	360	2.2	<0.1	9	5	1	25	<1	2	<0.1	480	3	<0.01
NPA5	460	2.3	<0.1	11	6	1	29	<1	2	<0.1	610	3	<0.01
Median	420.0	2.3	-	11.0	6.0	1.0	25.0	-	2.0	-	520.0	3.0	-
Mean	423.3	2.3	-	10.7	5.8	1.0	26.7	-	2.2	-	540.0	2.8	-
Std Deviation	44.6	0.2	-	1.0	0.8	0.0	3.1	-	0.4	-	52.5	0.4	-

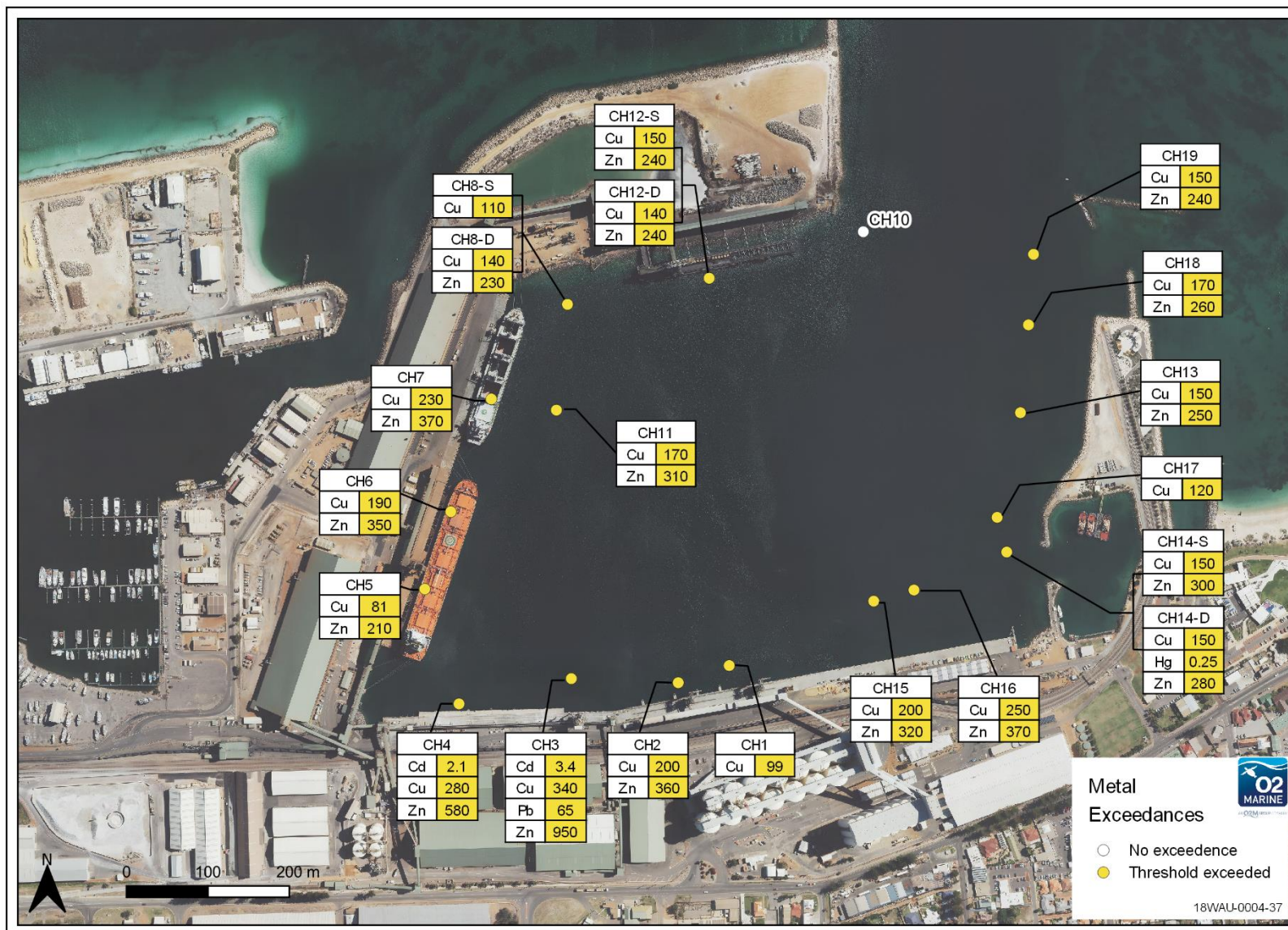


Figure 3-6 Spatial extent of metals and TBTs which exceeded the DGV and SGV, respectively.

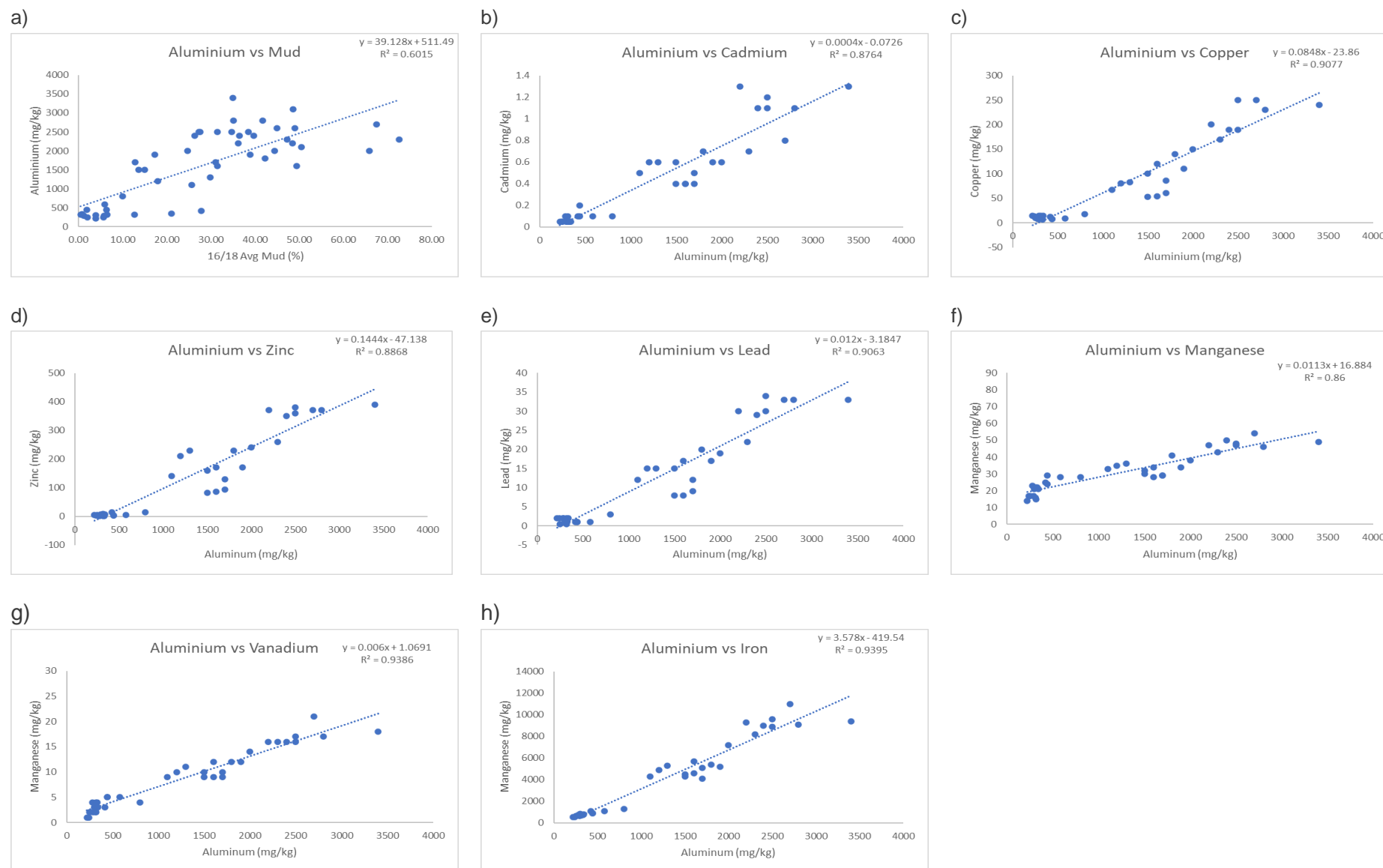


Figure 3-7 Linear regression showing strong correlation between concentrations of Aluminium and a) proportion of muds (clays and silts), b) cadmium, c) copper, d) zinc, e) lead, f) manganese, g) vanadium and h) iron.

3.3.3. Comparison of Data with Ambient Baseline Concentrations

In accordance with the SAP, metal concentrations exceeding screening levels or for metals with no screening levels were normalised against reference sites to allow comparison with ambient baseline concentrations. The enrichment classifications are based on the SAP (O2M 2019) and are presented in **Table 3-6**.

As there are no identified contamination sources, comparison with ambient baseline concentrations was not calculated for the nearshore placement area.

Probably Clean - Channel Sediments

Enrichment Factor (EF) results for 'Probably Clean' sediments with no screening guidelines reported above LoRs range between 'No Enrichment' to 'Minor' for iron and manganese and "No Enrichment" for vanadium.

Probably Contaminated - Inner Harbour Sediments

EF results for 'Probably Contaminated' sediments with no screening guidelines reported above LoRs range from 'No Enrichment' for manganese and vanadium, to 'Minor' for iron. Cadmium exceeds the DGV level at CH3 reports 'Moderately Severe' enrichment, with remaining sites ranging between 'Minor' to 'Moderate'. Lead exceeds the screening level at site CH3 but was not normalised in accordance with the SAP due to anthropogenic contamination occurring at this location. Copper exceeds the DGV level at all sites and ranges between 'Minor' to 'Moderately Severe' enrichment. Zinc exceeds the DGV level at sites CH2 to CH6 and recorded EFs from all sites between 'Severe' and 'Extremely Severe'.

Suspect - Inner Harbour Sediments

EF results for 'Suspect' sediments with no screening guidelines reported above LoRs correspond to 'No Enrichment' for manganese and vanadium, with iron ranging from 'No Enrichment' to 'Minor'. Copper exceeds the DGV at all sites except CH10, and records EFs for all sites, including CH10, between 'Minor' to 'Moderate'. Except for three sites, zinc exceeds the DGV with corresponding EFs all reporting 'Severe'. Mercury exceeds the DGV at one site (CH14-D), although similar for lead above no normalising calculations were undertaken in accordance with the SAP due to the potential for anthropogenic influences.

Table 3-6 Aluminium normalisation classifications for determining the enrichment factor of parameters at sites which either exceed the DGV value, or there were no guideline values (except Mn). Enrichment Level - No Enrichment (NE), Minor (Mi), Moderate (Mo), Moderately Severe (MS), Severe (S), Very Severe (VS), Extremely Severe (ES). Bold, red font indicates DGV exceedances from Table 4-7.

Site	Cd	Cu	Pb	Mn	Zn	Fe	V	Hg
Probably Clean – Channel								
NC1	-	-	-	NE	-	NE	NE	-
NC3	-	-	-	NE	-	Mi	-	-
NC5	-	-	-	Mi	-	Mi	-	-
NC7	-	-	-	NE	-	Mi	NE	-
NC9	-	-	-	NE	-	Mi	NE	-
NC11	-	-	-	NE	-	Mi	NE	-
NC13	-	-	-	Mi	-	Mi	NE	-
NC17-1	-	-	-	NE	-	Mi	NE	-
NC18	-	-	-	Mi	-	Mi	NE	-
NC19	-	-	-	NE	-	Mi	NE	-
Suspect – Inner Harbour								
CH7	-	Mo	-	NE	S	Mi	NE	NE
CH8-S	-	Mi	-	NE	S	Mi	NE	NE
CH8-D	-	Mo	-	NE	S	Mi	NE	NE
CH10	-	Mi	-	NE	MS	Mi	NE	NE
CH11	-	Mo	-	NE	S	Mi	NE	NE
CH12-S	-	Mo	-	NE	S	Mi	NE	NE
CH12-D	-	Mo	-	NE	S	Mi	NE	NE
CH16	-	Mo	-	NE	S	Mi	NE	NE
CH17	-	Mo	-	NE	S	Mi	NE	NE
CH18	-	Mo	-	NE	S	Mi	NE	NE
CH19	-	Mo	-	NE	S	Mi	NE	NE
Probably Contaminated - Inner Harbour								
CH1	Mi	-	-	NE	-	Mi	NE	-
CH2	Mi	-	-	NE	-	Mi	NE	-
CH3	MS	-	-	NE	-	Mi	NE	-
CH4	Mo	-	-	NE	-	Mi	NE	-
CH5	Mi	Mo	Mo	NE	VS	Mi	NE	-
CH6	Mi	Mo	Mo	NE	S	Mi	NE	-

3.3.4. Elutriate Metals

Elutriate metals were collected and analysed in accordance with the SAP (O2M 2019), with results presented in **Table 3-7** and raw data provided in **Appendix B**.

The LoR for copper was insufficiently low to provide comparison with the 99% SPL. However, ANZG (2018) guidelines classify port areas as *slightly to moderately disturbed* ecosystems, indicating the 99% SPL is not required to be met within inner harbour sites.

Dissolved metal concentrations for cadmium, copper and lead are below the laboratory LoRs for all analysed samples. Dissolved zinc concentrations range between 0.007 mg/L to 0.032 mg/L in the 'Probably Contaminated' dredge sediments, with one value exceeding the 90% SPL and two exceeding the 95% SPL. Dissolved copper concentrations from the four 'Suspect' sites and composite samples are all below the LoR. Zinc elutriate concentrations in two samples (CH8 & CH13-15) are above the 90% SPL, and the third sample (CH10-12) below the 95% SPL.

Figure 3-8 spatially displays the sites which exceeded the SPLs (95% and 99%) for zinc.

Table 3-7 Elutriate concentrations for metals which exceeded screening levels or were above ambient background levels. Red indicates 90% trigger exceedances.

Dissolved Metal (mg/L)	Cd	Cu	Pb	Zn
99% SPL	0.0007	0.0003	0.0022	0.007
90% SPL	0.014	0.003	0.0066	0.023
LoR	0.0001	0.001	0.001	0.001
Probably Contaminated – Inner Harbour				
CH1	-	<0.002	-	NA
CH2	-	<0.002	-	0.021
CH3	<0.0002	<0.002	0.001	0.032
CH4	<0.0002	<0.002	-	0.015
CH5	-	<0.002	-	0.007
CH6	-	<0.002	-	0.019
Suspect – Inner Harbour				
CH7	-	<0.002	-	0.26
CH8-S	-	<0.002	-	-
Composite 1	-	<0.002	-	0.009
Composite 2	-	<0.002	-	0.025

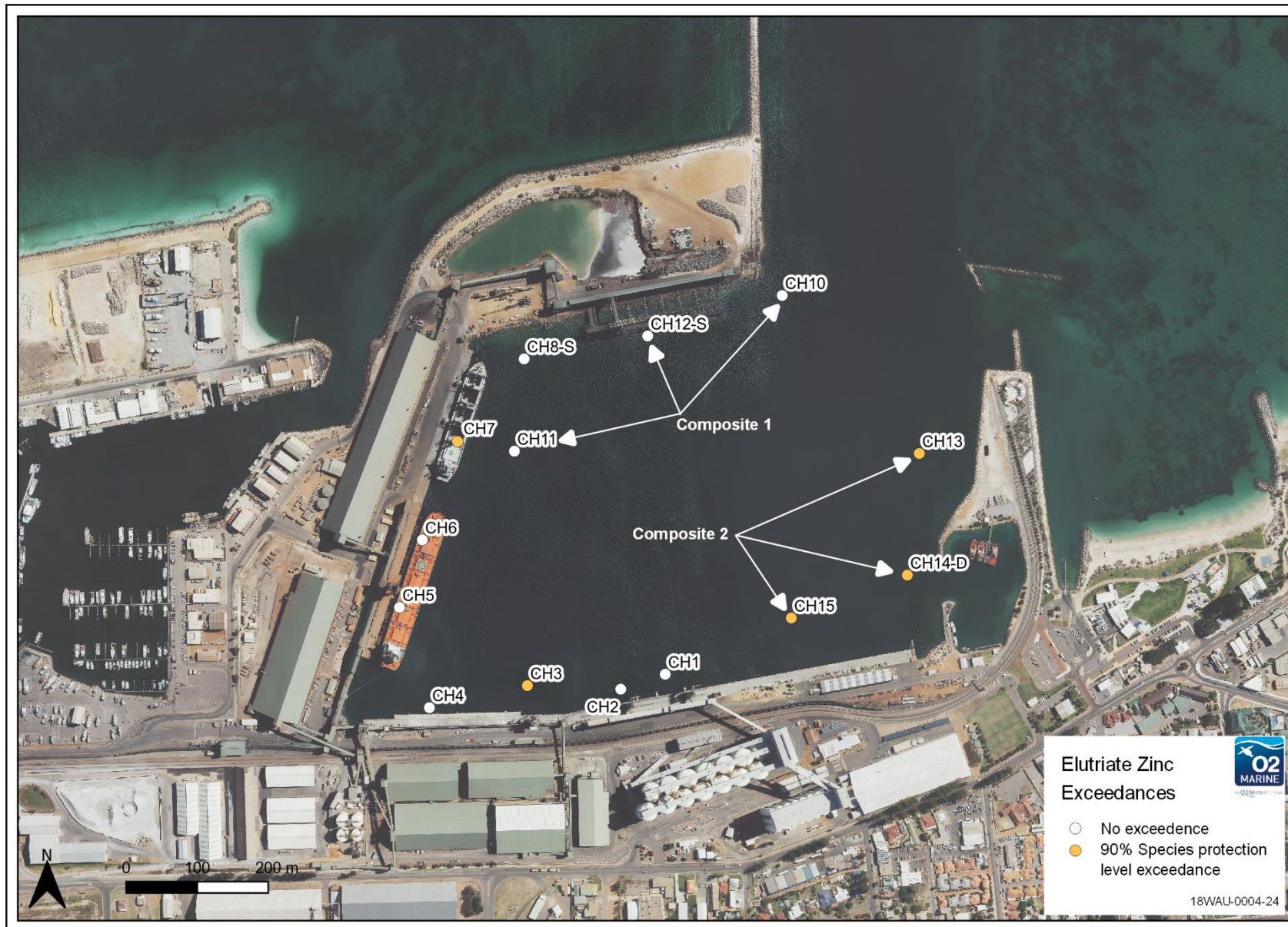


Figure 3-8 Spatial extent of sites which exceeded the 90% species Protection Levels for zinc

3.3.5. Bioavailable Metals

Bioavailable metals were collected and analysed as outlined in the SAP (O2M 2019) and as presented in **Table 2-2**. Bioavailable metals results are presented in **Table 3-8** and raw data are provided in **Appendix B**.

Bioavailable concentrations of cadmium, copper and lead are all below the laboratory LoR. Bioavailable zinc concentrations for 'Probably Contaminated' and 'Suspect' sites are below the DGV value ranging between 2 mg/kg and 8 mg/kg.

Table 3-8 Bioavailable metal results which exceeded screening levels or were above ambient background levels.

Bioavailable Metal (mg/kg)	Cd	Cu	Pb	Zn
DGV	1.5	65	50	200
LoR	0.1	1	1	1
Probably Contaminated – Inner Harbour				
CH1	-	<1	-	-
CH2	-	<1	-	2
CH3	<0.1	<1	<1	3
CH4	<0.1	<1	-	5
CH5	-	<1	-	8
CH6	-	<1	-	6
Suspect – Inner Harbour				
CH7	-	<1	-	4
CH8-S	-	<1	-	-
Composite 1	-	2	-	4
Composite 2	-	2	-	2

3.4. Nutrients

3.4.1. Nutrients in Sediments

Results from nutrients analysis in sediments are presented in **Table 3-9**. Results indicate that total nitrogen (TN) solely consist of organic forms, typically represented by ~100% total kjeldahl nitrogen (TKN) with very small contributions of ammonia. Nitrate and nitrite are not present in sediments from Berth 3-6 with all results detected below the LoRs. TKN ranges from 870 mg/kg (CH6) to 2,300 mg/kg (CH2 and CH3). Phosphorous ranges between 370 mg/kg (CH7) to 710 mg/kg (CH1).

Table 3-9 Nutrient concentrations in sediments from Berth 3, 4 5, and 6 sample locations

Site	Phosphorus	Total Nitrogen	Total Kjeldahl Nitrogen	NOx-N
Units	mg/kg			
LoR	1	10	10	1
CH1	710	2,300	2,300	<1
CH2	610	2,300	2,300	<1
CH3	490	1,400	1,400	<1
CH4	450	1,300	1,300	<1
CH5	400	910	910	<1
CH6	380	870	870	<1
CH7	370	1,400	1,400	<1
CH8	380	1,200	1,200	<1

3.4.2. Nutrients in Porewater

Results from nutrients analysis in sediments are presented in **Table 3-10**. All detections exceed the adopted DGV for all parameters. Results for nitrate and nitrate are low, with only one real detection at CH2. Ammonia was quite variable with results ranging from 0.06 mg/L (CH7) to 29 mg/L (CH1). FRP results are all very low ranging between 0.03 mg/L (CH7) to 0.94 mg/L (CH1). Interestingly, ammonia and FRP results for CH1 and CH2 show a high level of variability, considering they are sampled from the same shipping pocket at Berth 3.

Table 3-10 Nutrient concentrations in sediment porewaters from Berth 3, 4 5, and 6 sample locations. Red font indicate exceedances of the DGV.

Site	Nitrite-N	Nitrate-N	Ammonia-N	Filterable Reactive Phosphorus
Units	mg/L			
DGV	0.005	0.005	0.005	0.005
LoR	0.01	0.01	0.02	0.01
CH1	<0.01	<0.01	29	0.94
CH2	0.44	0.35	0.79	0.04
CH3	<0.01	<0.01	11	0.15
CH4	<0.01	<0.01	7.5	0.11
CH5	<0.01	0.04	7.9	0.15
CH6	0.04	0.05	3.9	0.06
CH7	0.01	0.34	0.06	0.03
CH8	0.04	0.16	1.2	0.24

3.5. QA/QC Assessment

3.5.1. Laboratory Assessment

The laboratory quality control report and the laboratory QA/QC compliance assessment report are provided in **Appendix D**. The findings of these results determined:

- > No Method Blank outliers occur;
- > No Duplicate outliers occur;
- > No Laboratory Control outliers occur;
- > No Matrix Spike outliers exist;
- > No Surrogate recovery outliers exist;
- > All samples were submitted and tested within analysis holding time compliance; and
- > The number of QC samples was tested in accordance with or greater than guidance provided in NEPM (2012).

No results were qualified as unusable during the data review process.

Matrix spike recoveries were not determined for Aluminium and Iron in one (1) interlaboratory split samples (TRIP-S2) due to the background level being greater than or equal to four times the spike level. NAGD (2009) recommends matrix spike data should not be reported if the naturally occurring levels in the sample are greater than twice the spiking level. Therefore, the matrix spike recoveries for Aluminium and Iron can be omitted from reported results.

3.5.2. Field QA/QC

The Relative Standard Deviation (RSDs) for field split and triplicate samples are presented in **0**.

No field split samples for metals returned RSD results >50% for the three split samples collected. Calculated RSDs ranged from 3-50%. One exceedance were calculated within the nutrient RSD calculations, although this was a result of differing laboratory detection limits combined with low level detection. This resulted in a proportionally higher RSD when assessing low level results. The secondary laboratory test result for TBT at CH8 and CH3 (0.25 & 2.2 µgSn/kg) is outside the accepted range of the primary result (2.8 & 12 µgSn/kg), with an RPD of 167% and 138%, respectively. The secondary laboratory test result for TOC at CH8 and CH3 (<1 & 1.1%) is also outside the accepted range of the primary result (1.2 & 1.9%), with an RPD of 82% and 52%, respectively. The secondary results for moisture at three sites (CH8, CH2, CH3) are within the accepted range. It should be noted that TBT and TOC sampling at CH3 used a composite sample from three replicates and therefore represents comparison against a replicate sample rather than a true split duplicate. TBT can be highly variable when present due to the scattering nature of paint flakes within sediments. Whilst results for TOC are also outside the accepted range, the difference between <1% and 1.2% may be very minor from the split sample and results are only just outside acceptable levels for the replicate at CH3, which largely identifies a large proportional difference between two small values (i.e. 2 is 100% greater than 1).

Field triplicates collected from the same site, at the same location, are all typically within the accepted range for RSDs (<50%). Non-exceeding RSDs ranged from 0-39%.

No results were qualified as unusable during the data review process due to and RPDs or RSDs not being met. These results provide confidence that the primary laboratory and field procedures were of acceptable quality for all elements from which meaningful conclusions can be drawn.

4. Discussion

4.1. Preliminary Site Investigation

As detailed in the SAP, the preliminary site investigation reviewed previous sediment assessments and historical data sources to identify contaminants of potential concern and classify the likely current status of accumulated sediments. The SAP identified three classifications for the proposed dredge material in accordance with the NAGD (2009) and included the following:

- > 'Probably Contaminated' sediments occurring within the Berth 3, 4 and 5 pockets;
- > 'Suspect' sediments which occurred primarily within the north-western and south-eastern corners of the inner harbour, including the Berth 6 and 7 pockets; and
- > 'Probably Clean' sediments which occurred in high spots along the NC edges.

The preliminary site investigation reviewed three key sources of historical sediment information which included previous dredge sediment assessments, routine Licence compliance surveillance monitoring and the terrestrial contaminated sites Detailed Site Investigation. With respect to the historical findings and historical and current port related activities, the site was typically divided between the Navigational Channel (NC) and Commercial harbour (CH). No contaminants of potential concern (CoPC) were identified within NC sediments, however PASS was identified from most samples, with the acid neutralising capacity considered sufficient to neutralise the acid producing ability. The following contaminants were identified as CoPC within the CH:

- > Metals;
- > TBTs, and
- > Acid sulphate soils.

The purpose of this detailed sediment site investigation was to determine the extent of current contaminant concentrations to inform maintenance dredge management plans, primarily with respect to environmental impact assessment and management.

4.2. Detailed Site Investigation

A detailed site investigation of sediments within the CH and NC was implemented in accordance with the SAP between 16-18 June 2019, 18-20 February 2020 and 23 and 24 March 2021. Only minor deviations from the SAP (O2M 2019) occurred as described within **Section 2**. The selected methodologies were considered successful with the exception of core refusal occurring at most NC sites due to the unconfined surficial sediments becoming compacted over time below approximately 40 cm.

In addition, samples were collected from the nearshore MPA during 12 May 2021. Samples were collected from the sites identified in **Section 2**, which deviated from those presented in the SAP.

A summary of the results from the detailed site investigation is described below.

4.2.1. Sediment Properties

Surficial sediment characteristics typically vary primarily due to location. NC samples are characterised by a high degree of uniformity across sample sites, typically dominated by yellow to grey, fine to medium sands (\bar{x} > 91%). Inner harbour sediments are more variable with three distinct sediment types occurring with respect to their location within the CH. Sediments within the CH but occurring near the entrance to the channel were generally similar to NC sediments dominated by yellow to grey, fine to medium sands. Sediments within the north-west CH comprise medium fine silty sands, typically grey, brown or dark grey, whilst in the south-east of the harbour sediments are fine silty sands, typically grey to dark grey. All CH samples comprised a greater silt proportion (range 34.3-62.8%) when compared to NC sediments (range 1.9-17.5%) and much lower proportions of fine to medium sand, which range between 22.5-58.2% and 78.7-96.6%, respectively. Sediment samples of the north-western corner of the harbour contained a higher percentage of sand (\bar{x} = 53.5%) and lower percentage of silt (\bar{x} = 36.6%) compared with the south-eastern sediment samples, with averages of 29.4% and 58.8%, respectively. Sediments comprised very low proportions of gravel or clay sized particles across the study area with combined averages lower than 1.05% and 6%, respectively. Samples from the nearshore placement area are typically yellow-light brown medium to fine sands, very similar in observable appearance to the NC samples. PSDs for these sediments were dominated by medium sand sized particles, with fine sands being the second dominant by proportion. No observable fauna was identified.

These results suggest that the NC sediments are most likely to have originated from natural sources such as coastal silicate sands transported to the channel via localised northern longshore drift, or marine carbonate sediments transported via oceanic currents and swell. Vessel traffic are primarily considered responsible for the current pattern of accumulation occurring along the channel edges due to the effects of ship and tug propulsion blasting the channel center, causing unconsolidated sediments to become trapped along the steep channel walls. The sediments at the nearshore placement area are typically comparable with those within the NC, suggesting they are of a similar origin. Slightly greater PSDs at the nearshore placement area suggests the finer particles are continuously being mobilised by waves and currents which enter the littoral drift and migrate northwards or temporarily deposited on coastal beaches. Medium sands require slightly higher energy to mobilise, hence are greater by proportion at the Nearshore MPA.

Within the CH, sediments comprising a greater proportion of finer particles are likely to be a result of positioning in relation to Champion Bay along with previous dredging and port related bulk loading activities. The northwards facing aspect of the harbour mouth facilitates minimal migration of naturally sourced marine sediments, such as those characteristic of the NC, which typically drift from south to north. Previous dredge campaigns have also contributed to the fines present through the crushing and grinding of hard substrate and coarser particles into finer particles, a mechanism typically associated with previous capital dredging. Spillages and windblown dust from loading perforations would also contribute fines to the sediments within the CH. Within the CH, the two distinct differences in sediment characteristics are likely a result of altered tug and ship propeller mechanisms associated with turning vessels, (resulting in the finest particles migrating to the south-east) and standard vessel mooring activities which result in remaining sediments accumulating within the deeper berth pockets. Routine sediment sampling results identify consistency with PSDs for the north-west corner in this investigation, whilst identifying similar characteristics for sediments within the Berth 3, 4 and 5 shipping pockets (O2M 2018).

4.2.2. Tributyltin

TBTs were collected and analysed from all eight 'Suspect' and three 'Probably Contaminated' sites. No exceedances were recorded from 'Suspect' sediments. The 95% UCL of the means exceeded the adopted SQG at 'Probably Contaminated' sites, with two of the three sites also exceeding this level. TBTs were identified within the SAP (O2M 2019) to be collected at 50% of the sites due to the recent routine monitoring program recording no DGV exceedances across Berths 3, 4 and 5. However, DGV exceedances were recorded during 2016 (Berth 3 – two sites) and 2014 (Berth 3 – two sites; and 4 – one site). The overall trend for these berths upon review of the long-term historical data indicates a decreasing trend in TBT contamination.

Subsequent elutriate testing was conducted at three locations within the 'Probably Contaminated' sites with all results being below the Laboratory LoR and the 95% SPL. Therefore, it is uncertain from this investigation that the contamination risk profile of TBT present from the 'Probably Contaminated' sediments is commensurate, in fact lower, than the level awarded *moderately to slightly disturbed ecosystems* (ANZG 2018). However, the Laboratory detection level applied was above the 99% SPL (0.0004 µgSn/L) and therefore the level of risk TBTs pose to marine organisms if they were to be sea-dumped at an offshore location awarded this level of protection is uncertain from this study. Further investigation into the existing environment of the proposed sea-dump location, along with metocean conditions would require further assessment to determine the actual risk.

It should also be noted there was a considerable difference between the primary and secondary laboratory for the QA/QC samples CH3 and CH8, with associated RSDs outside of the acceptable range (138% and 167%, respectively). TBTs are typically highly variable within substrates due to their association with paint flakes, rather than a more consistent binding with finer sediment particles (as is typically the case for metals). This often leads to significant inter-site variation in results between replicate samples and temporally during routine surveys as identified within the long-term historical dataset from Licence compliance sampling.

4.2.3. Acid sulphate Soils

A total of 14 samples from the CH (eight from 'Suspect' and six from 'Probably Contaminated') and seven from the NC were analysed for chromium reducible sulphur in accordance with the SAP (O2M 2019). All CH samples and one NC sample exceeded the DER (2015) reduced inorganic sulphur action criterion of 0.03%, on average by 13-fold within CH samples. In accordance with recommendations from DER (2015), if the concentration meets or exceeds the 'action criteria', an acid sulfate soil management plan should be prepared for DWER.

To determine the net acidity of the PASS sediment samples, quantitative laboratory analyses for PASS was undertaken to measure the net effect of acid-generating processes in the sediment, balanced against acid-neutralising (or basic) components that may be present. The results indicate that the potential acidity of these sediments are effectively buffered from the acid neutralising capacity (ANC), and therefore there would be a negative net acidity following disturbance of these sediments. These findings are similar with a previous investigation by GHD (2011) with the exception that this investigation identified a lower number of exceedances of the S_{cr} action criteria within the NC. GHD (2011) concluded that there was sufficient ANC, even using a conservative 10% estimate, to maintain a net negativity acidity. Terrestrial based ASS investigations undertaken by Coffey (2017) assessed the reclaimed dredge material previously analysed in-situ by GHD (2011). Results from Coffey (2017) were

comparable to GHD (2011) observing no AASS, PASS and there is sufficient ANC to maintain net negative acidity. S_{cr} exceeded the DER action criteria at two from six samples, suggesting PASS was present. Net acidity was reported below the LoR ($<0.02\%$ S) for eight samples suggesting no ASS impacts had occurred from these sediments. It must be noted however, that these sediments were specifically placed below the water table within the reclaim cell to ensure no oxygenation of PASS could occur, thus reducing the ability for these soils to acidify. Coffey (2017) also concluded that potential acidity of these dredge material are sufficiently buffered from the ANC.

It is recommended that either relocation to a designated and approved sea-dumping site or burial below the water table within the existing Berth 7 reclaim pond are considered as suitable placement options for CH sediments.

As the DER action criteria for all sites within the CH and one site within the NC is exceeded, an Acid Sulphate Soils Management Plan will need to be developed and approved by the Department of Water and Environmental Regulation prior to any dredging activities occurring.

4.2.4. Metals and Metalloids

Comparison of the 95% UCLs of the means against adopted screening levels identified no exceedances for any metals from any of the samples analysed from the NC or nearshore MPA, whilst copper and zinc exceeded within both the 'Suspect' and 'Probably Contaminated' location designated within the CH. Screening exceedances occurred for total cadmium (two sites), copper (16 sites), lead (one site), mercury (one site) and zinc (14 sites) within the CH. All concentrations for total metals were below the relevant HILs and EILs with the exception of the low level EIL established for zinc (three sites).

In accordance with NAGD (2009), if the 95% UCL of a contaminant exceeds the specified screening level, comparison to natural background concentrations is required. O2M (2018) identified distinct differences within the grain sizes of inner harbour sediments and the sites used for routine monitoring reference locations. Normalisation against aluminium was therefore undertaken to allow for comparison with ambient background levels. Due to potential (unconfirmed) historical anthropogenic aluminium inputs within the south-eastern corner of the CH and confirmed anthropogenic inputs of copper, zinc and lead (O2M 2016, 2017, 2018 and 2019b) within the Berth 3 and 4 shipping pockets normalisation from sites CH13-CH15 and metals copper, lead and zinc from CH1-4 were not undertaken.

Normalisation of metals for screening level exceedances returned results between 'minor' to 'extremely severe', except for one mercury exceedance which was deemed 'No Enrichment'. In accordance with the NAGD, normalised results identified further assessment of bioavailability and elutriate concentrations for most samples will be required to determine environmental contaminants of potential concern for placement of the material. Metals without screening levels all returned values below 'minor', which is considered acceptable within the guidance of ANZG (2018) for a slightly to moderately disturbed ecosystem, such as a Port harbour or approved sea dumping location.

Assessment for dissolved concentrations (elutriates) and bioavailability (using dilute acid extraction (DAE)) was undertaken for cadmium (two samples), copper (10 samples), lead (one sample) and zinc (eight samples). Zinc exceeded the 95% SPL at one site within each of the 'Probably Contaminated' and 'Suspect' designated areas and the 90% SPL at two sites both within the 'Probably Contaminated' area. Bioavailability assessed using DAE identified zinc as the only metal recording a concentration above the LoRs but retained an average concentration (all sites tested) of 4.25 mg/L, significantly lower than the DGV screening level. These results indicate that during dredging there may be some release

of zinc bound to sediments into the surrounding marine environment, however the bioavailability of zinc available for uptake by marine organisms is extremely low. Other metals, as assessed, will have extremely low potential to cause any adverse environmental impacts during the proposed dredging project. Due to the level of dilution that the CH receives through tidal and swell generated water exchange, the dissolved zinc concentrations as assessed under laboratory conditions, along with the bioavailability assessment, is unlikely to pose any significant risk to marine organisms or long term water quality during, or post, the proposed dredging program.

These results are considered to be similar, albeit with typically lower concentrations and numbers of exceedances to GHD (2011). The GHD (2011) investigation undertook elutriate and bioavailability analysis on all CH samples collected and identified elutriate exceedances for copper, nickel and zinc, whilst copper, lead and zinc exceeded screening levels for bioavailable concentrations, with the 95% UCL of the mean for lead also exceeding the screening level. These sediments were placed into the Berth 7 reclaim which has since been subject to a terrestrial detailed site investigation including soil and groundwater assessed of metals. This investigation identified elevations of zinc above the EILs in two soil samples and elevations of dissolved cobalt (two sites), lead (3 sites) above the 95% SPL and copper (two sites) above the 90% SPL in groundwater (Coffey 2015). Follow up site investigations determined the concentrations of copper in groundwater would need to be >100 mg/L to result in 10 ug/L concentrations within the CH marine environment using dilution factors as described in Coffey (2017). Based upon groundwater monitoring results conducted at the Berth 7 reclaim, Coffey (2017) concluded *'the contribution of groundwater copper concentrations to the marine environment is considered to be negligible, and therefore poses no unacceptable risk to the marine environment of the Commercial Shipping Harbour'*. It should be noted that these reports have both been subject to a full audit and acceptance by an accredited Contaminated Sites Auditor acting on behalf of MWPA.

Based upon the lower concentrations of dissolved metals and associated bioavailable concentrations identified during this investigation, compared with 2011, the use of the CH sediments for land based reclamation is unlikely to pose any additional risk to the marine environment within the CH or the surrounding higher-value waters of Champion Bay. These sediments are also within the acceptable levels required for sea-dumping at an appropriate and approved location.

4.2.5. Nutrients

Nitrogen

Nitrogen within sediments occur almost entirely in organic forms, with no detections of nitrite/nitrate above LoRs. Nitrogen concentrations were typically highest at Berths 3, 4 and 6 which is commensurate with handling activities for import and export of fertilisers which occurs at these Berths. Nitrogen concentrations and spatial distribution results are highly comparable with GHD (2015) which reported TKN ranging between 1,300-2,200 mg/kg, compared with 1,200-2,300 mg/kg from this investigation at the same sites.

Nitrogen within porewater are considerably lower than sediment concentrations, however all detections exceeded the DGV applied. However, the DGV applied is not considered appropriate for a modified Port environment, rather being applicable to natural, undisturbed environments. The proportionately lower results for inorganic nitrogen in porewater compared to organic nitrogen forms in sediments support nitrogen typically occurring as particulate, and from anthropogenic sources (i.e. fertilisers). Furthermore, this demonstrates that either the denitrification processes acting on the particulate

nitrogen are suitably slow, or dilution factors suitably large, that there are low concentrations within porewaters, and likely even lower concentrations in the adjacent water column.

Nitrogen concentrations, and relationships between nitrogen forms, within porewaters are also comparable to the groundwater results and characteristics presented within Coffey (2015). Concentrations of NO_x and ammonia are typically comparable, with ammonia being more variable in both investigations. The distribution of nitrogen forms within groundwater indicate a similar relationship, typically occurring as organic forms identifying an anthropogenic source, and slow denitrification processes or high dilution factors occurring to explain low inorganic concentrations. However, a nutrient flux study (Coffey 2017) determined that whilst high level of nitrogen occur within groundwater the nitrogen flux, or annual export of nitrogen between groundwater and the marine environment is not sufficient to cause adverse impacts related to poor water quality from nitrogen enrichment within the water column.

Based upon these results there is a very low risk of marine environmental impacts posed by relocation of sediments into the Berth 7 reclaim area, or if relocated to an offshore disposal area due to high dilution factors which would be applied within the water column significantly reducing any water column concentrations.

Phosphorous

Total phosphorous concentrations in sediments are highest at Berth 3, with typically declining concentrations from Berth 4 to Berth 6 where the lowest concentration was reported. Phosphorus concentrations in sediments, and their spatial distribution from this investigation are highly comparable to GHD 2015. The concentration of phosphorus in sediments is also comparable to results obtained from 3.5 m below the surface at the Berth 7 reclaim, commensurate with where inner harbour sediments have been placed in the past.

FRP results within porewaters follow a similar spatial pattern as sediments with highest results reported at Berth 3 and lowest at Berth 6. Concentrations, and spatial pattern are typically comparable with GDH (2015) and indicate that phosphorous, like nitrogen, typically are occurring as particulates, rather than dissolved within porewaters. FRP concentrations within porewaters are typically within the range identified in groundwater at the existing reclaim area (Coffey 205).

Based upon these results there is a very low risk of marine environmental impacts posed by relocation of sediments into the Berth 7 reclaim area, or if relocated to an offshore disposal area due to high dilution factors which would be applied within the water column significantly reducing any water column concentrations.

4.2.6. QA/QC Assessment

Review of the laboratory and field QA/QC outputs identified that no results collected during the detailed site investigation were qualified as being unusable during the data review process.

All laboratory QA/QC compliance assessments met necessary recommendations except matrix spike recoveries for Aluminium and Iron in one (1) interlaboratory split sample. These were not determined due to the background level being greater than or equal to four times the spike level. NAGD (2009) recommends that matrix spike data should not be reported if the naturally occurring levels in the sample are greater than twice the spiking level. It was considered unlikely that gross errors have occurred

during the laboratory testing procedure which has significantly affected interpretation of the results, particularly as aluminium and iron results (at routinely samples sites CH1-CH8) were comparable with historical results.

The RSD of $\pm 35\%$ for field splits and $\pm 50\%$ in field replicates were considered acceptable, with RSDs only exceeded by a few parameters. All field replicates for assessed metals were within the acceptable range for each of the three samples, with only silver, mercury, TBT and TOC recording RSDs greater than 35% in field splits. Analysis of the exceedances concluded that these results should be used as a guide during interpretation, however the overall data for the program are of sufficient quality for the purposes and objectives of this sample program.

4.3. Suitability of Material for Onshore Placement

The dredge material has not yet been identified for a particular placement methodology. The purpose of this investigation is to categorise the material and identify environmentally acceptable placement options through which MWPA can apply to dredge management planning and guide the required approvals as determined by the finalised scope. MWPA has several available options through which the dredge material can be either re-used (land reclamation or sustainable relocation) or via identification and assessment of an appropriate sea placement site.

4.3.1. Suitability of Sediments for Onshore Placement

The 2011 maintenance dredge program identified land-based placement of all dredge material from sediments accumulated with the CH and NC within the Berth 7 reclaim pond as the most suitable option. The 2002/2003 capital dredge project also utilised the reclaim for placement of 'contaminated' sediments below the water table and some channel sediments to 'cap' the lower lying CH sediments (URS 2001). The Berth 7 reclaim was designed purposely during the 2002/2003 capital dredge and Port upgrade project to aid in land reclamation required to construct a seventh berth, increase lay down space and for securing the placement of harbour sediments in an environmentally sensitive manner. This investigation has determined that with respect to contaminants, harbour sediments are characterised by a lower risk profile than during the early 2000s investigations (ATA 2000, URS 2001) and prior to the 2012 maintenance dredge program (Oceanica 2010a; 2010b, GHD 2011). TBT elutriate waters which may return into the harbour are also consistent with the SPL awarded to the harbour (ANZG 2018). Acid sulphate soils are consistent with findings from GHD (2011) for the CH, with NC sediments currently posing a lower risk. Analysis of acid sulfate soils undertaken during the project determined samples from each area exceed the action criterion of 0.03%S for managing acid sulfate soils, indicating PASS sediments are present within the material to be dredged. In accordance with recommendations from DER (2015), an acid sulfate soil management plan should be prepared for submission to DWER for the proposed dredge project. However, quantitative laboratory analyses for PASS indicate the natural acid neutralising capacity of the sediment samples provide sufficient buffering for acid-generating processes, and treatment (i.e. lime dosing neutralisation of ASS) for excavated sediment is unlikely to be required. Therefore, the material is considered suitable for onshore placement. Coffey (2017) confirmed that while PASS is present within the Berth 7 reclaim soils (previous dredge material), no ASS currently exists and there is sufficient ANC within these soils to buffer acid generation. Coffey (2017) further concluded that disturbance or dewatering would provide suitable conditions for oxidation potentially resulting in acidification of groundwater and any such disturbance should be managed through an acid sulfate soil management plan.

It is therefore recommended that all identified dredge material are suitable for land-based reclamation within the Berth 7 reclaim pond.

4.3.2. Suitability of Sediments for Sustainable Relocation

For the purposes of re-usage of dredge material as sustainable relocation for coastal resilience several factors need to be considered. These include the suitability relevant to sediment contaminants, the methods and location selected for placement and the potential impacts to marine ecosystems through placement and dispersion. This investigation specifically deals with the suitability of sediments to be used for sustainable relocation based upon physical and chemical properties as identified through the detailed site investigation. A separate environmental impact investigation would be required to determine that sustainable relocation of dredge material would not adversely affect the coastal system, or adjacent ecological communities, particularly the benthic communities and habitat, such as seagrasses.

‘Probably Clean’ sediments occurring within the NC have been identified as contaminant free, naturally occurring marine sediments, although with a very low potential to acidify causing ASS. If used for the purposes of sustainable relocation and not provide the opportunity to oxidate then ASS would not be of concern from these sediments. It is therefore considered that sustainable relocation, based upon physical and chemical properties of NC sediments, is a potential placement methodology.

Inner harbour sediments, with the exception of harbour entrance sites (CH10, CH13, CH18 and CH19) are significantly different to the naturally occurring sediment found at the reference locations (O2M 2018, 2019b), within the NC and the wider natural system (i.e. Champion Bay). Observed differences within physical properties, particularly physical appearance (colour and foreign material) and PSD (finer particle sizes), are characteristic of CH sediments. Finer particle sizes characteristic of these sediments would behave differently when subjected to the same metocean conditions (i.e. dispersion, coastal migration) and the darker greys and browns potentially able to create undesirable aesthetics compared with naturally occurring marine sediments. Elevated dissolved zinc above the 99% SPL and the uncertainty of dissolved copper (due to LoRs above 99% SPL) would be typically unsuitable for relocation to a *High Ecological/Conservation Value System* (ANZG 2018) such as the coastal zone along the foreshore and northern beaches of Geraldton. The impacts of relocation of sediments containing high levels of metals, elevated TBTs and dissolvable metals also creates a social risk to Port Authority that would need to be carefully assessed and considered if elected for this re-use category.

Sites located at the entrance to the shipping channel (CH10, CH13, CH18 and CH19) would be considered suitable for sustainable relocation. They have been identified as contaminant free, naturally occurring marine sediments, although with a very low potential to acidify causing ASS. If used for the purposes of sustainable relocation and not provide the opportunity to oxidate then ASS would not be of concern from these sediments. Total copper and zinc were detected in these sediments, though when tested for elutriates and bioavailability zinc is of any concern for marine water quality. Given the significant dilution occurring with combining the sediments with the NC sediments, and waves and currents at the disposal site, there is a very low risk any exceedances of the 99% SPL for marine water quality would occur from the sediments. It is therefore considered that sustainable relocation, based upon physical and chemical properties of these sediments, is a potential placement methodology.

Based upon the assessment contained within this investigation NC sediments are suitable for sustainable relocation for coastal stability purposes, however CH sediments are not recommended for this purpose.

4.3.3. Suitability of Sediments for Offshore Placement

For the purposes of this assessment the principles and requirements of the NAGD (2009) were specifically integrated and implemented into this detailed site investigation to ensure the suitability of sea-dumping classification was assessed for all sediments. Based upon the Preliminary Site Assessment outlined within the SAP and the results presented within this report, with the exclusion of TBTs (elevated total and elutriates above the 99% SPL) which require further assessment to inform their specific risk for offshore placement, all physical and chemical properties reported and discussed provide suitable justification for the suitability of sea-dumping as an option for all three sediment categories.

It should be noted however, that whilst sediments are deemed suitable for sea-dumping, this report does not provide this recommendation based upon any level of environmental impact assessment as is required for referral under the Environmental Protection Act 1986 or to obtain a sea-dumping permit. These recommendations are exclusively based upon the contaminant properties reported and discussed within this report.

5. Conclusion

Channel sediments were characterised as medium to fine grained, yellow to grey sediments of natural origins such as coastal silicate sands transported to the channel via localised northern longshore drift, or marine carbonate sediments transported via oceanic currents and swell. Inner harbour sediments were similar physically to those within the channel at the harbour entrance, however, were slightly finer in Berths 3-7 pockets and finer again in the south-eastern corner. Appearance ranged from grey to dark grey and brown throughout the berth pockets and the south-eastern corner.

Channel sediments were assessed as contaminant free, which is consistent with previous channel sediments assessments. 'Suspect' sediments contain total copper, zinc and mercury (one site only) above the DGV levels with 95% UCLs of the means exceeding for copper and zinc. 'Probably Contaminated' sediments contain total cadmium (two sites, copper (all sites), lead (one site) and zinc (five sites) above the DGV screening levels with 95% UCLs of the means exceeding for copper and zinc. Normalised raw data identified 'Moderate' or higher levels of enrichment for cadmium, copper, lead and zinc occurring within the inner harbour.

Elutriate (dissolved metals) analysis identified exceedances of the screening levels for zinc only within inner harbour sediments. All bioavailable concentrations, as assessed via dilute acid extraction, are below the screening guideline for all sites within the inner harbour, with only copper and zinc detected above LoRs.

TBTs normalised to 1% total organic carbon exceed the screening level at two from three sites within the Berths 3,4 and 5 shipping pockets. Subsequent assessment undertaken on three samples from the 'Probably Contaminated' sites CH4, CH5 and CH6 were analysed for elutriate TBTs. All results were reported below the laboratory LoR and the 95% recommended for moderately disturbed ecosystems (ANZG 2018).

The potential for sediments to produce acid sulphate soil was assessed through laboratory analysis of the sulfur reducible chromium suite. Action level criteria exceedances occur at all inner sites and one channel sites. The results indicate that the potential acidity of these sediments are effectively buffered from the acid neutralising capacity (ANC), and therefore there would be a negative net acidity following disturbance of these sediments. However, as the DER (2015) action criteria was exceeded an Acid Sulfate Soils Management Plan will need to be developed, submitted and approved by the Department of Water and Environmental Regulation prior to project commencement.

Inner harbour sediments were analysed for nutrients at Berth 3-6. Nitrogen and phosphorus results indicate that they exist typically as particulates, with proportionately lower concentrations occurring in porewaters. Concentrations and characteristics were typically similar to previous nutrient investigations indicating little to know change over time, as well as porewater concentrations being comparable current groundwater concentrations within the existing reclamation area. These results indicate that sediments are not changing over time, and therefore will pose no further risk to marine environmental quality through relocation into the reclaim. It is also arguable that due to sufficient dilution factors applicable within the open ocean these concentrations could be suitable for ocean disposal, however, due to other considerations, these sediments are identified for land reclamation.

Based upon the assessment of sediment sampling results presented within this report the following options for dredge material placement are available for MWPA to further assess during project scoping and related environmental impact assessment:

- > Beneficial re-use through sustainable relocation for coastal resilience
 - Channel and harbour entrance sediments only
- > Placement within the Berth 7 reclaim pond
 - All dredge material
- > Sea Dumping
 - All dredge material – management consideration required for elutriate TBTs from ‘Probably Contaminated’ sediments due to insufficient data to assess impacts for 99% SPL required at sea dumping locations.

5.1. Recommendations

This investigation identified the following recommendations:

- > Any consideration for offshore sea-dumping of “Probably Contaminated” sediments will require further risk assessment for elutriate TBTs based upon environmental and metocean consideration at the selected material placement site.
- > Due to the potential for historic anthropogenic inputs associated with the closed vessel slipway and vessel maintenance facility once located within the south eastern corner of the inner harbour, lithium is likely to be a better normalising element rather than aluminium for future surveys.
- > Any land reclamation activities using sediments from the NC or CH will require an Acid Sulfate Soils Management Plan.

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Appendix A Sample Chain of Custody Forms

Chain of Custody (CoC) Record

Project: Geraldton Port Baseline Sediment Characterisation Sampling 2019				Laboratory: ARL		Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager.											
Client: Midwest Ports Authority		Job No.: 18WAU-0004		Address: 46-48 Banksia Road, WELSHPOOL, WA, 6106		Email laboratory analysis results to O2M Project Manager.											
Lab Quote No.: O2M160419Rev1		Turnaround Time: Standard		Lab. Contact: Kim Rogers													
O2M Project Manager: Russell Stevens (0447 465 009)		Email Address: russell.stevens@o2marine.com.au															
O2M Sample ID	Laboratory Sample ID	Date	Time	Sample Matrix S: Soil / SL: Sludge / W: Water / A: Air	Containers Type B: Bottle / Jar / Vial / G-Glass / P-Plastic / B-Bag	No. of Samples	Total Volume (mL)	Trace Metals (Al, As, Cd, Co, Cr, Pb, Mn, Ni, Zn, Ag, Fe, V)	Mercury - total - Low Level	Organotest - TBT	Chromium Red Sulphur suite	TOC	Particle Size Distribution	Dilute Acid Extraction	Elutriate	Chrysalography	Comments
NC1	1	17/06/2019	3:30	S	1J, 2P	3	500	X	X		X	X					All soil samples are marine sediment
NC3-S	2	17/06/2019	2:30	S	1J, 2P	3	500	X	X		X	X					Shading indicates sample shared with Geraldton Port Compliance Sediment Sampling 2019 - Shared tests (i.e. total metals only required to be tested once but reported separately for both programs as indicated)
NC5-S	3	17/06/2019	1:45	S	1J, 2P	3	500	X	X		X	X					
NC7-S	4	16/06/2019	4:00	S	1J, 2P	3	500	X	X		X	X					
NC9	5	16/06/2019	3:15	S	1J, 2P	3	500	X	X		X	X					
NC11	6	16/06/2019	2:40	S	1J, 2P	3	500	X	X		X	X					
NC13	7	16/06/2019	2:00	S	1J, 2P	3	500	X	X		X	X					X - Undertake Analysis
CH1-1	8	18/06/2019	8:50	S	1J, 1P	2	250	X	X		X			H			H - Hold sample - do not analyse
CH1-2	9	18/06/2019	8:50	S	1J, 1P	2	250	X	X					H			
CH1-3	10	18/06/2019	8:50	S	1J, 1P	2	250	X	X					H			
CH2-1	11	18/06/2019	9:15	S	2J, 1P	3	400	X	X		X			H	H		
CH3-1	12	18/06/2019	10:00	S	2J, 1P	3	400	X	X		X			H	H		
CH4-1	13	18/06/2019	10:15	S	2J, 1P	3	400	X	X		X			H	H		
CH5-1	14	17/06/2019	11:30	S	1J, 1P	2	250	X	X		X			H			
CH5-2	15	17/06/2019	11:30	S	1J, 1P	2	250	X	X					H			
CH5-3	16	17/06/2019	11:30	S	1J, 1P	2	250	X	X					H			
CH6-1	17	17/06/2019	11:00	S	1J, 1P	2	250	X	X		X			H			
CH7-1	18	17/06/2019	9:55	S	2J, 1P	3	400	X	X		X			H	H		
CH8-1	19	17/06/2019	10:15	S	2J, 1P	3	400	X	X		X			H	H		
CH8-D	20	17/06/2019	10:15	S	3J, 2P	5	900	X	X	X	X	X	X	H	H		
CH10-1	21	17/06/2019	8:45	S	2J, 1P	3	400	X	X		X			H	H		
CH10-2	22	17/06/2019	8:45	S	1J, 1P	2	250	X	X					H			
CH10-3	23	17/06/2019	8:45	S	1J, 1P	2	250	X	X					H			
CH11	24	18/06/2019	11:15	S	3J, 2P	5	900	X	X	X	X	X	X	H	H		
CH12-S	25	17/06/2019	9:10	S	3J, 2P	5	900	X	X	X	X	X	X	H	H		
CH12-D	26	17/06/2019	9:10	S	3J, 2P	5	900	X	X	X		X	X	H	H		
CH13	27	17/06/2019	4:00	S	3J, 2P	5	900	X	X	X	X	X	X	H	H		
CH14-S	28	18/06/2019	11:30	S	3J, 2P	5	900	X	X	X	X	X	X	H	H		
CH14-D	29	18/06/2019	11:30	S	3J, 2P	5	900	X	X	X		X	X	H	H		
CH15	30	18/06/2019	12:00	S	3J, 2P	5	900	X	X	X	X	X	X	H	H		
DUP-4	31	17/06/2019	11:30	S	1J	1	200	X	X								
DUP-5	32	18/06/2019	9:15	S	1J	1	200	X	X								
TRIP-S1	33	17/06/2019	10:15	S	1J	1	200	X	X								
TRIP-S2	34	18/06/2019	9:15	S	1J	1	200	X	X								
TRIP-S3	35	18/06/2019	10:00	S	1J	1	200	X	X								
RINSB	36	18/06/2019	12:30	W	1J	1	200	X	X								
TRIPB	37	18/06/2019	12:35	S	1J	1	200	X	X								

Sampled By: R. Stevens	Date/Time: 19/06/2019 1200hrs	Relinquished By: R. Stevens
Received By Lab:	Date/Time:	Courier:
Sample Cold (Yes/No):	Sample Container Sealed (Yes/No):	

Chain of Custody (CoC) Record

[illegible]

Chain of Custody (CoC) Record

[illegible]

Chain of Custody (CoC) Record

Project:		Geraldton Port Sediment Sampling 2019				Laboratory:		ALS				Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager. Email laboratory analysis results to O2M Project Manager.			
Client:		Midwest Ports Authority		Job No.:		18WAW-0004		Address:		26 Rigali Way, Wangara WA 6065 Australia					
Lab Quote No.:		18P164v1		Turnaround Time:		Standard		Lab. Contact:		Lauren Blagioni					
O2M Project Manager:		Russell Stevens (0447 465 009)		Email Address:		russell.stevens@o2marine.com.au		Containers:		Analyses:					
O2M Sample ID	Laboratory Sample ID	Date	Time	Sample Matrix	Type	No. of Samples	Total Volume (mL)	Trace Metals (Al, As, Cd, Cu, Pb, Hg, Mn, Ni, Zn, Ag, Fe, V)	Mercury - total - Low Level	Organotin - TBT	Bioavailable metals	TOC	Comments		
TRIP-S1	1	17/06/2019	10:15	S	1L, 1P	2	250	X	X	X	H	X	All Soil samples are marine sediment		
TRIP-S2	2	18/06/2019	9:15	S	1L, 1P	2	250	X	X	X	H	X	H - Hold sample - do not analyse		
TRIP-S3	3	18/06/2019	10:00	S	1L, 1P	2	250	X	X	X	H	X	Required trace metals LORs: Arsenic, Cadmium, Silver 0.1 mg/kg, Aluminium 10 mg/kg Chromium 0.2 mg/kg Copper, Lead, Nickel, Zinc 1 mg/kg Iron 10 mg/kg Mercury 0.01 mg/kg		
Sampled By:	R. Stevens		Date/Time:	19/06/2019 1200hrs		Relinquished By:	R. Stevens								
Received By Lab:	R. Stevens		Date/Time:	20-6-19 09:40		Courier:									
Sample Cold (Yes/No):	Yes.		Sample Container Sealed (Yes/No):	Yes.											

Environmental Division
 Perth
 Work Order Reference
EP1905988





Chain of Custody (CoC) Record

Page 1 of 2

Project:	Geraldton Port Compliance Sediment Sampling 2020			Laboratory:	ALS 26 Rigall Way, Wangara WA 6065 Australia			Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager. Project Manager: Email laboratory analysis results to O2M Project Manager.					
Client:	Midwest Ports Authority	Job No.:	18WVAU-0004	Lab. Contact:	Lauren Biagioni								
Lab Quote No.:	EP/101/20	Turnaround Time:	Standard	Type	No. of Samples	Total Volume (ml)	Trace Metals (As, Ba, Cd, Cr, Cu, U, Pb, Mn, Ni, Zn, Ag, Fe, V)	Mercury - total - (low level)	Organobars - TBT	PAH - standard (15 Analytes)	Particle Size Distribution	Elutriate TBTs	Elutriate Metals + TBTs
O2M Project Manager	Russell Stevens (0647 465 009)	Email Address:	russell.stevens@o2marine.com.au	S-Cell / St-Cell / W-Cell / A-Cell	Plastic / B-Bag	Plastic / B-Bag	Plastic / B-Bag	Plastic / B-Bag	Plastic / B-Bag	Plastic / B-Bag	Plastic / B-Bag	Plastic / B-Bag	Plastic / B-Bag
O2M Sample ID	Laboratory Sample ID	Date	Time										
ORAL-1	1	20/02/2020	1125	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-2	2	20/02/2020	1130	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-3	3	20/02/2020	1140	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-4	4	20/02/2020	1200	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-5	5	20/02/2020	1205	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-6	6	20/02/2020	1210	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-7	7	20/02/2020	1100	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-8	8	18/02/2020	1110	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-9	9	18/02/2020	1120	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-10	10	18/02/2020	1030	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-11	11	18/02/2020	1040	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-12	12	18/02/2020	1050	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-13	13	19/02/2020	1050	S	41, 2P	6	200	X	X	X	X	X	
ORAL-14	14	19/02/2020	1100	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-15	15	19/02/2020	1115	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-16	16	20/02/2020	1050	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-17	17	20/02/2020	1055	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-18	18	20/02/2020	1100	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-19	19	20/02/2020	940	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-20	20	20/02/2020	950	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-21	21	20/02/2020	1000	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-22	22	20/02/2020	900	S	41, 2P	6	1500	X	X	X	X	X	
ORAL-23	23	20/02/2020	915	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-24	24	20/02/2020	920	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-25	25	18/02/2020	1710	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-26	26	18/02/2020	1715	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-27	27	18/02/2020	1720	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-28	28	18/02/2020	1630	S	41, 2P	6	1500	X	X	X	X	X	
ORAL-29	29	18/02/2020	1640	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-30	30	18/02/2020	1645	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-31	31	18/02/2020	1745	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-32	32	18/02/2020	1800	S	21, 2P	4	1000	X	X	X	X	X	
ORAL-33	33	18/02/2020	1810	S	21, 2P	4	1000	X	X	X	X	X	
Sampled By:	R Stevens			Date/Time:	24/02/2020 1200								
Received By Lab:	25/2/2020			Date/Time:	1:00PM SP								
Sample Cold (Yes/No):	18.1			Sample Container Sealed (Yes/No):	SP								
Relinquished By:	R Stevens			Date/Time:	24/02/2020 1200								
Courier:													

Environmental Division
Perth
Work Order Reference
EP2001971



Telephone : + 61-8-9406 1301



Chain of Custody (CoC) Record

Project:	Gerlainton Port Compliance Sediment Sampling 2019				Laboratory:	ARL										Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager.	
Client:	Midwest Ports Authority	Job No.:	18WAL-0004		Address:	46-48 Banksia Road, WELLSPOOL, WA. 6106										Project Manager.	
Lab Quote No.:	O2M180413Rev1	Turnaround Time:	Standard		Lab. Contact:	Kirm Rogers Analyses										Email laboratory analysis results to O2M Project Manager.	
O2M Project Manager	Russell Stevens (0447 465 009)	Email Address: russell.stevens@o2marine.com.au			Type	PART - Standard (16 Analyses)										All soil samples are marine sediment	
O2M Sample ID	Laboratory Sample ID	Date	Time	Sample Matrix	No. of Samples	Trace Metals (As, Cd, Cu, Li, Pb, Mn, Ni, Zn, Ag, Fe, V)	Mercury - total - low level	Organotins - TBT	TOC	Particle Size Distribution	Elutriate TBTs	Elutriate Metals + TBTs	Elutriate Acid Extraction (Metals)	Comments			
CH10-1	34	19/02/2020	1140	S	21, 2P	4	1000	X	X	X	X	X					
CH10-2	35	19/02/2020	1145	S	21, 2P	4	1000	X	X	X	X	X					
CH10-3	36	19/02/2020	1150	S	21, 2P	4	1000	X	X	X	X	X					
YMT-1	37	18/02/2020	1200	S	21, 2P	4	1000	X	X	X	X	X					
YMT-2	38	18/02/2020	1210	S	21, 2P	4	1000	X	X	X	X	X					
YMT-3	39	18/02/2020	1215	S	21, 2P	4	1000	X	X	X	X	X					
TBT-1	40	18/02/2020	1300	S	21, 2P	4	1000	X	X	X	X	X					
TBT-2	41	18/02/2020	1305	S	21, 2P	4	1000	X	X	X	X	X					
TBT-3	42	18/02/2020	1310	S	21, 2P	4	1000	X	X	X	X	X					
CS1-1	43	18/02/2020	1500	S	21, 2P	4	1000	X	X	X	X	X					
CS1-2	44	18/02/2020	1510	S	21, 2P	4	1000	X	X	X	X	X					
CS1-3	45	18/02/2020	1515	S	21, 2P	4	1000	X	X	X	X	X					
CS2-1	46	18/02/2020	1530	S	21, 2P	4	1000	X	X	X	X	X					
CS2-2	47	18/02/2020	1535	S	21, 2P	4	1000	X	X	X	X	X					
CS2-3	48	18/02/2020	1545	S	21, 2P	4	1000	X	X	X	X	X					
CH7-1	49	19/02/2020	1000	S	21, 2P	4	1000	X	X	X	X	X					
CH7-2	50	19/02/2020	1005	S	21, 2P	4	1000	X	X	X	X	X					
CH7-3	51	19/02/2020	1015	S	21, 2P	4	1000	X	X	X	X	X					
CH8-1	52	19/02/2020	920	S	21, 2P	4	1000	X	X	X	X	X					
CH8-2	53	19/02/2020	930	S	21, 2P	4	1000	X	X	X	X	X					
CH8-3	54	19/02/2020	935	S	21, 2P	4	1000	X	X	X	X	X					
DUP-1	55	18/02/2020		S	21, 2P	4	1000	X	X	X	X	X					
DUP-2	56	18/02/2020		S	21, 2P	4	1000	X	X	X	X	X					
DUP-3	57	20/02/2020		S	21, 2P	4	1000	X	X	X	X	X					
DUP-4	58	20/02/2020		S	21, 2P	4	1000	X	X	X	X	X					
DUP-5	59	20/02/2020		S	21, 2P	4	1000	X	X	X	X	X					
TRIP-P1	60	18/02/2020		S	21, 2P	4	1000	X	X	X	X	X					
TRIP-P2	61	19/02/2020		S	21, 2P	4	1000	X	X	X	X	X					
TRIP-P3	62	20/02/2020		S	21, 2P	4	1000	X	X	X	X	X					
RINSB	63	19/02/2020		W	3B	4	1000	X	X	X	X	X					
Elutriate Water	64	20/02/2020	990	W	2B	2	101					X					
Relinquished By:	R Stevens	Date/Time:	24/02/2020 1200		Relinquished By:	R Stevens											
Received By Lab:		Date/Time:	19M		Courier:												
Sample Cold (Yes/No):	25-1-2020				Sample Container Sealed (Yes/No):												

Chain of Custody (CoC) Record

Project: Geraldton Port Baseline Sediment Characterisation Sampling 2021				Laboratory: ARL		Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager. Email laboratory analysis results to O2M Project Manager.	
Client: Midwest Ports Authority				Address: 46-48 Banksia Road, WELSHPOOL, WA, 6106			
Job No.: 18WAU-0004				Lab. Contact: Kim Rogers			
Turnaround Time: Standard							
O2M Project Manager: Russell Stevens (0447 465 009)				Email Address: russell.stevens@o2marine.com.au			
O2M Sample ID	Laboratory Sample ID	Date	Time	Sample Matrix	Containers	Analyses	
				S-Sediment / Sl-Sludge / W-Water / A-Air	Type B-Bottle / J-Jar / V-Vial / G-Glass / P-Plastic / B-Bag	No. of Samples	Total Volume (mL)
							Trace Metals (Al, As, Cd, Cr, Cu, Pb, Mn, Ni, Zn, Ag, Fe, V)
							Mercury - total - Low Level
							Organotins - TBT
							TOC
							Particle Size Distribution
							TEN, TN, Nox-N, TP
							Porewater (NO ₂ , NO ₃ , NH ₄ , FFP)
							Comments
NC17-1	1	24/03/2021	9:05	S	J	2	X X
NC17-2	2	24/03/2021	2:18	S	J	2	X X
NC17-3	3	24/03/2021	9:35	S	J	2	X X
NC18	4	24/03/2021	2:18	S	J	2	X X
NC19	5	24/03/2021	9:35	S	J	2	X X
CH16	6	24/03/2021	9:45	S	J	2	X X X X X
CH17	7	23/03/2021	11:00	S	J	2	X X X X X
CH18	8	23/03/2021	10:30	S	J	2	X X X X X
CH19	9	23/03/2021	10:45	S	J	2	X X X X X
CH1-1	10	24/03/2021	10:00	S	J	3	X X
CH2-1	11	24/03/2021	10:35	S	J	3	X X
CH3-1	12	24/03/2021	1:45	S	J	3	X X
CH3-2	13	24/03/2021	1:45	S	J	3	X X
CH3-3	14	24/03/2021	1:45	S	J	3	X X
CH4-1	15	24/03/2021	11:15	S	J	3	X X
CH5-1	16	24/03/2021	11:50	S	J	3	X X
CH6-1	17	24/03/2021	12:15	S	J	3	X X
CH7-1	18	24/03/2021	12:40	S	J	3	X X
CH8-1	19	24/03/2021	1:10	S	J	3	X X
SPLIT-P4	20	24/03/2021		S	J	4	X X
Sampled By: R. Stevens				Date/Time: 23 & 24/03/2021		Relinquished By: C. Lane	
Received By Lab: N Hannah				Date/Time: 25/3/21		Courier:	
Sample Cold (Yes/No): 9.2				Sample Container Sealed (Yes/No):		NA	

[illegible]

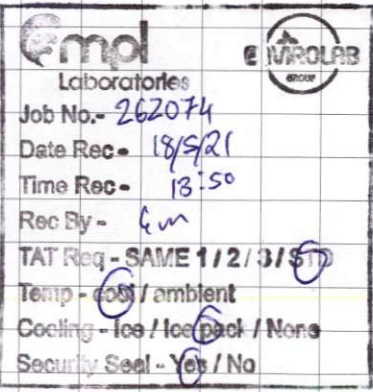
Environmental Division
Perth
Work Order Reference
EP2103295

1 telephone : 618-594-7-301

Chain of Custody (CoC) Record

Project: Geraldton Port Baseline Sediment Characterisation Sampling 2019				Laboratory: ARL		Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager. Email laboratory analysis results to O2M Project Manager.																					
Client: Midwest Ports Authority				Job No.: 18WAU-0004												Address: 46-48 Banksia Road, WELSHPOOL, WA, 6106											
Lab Quote No.:				Turnaround Time: Standard												Lab. Contact: Kim Rogers											
O2M Project Manager: Russell Stevens (0447 465 009)				Email Address: russell.stevens@o2marine.com.au																							
O2M Sample ID	Laboratory Sample ID	Date	Time	Sample Matrix S-Soil / SL-Sludge / W-Water / A-Air	Type B-Bottle / J-Jar / V-Vial / G-Glass / P-Plastic / B-Bag	No. of Samples	Total Volume (mL)	Trace Metals (Al, As, Cd, Cr, Cu, Pb, Mn, Ni, Zn, Ag, Fe, V)	Mercury - total - Low Level	Organotins - TBT	TOC	Particle Size Distribution	Moisture				Comments										
NPA1-A	21-08919-1	12/05/2021	2:55	S	J & B	2	750	x	x	x	x	x	x				All soil samples are marine sediment										
NPA1-B	-2	12/05/2021	2:55	S	J & B	2	750	x	x	x	x	x	x														
NPA1-C	-3	12/05/2021	2:55	S	J & B	2	750	x	x	x	x	x	x				Required trace metals LORs: Arsenic, Cadmium, Silver 0.1 mg/kg, Aluminium 10 mg/kg Chromium 0.2 mg/kg Copper, Lead, Nickel, Zinc 1 mg/kg Iron 10 mg/kg Mercury 0.01 mg/kg										
NPA2	-4	12/05/2021	2:40	S	J & B	2	750	x	x	x	x	x	x														
NPA3	-5	12/05/2021	2:20	S	J & B	2	750	x	x	x	x	x	x														
NPA4	-6	12/05/2021	3:05	S	J & B	2	750	x	x	x	x	x	x														
NPA5	-7	12/05/2021	3:15	S	J & B	2	750	x	x	x	x	x	x														
DUP1	-8	12/05/2021	-	S	J	1	250	x	x	x	x		x														
Sampled By: R. Stevens				Date/Time: 12/05/2021				Relinquished By: R. Stevens				13/05/2021															
Received By Lab: NH - ARL				Date/Time: 14/5/21				Courier:																			
Sample Cold (Yes/No): 1-2				Sample Container Sealed (Yes/No): Y																							
Pentagon																											

Chain of Custody (CoC) Record

Project: Geraldton Port Baseline Sediment Characterisation Sampling 2019				Laboratory: ARL - Subcontracted				Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager. Email laboratory analysis results to O2M Project Manager.						
Client: Midwest Ports Authority				Address: TBA										
Job No.: 18WAU-0004				Lab. Contact: Kim Rogers										
Lab Quote No.:		Turnaround Time: Standard		Containers S-Soil / SL-Sludge / W-Water / A-Air B-Bottle / J-Jar / V-Vial / G-Glass / P-Plastic / B-Bag No. of Samples Total Volume (mL) Trace Metals (Al, As, Cd, Cr, Cu, Pb, Mn, Ni, Zn, Ag, Fe, V) Mercury - total - Low Level Organotins - TBT TOC Moisture										
O2M Project Manager: Russell Stevens (0447 465 009)		Email Address: russell.stevens@o2marine.com.au												
O2M Sample ID	Laboratory Sample ID	Date	Time											
i DUP2				S	2 x J	2	500	X	X	X	X	X	All soil samples are marine sediment	
				<div style="border: 1px solid black; padding: 5px; display: inline-block;">  <p>Emol Laboratories Job No. - 262074 Date Rec - 18/5/21 Time Rec - 13:50 Rec By - Gm TAT Req - SAME 1/2/3/5/10 Temp - 400 / ambient Cooling - Ice / Ice pack / None Security Seal - Yes / No</p> </div> <div style="margin-left: 20px;"> <p>0.5 mg/kg</p> <p>1000/15</p> </div>										
Sampled By: R. Stevens				Date/Time:				Relinquished By: R. Stevens						
Received By Lab: Gm				Date/Time: 18/5/21				Courier:						
Sample Cold (Yes/No):		Sample Container Sealed (Yes/No):												

Required trace metals LORs:
 Arsenic 0.1 mg/kg
 Cadmium 0.1 mg/kg
 Silver 0.1 mg/kg
 Aluminium 10 mg/kg
 Chromium 0.2 mg/kg
 Copper, Lead, Nickel, Zinc 1 mg/kg
 Iron 10 mg/kg
 Mercury 0.01 mg/kg

Appendix B Primary Laboratory Analytical Reports

LABORATORY REPORT

Job Number: 19-09740-A
Revision: 00
Date: 28 August 2019

ADDRESS: **O2 Marine**
Suite 2, 4B Mews Rd
Fremantle WA 6160

ATTENTION: Russell Stevens

DATE RECEIVED: 19/06/2019

YOUR REFERENCE: 18WAU-0004

PURCHASE ORDER:

APPROVALS:



Kim Rodgers
General Manager

REPORT COMMENTS:

This report is issued by Analytical Reference Laboratory (WA) Pty Ltd. The report shall not be reproduced except in full without written approval from the laboratory.

Samples are analysed on an as received basis unless otherwise noted.

Elutriation subcontracted to MPL, NATA Accred No. 2901, Report Number 231512

METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377
Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 401/403	Metals in Soil and Sediment by ICPOES/MS
Subcontracting	See Report Comments section for more information.



WORLD RECOGNISED
ACCREDITATION

Accredited for compliance with
ISO/IEC 17025 - Testing

O2 Marine
Job No: 19-09740-A

LABORATORY REPORT
Revision: 00

Date: 28/08/19

Metals in Soil and Sediment			Sample No	19-09740-A-48	19-09740-A-49
Sample Description				Composite 1: CH10-1, CH11, CH12-S, CH12-D	Composite 2: CH13, CH14-S, CH14-D, CH15
Sample Date				17/06/2019	17/06/2019
ANALYTE	LOR	Units		Result	Result
Copper - 1M HCl	1	mg/kg		2	2
Zinc - 1M HCl	1	mg/kg		4	2

Metals in Water			Sample No	19-09740-A-48	19-09740-A-49
Sample Description				Composite 1: CH10-1, CH11, CH12-S, CH12-D	Composite 2: CH13, CH14-S, CH14-D, CH15
Sample Date				17/06/2019	17/06/2019
ANALYTE	LOR	Units		Result	Result
Copper - Elutriate	0.002	mg/L		<0.002	<0.002
Zinc - Elutriate	0.005	mg/L		0.009	0.025

Result Definitions

LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting

* Denotes test not covered by NATA Accreditation

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

LABORATORY REPORT

Job Number: 19-09631-A
Revision: 00
Date: 31 July 2019

ADDRESS: O2 Marine
Suite 2, 4B Mews Rd
Fremantle WA 6160

ATTENTION: Josh Abbott

DATE RECEIVED: 19/06/2019

YOUR REFERENCE: 18WAU-0004

PURCHASE ORDER:

APPROVALS:



Douglas Todd
Laboratory Manager

REPORT COMMENTS:

This report is issued by Analytical Reference Laboratory (WA) Pty Ltd. The report shall not be reproduced except in full without written approval from the laboratory.

Samples are analysed on an as received basis unless otherwise noted.

Elutriate Metals were subcontracted to MPL, Report No 230092

METHOD REFERENCES:

Method ID	Method Description
ARL No. 401/403	Metals in Soil and Sediment by ICPOES/MS
ARL No. 29/402/403	Metals in Water by AAS/ICPOES/ICPMS

O2 Marine
Job No: 19-09631-A

LABORATORY REPORT
Revision: 00

Date: 31/07/19

Metals			Sample No	19-09631-A-13	19-09631-A-16	19-09631-A-19	19-09631-A-22	19-09631-A-25
Sample Description				CH1-1	CH2-1	CH3-1	CH4-1	CH5-1
Sample Date				18/06/2019	18/06/2019	18/06/2019	18/06/2019	17/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Cadmium - Bioavailable	0.1	mg/kg			<0.1	<0.1		
Cadmium - Elutriate	0.0002	mg/L			<0.0002	<0.0002		
Copper - Bioavailable	1	mg/kg	<1	<1	<1	<1	<1	<1
Copper - Elutriate	0.002	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead - Bioavailable	1	mg/kg			<1			
Lead - Elutriate	0.002	mg/L			<0.002			
Zinc - Bioavailable	1	mg/kg		2	3	5	8	
Zinc - Elutriate	0.005	mg/L		0.021	0.032	0.015	0.007	

Metals			Sample No	19-09631-A-28	19-09631-A-49	19-09631-A-52
Sample Description				CH6-1	CH7-1	CH8-1
Sample Date				17/06/2019	17/06/2019	17/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result
Copper - Bioavailable	1	mg/kg	<1	<1	<1	
Copper - Elutriate	0.002	mg/L	<0.002	<0.002	<0.002	
Zinc - Bioavailable	1	mg/kg	6	4		
Zinc - Elutriate	0.005	mg/L	0.019	0.26		

Result Definitions

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

* Denotes test conducted by in-house methodology.

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

LABORATORY REPORT**Job Number:** 19-09740
Revision: 02
Date: 27 August 2019**ADDRESS:** **O2 Marine**
Suite 2, 4B Mews Rd
Fremantle WA 6160**ATTENTION:** Russell Stevens**DATE RECEIVED:** 19/06/2019**YOUR REFERENCE:** 18WAU-0004**PURCHASE ORDER:****APPROVALS:**
Kim Rodgers
General Manager

Sean Sangster
Inorganics Supervisor**REPORT COMMENTS:**

This report is issued by Analytical Reference Laboratory (WA) Pty Ltd. The report shall not be reproduced except in full without written approval from the laboratory.

Samples are analysed on an as received basis unless otherwise noted.

Tributyltin as Sn analysis subcontracted to MPL, NATA Accred No. 2901, Report Number 228636

Metals and TOC in soils analysis was conducted on a dry weight basis.

METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377

Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561

Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 401/403	Metals in Soil and Sediment by ICPOES/MS
ARL No. 030	Metals in Soil and Sediment by AAS
ARL No. 406	Mercury by Cold Vapour Atomic Absorption Spectrophotometry
ARL No. 29/402/403	Metals in Water by AAS/ICPOES/ICPMS
ARL No. 040	Arsenic by Hydride Atomic Absorption
ARL No. 135	Moisture
ARL No. 201	KCL Extractable pH and TAA
ARL No. 204	Sulfur, Calcium and Magnesium by KCl Extraction
ARL No. 205	Sulfur, Calcium and Magnesium by 4M HCl Extraction
ARL No. 207	Chromium Reducible Sulfur
ARL No. 136	Lime Equivalence in Biosolids
ARL No. 210	Acid Sulfate Soils Method Codes and Further Calculations
ARL No. 064	Total Organic Carbon in Sediment
Subcontracting	See Report Comments section for more information.

**WORLD RECOGNISED
ACCREDITATION**Accredited for compliance with
ISO/IEC 17025 - Testing**ARL GROUP**46-48 Banksia Road, Welshpool, Western Australia 6106
Telephone: 08 6253 4444 Facsimile: 08 6253 4440 www.arlgroup.com.au

O2 Marine
Job No: 19-09740

LABORATORY REPORT
Revision: 02

Date: 27/08/19

Metals in Soil and Sediment			Sample No	19-09740-1	19-09740-2	19-09740-3	19-09740-4	19-09740-5
Sample Description				NC1	NC3-S	NC5-S	NC7-S	NC9
Sample Date				17/06/2019	17/06/2019	17/06/2019	16/06/2019	16/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Aluminium	1	mg/kg	800	220	240	290	310	
Arsenic	0.1	mg/kg	1.9	1.4	1.3	1.1	1.5	
Cadmium	0.1	mg/kg	0.1	<0.1	<0.1	<0.1	0.1	
Chromium	1	mg/kg	11	12	13	12	11	
Copper	1	mg/kg	18	14	13	15	14	
Lead	1	mg/kg	3	2	2	2	1	
Manganese	1	mg/kg	28	14	17	17	16	
Nickel	1	mg/kg	1	<1	<1	<1	<1	
Zinc	1	mg/kg	15	5	3	6	6	
Silver	1	mg/kg	<1	<1	<1	<1	<1	
Iron	1	mg/kg	1,300	540	520	650	700	
Vanadium	2	mg/kg	4	<2	<2	2	2	
Mercury	0.02	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	

Metals in Soil and Sediment			Sample No	19-09740-6	19-09740-7	19-09740-8	19-09740-9	19-09740-10
Sample Description				NC11	NC13	CH1-1	CH1-2	CH1-3
Sample Date				16/06/2019	16/06/2019	18/06/2019	18/06/2019	18/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Aluminium	1	mg/kg	340	300	2,000	2,400	2,500	
Arsenic	0.1	mg/kg	1.7	2.0	6.3	6.6	6.3	
Cadmium	0.1	mg/kg	<0.1	<0.1	0.8	1.3	0.8	
Chromium	1	mg/kg	11	15	18	22	19	
Copper	1	mg/kg	14	12	99	120	110	
Lead	1	mg/kg	2	1	16	19	21	
Manganese	1	mg/kg	21	21	59	53	57	
Nickel	1	mg/kg	<1	<1	3	4	4	
Zinc	1	mg/kg	7	3	180	200	190	
Silver	1	mg/kg	<1	<1	<1	<1	<1	
Iron	1	mg/kg	780	820	5,400	5,900	6,000	
Vanadium	2	mg/kg	3	3	14	16	15	
Mercury	0.02	mg/kg	<0.02	<0.02	0.07	0.03	0.06	

Metals in Soil and Sediment			Sample No	19-09740-11	19-09740-12	19-09740-13	19-09740-14	19-09740-15
Sample Description				CH2-1	CH3-1	CH4-1	CH5-1	CH5-2
Sample Date				18/06/2019	18/06/2019	18/06/2019	17/06/2019	17/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Aluminium	1	mg/kg	2,400	2,800	2,600	1,200	1,300	
Arsenic	0.1	mg/kg	6.0	7.1	8.0	4.1	4.1	
Cadmium	0.1	mg/kg	1.1	3.4	2.1	0.6	0.6	
Chromium	1	mg/kg	18	22	26	13	14	
Copper	1	mg/kg	200	340	280	81	83	
Lead	1	mg/kg	31	65	48	15	15	
Manganese	1	mg/kg	47	59	51	35	36	
Nickel	1	mg/kg	4	5	6	2	2	
Zinc	1	mg/kg	360	950	580	210	230	
Silver	1	mg/kg	<1	1	<1	<1	<1	
Iron	1	mg/kg	8,100	9,600	9,300	4,900	5,300	

O2 Marine

Job No: 19-09740

LABORATORY REPORT

Revision: 02

Date: 27/08/19

Metals in Soil and Sediment			Sample No	19-09740-11	19-09740-12	19-09740-13	19-09740-14	19-09740-15
Sample Description				CH2-1	CH3-1	CH4-1	CH5-1	CH5-2
Sample Date				18/06/2019	18/06/2019	18/06/2019	17/06/2019	17/06/2019
Vanadium	2	mg/kg		18	19	17	10	11
Mercury	0.02	mg/kg		0.08	0.11	0.09	0.04	0.04

Metals in Soil and Sediment			Sample No	19-09740-16	19-09740-17	19-09740-18	19-09740-19	19-09740-20
Sample Description				CH5-3	CH6-1	CH7-1	CH8-1	CH8-D
Sample Date				17/06/2019	17/06/2019	17/06/2019	17/06/2019	17/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Aluminium	1	mg/kg	1,100	2,400	2,800	1,900	1,800	
Arsenic	0.1	mg/kg	4.6	5.9	6.0	3.9	4.0	
Cadmium	0.1	mg/kg	0.5	1.1	1.1	0.6	0.7	
Chromium	1	mg/kg	14	20	19	15	17	
Copper	1	mg/kg	67	190	230	110	140	
Lead	1	mg/kg	12	29	33	17	20	
Manganese	1	mg/kg	33	50	46	34	41	
Nickel	1	mg/kg	2	4	4	3	4	
Zinc	1	mg/kg	140	350	370	170	230	
Silver	1	mg/kg	<1	<1	<1	<1	<1	
Iron	1	mg/kg	4,300	9,000	9,100	5,200	5,400	
Vanadium	2	mg/kg	9	16	17	12	12	
Mercury	0.02	mg/kg	0.03	0.07	0.13	0.06	0.09	

Metals in Soil and Sediment			Sample No	19-09740-21	19-09740-22	19-09740-23	19-09740-24	19-09740-25
Sample Description				CH10-1	CH10-2	CH10-3	CH11	CH12-S
Sample Date				17/06/2019	17/06/2019	17/06/2019	18/06/2019	17/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Aluminium	1	mg/kg	1,500	1,700	1,600	2,000	2,200	
Arsenic	0.1	mg/kg	4.1	4.9	3.8	4.7	4.5	
Cadmium	0.1	mg/kg	0.4	0.5	0.4	0.9	0.5	
Chromium	1	mg/kg	19	19	14	20	19	
Copper	1	mg/kg	53	61	54	170	150	
Lead	1	mg/kg	8	9	8	27	22	
Manganese	1	mg/kg	30	29	28	70	49	
Nickel	1	mg/kg	3	3	2	4	4	
Zinc	1	mg/kg	83	94	87	310	240	
Silver	1	mg/kg	<1	<1	<1	<1	<1	
Iron	1	mg/kg	4,500	5,100	4,600	7,400	12,000	
Vanadium	2	mg/kg	9	10	9	17	14	
Mercury	0.02	mg/kg	0.03	0.03	0.04	0.08	0.06	

Metals in Soil and Sediment			Sample No	19-09740-26	19-09740-27	19-09740-28	19-09740-29	19-09740-30
Sample Description				CH12-D	CH13	CH14-S	CH14-D	CH15
Sample Date				17/06/2019	17/06/2019	18/06/2019	18/06/2019	18/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Aluminium	1	mg/kg	1,900	2,200	5,300	4,300	2,300	
Arsenic	0.1	mg/kg	4.4	6.4	8.6	7.0	6.2	
Cadmium	0.1	mg/kg	0.7	0.8	1.1	0.8	1.0	
Chromium	1	mg/kg	18	20	26	23	22	
Copper	1	mg/kg	140	150	150	150	200	
Lead	1	mg/kg	20	23	38	32	31	

O2 Marine

Job No: 19-09740

LABORATORY REPORT

Revision: 02

Date: 27/08/19

Metals in Soil and Sediment			Sample No	19-09740-26	19-09740-27	19-09740-28	19-09740-29	19-09740-30
Sample Description				CH12-D	CH13	CH14-S	CH14-D	CH15
Sample Date				17/06/2019	17/06/2019	18/06/2019	18/06/2019	18/06/2019
Manganese	1	mg/kg		49	42	77	72	52
Nickel	1	mg/kg		3	4	5	5	4
Zinc	1	mg/kg		240	250	300	280	320
Silver	1	mg/kg		<1	<1	<1	<1	<1
Iron	1	mg/kg		7,100	7,900	9,100	8,000	8,800
Vanadium	2	mg/kg		13	16	24	21	18
Mercury	0.02	mg/kg		0.08	0.07	0.12	0.25	0.07

Metals in Soil and Sediment			Sample No	19-09740-31	19-09740-32	19-09740-33	19-09740-34	19-09740-35
Sample Description				DUP-4	DUP-5	TRIP-S1	TRIP-S2	TRIP-S3
Sample Date				17/06/2019	18/06/2019	17/06/2019	18/06/2019	18/06/2019
ANALYTE	LOR	Units		Result	Result	Result	Result	Result
Aluminium	1	mg/kg		1,200	1,900	1,400	3,100	2,900
Arsenic	0.1	mg/kg		4.1	5.1	3.7	6.9	6.1
Cadmium	0.1	mg/kg		0.6	1.0	0.5	1.3	3.5
Chromium	1	mg/kg		13	17	15	22	19
Copper	1	mg/kg		83	180	86	200	320
Lead	1	mg/kg		16	30	13	31	65
Manganese	1	mg/kg		35	42	33	50	50
Nickel	1	mg/kg		2	3	2	5	4
Zinc	1	mg/kg		180	310	130	350	940
Silver	1	mg/kg		<1	<1	<1	<1	<1
Iron	1	mg/kg		4,700	6,900	3,900	8,400	8,700
Vanadium	2	mg/kg		10	15	9	18	18
Mercury	0.02	mg/kg		0.04	0.09	0.04	0.09	0.10

Metals in Water			Sample No	19-09740-36	19-09740-37
Sample Description				RINSB	TRIPB
Sample Date				18/06/2019	18/06/2019
ANALYTE	LOR	Units		Result	Result
Aluminium - Dissolved	0.01	mg/L		<0.01	<0.01
Arsenic - Dissolved	0.001	mg/L		<0.001	<0.001
Cadmium - Dissolved	0.0001	mg/L		<0.0001	<0.0001
Chromium - Dissolved	0.001	mg/L		<0.001	<0.001
Copper - Dissolved	0.001	mg/L		<0.001	<0.001
Lead - Dissolved	0.001	mg/L		<0.001	<0.001
Manganese - Dissolved	0.01	mg/L		<0.01	<0.01
Nickel - Dissolved	0.001	mg/L		<0.001	<0.001
Zinc - Dissolved	0.005	mg/L		<0.005	<0.005
Silver - Dissolved	0.001	mg/L		<0.001	<0.001
Iron - Dissolved	0.01	mg/L		<0.01	<0.01
Vanadium - Dissolved	0.01	mg/L		<0.01	<0.01
Mercury - Total	0.0001	mg/L		<0.0001	<0.0001

O2 Marine

Job No: 19-09740

LABORATORY REPORT

Revision: 02

Date: 27/08/19

Chromium Reducible Sulfur			Sample No	19-09740-1	19-09740-2	19-09740-3	19-09740-4	19-09740-5
Sample Description				NC1	NC3-S	NC5-S	NC7-S	NC9
Sample Date				17/06/2019	17/06/2019	17/06/2019	16/06/2019	16/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Moisture	0.1	%w/w	33.1	31.8	27.2	31.0	36.4	
pH _{KCl} (23A)	0.1	pH Units	9.5	9.7	9.8	9.7	9.7	
Titrateable Actual Acidity (23F)	2	mol H ⁺ /t	<2	<2	<2	<2	<2	
Sulphidic - TAA (s-23F)	0.005	% Pyrite Sulfur	<0.005	<0.005	<0.005	<0.005	<0.005	
KCl Extractable Sulfur (23Ce)	0.005	% S	0.053	0.051	0.035	0.042	0.060	
HCl Extractable Sulfur (20Be)	0.005	% S	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (23J)	0.005	% S	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (a-23J)	4	mole H ⁺ /t	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (s-23J)	0.005	% Pyrite S	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Chromium Reducible Sulfur (22B)	0.01	% S	0.02	0.02	0.01	0.02	<0.01	
Chromium Reducible Sulfur (a-22B)	8	mole H ⁺ /t	12	12	<8	12	<8	
Acid Neutralising Capacity BT (19A2)	0.05	% CaCO ₃	89	100	88	94	93	
Acid Neutralising Capacity BT (a-19A2)	10	mole H ⁺ /t	18,000	20,000	18,000	19,000	19,000	
Acid Neutralising Capacity BT (s-19A2)	0.02	% Pyrite S	29	32	28	30	30	
ANC Fineness Factor	0.5	-	1.5	1.5	1.5	1.5	1.5	
Net Acidity	0.01	% S	<0.01	<0.01	<0.01	<0.01	<0.01	
Net Acidity	10	mole H ⁺ /t	<10	<10	<10	<10	<10	
Liming Rate	1	kg CaCO ₃ /t	<1	<1	<1	<1	<1	
Net Acidity excluding ANC	0.01	% S	0.02	0.02	0.01	0.02	<0.01	
Net Acidity excluding ANC	10	mole H ⁺ /t	10	10	<10	10	<10	
Liming Rate excluding ANC	1	kg CaCO ₃ /t	2	2	1	2	<1	

Chromium Reducible Sulfur			Sample No	19-09740-6	19-09740-7	19-09740-8	19-09740-11	19-09740-12
Sample Description				NC11	NC13	CH1-1	CH2-1	CH3-1
Sample Date				16/06/2019	16/06/2019	18/06/2019	18/06/2019	18/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Moisture	0.1	%w/w	36.1	29.5	39.4	48.4	50.6	
pH _{KCl} (23A)	0.1	pH Units	9.6	9.0	9.2	8.9	9.0	
Titrateable Actual Acidity (23F)	2	mol H ⁺ /t	<2	<2	<2	<2	<2	
Sulphidic - TAA (s-23F)	0.005	% Pyrite Sulfur	<0.005	<0.005	<0.005	<0.005	<0.005	
KCl Extractable Sulfur (23Ce)	0.005	% S	0.059	0.037	0.071	0.10	0.11	
HCl Extractable Sulfur (20Be)	0.005	% S	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (23J)	0.005	% S	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (a-23J)	4	mole H ⁺ /t	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (s-23J)	0.005	% Pyrite S	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Chromium Reducible Sulfur (22B)	0.01	% S	0.04	0.02	0.26	0.39	0.62	
Chromium Reducible Sulfur (a-22B)	8	mole H ⁺ /t	25	12	160	240	390	

ARL GROUP

46-48 Banksia Road, Welshpool, Western Australia 6106

Telephone: 08 6253 4444 Facsimile: 08 6253 4440 www.arlgroup.com.au

O2 Marine

Job No: 19-09740

LABORATORY REPORT

Revision: 02

Date: 27/08/19

Chromium Reducible Sulfur			Sample No	19-09740-6	19-09740-7	19-09740-8	19-09740-11	19-09740-12
Sample Description				NC11	NC13	CH1-1	CH2-1	CH3-1
Sample Date				16/06/2019	16/06/2019	18/06/2019	18/06/2019	18/06/2019
Acid Neutralising Capacity BT (19A2)	0.05	% CaCO ₃		97	70	62	77	78
Acid Neutralising Capacity BT (a-19A2)	10	mole H ⁺ /t		19,000	14,000	12,000	15,000	16,000
Acid Neutralising Capacity BT (s-19A2)	0.02	% Pyrite S		31	22	20	25	25
ANC Fineness Factor	0.5	-		1.5	1.5	1.5	1.5	1.5
Net Acidity	0.01	% S		<0.01	<0.01	<0.01	<0.01	<0.01
Net Acidity	10	mole H ⁺ /t		<10	<10	<10	<10	<10
Liming Rate	1	kg CaCO ₃ /t		<1	<1	<1	<1	<1
Net Acidity excluding ANC	0.01	% S		0.04	0.02	0.26	0.39	0.62
Net Acidity excluding ANC	10	mole H ⁺ /t		30	10	160	240	390
Liming Rate excluding ANC	1	kg CaCO ₃ /t		3	2	23	34	54

Chromium Reducible Sulfur			Sample No	19-09740-13	19-09740-14	19-09740-17	19-09740-18	19-09740-19
Sample Description				CH4-1	CH5-1	CH6-1	CH7-1	CH8-1
Sample Date				18/06/2019	17/06/2019	17/06/2019	17/06/2019	17/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Moisture	0.1	%w/w	47.7	31.4	41.2	50.3	37.7	
pH _{KCl} (23A)	0.1	pH Units	8.9	9.3	9.1	8.9	9.3	
Titrate Actual Acidity (23F)	2	mol H ⁺ /t	<2	<2	<2	<2	<2	
Sulphidic - TAA (s-23F)	0.005	% Pyrite Sulfur	<0.005	<0.005	<0.005	<0.005	<0.005	
KCl Extractable Sulfur (23Ce)	0.005	% S	0.10	0.051	0.078	0.11	0.073	
HCl Extractable Sulfur (20Be)	0.005	% S	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (23J)	0.005	% S	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (a-23J)	4	mole H ⁺ /t	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (s-23J)	0.005	% Pyrite S	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Chromium Reducible Sulfur (22B)	0.01	% S	0.72	0.24	0.42	0.46	0.31	
Chromium Reducible Sulfur (a-22B)	8	mole H ⁺ /t	450	150	260	290	190	
Acid Neutralising Capacity BT (19A2)	0.05	% CaCO ₃	72	88	71	74	63	
Acid Neutralising Capacity BT (a-19A2)	10	mole H ⁺ /t	14,000	18,000	14,000	15,000	13,000	
Acid Neutralising Capacity BT (s-19A2)	0.02	% Pyrite S	23	28	23	24	20	
ANC Fineness Factor	0.5	-	1.5	1.5	1.5	1.5	1.5	
Net Acidity	0.01	% S	<0.01	<0.01	<0.01	<0.01	<0.01	
Net Acidity	10	mole H ⁺ /t	<10	<10	<10	<10	<10	
Liming Rate	1	kg CaCO ₃ /t	<1	<1	<1	<1	<1	
Net Acidity excluding ANC	0.01	% S	0.72	0.24	0.42	0.46	0.31	
Net Acidity excluding ANC	10	mole H ⁺ /t	450	150	260	290	190	
Liming Rate excluding ANC	1	kg CaCO ₃ /t	62	21	36	40	27	

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Chromium Reducible Sulfur			Sample No	19-09740-20	19-09740-21	19-09740-24	19-09740-25	19-09740-27
Sample Description				CH8-D	CH10-1	CH11	CH12-S	CH13
Sample Date				17/06/2019	17/06/2019	18/06/2019	17/06/2019	17/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Moisture	0.1	%w/w	40.1	33.0	46.3	39.2	60.8	
pH _{KCl} (23A)	0.1	pH Units	9.2	9.1	9.1	9.2	8.6	
Titrateable Actual Acidity (23F)	2	mol H ⁺ /t	<2	<2	<2	<2	<2	
Sulphidic - TAA (s-23F)	0.005	% Pyrite Sulfur	<0.005	<0.005	<0.005	<0.005	<0.005	
KCl Extractable Sulfur (23Ce)	0.005	% S	0.067	0.058	0.082	0.069	0.14	
HCl Extractable Sulfur (20Be)	0.005	% S	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (23J)	0.005	% S	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (a-23J)	4	mole H ⁺ /t	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (s-23J)	0.005	% Pyrite S	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	
Chromium Reducible Sulfur (22B)	0.01	% S	0.18	0.17	0.26	0.32	0.23	
Chromium Reducible Sulfur (a-22B)	8	mole H ⁺ /t	110	110	160	200	140	
Acid Neutralising Capacity BT (19A2)	0.05	% CaCO ₃	67	55	78	74	80	
Acid Neutralising Capacity BT (a-19A2)	10	mole H ⁺ /t	13,000	11,000	16,000	15,000	16,000	
Acid Neutralising Capacity BT (s-19A2)	0.02	% Pyrite S	21	18	25	24	26	
ANC Fineness Factor	0.5	-	1.5	1.5	1.5	1.5	1.5	
Net Acidity	0.01	% S	<0.01	<0.01	<0.01	<0.01	<0.01	
Net Acidity	10	mole H ⁺ /t	<10	<10	<10	<10	<10	
Liming Rate	1	kg CaCO ₃ /t	<1	<1	<1	<1	<1	
Net Acidity excluding ANC	0.01	% S	0.18	0.17	0.26	0.32	0.23	
Net Acidity excluding ANC	10	mole H ⁺ /t	110	110	160	200	140	
Liming Rate excluding ANC	1	kg CaCO ₃ /t	16	15	23	28	20	

Chromium Reducible Sulfur			Sample No	19-09740-28	19-09740-30
Sample Description				CH14-S	CH15
Sample Date				18/06/2019	18/06/2019
ANALYTE	LOR	Units	Result	Result	
Moisture	0.1	%w/w	43.6	54.3	
pH _{KCl} (23A)	0.1	pH Units	8.9	8.8	
Titrateable Actual Acidity (23F)	2	mol H ⁺ /t	<2	<2	
Sulphidic - TAA (s-23F)	0.005	% Pyrite Sulfur	<0.005	<0.005	
KCl Extractable Sulfur (23Ce)	0.005	% S	0.048	0.12	
HCl Extractable Sulfur (20Be)	0.005	% S	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (23J)	0.005	% S	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (a-23J)	4	mole H ⁺ /t	NOT REQUIRED	NOT REQUIRED	
Net Acid Soluble Sulfur (s-23J)	0.005	% Pyrite S	NOT REQUIRED	NOT REQUIRED	
Chromium Reducible Sulfur (22B)	0.01	% S	0.74	0.58	
Chromium Reducible Sulfur (a-22B)	8	mole H ⁺ /t	460	360	

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Chromium Reducible Sulfur			Sample No	19-09740-28	19-09740-30
Sample Description				CH14-S	CH15
Sample Date				18/06/2019	18/06/2019
Acid Neutralising Capacity BT (19A2)	0.05	% CaCO ₃		81	77
Acid Neutralising Capacity BT (a-19A2)	10	mole H ⁺ /t		16,000	15,000
Acid Neutralising Capacity BT (s-19A2)	0.02	% Pyrite S		26	25
ANC Fineness Factor	0.5	-		1.5	1.5
Net Acidity	0.01	% S		<0.01	<0.01
Net Acidity	10	mole H ⁺ /t		<10	<10
Liming Rate	1	kg CaCO ₃ /t		<1	<1
Net Acidity excluding ANC	0.01	% S		0.74	0.58
Net Acidity excluding ANC	10	mole H ⁺ /t		460	360
Liming Rate excluding ANC	1	kg CaCO ₃ /t		64	50

Misc. Inorganics in Soil			Sample No	19-09740-20	19-09740-24	19-09740-25	19-09740-26	19-09740-27
Sample Description				CH8-D	CH11	CH12-S	CH12-D	CH13
Sample Date				17/06/2019	18/06/2019	17/06/2019	17/06/2019	17/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
TOC	0.1	%	1.2	1.4	1.3	1.1	3.0	

Misc. Inorganics in Soil			Sample No	19-09740-28	19-09740-29	19-09740-30	19-09740-45	19-09740-46
Sample Description				CH14-S	CH14-D	CH15	CH1 (Comp CH1-1, CH1-2, CH1-3)	CH3 (Comp CH3-1, CH3-2, CH3-3)
Sample Date				18/06/2019	18/06/2019	18/06/2019	18/06/2019	18/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
TOC	0.1	%	2.4	2.0	2.6	1.3	1.9	

Misc. Inorganics in Soil			Sample No	19-09740-47
Sample Description				CH5 (Comp CH5-1, CH5-2, CH5-3)
Sample Date				17/06/2019
ANALYTE	LOR	Units	Result	
TOC	0.1	%	0.5	

Subcontracting			Sample No	19-09740-20	19-09740-24	19-09740-25	19-09740-26	19-09740-27
Sample Description				CH8-D	CH11	CH12-S	CH12-D	CH13
Sample Date				17/06/2019	18/06/2019	17/06/2019	17/06/2019	17/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Tributyl tin	0.50	µg Sn/kg	2.8	7.6	9.0	2.9	3.9	

Subcontracting			Sample No	19-09740-28	19-09740-29	19-09740-30	19-09740-45	19-09740-46
Sample Description				CH14-S	CH14-D	CH15	CH1 (Comp CH1-1, CH1-2, CH1-3)	CH3 (Comp CH3-1, CH3-2, CH3-3)
Sample Date				18/06/2019	18/06/2019	18/06/2019	18/06/2019	18/06/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Tributyl tin	0.50	µg Sn/kg	8.2	11	7.2	17	12	

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Job No: 19-09740

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Revision: 02

Date: 27/08/19

Subcontracting		Sample No	19-09740-47
Sample Description		CH5 (Comp CH5-1, CH5-2, CH5-3)	
		Sample Date	17/06/2019
ANALYTE	LOR	Units	Result
Tributyl tin	0.50	µg Sn/kg	6.4

Result Definitions

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

* Denotes test not covered by NATA Accreditation

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

CERTIFICATE OF ANALYSIS 228636**Client Details**

Client	Analytical Reference Laboratory (WA)
Attention	Ryan Seaton
Address	46-48 Banksia Road, Welshpool, WA, 6106

Sample Details

Your Reference	<u>19-09740</u>
Number of Samples	8 Soils
Date samples received	24/06/2019
Date completed instructions received	24/06/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	03/07/2019
Date of Issue	28/06/2019
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Results Approved By

Michael Kubiak, Laboratory Manager

Authorised By

Michael Kubiak, Laboratory Manager

Organotin Compounds in Soil

Our Reference		228636-1	228636-2	228636-3	228636-4	228636-5
Your Reference	UNITS	19-09740-20	19-09740-24	19-09740-25	19-09740-26	19-09740-27
Sample ID		CH8-D	CH11	CH12-S	CH12-D	CH13
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	27/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Date analysed	-	28/06/2019	28/06/2019	28/06/2019	28/06/2019	28/06/2019
Tributyltin as Sn	µg/kg	2.8	7.6	9.0	2.9	3.9
Surrogate Triphenyltin	%	4	97	97	97	96

Organotin Compounds in Soil

Our Reference		228636-6	228636-7	228636-8
Your Reference	UNITS	19-09740-28	19-09740-29	19-09740-30
Sample ID		CH14-S	CH14-D	CH15
Type of sample		Soil	Soil	Soil
Date extracted	-	27/06/2019	27/06/2019	27/06/2019
Date analysed	-	28/06/2019	28/06/2019	28/06/2019
Tributyltin as Sn	µg/kg	8.2	11	7.2
Surrogate Triphenyltin	%	95	95	95

Moisture						
Our Reference		228636-1	228636-2	228636-3	228636-4	228636-5
Your Reference	UNITS	19-09740-20	19-09740-24	19-09740-25	19-09740-26	19-09740-27
Sample ID		CH8-D	CH11	CH12-S	CH12-D	CH13
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	27/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Date analysed	-	28/06/2019	28/06/2019	28/06/2019	28/06/2019	28/06/2019
Moisture	%	35	46	35	35	58

Moisture				
Our Reference		228636-6	228636-7	228636-8
Your Reference	UNITS	19-09740-28	19-09740-29	19-09740-30
Sample ID		CH14-S	CH14-D	CH15
Type of sample		Soil	Soil	Soil
Date prepared	-	27/06/2019	27/06/2019	27/06/2019
Date analysed	-	28/06/2019	28/06/2019	28/06/2019
Moisture	%	43	53	53

Method ID	Methodology Summary
INORG-008	Moisture content determined by heating at 105 deg C for a minimum of 12 hours.
ORG-018	<p>Based on SFS-EN ISO 17353, ISO/DIS 23161 and NIOSH 5504.</p> <p>Air samples are extracted with acetonitrile containing 0.1% acetic acid using sonication. Extracts are then derivatised and extracted.</p> <p>Soils are extracted with a mix of water and methanolic KOH solution, neutralised and then derivatised and extracted.</p> <p>Water samples are pH adjusted, salt added and then derivatised, extracted into hexane and concentrated to a small volume.</p> <p>The extracts are analysed by GC/MSMS.</p>

QUALITY CONTROL: Organotin Compounds in Soil					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	228636-2
Date extracted	-			27/06/2019	1	27/06/2019	27/06/2019		27/06/2019	27/06/2019
Date analysed	-			28/06/2019	1	28/06/2019	28/06/2019		28/06/2019	28/06/2019
Tributyltin as Sn	µg/kg	0.5	ORG-018	<0.5	1	2.8	3.6	25	111	#
Surrogate Triphenyltin	%		ORG-018	100	1	4	98	184	100	94

QUALITY CONTROL: Moisture					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			27/06/2019	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Date analysed	-			28/06/2019	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Moisture	%	0.1	INORG-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available).

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) a

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

#2MS - # Percent recovery is not possible to report as possitive TBT in the sample.

CERTIFICATE OF ANALYSIS 230092**Client Details**

Client	Analytical Reference Laboratory (WA)
Attention	Ryan Seaton
Address	46-48 Banksia Road, Welshpool, WA, 6106

Sample Details

Your Reference	<u>19-09631</u>
Number of Samples	8 Soil
Date samples received	23/07/2019
Date completed instructions received	23/07/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	01/08/2019
Date of Issue	29/07/2019
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Results Approved By

Heram Halim, Operations Manager

Authorised By

Michael Kubiak, Laboratory Manager

Dissolved Metals in Water

Our Reference		230092-1	230092-2	230092-3	230092-4	230092-5
Your Reference	UNITS	19-09631-13	19-09631-16	19-09631-19	19-09631-22	19-09631-25
Location		CH1-1	CH2-1	CH3-1	CH4-1	CH5-1
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	26/07/2019	26/07/2019	26/07/2019	26/07/2019	26/07/2019
Date analysed	-	26/07/2019	26/07/2019	26/07/2019	26/07/2019	26/07/2019
Cadmium-Dissolved	mg/L	[NA]	[NA]	<0.0002	<0.0002	[NA]
Copper-Dissolved	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Lead-Dissolved	mg/L	[NA]	[NA]	<0.002	[NA]	[NA]
Zinc-Dissolved	mg/L	[NA]	0.021	0.032	0.015	0.007

Dissolved Metals in Water

Our Reference		230092-6	230092-7	230092-8	230092-9
Your Reference	UNITS	19-09631-28	19-09631-49	19-09631-52	Elutriate
Location		CH6-1	CH7-1	CH8-1	-
Type of sample		Soil	Soil	Soil	Elutriate
Date prepared	-	26/07/2019	26/07/2019	26/07/2019	26/07/2019
Date analysed	-	26/07/2019	26/07/2019	26/07/2019	26/07/2019
Cadmium-Dissolved	mg/L	[NA]	[NA]	[NA]	<0.0002
Copper-Dissolved	mg/L	<0.002	<0.002	<0.002	<0.002
Lead-Dissolved	mg/L	[NA]	[NA]	[NA]	<0.002
Zinc-Dissolved	mg/L	0.019	0.26	[NA]	0.008

Method ID	Methodology Summary
METALS-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Dissolved Metals in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	230092-2
Date prepared	-			26/07/2019	1	26/07/2019	26/07/2019		26/07/2019	26/07/2019
Date analysed	-			26/07/2019	1	26/07/2019	26/07/2019		26/07/2019	26/07/2019
Cadmium-Dissolved	mg/L	0.0001	METALS-022	<0.0001	[NT]	[NT]	[NT]	[NT]	102	99
Copper-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.002	<0.002	0	100	90
Lead-Dissolved	mg/L	0.001	METALS-022	<0.001	[NT]	[NT]	[NT]	[NT]	106	92
Zinc-Dissolved	mg/L	0.001	METALS-022	<0.001	[NT]	[NT]	[NT]	[NT]	98	93

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available).	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) a

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

Elutriate preparation as per NAGD, as detailed in internal method INORG - 004.

Please note Elutriate Blank results reported as sample #9.

Note: Some results have raised pqls. In these cases the sample's high TDS required the sample to be diluted prior to analysis.

CERTIFICATE OF ANALYSIS 230916**Client Details**

Client	Analytical Reference Laboratory (WA)
Attention	Maja G
Address	46-48 Banksia Road, Welshpool, WA, 6106

Sample Details

Your Reference	<u>19-09740, 19-12809</u>
Number of Samples	3 Soil, 8 Water
Date samples received	07/08/2019
Date completed instructions received	07/08/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	16/08/2019
Date of Issue	19/08/2019
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Heram Halim, Operations Manager
Michael Kubiak, Laboratory Manager

Authorised By

Michael Kubiak, Laboratory Manager

Organotin Compounds in Soil					
Our Reference			230916-1	230916-2	230916-3
Your Reference	UNITS	PQL	19-09740-45	19-09740-46	19-09740-47
Sample ID			CH1	CH3	CH5
Type of sample			Soil	Soil	Soil
Date extracted	-		14/08/2019	14/08/2019	14/08/2019
Date analysed	-		15/08/2019	15/08/2019	15/08/2019
Tributyltin as Sn	µg/kg	0.5	17	12	6.4
Surrogate Triphenyltin	%		89	91	95

Moisture					
Our Reference			230916-1	230916-2	230916-3
Your Reference	UNITS	PQL	19-09740-45	19-09740-46	19-09740-47
Sample ID			CH1	CH3	CH5
Type of sample			Soil	Soil	Soil
Date prepared	-		14/08/2019	14/08/2019	14/08/2019
Date analysed	-		14/08/2019	14/08/2019	14/08/2019
Moisture	%	0.1	42	43	30

Miscellaneous Inorganics

Our Reference			230916-4	230916-5	230916-6	230916-7	230916-8
Your Reference	UNITS	PQL	19-12809-1	19-12809-2	19-12809-3	19-12809-4	19-12809-5
Sample ID			Rocky Point	Locker Island Bottom	Locker Island Top	Locker Point Bottom	Locker Point Top
Type of sample			Water	Water	Water	Water	Water
Date prepared	-		13/08/2019	13/08/2019	13/08/2019	13/08/2019	13/08/2019
Date analysed	-		13/08/2019	13/08/2019	13/08/2019	13/08/2019	13/08/2019
Total Organic Carbon	mg/L	1	1	1	1	1	1
Dissolved Organic Carbon	mg/L	1	<1	1	1	1	1

Miscellaneous Inorganics

Our Reference			230916-9	230916-10	230916-11	230916-12	230916-13
Your Reference	UNITS	PQL	19-12809-6	19-12809-7	19-12809-8	19-12809-9	19-12809-10
Sample ID			Urala Creek North Channel	Urala Creek North Near Top	Urala Creek North Bottom	Urala Creek South Channel	Urala Creek South Off
Type of sample			Water	Water	Water	Water	Water
Date prepared	-		13/08/2019	13/08/2019	13/08/2019	13/08/2019	13/08/2019
Date analysed	-		13/08/2019	13/08/2019	13/08/2019	13/08/2019	13/08/2019
Total Organic Carbon	mg/L	1	1	1	1	1	2
Dissolved Organic Carbon	mg/L	1	1	1	1	1	1

Miscellaneous Inorganics

Our Reference			230916-14	230916-15	230916-16	230916-17	230916-18
Your Reference	UNITS	PQL	19-12809-11	19-12809-12	19-12809-13	19-12809-14	19-12809-15
Sample ID			Urala Creek South Near	Fly Island Top	Fly Island Bottom	Eva Island Top	Eva Island Bottom
Type of sample			Water	Water	Water	Water	Water
Date prepared	-		13/08/2019	13/08/2019	13/08/2019	13/08/2019	13/08/2019
Date analysed	-		13/08/2019	13/08/2019	13/08/2019	13/08/2019	13/08/2019
Total Organic Carbon	mg/L	1	2	2	1	2	1
Dissolved Organic Carbon	mg/L	1	1	2	1	1	1

Miscellaneous Inorganics

Our Reference			230916-19	230916-20	230916-21
Your Reference	UNITS	PQL	19-12809-16	19-12809-17	19-12809-18
Sample ID			Tent Island Top	Locker SW	Tent Island Bottom
Type of sample			Water	Water	Water
Date prepared	-		13/08/2019	13/08/2019	13/08/2019
Date analysed	-		13/08/2019	13/08/2019	13/08/2019
Total Organic Carbon	mg/L	1	1	<1	2
Dissolved Organic Carbon	mg/L	1	<1	<1	1

Method ID	Methodology Summary
INORG-008	Moisture content determined by heating at 105 deg C for a minimum of 12 hours.
INORG-110	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Dissolved/Total Carbon and Dissolved/Total Organic and Inorganic Carbon by high temperature catalytic combustion with NDIR
ORG-018	Based on SFS-EN ISO 17353, ISO/DIS 23161 and NIOSH 5504. Air samples are extracted with acetonitrile containing 0.1% acetic acid using sonication. Extracts are then derivatised and extracted. Soils are extracted with a mix of water and methanolic KOH solution, neutralised and then derivatised and extracted. Water samples are pH adjusted, salt added and then derivatised, extracted into hexane and concentrated to a small volume. The extracts are analysed by GC/MSMS.

QUALITY CONTROL: Organotin Compounds in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	230916-1
Date extracted	-			14/08/2019	[NT]	[NT]	[NT]	[NT]	14/08/2019	14/08/2019
Date analysed	-			15/08/2019	[NT]	[NT]	[NT]	[NT]	15/08/2019	15/08/2019
Tributyltin as Sn	µg/kg	0.5	ORG-018	<0.5	[NT]	[NT]	[NT]	[NT]	102	103
Surrogate Triphenyltin	%		ORG-018	98	[NT]	[NT]	[NT]	[NT]	107	105

QUALITY CONTROL: Moisture					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			14/08/2019	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Date analysed	-			14/08/2019	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Moisture	%	0.1	INORG-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	230916-12
Date prepared	-			13/08/2019	11	13/08/2019	13/08/2019		13/08/2019	13/08/2019
Date analysed	-			13/08/2019	11	13/08/2019	13/08/2019		13/08/2019	13/08/2019
Total Organic Carbon	mg/L	1	INORG-110	<1	11	1	1	0	102	[NT]
Dissolved Organic Carbon	mg/L	1	INORG-110	<1	11	1	<1	0	101	92

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	230916-15
Date prepared	-			[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	13/08/2019
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	13/08/2019
Total Organic Carbon	mg/L	1	INORG-110	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	95

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

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Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
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LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available).	

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For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) a

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

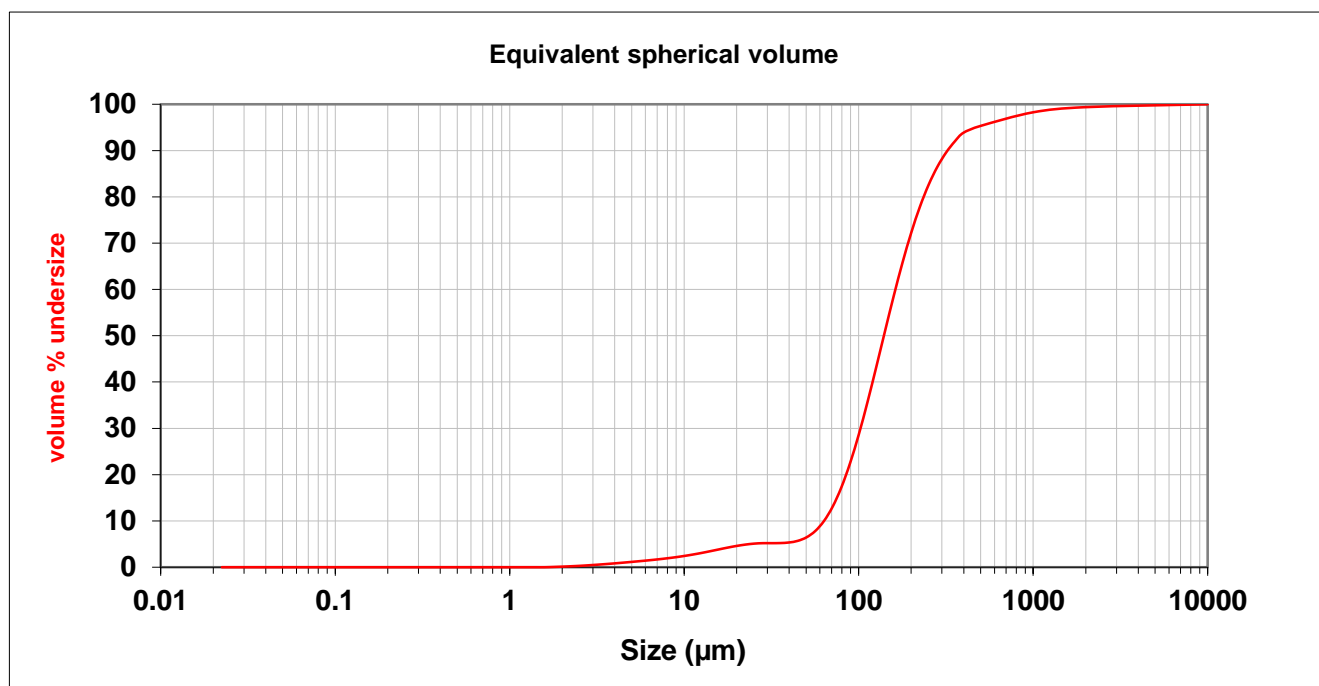
When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Client: ARL
Client ID: NC1
Job No : 19_0992
Lab ID No : 19_0992_01

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 3 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

Size (µm)	Vol In %
0.020	0.83
3.991	
Clay	

Size (µm)	Vol In %
3.991	9.15
63.246	
Silt	

Size (µm)	Vol In %
63.246	72.64
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	12.70
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	4.05
2000.000	
Coarse sand	

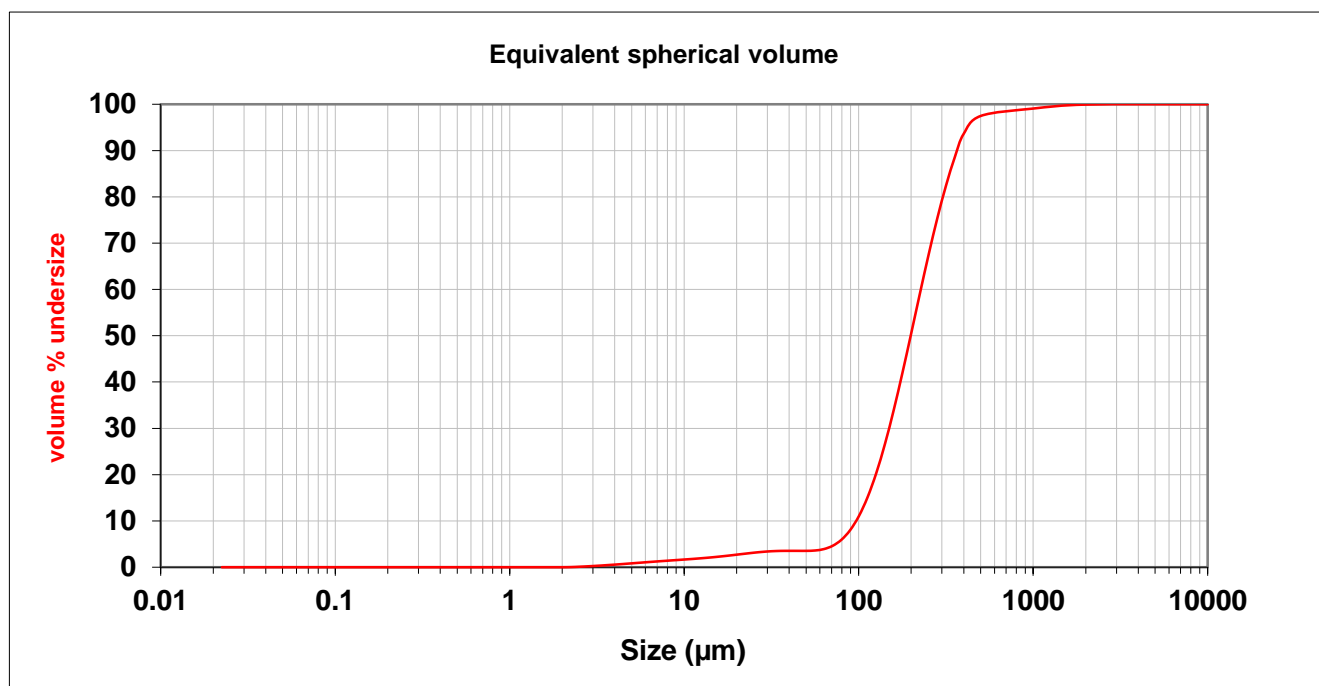
Size (µm)	Vol In %
2000.00	0.62
10000.00	
Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: NC3-S
Job No : 19_0992
Lab ID No : 19_0992_02

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 6 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

Size (µm)	Vol In %
0.020	0.56
3.991	
Clay	

Size (µm)	Vol In %
3.991	3.36
63.246	
Silt	

Size (µm)	Vol In %
63.246	63.64
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	29.91
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	2.46
2000.000	
Coarse sand	

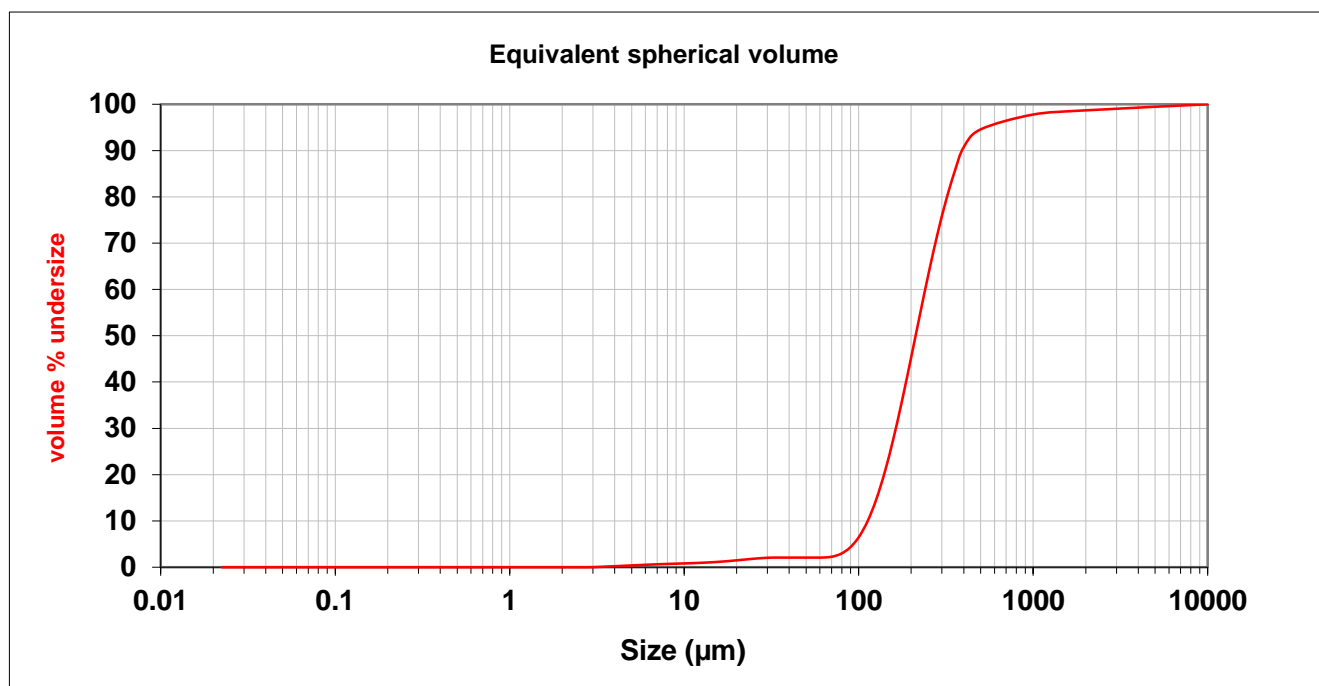
Size (µm)	Vol In %
2000.00	0.07
10000.00	
Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: NC5-S
Job No : 19_0992
Lab ID No : 19_0992_03

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 4 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

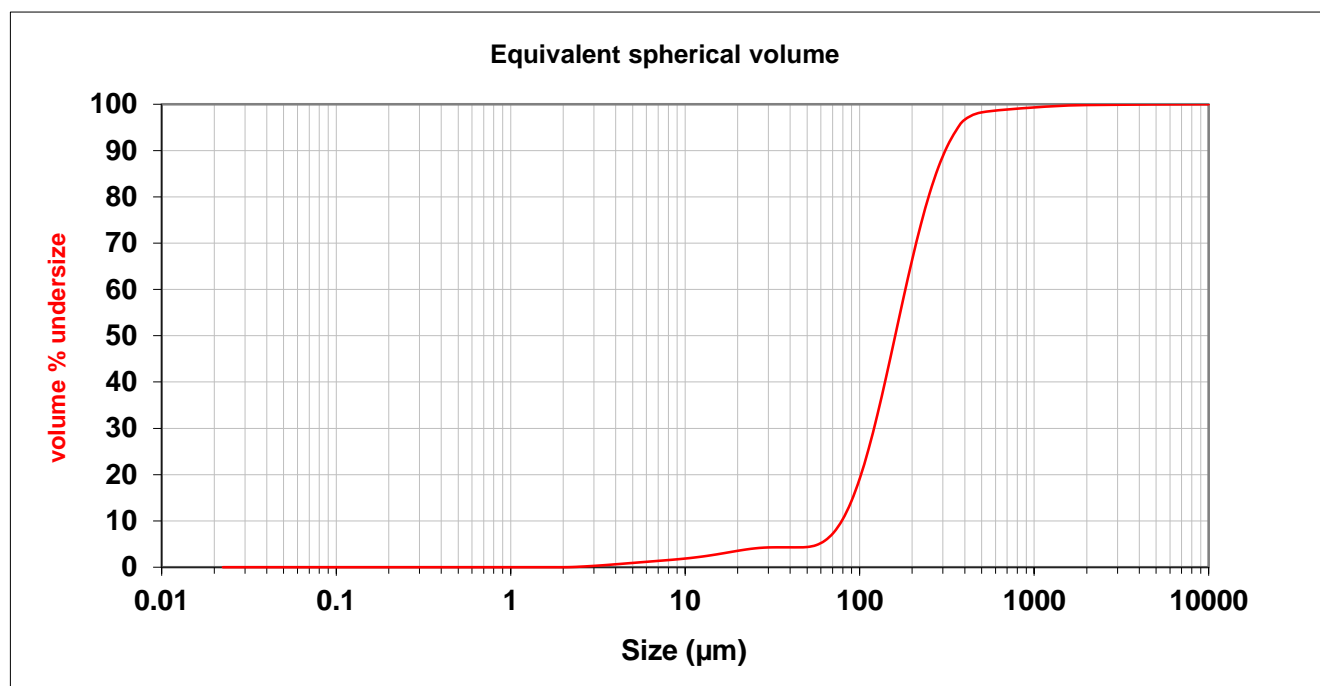
Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %
0.020	0.21	3.991	1.89	63.246	61.43	251.785	31.05	500.000	4.11	2000.00	1.32
3.991		63.246		251.785		500.000		2000.000		10000.00	
Clay		Silt		Fine sand		Medium sand		Coarse sand		Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: NC7-S
Job No : 19_0992
Lab ID No : 19_0992_04

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 5 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

Size (µm)	Vol In %
0.020	0.63
3.991	
Clay	

Size (µm)	Vol In %
3.991	5.12
63.246	
Silt	

Size (µm)	Vol In %
63.246	75.03
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	17.47
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	1.59
2000.000	
Coarse sand	

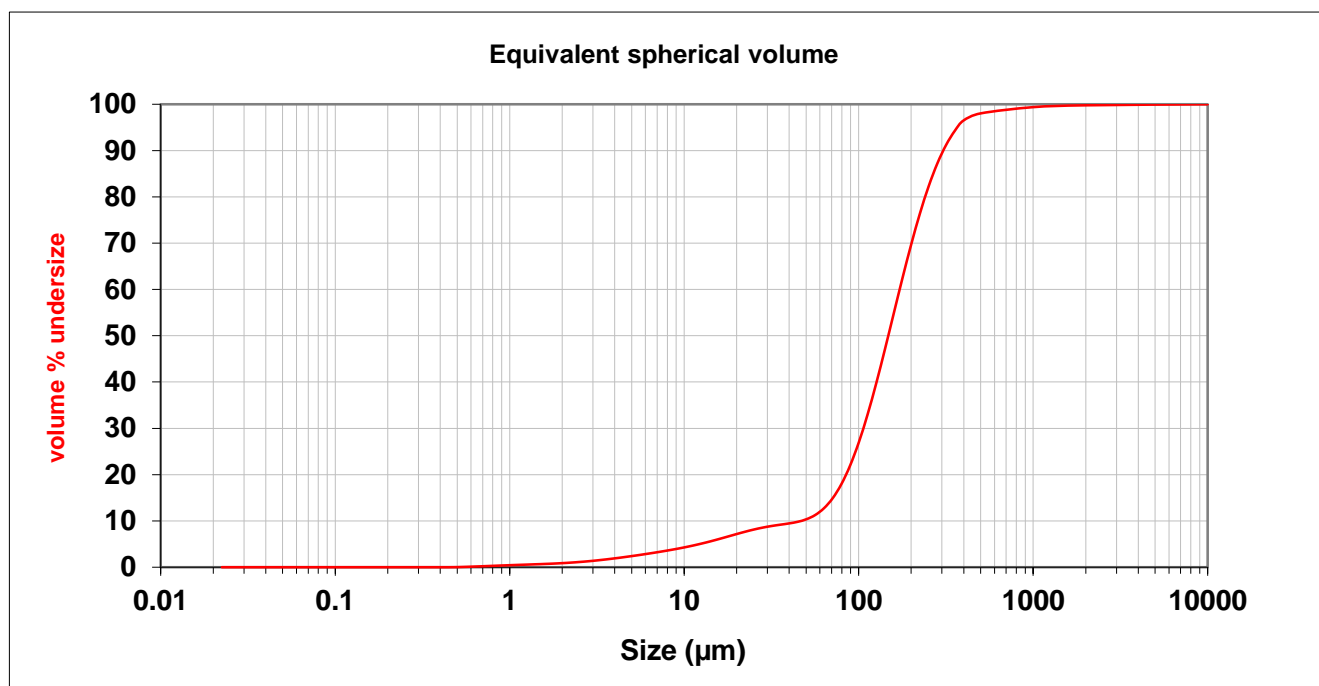
Size (µm)	Vol In %
2000.00	0.17
10000.00	
Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: NC9
Job No : 19_0992
Lab ID No : 19_0992_05

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 9 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

Size (µm)	Vol In %
0.020	1.91
3.991	
Clay	

Size (µm)	Vol In %
3.991	10.83
63.246	
Silt	

Size (µm)	Vol In %
63.246	69.55
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	15.74
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	1.75
2000.000	
Coarse sand	

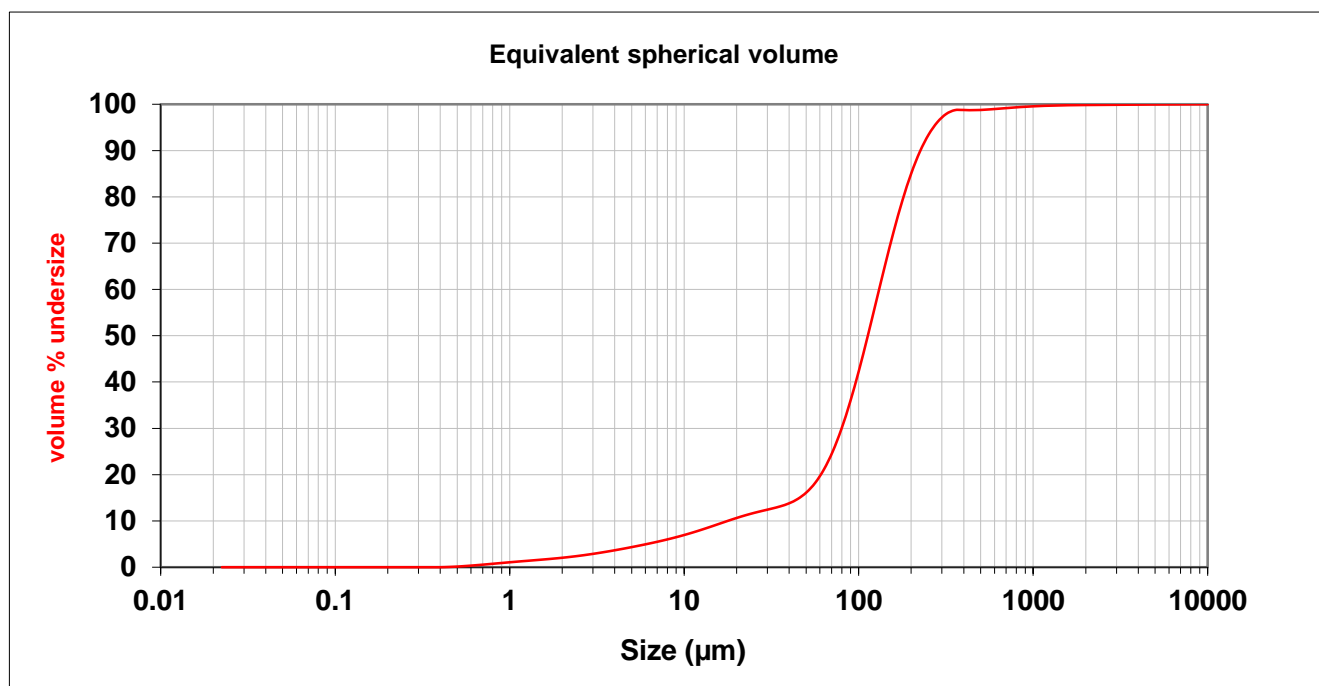
Size (µm)	Vol In %
2000.00	0.22
10000.00	
Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: NC11
Job No : 19_0992
Lab ID No : 19_0992_06

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 13 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

Size (µm)	Vol In %
0.020	3.65
3.991	
Clay	

Size (µm)	Vol In %
3.991	17.48
63.246	
Silt	

Size (µm)	Vol In %
63.246	72.32
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	5.31
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	1.07
2000.000	
Coarse sand	

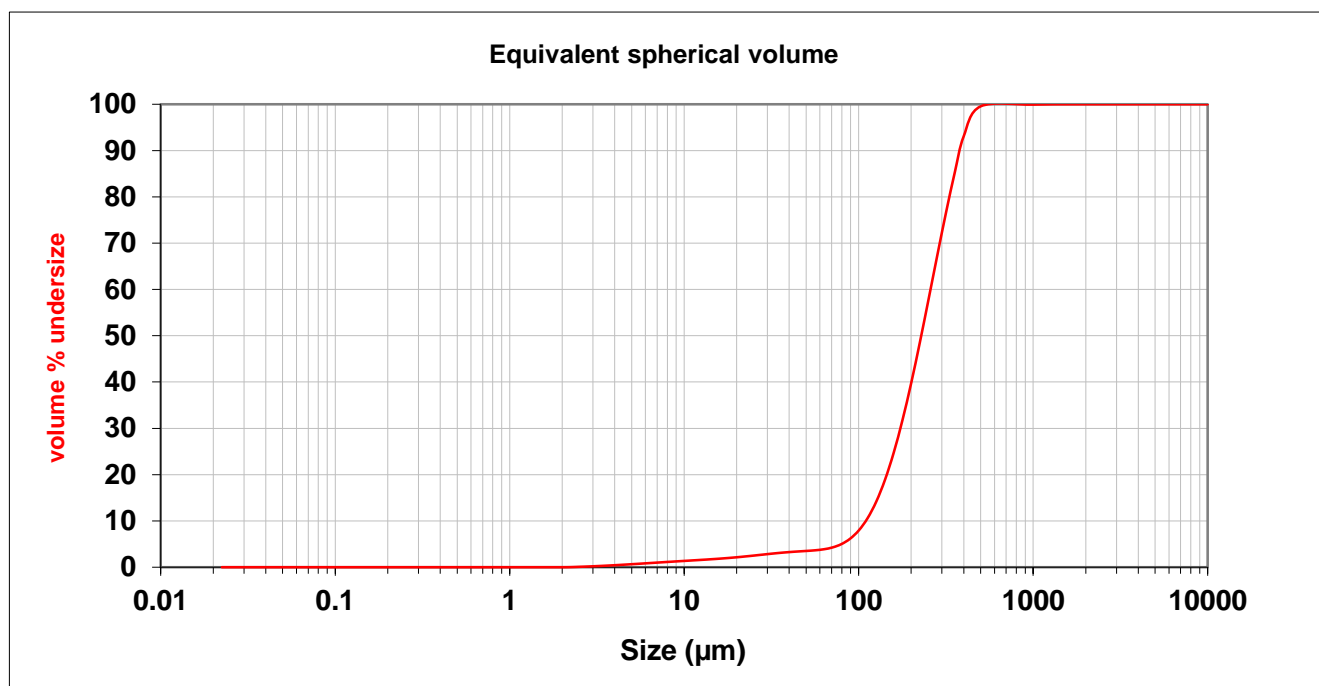
Size (µm)	Vol In %
2000.00	0.16
10000.00	
Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: NC13
Job No : 19_0992
Lab ID No : 19_0992_07

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 14 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

Size (µm)	Vol In %
0.020	0.43
3.991	
Clay	

Size (µm)	Vol In %
3.991	3.45
63.246	
Silt	

Size (µm)	Vol In %
63.246	54.10
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	41.58
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	0.45
2000.000	
Coarse sand	

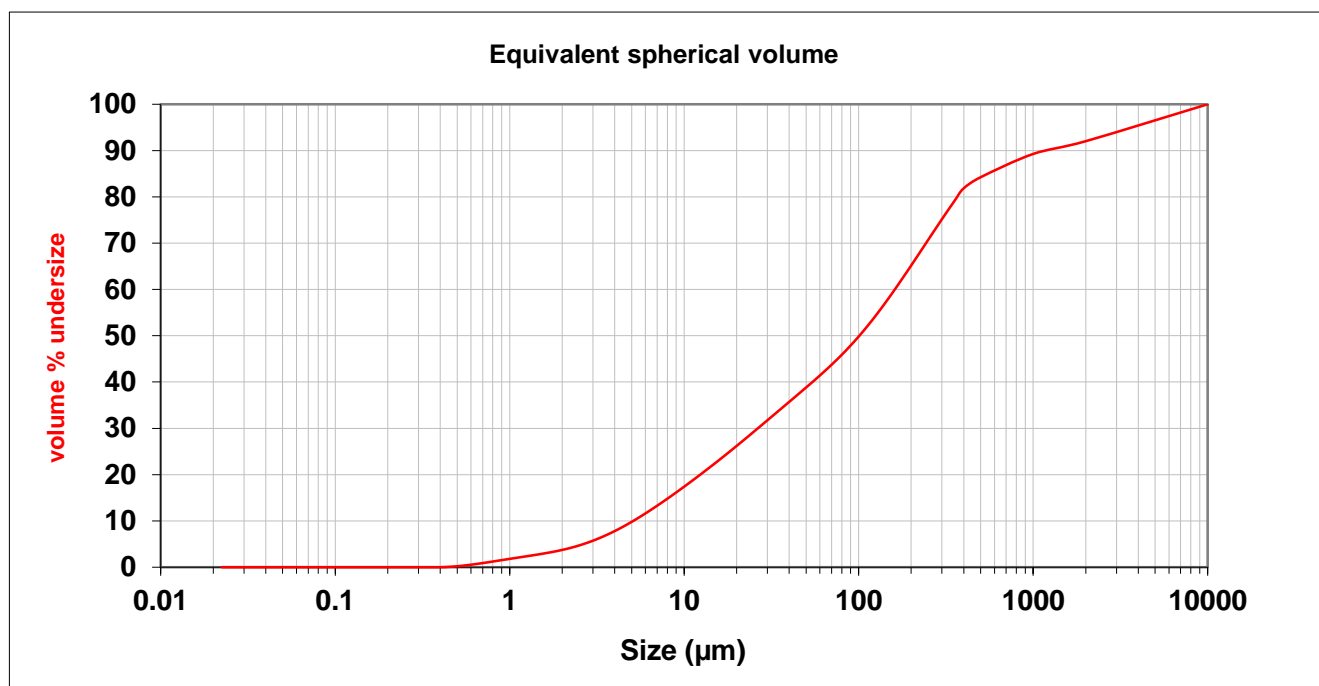
Size (µm)	Vol In %
2000.00	0.00
10000.00	
Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: CH8-D
Job No : 19_0992
Lab ID No : 19_0992_08

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 3 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

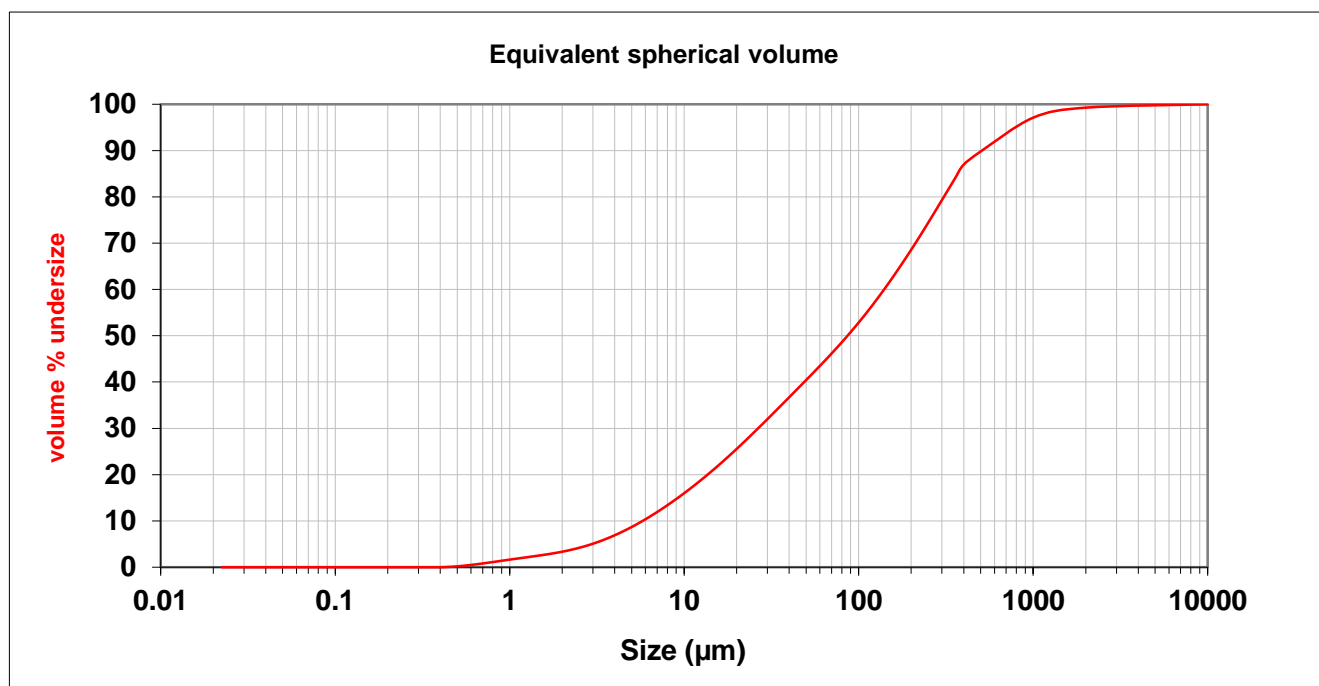
Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %
0.020		3.991		63.246		251.785		500.000		2000.00	
	7.79		34.42		28.66		13.37		7.78		7.98
3.991		63.246		251.785		500.000		2000.000		10000.00	
	Clay		Silt		Fine sand		Medium sand		Coarse sand		Gravel

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: CH11
Job No : 19_0992
Lab ID No : 19_0992_09

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 6 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

Size (µm)	Vol In %
0.020	6.89
3.991	
Clay	

Size (µm)	Vol In %
3.991	37.52
63.246	
Silt	

Size (µm)	Vol In %
63.246	30.17
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	15.22
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	9.48
2000.000	
Coarse sand	

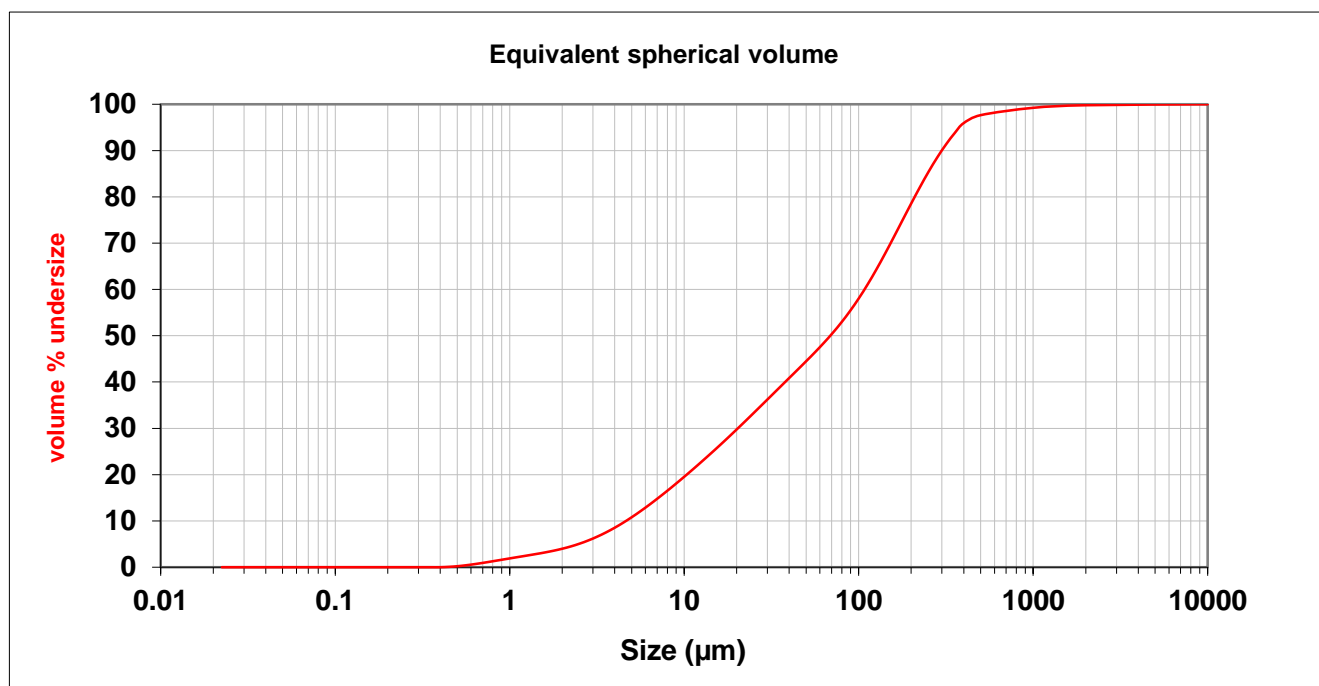
Size (µm)	Vol In %
2000.00	0.73
10000.00	
Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: CH12-S
Job No : 19_0992
Lab ID No : 19_0992_10

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 4 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

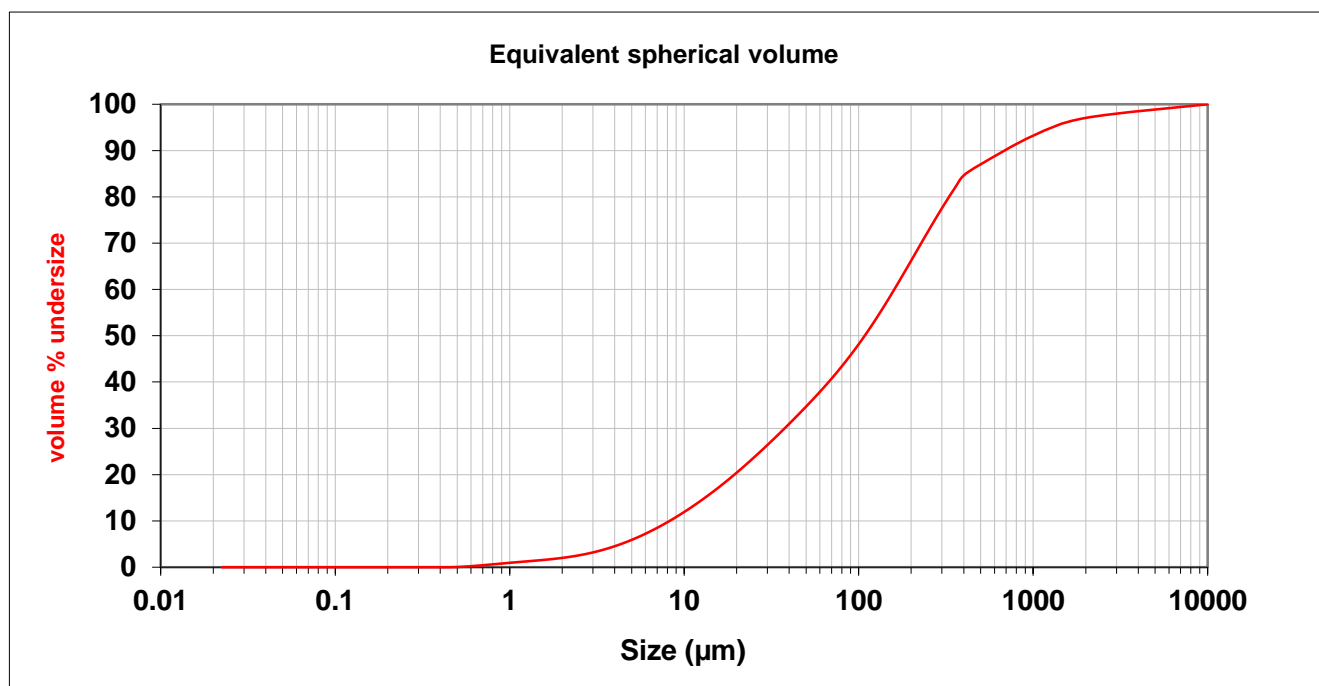
Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %
0.020	8.51	3.991	39.97	63.246	36.97	251.785	12.19	500.000	2.15	2000.00	0.21
3.991		63.246		251.785		500.000		2000.000		10000.00	
Clay		Silt		Fine sand		Medium sand		Coarse sand		Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: CH12-D
Job No : 19_0992
Lab ID No : 19_0992_11

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 3 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

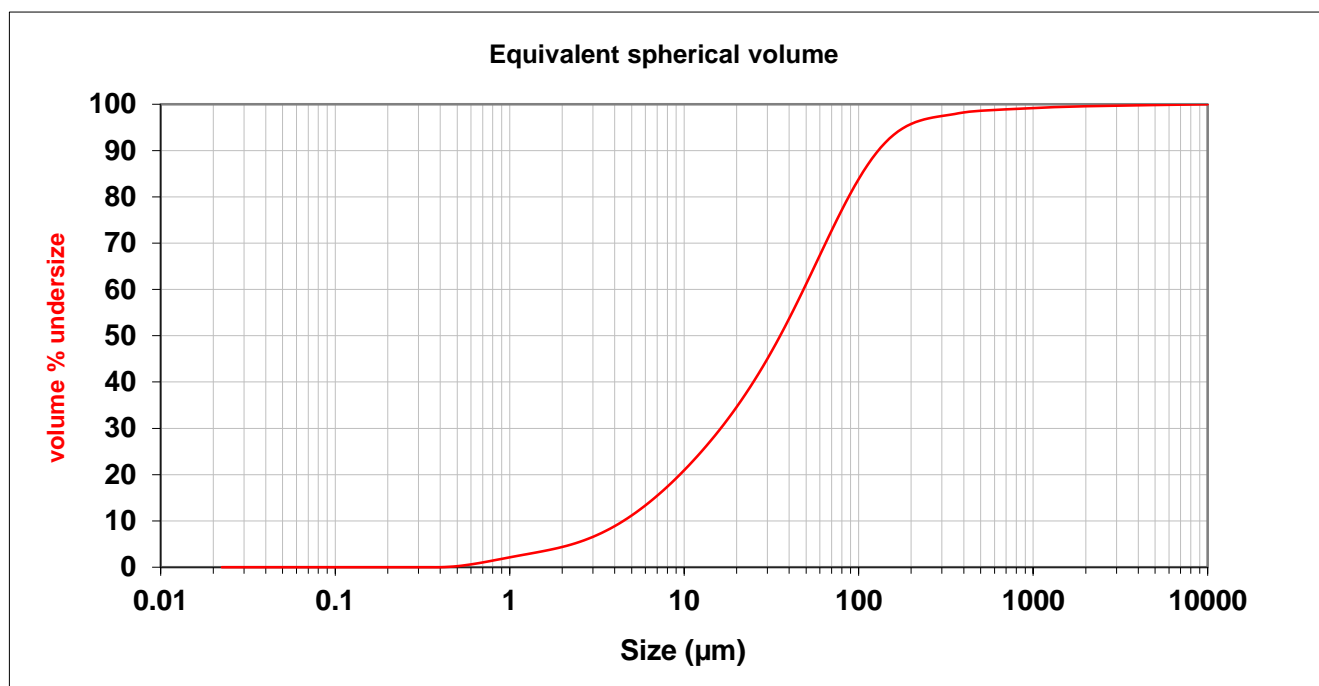
Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %
0.020	4.52	3.991	34.34	63.246	33.89	251.785	14.27	500.000	10.02	2000.00	2.95
3.991		63.246		251.785		500.000		2000.000		10000.00	
Clay		Silt		Fine sand		Medium sand		Coarse sand		Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: CH13
Job No : 19_0992
Lab ID No : 19_0992_12

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 15 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

Size (μm)	Vol In %
0.020	8.86
3.991	
Clay	

Size (μm)	Vol In %
3.991	60.40
63.246	
Silt	

Size (μm)	Vol In %
63.246	27.69
251.785	
Fine sand	

Size (μm)	Vol In %
251.785	1.64
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	0.98
2000.000	
Coarse sand	

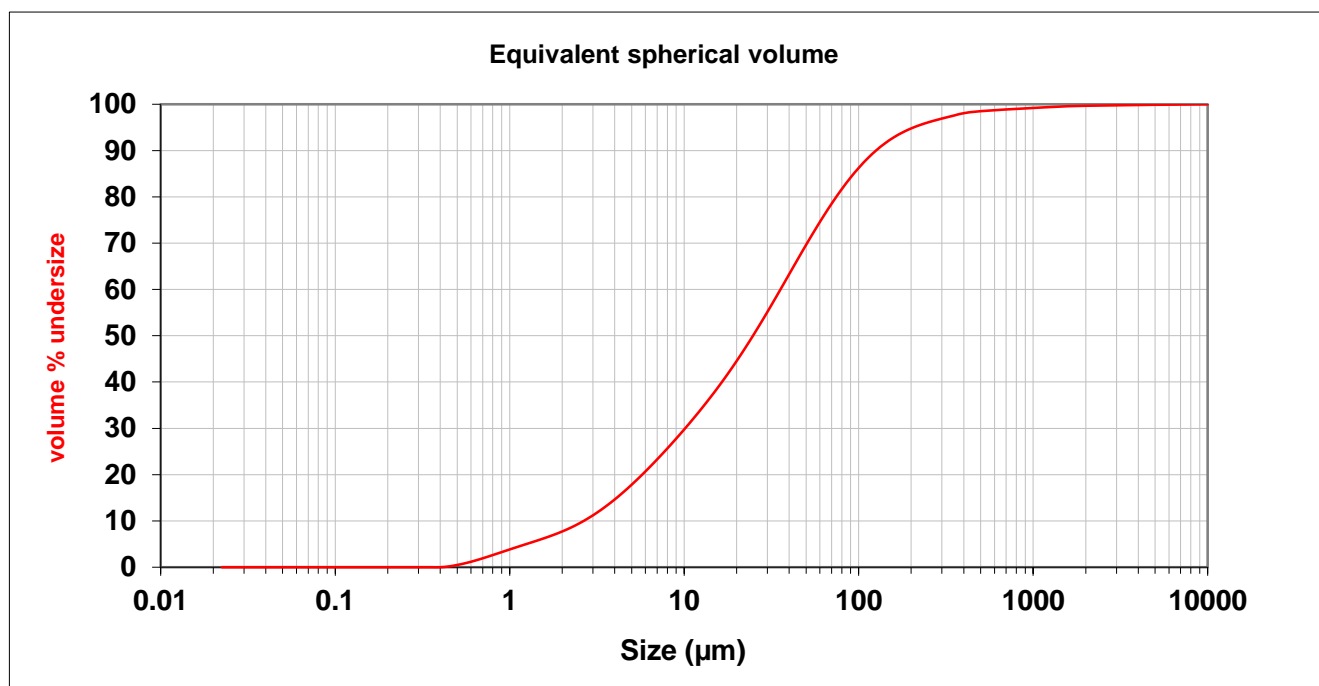
Size (µm)	Vol In %
2000.00	0.43
10000.00	
Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Client: ARL
Client ID: CH14-S
Job No : 19_0992
Lab ID No : 19_0992_13

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 4 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

Size (µm)	Vol In %
0.020	14.61
3.991	
Clay	

Size (µm)	Vol In %
3.991	61.37
63.246	
Silt	

Size (µm)	Vol In %
63.246	20.14
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	2.38
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	1.17
2000.000	
Coarse sand	

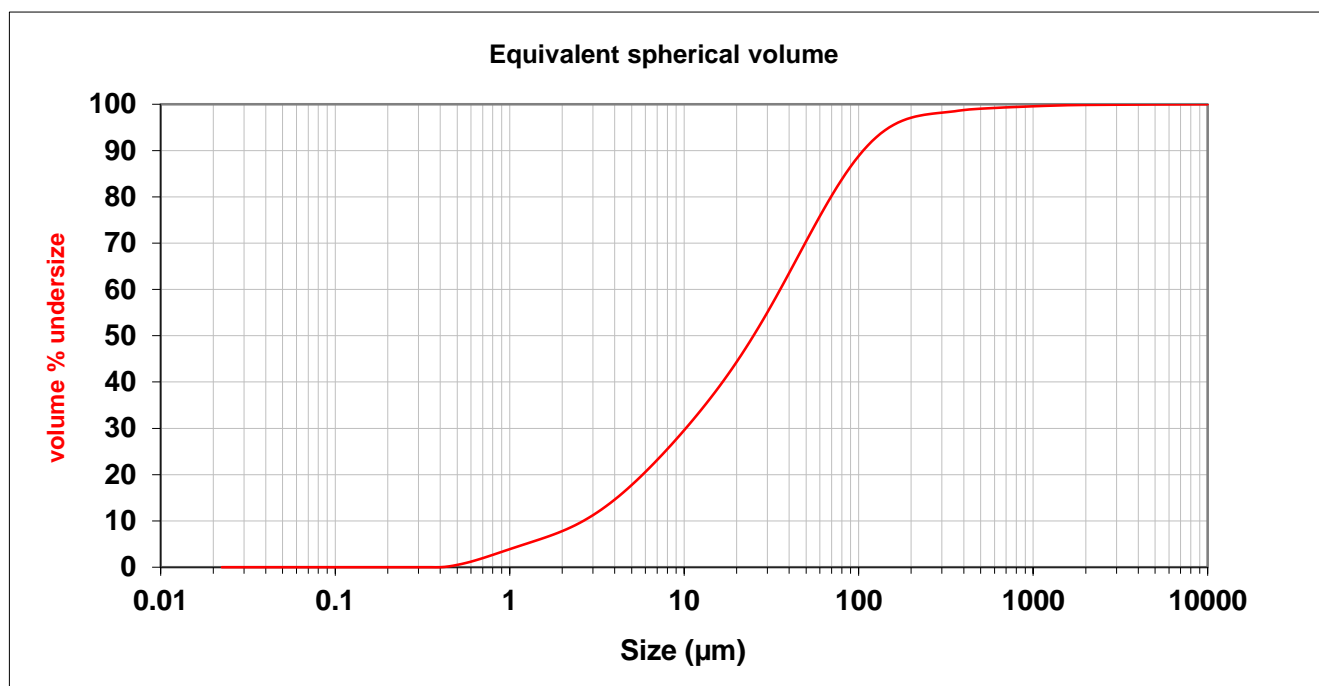
Size (µm)	Vol In %
2000.00	0.32
10000.00	
Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: CH14-D
Job No : 19_0992
Lab ID No : 19_0992_14

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 7 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

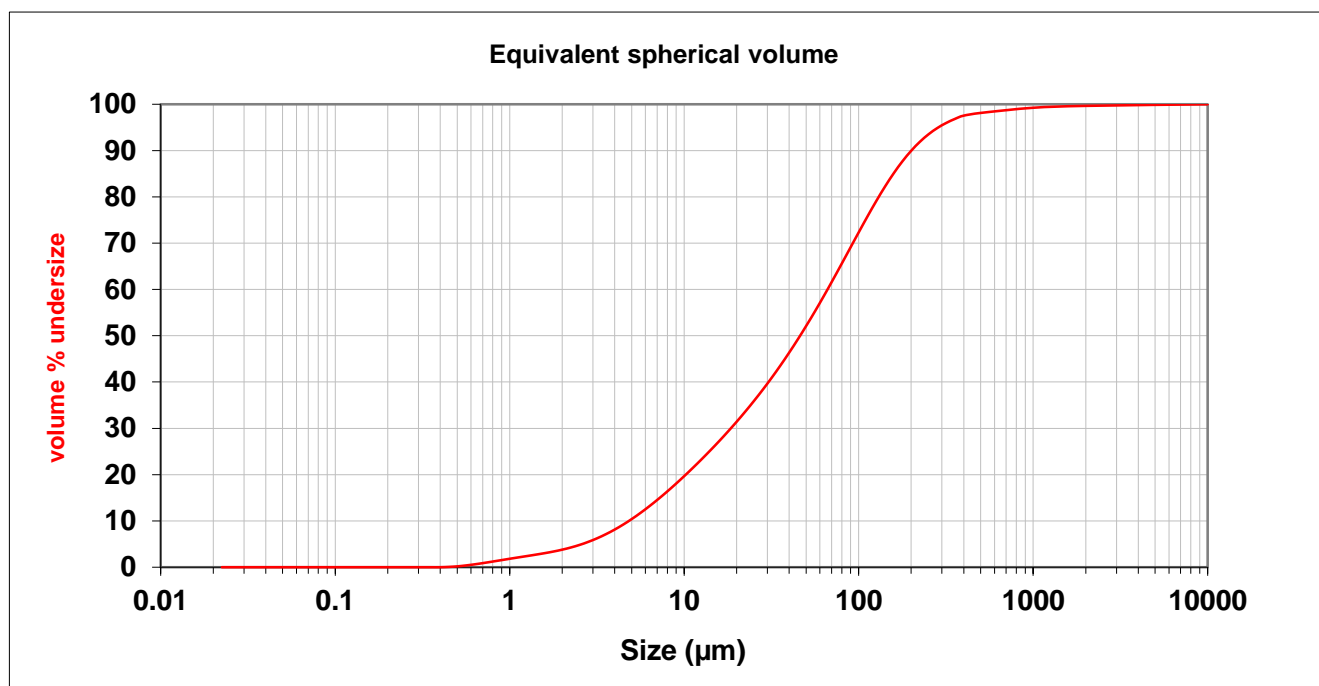
Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %
0.020	14.59	3.991	62.80	63.246	20.47	251.785	1.19	500.000	0.81	2000.00	0.15
3.991		63.246		251.785		500.000		2000.000		10000.00	
Clay		Silt		Fine sand		Medium sand		Coarse sand		Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Client: ARL
Client ID: CH15
Job No : 19_0992
Lab ID No : 19_0992_15

Analysis : Size distribution analysis by laser diffraction (ISO13320-1:1999) and wet sieving
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 5 min sonication
Analysis Model: General purpose
Result units: Volume



Wentworth Scale

Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %
0.020	8.12	3.991	50.52	63.246	34.90	251.785	4.59	500.000	1.53	2000.00	0.35
3.991		63.246		251.785		500.000		2000.000		10000.00	
Clay		Silt		Fine sand		Medium sand		Coarse sand		Gravel	

Analyst: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Reported by: Dan Cukierski, B.Sc.(Geology), M.Sc.(Geoscience)
Approved by: Sandy Lam, B.Sc.(Multidisciplinary)

Note: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

CERTIFICATE OF ANALYSIS

Work Order : **EP2001971**
Client : **WA MARINE PTY LTD**
Contact : Russell Stevens
Address : SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370
DUNSBOROUGH, PERTH WA, AUSTRALIA 6281
Telephone : ----
Project : 18WAU-0004 Geraldton Port Compliance Sediment Sampling
2020
Order number : ----
C-O-C number : ----
Sampler : Russell Stevens
Site : ----
Quote number : EP/101/20
No. of samples received : 64
No. of samples analysed : 64

Page : 1 of 33
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 25-Feb-2020 13:00
Date Analysis Commenced : 26-Feb-2020
Issue Date : 13-Mar-2020 15:57



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
David Viner	SENIOR LAB TECH	Perth Organics, Wangara, WA
Matt Frost	Assistant Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Matt Frost	Assistant Laboratory Manager	Brisbane Organics, Stafford, QLD



General Comments

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

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

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

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

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

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

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

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenzo(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- TOC and TBT conducted by ALS Brisbane, NATA Site No. 818.
- PSD conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- EG020-SD: Poor matrix spike recovery was obtained for copper, zinc on sample EP2001971-055 due to possible matrix interference. Results have been confirmed by re-extraction and re-analysis.
- EP132B-SD: Poor duplicate precision due to high moisture content and sample heterogeneity. Chromatogram profiles have been reviewed.
- EP132B-SD: Poor matrix spike recovery due to high moisture content and sample heterogeneity. Chromatogram profiles have been reviewed.
- EP132B-SD: LOR has been raised for various analytes on various samples due to high moisture content and/or matrix interferences.
- EP090 Organotin Analysis: The LOR for Tributyltin in sample ORA2-1 has been raised due to matrix interference.
- EN68: This analysis in accordance with National Ocean Disposal Guidelines, Commonwealth of Australia, 2002 - (modified). Results reported are those determined on a 1:4 sediment/seawater elutriate without blank correction.



Analytical Results

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

Client sample ID

				CH3-1	CH4-1	CH6-1	Elutriate Water	----
Client sampling date / time				20-Feb-2020 09:40	20-Feb-2020 09:00	18-Feb-2020 16:30	20-Feb-2020 09:30	----
Compound	CAS Number	LOR	Unit	EP2001971-019	EP2001971-022	EP2001971-028	EP2001971-064	-----
				Result	Result	Result	Result	----
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	<2	<2	<2	<2	----
EP090S: Organotin Surrogate								
Tripopyltin	----	5	%	46.1	39.8	56.5	91.5	----



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	ORA1-1	ORA1-2	ORA1-3	ORA2-1	ORA2-2
Client sampling date / time					20-Feb-2020 11:25	20-Feb-2020 11:30	20-Feb-2020 11:40	20-Feb-2020 12:00	20-Feb-2020 12:05
Compound	CAS Number	LOR	Unit		EP2001971-001	EP2001971-002	EP2001971-003	EP2001971-004	EP2001971-005
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		31.8	34.2	37.0	61.3	54.9
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		3	2	2	12	10
Silt (4-62 µm)	----	1	%		1	1	2	10	9
Fine Sand (62-250 µm)	----	1	%		66	76	71	63	60
Medium Sand (250-500 µm)	----	1	%		24	18	21	11	18
Coarse Sand (500-2000 µm)	----	1	%		6	3	5	4	3
Gravel (2000-10000 µm)	----	1	%		1	<1	<1	1	<1
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.65	2.68	2.65	2.60	2.62
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		200	150	110	360	320
Iron	7439-89-6	50	mg/kg		390	330	260	1080	990
Vanadium	7440-62-2	2	mg/kg		<2	<2	<2	3	<2
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		1.91	1.93	1.37	2.86	3.28
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	0.3	0.2
Copper	7440-50-8	1.0	mg/kg		<1.0	1.8	<1.0	31.3	28.7
Lead	7439-92-1	1.0	mg/kg		1.1	<1.0	<1.0	2.3	2.5
Manganese	7439-96-5	10	mg/kg		19	16	12	17	17
Nickel	7440-02-0	1.0	mg/kg		<1.0	<1.0	<1.0	1.4	1.2
Silver	7440-22-4	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	7440-66-6	1.0	mg/kg		2.6	3.2	3.6	53.2	52.5
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		2.2	2.3	2.0	3.1	3.2
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.38	0.18	0.20	2.21	1.07
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	<0.5	<1.0	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	<5	<5	12	18
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				ORA1-1	ORA1-2	ORA1-3	ORA2-1	ORA2-2
Client sampling date / time				20-Feb-2020 11:25	20-Feb-2020 11:30	20-Feb-2020 11:40	20-Feb-2020 12:00	20-Feb-2020 12:05
Compound	CAS Number	LOR	Unit	EP2001971-001	EP2001971-002	EP2001971-003	EP2001971-004	EP2001971-005
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	10	11
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<5	<5
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<5	<5
Phenanthrene	85-01-8	4	µg/kg	<4	<4	<4	<5	6
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	<5	6
Fluoranthene	206-44-0	4	µg/kg	<4	<4	<4	<5	<5
Pyrene	129-00-0	4	µg/kg	<4	<4	<4	<5	<5
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	<5	<5
Chrysene	218-01-9	4	µg/kg	<4	<4	<4	<5	<5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	<4	<4	<5	<5
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	<5	<5
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	<5	<5
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	<4	<5	<5
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<5	<5
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	<4	<5	<5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<5	<5
Indeno(1,2,3,cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	<5	<5
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	<4	<4	<4	22	41
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<4	<4	<4	<5	<5
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	5	5	5	<5	<5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	10	10	10	10
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	74.5	66.5	79.9	92.6	60.3
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	78.9	81.2	84.1	90.4	85.2
Anthracene-d10	1719-06-8	10	%	71.2	77.3	75.5	75.0	71.7
4-Terphenyl-d14	1718-51-0	10	%	85.1	73.6	93.7	119	111



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	ORA2-3	FBH1-1	FBH1-2	FBH1-3	FBH2-1
Client sampling date / time					20-Feb-2020 12:10	18-Feb-2020 11:00	18-Feb-2020 11:10	18-Feb-2020 11:20	18-Feb-2020 10:30
Compound	CAS Number	LOR	Unit		EP2001971-006	EP2001971-007	EP2001971-008	EP2001971-009	EP2001971-010
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		47.4	40.5	40.7	39.9	42.9
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		5	15	13	13	13
Silt (4-62 µm)	----	1	%		1	12	13	12	15
Fine Sand (62-250 µm)	----	1	%		80	54	56	53	68
Medium Sand (250-500 µm)	----	1	%		13	8	8	8	2
Coarse Sand (500-2000 µm)	----	1	%		1	7	7	8	1
Gravel (2000-10000 µm)	----	1	%		<1	3	4	5	<1
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.62	2.62	2.63	2.64	2.54
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		190	1750	1920	2010	2850
Iron	7439-89-6	50	mg/kg		460	5030	5160	5330	6070
Vanadium	7440-62-2	2	mg/kg		<2	12	12	11	12
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		2.06	5.82	6.26	5.42	6.68
Cadmium	7440-43-9	0.1	mg/kg		0.2	0.2	0.2	0.3	0.3
Copper	7440-50-8	1.0	mg/kg		8.9	373	460	371	349
Lead	7439-92-1	1.0	mg/kg		1.3	28.3	29.3	27.4	24.2
Manganese	7439-96-5	10	mg/kg		16	26	26	26	31
Nickel	7440-02-0	1.0	mg/kg		<1.0	3.0	3.1	3.2	4.0
Silver	7440-22-4	0.1	mg/kg		<0.1	0.2	0.2	0.2	0.4
Zinc	7440-66-6	1.0	mg/kg		18.0	320	313	287	284
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		2.9	4.4	4.6	4.8	5.8
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	0.09	0.10	0.09	0.09
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.32	0.79	0.84	0.86	1.03
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	27.1	27.2	27.2	16.9
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		8	9	12	10	8
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				ORA2-3	FBH1-1	FBH1-2	FBH1-3	FBH2-1
Client sampling date / time				20-Feb-2020 12:10	18-Feb-2020 11:00	18-Feb-2020 11:10	18-Feb-2020 11:20	18-Feb-2020 10:30
Compound	CAS Number	LOR	Unit	EP2001971-006	EP2001971-007	EP2001971-008	EP2001971-009	EP2001971-010
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	6	5	5
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	<4	24	29	23	21
Anthracene	120-12-7	4	µg/kg	<4	6	9	6	6
Fluoranthene	206-44-0	4	µg/kg	<4	47	62	49	50
Pyrene	129-00-0	4	µg/kg	<4	43	61	45	49
Benz(a)anthracene	56-55-3	4	µg/kg	<4	21	28	22	24
Chrysene	218-01-9	4	µg/kg	<4	18	25	21	22
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	33	42	36	36
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	15	22	16	17
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	17	25	19	22
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	23	31	25	27
Perylene	198-55-0	4	µg/kg	<4	5	7	5	6
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	23	30	26	28
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	4	5	4	5
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	18	24	20	22
Coronene	191-07-1	5	µg/kg	<5	7	7	8	8
^ Sum of PAHs	----	4	µg/kg	8	313	429	340	356
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<4	36	48	39	42
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	5	36	48	39	42
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	36	48	39	42
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	82.8	82.0	75.0	61.6	89.4
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	76.6	74.6	86.1	83.9	80.1
Anthracene-d10	1719-06-8	10	%	71.7	72.2	76.3	74.8	74.3
4-Terphenyl-d14	1718-51-0	10	%	86.9	97.1	110	91.8	91.9



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	FBH2-2	FBH2-3	CH1-1	CH1-2	CH1-3
Client sampling date / time					18-Feb-2020 10:40	18-Feb-2020 10:50	19-Feb-2020 10:50	19-Feb-2020 11:00	19-Feb-2020 11:15
Compound	CAS Number	LOR	Unit		EP2001971-011	EP2001971-012	EP2001971-013	EP2001971-014	EP2001971-015
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		43.9	44.7	51.7	53.6	49.6
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		10	12	21	25	19
Silt (4-62 µm)	----	1	%		19	16	28	26	27
Fine Sand (62-250 µm)	----	1	%		68	69	45	45	47
Medium Sand (250-500 µm)	----	1	%		2	2	5	1	4
Coarse Sand (500-2000 µm)	----	1	%		1	1	2	2	2
Gravel (2000-10000 µm)	----	1	%		<1	<1	<1	1	<1
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.51	2.51	2.53	2.52	2.54
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		2200	3100	2760	2310	2820
Iron	7439-89-6	50	mg/kg		4760	6440	6770	6060	6800
Vanadium	7440-62-2	2	mg/kg		10	13	17	16	17
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		5.83	7.18	7.49	7.45	7.13
Cadmium	7440-43-9	0.1	mg/kg		0.2	0.3	1.1	0.9	1.0
Copper	7440-50-8	1.0	mg/kg		286	370	206	184	198
Lead	7439-92-1	1.0	mg/kg		22.7	27.1	34.4	33.6	37.5
Manganese	7439-96-5	10	mg/kg		26	32	55	52	109
Nickel	7440-02-0	1.0	mg/kg		4.2	4.5	4.8	4.9	5.2
Silver	7440-22-4	0.1	mg/kg		0.2	0.3	0.4	0.4	0.5
Zinc	7440-66-6	1.0	mg/kg		265	303	342	308	336
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		4.4	6.3	5.6	5.0	5.5
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.05	0.10	0.06	0.05	0.05
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		1.08	1.19	1.67	1.85	1.84
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		17.9	21.7	2.1	2.0	1.4
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		8	8	12	10	9
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	7	6	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				FBH2-2	FBH2-3	CH1-1	CH1-2	CH1-3
Client sampling date / time				18-Feb-2020 10:40	18-Feb-2020 10:50	19-Feb-2020 10:50	19-Feb-2020 11:00	19-Feb-2020 11:15
Compound	CAS Number	LOR	Unit	EP2001971-011	EP2001971-012	EP2001971-013	EP2001971-014	EP2001971-015
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	4	4	<5	<5	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<5	<5	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<5	<5	<4
Phenanthrene	85-01-8	4	µg/kg	21	20	21	17	18
Anthracene	120-12-7	4	µg/kg	7	7	5	8	5
Fluoranthene	206-44-0	4	µg/kg	45	44	32	26	29
Pyrene	129-00-0	4	µg/kg	44	43	30	26	28
Benz(a)anthracene	56-55-3	4	µg/kg	21	21	14	13	14
Chrysene	218-01-9	4	µg/kg	20	18	12	10	12
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	34	33	21	19	19
Benzo(k)fluoranthene	207-08-9	4	µg/kg	16	18	10	8	10
Benzo(e)pyrene	192-97-2	4	µg/kg	19	20	12	12	12
Benzo(a)pyrene	50-32-8	4	µg/kg	24	25	17	16	17
Perylene	198-55-0	4	µg/kg	5	6	<5	<5	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	24	25	15	14	14
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	4	4	<5	<5	<4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	19	20	12	10	10
Coronene	191-07-1	5	µg/kg	8	7	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	323	323	220	195	197
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	37	39	23	21	22
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	37	39	25	23	24
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	37	39	27	25	26
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	88.9	97.2	75.5	79.7	73.1
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	73.3	70.5	92.6	82.1	81.6
Anthracene-d10	1719-06-8	10	%	71.6	70.1	78.9	71.6	71.2
4-Terphenyl-d14	1718-51-0	10	%	94.6	81.1	126	85.9	84.4



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH2-1	CH2-2	CH2-3	CH3-1	CH3-2
Client sampling date / time				20-Feb-2020 10:50	20-Feb-2020 10:55	20-Feb-2020 11:00	20-Feb-2020 09:40	20-Feb-2020 09:50
Compound	CAS Number	LOR	Unit	EP2001971-016	EP2001971-017	EP2001971-018	EP2001971-019	EP2001971-020
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	40.0	43.0	44.2	37.3	38.4
EA150: Particle Sizing								
Clay (<4 µm)	----	1	%	20	19	23	17	13
Silt (4-62 µm)	----	1	%	16	19	20	11	19
Fine Sand (62-250 µm)	----	1	%	49	46	46	41	37
Medium Sand (250-500 µm)	----	1	%	6	9	8	18	17
Coarse Sand (500-2000 µm)	----	1	%	7	4	3	9	10
Gravel (2000-10000 µm)	----	1	%	2	2	<1	3	5
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.59	2.58	2.58	2.68	2.64
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	1440	1910	2220	1630	1870
Iron	7439-89-6	50	mg/kg	4350	5540	6190	4730	5410
Vanadium	7440-62-2	2	mg/kg	11	13	15	12	12
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	5.11	6.31	6.88	5.47	5.53
Cadmium	7440-43-9	0.1	mg/kg	1.7	2.3	3.5	1.3	1.7
Copper	7440-50-8	1.0	mg/kg	196	252	327	171	208
Lead	7439-92-1	1.0	mg/kg	50.9	62.6	85.2	42.5	48.4
Manganese	7439-96-5	10	mg/kg	48	55	77	49	54
Nickel	7440-02-0	1.0	mg/kg	3.6	3.8	3.8	3.5	3.8
Silver	7440-22-4	0.1	mg/kg	0.5	0.8	0.8	0.5	0.5
Zinc	7440-66-6	1.0	mg/kg	517	658	972	435	540
EG020T: Total Metals by ICP-MS								
Lithium	7439-93-2	0.1	mg/kg	3.5	4.1	4.6	3.6	4.0
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.04	0.05	0.06	0.04	0.04
EN68: Seawater Elutriate Testing Procedure								
Seawater Sampling Date	----	-	-	----	----	----	27/02/2020	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.19	1.29	1.29	0.90	0.88
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	2.9	2.7	3.2	5.3	2.4



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH2-1	CH2-2	CH2-3	CH3-1	CH3-2
Client sampling date / time				20-Feb-2020 10:50	20-Feb-2020 10:55	20-Feb-2020 11:00	20-Feb-2020 09:40	20-Feb-2020 09:50
Compound	CAS Number	LOR	Unit	EP2001971-016	EP2001971-017	EP2001971-018	EP2001971-019	EP2001971-020
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	17	10	43	41	7
2-Methylnaphthalene	91-57-6	5	µg/kg	19	<5	20	9	<5
Acenaphthylene	208-96-8	4	µg/kg	6	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	75	<4	36	4	<4
Fluorene	86-73-7	4	µg/kg	54	<4	39	5	<4
Phenanthrene	85-01-8	4	µg/kg	387	37	283	50	33
Anthracene	120-12-7	4	µg/kg	48	6	26	8	8
Fluoranthene	206-44-0	4	µg/kg	340	69	193	49	76
Pyrene	129-00-0	4	µg/kg	320	58	154	44	66
Benz(a)anthracene	56-55-3	4	µg/kg	125	31	58	16	38
Chrysene	218-01-9	4	µg/kg	90	26	46	13	31
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	123	43	56	19	43
Benzo(k)fluoranthene	207-08-9	4	µg/kg	66	21	26	8	20
Benzo(e)pyrene	192-97-2	4	µg/kg	78	30	35	10	23
Benzo(a)pyrene	50-32-8	4	µg/kg	107	33	48	14	31
Perylene	198-55-0	4	µg/kg	25	9	11	<4	8
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	87	32	34	11	22
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	17	8	8	<4	6
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	68	25	27	8	18
Coronene	191-07-1	5	µg/kg	20	6	7	<5	<5
^ Sum of PAHs	----	4	µg/kg	2070	444	1150	309	430
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	164	54	74	19	49
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	164	54	74	21	49
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	164	54	74	23	49
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	97.5	80.3	73.9	87.2	68.4
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	98.0	93.0	86.2	78.1	92.2
Anthracene-d10	1719-06-8	10	%	83.0	79.6	72.8	71.5	80.6
4-Terphenyl-d14	1718-51-0	10	%	103	98.9	89.4	89.2	102



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	CH3-3	CH4-1	CH4-2	CH4-3	CH5-1
Client sampling date / time					20-Feb-2020 10:00	20-Feb-2020 09:00	20-Feb-2020 09:15	20-Feb-2020 09:20	18-Feb-2020 17:10
Compound	CAS Number	LOR	Unit		EP2001971-021	EP2001971-022	EP2001971-023	EP2001971-024	EP2001971-025
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		37.4	44.6	44.4	36.1	37.1
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		14	23	16	11	18
Silt (4-62 µm)	----	1	%		18	23	29	12	13
Fine Sand (62-250 µm)	----	1	%		39	38	42	16	33
Medium Sand (250-500 µm)	----	1	%		17	10	8	12	16
Coarse Sand (500-2000 µm)	----	1	%		10	5	4	16	15
Gravel (2000-10000 µm)	----	1	%		3	1	1	33	5
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.64	2.60	2.55	2.62	2.56
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		1670	1840	2480	1790	1720
Iron	7439-89-6	50	mg/kg		4570	5400	6560	14800	4590
Vanadium	7440-62-2	2	mg/kg		12	14	16	13	12
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		5.07	6.14	6.60	7.72	5.43
Cadmium	7440-43-9	0.1	mg/kg		1.7	1.3	1.7	1.0	0.9
Copper	7440-50-8	1.0	mg/kg		182	198	251	161	135
Lead	7439-92-1	1.0	mg/kg		40.4	46.6	46.8	35.7	27.9
Manganese	7439-96-5	10	mg/kg		53	50	55	159	46
Nickel	7440-02-0	1.0	mg/kg		3.3	3.8	4.1	7.1	3.2
Silver	7440-22-4	0.1	mg/kg		0.6	0.6	0.6	0.4	0.4
Zinc	7440-66-6	1.0	mg/kg		512	431	557	372	296
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		3.6	4.2	4.7	3.9	3.6
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.04	0.04	0.06	0.05	0.05
EN68: Seawater Elutriate Testing Procedure									
Seawater Sampling Date	----	-	-		----	27/02/2020	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.72	1.03	0.93	0.63	0.73
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		3.8	3.0	3.2	4.9	2.1



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH3-3	CH4-1	CH4-2	CH4-3	CH5-1
Client sampling date / time				20-Feb-2020 10:00	20-Feb-2020 09:00	20-Feb-2020 09:15	20-Feb-2020 09:20	18-Feb-2020 17:10
Compound	CAS Number	LOR	Unit	EP2001971-021	EP2001971-022	EP2001971-023	EP2001971-024	EP2001971-025
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	6	11	9	7	8
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	6	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<4	4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	9	5	<4	14
Fluorene	86-73-7	4	µg/kg	<4	8	5	<4	12
Phenanthrene	85-01-8	4	µg/kg	14	153	63	11	131
Anthracene	120-12-7	4	µg/kg	4	15	10	<4	21
Fluoranthene	206-44-0	4	µg/kg	22	176	79	20	195
Pyrene	129-00-0	4	µg/kg	23	142	66	20	121
Benz(a)anthracene	56-55-3	4	µg/kg	10	51	28	12	51
Chrysene	218-01-9	4	µg/kg	9	41	23	10	36
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	13	53	30	18	46
Benzo(k)fluoranthene	207-08-9	4	µg/kg	7	27	17	9	22
Benzo(e)pyrene	192-97-2	4	µg/kg	8	28	20	11	25
Benzo(a)pyrene	50-32-8	4	µg/kg	11	39	25	14	38
Perylene	198-55-0	4	µg/kg	<4	8	6	4	10
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	9	23	18	13	22
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	6	4	<4	8
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	6	18	13	9	19
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	142	818	421	158	779
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	15	60	38	19	60
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	17	60	38	21	60
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	19	60	38	23	60
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	79.4	96.0	104	92.5	88.3
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	82.0	77.2	82.9	85.8	80.6
Anthracene-d10	1719-06-8	10	%	70.6	70.6	73.5	77.3	76.2
4-Terphenyl-d14	1718-51-0	10	%	118	83.7	93.4	93.6	96.4



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	CH5-2	CH5-3	CH6-1	CH6-2	CH6-3
Client sampling date / time					18-Feb-2020 17:15	18-Feb-2020 17:20	18-Feb-2020 16:30	18-Feb-2020 16:40	18-Feb-2020 16:45
Compound	CAS Number	LOR	Unit		EP2001971-026	EP2001971-027	EP2001971-028	EP2001971-029	EP2001971-030
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		32.7	32.9	37.6	39.2	34.8
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		13	16	17	19	13
Silt (4-62 µm)	----	1	%		12	9	12	10	13
Fine Sand (62-250 µm)	----	1	%		31	36	38	38	33
Medium Sand (250-500 µm)	----	1	%		19	19	19	18	23
Coarse Sand (500-2000 µm)	----	1	%		18	15	13	13	15
Gravel (2000-10000 µm)	----	1	%		7	5	1	1	3
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.57	2.57	2.60	2.57	2.56
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		1620	1490	1230	1700	1580
Iron	7439-89-6	50	mg/kg		5110	4600	3600	4360	4090
Vanadium	7440-62-2	2	mg/kg		11	10	11	12	11
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		5.54	4.68	4.98	5.47	4.98
Cadmium	7440-43-9	0.1	mg/kg		1.1	0.9	0.7	1.0	0.9
Copper	7440-50-8	1.0	mg/kg		145	117	124	142	131
Lead	7439-92-1	1.0	mg/kg		27.6	22.5	28.1	27.6	25.6
Manganese	7439-96-5	10	mg/kg		46	44	44	49	55
Nickel	7440-02-0	1.0	mg/kg		3.2	2.8	2.5	3.0	2.9
Silver	7440-22-4	0.1	mg/kg		0.4	0.3	0.4	0.3	0.3
Zinc	7440-66-6	1.0	mg/kg		327	282	233	309	285
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		3.6	3.2	3.1	3.8	3.6
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.03	0.03	0.03	0.04	0.03
EN68: Seawater Elutriate Testing Procedure									
Seawater Sampling Date	----	-	-		----	----	27/02/2020	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.71	0.48	0.59	0.73	0.62
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		1.4	1.7	8.2	2.2	1.6



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH5-2	CH5-3	CH6-1	CH6-2	CH6-3
Client sampling date / time				18-Feb-2020 17:15	18-Feb-2020 17:20	18-Feb-2020 16:30	18-Feb-2020 16:40	18-Feb-2020 16:45
Compound	CAS Number	LOR	Unit	EP2001971-026	EP2001971-027	EP2001971-028	EP2001971-029	EP2001971-030
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	6	7	11	10	6
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	10	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	5	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	31	16	13	15	5
Anthracene	120-12-7	4	µg/kg	20	<4	<4	8	<4
Fluoranthene	206-44-0	4	µg/kg	58	19	17	23	7
Pyrene	129-00-0	4	µg/kg	52	17	16	21	6
Benzo(a)anthracene	56-55-3	4	µg/kg	52	8	8	10	<4
Chrysene	218-01-9	4	µg/kg	37	6	7	8	<4
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	90	10	12	13	5
Benzo(k)fluoranthene	207-08-9	4	µg/kg	37	5	6	8	<4
Benzo(e)pyrene	192-97-2	4	µg/kg	47	6	7	8	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	68	9	9	10	<4
Perylene	198-55-0	4	µg/kg	16	<4	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	47	6	6	7	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	15	<4	<4	<4	<4
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	39	5	4	5	<4
Coronene	191-07-1	5	µg/kg	6	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	636	114	116	146	29
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	106	12	12	14	<4
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	106	14	14	16	5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	106	16	16	18	10
EP090S: Organotin Surrogate								
Tripopyltn	----	0.5	%	57.4	87.2	97.8	104	95.4
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	88.8	97.6	82.8	87.0	74.2
Anthracene-d10	1719-06-8	10	%	79.9	82.6	73.5	76.5	73.0
4-Terphenyl-d14	1718-51-0	10	%	108	101	87.8	72.1	76.5



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	CH9-1	CH9-2	CH9-3	CH10-1	CH10-2
Client sampling date / time					18-Feb-2020 17:45	18-Feb-2020 18:00	18-Feb-2020 18:10	19-Feb-2020 11:40	19-Feb-2020 11:45
Compound	CAS Number	LOR	Unit		EP2001971-031	EP2001971-032	EP2001971-033	EP2001971-034	EP2001971-035
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		37.9	28.9	28.7	56.2	56.2
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		14	7	8	15	17
Silt (4-62 µm)	----	1	%		11	7	4	20	15
Fine Sand (62-250 µm)	----	1	%		19	12	11	49	41
Medium Sand (250-500 µm)	----	1	%		10	12	11	10	8
Coarse Sand (500-2000 µm)	----	1	%		19	28	23	5	11
Gravel (2000-10000 µm)	----	1	%		29	34	43	1	8
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.55	2.55	2.55	2.35	2.35
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		2440	1120	980	1720	1440
Iron	7439-89-6	50	mg/kg		4660	2920	2620	4220	3460
Vanadium	7440-62-2	2	mg/kg		14	13	10	11	12
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		6.51	5.15	4.41	6.00	6.35
Cadmium	7440-43-9	0.1	mg/kg		0.9	0.5	0.4	0.5	0.5
Copper	7440-50-8	1.0	mg/kg		146	47.4	50.6	74.5	50.6
Lead	7439-92-1	1.0	mg/kg		37.6	10.5	11.1	14.3	10.0
Manganese	7439-96-5	10	mg/kg		67	69	69	37	54
Nickel	7440-02-0	1.0	mg/kg		3.5	2.1	1.7	3.7	3.0
Silver	7440-22-4	0.1	mg/kg		0.5	0.2	0.1	0.3	0.1
Zinc	7440-66-6	1.0	mg/kg		305	111	122	147	101
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		4.4	3.1	2.8	3.7	3.8
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.04	0.01	0.02	0.03	0.02
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.38	0.36	0.23	2.16	1.64
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		1.3	1.4	0.9	1.4	0.9
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		6	6	<5	16	23
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	7	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH9-1	CH9-2	CH9-3	CH10-1	CH10-2
Client sampling date / time				18-Feb-2020 17:45	18-Feb-2020 18:00	18-Feb-2020 18:10	19-Feb-2020 11:40	19-Feb-2020 11:45
Compound	CAS Number	LOR	Unit	EP2001971-031	EP2001971-032	EP2001971-033	EP2001971-034	EP2001971-035
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<5	6
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<5	<5
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<5	<5
Phenanthrene	85-01-8	4	µg/kg	12	10	<4	19	8
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	<5	<5
Fluoranthene	206-44-0	4	µg/kg	16	11	4	25	18
Pyrene	129-00-0	4	µg/kg	16	9	5	21	16
Benz(a)anthracene	56-55-3	4	µg/kg	8	<4	<4	11	9
Chrysene	218-01-9	4	µg/kg	6	<4	<4	9	8
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	10	5	<4	15	10
Benzo(k)fluoranthene	207-08-9	4	µg/kg	5	<4	<4	10	6
Benzo(e)pyrene	192-97-2	4	µg/kg	6	<4	<4	8	7
Benzo(a)pyrene	50-32-8	4	µg/kg	8	<4	<4	10	8
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<5	<5
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	5	<4	<4	8	5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<5	<5
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	8	7
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	98	41	9	167	131
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	10	<4	<4	14	11
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	13	5	5	16	13
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	15	10	10	18	15
EP090S: Organotin Surrogate								
Tripolytln	----	0.5	%	86.4	89.2	97.0	91.6	76.3
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	78.9	85.4	78.7	77.2	86.7
Anthracene-d10	1719-06-8	10	%	72.2	75.0	72.2	85.6	74.5
4-Terphenyl-d14	1718-51-0	10	%	88.3	89.3	86.2	73.4	96.2



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH10-3	YM1-1	YM1-2	YM1-3	TB1-1
Client sampling date / time				19-Feb-2020 11:50	18-Feb-2020 12:00	18-Feb-2020 12:10	18-Feb-2020 12:15	18-Feb-2020 13:00
Compound	CAS Number	LOR	Unit	EP2001971-036	EP2001971-037	EP2001971-038	EP2001971-039	EP2001971-040
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	55.8	39.1	31.7	29.0	29.6
EA150: Particle Sizing								
Clay (<4 µm)	----	1	%	18	17	13	10	6
Silt (4-62 µm)	----	1	%	22	17	4	10	4
Fine Sand (62-250 µm)	----	1	%	47	24	23	30	59
Medium Sand (250-500 µm)	----	1	%	8	7	9	15	13
Coarse Sand (500-2000 µm)	----	1	%	4	9	15	21	15
Gravel (2000-10000 µm)	----	1	%	1	27	36	14	4
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.33	2.65	2.69	2.69	2.66
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	1260	2920	2010	1880	590
Iron	7439-89-6	50	mg/kg	3480	7180	4980	3780	1120
Vanadium	7440-62-2	2	mg/kg	10	18	10	11	4
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	6.12	5.63	4.56	3.46	2.62
Cadmium	7440-43-9	0.1	mg/kg	0.4	0.2	0.1	0.1	0.1
Copper	7440-50-8	1.0	mg/kg	62.6	116	162	43.7	7.6
Lead	7439-92-1	1.0	mg/kg	12.9	32.6	70.4	11.8	5.8
Manganese	7439-96-5	10	mg/kg	30	46	40	28	23
Nickel	7440-02-0	1.0	mg/kg	3.3	4.8	3.1	2.6	1.0
Silver	7440-22-4	0.1	mg/kg	0.2	0.1	<0.1	<0.1	<0.1
Zinc	7440-66-6	1.0	mg/kg	113	113	53.5	53.9	21.6
EG020T: Total Metals by ICP-MS								
Lithium	7439-93-2	0.1	mg/kg	3.3	5.0	3.8	3.6	1.8
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.02	0.14	0.08	0.05	0.03
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	2.34	0.96	0.68	0.43	0.44
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	1.1	73.5	51.5	19.8	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	22	15	11	7	9
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH10-3	YM1-1	YM1-2	YM1-3	TB1-1
Client sampling date / time				19-Feb-2020 11:50	18-Feb-2020 12:00	18-Feb-2020 12:10	18-Feb-2020 12:15	18-Feb-2020 13:00
Compound	CAS Number	LOR	Unit	EP2001971-036	EP2001971-037	EP2001971-038	EP2001971-039	EP2001971-040
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	6	14	9	6	10
Acenaphthene	83-32-9	4	µg/kg	<5	14	4	<4	<4
Fluorene	86-73-7	4	µg/kg	<5	9	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	10	79	26	42	10
Anthracene	120-12-7	4	µg/kg	<5	20	9	10	12
Fluoranthene	206-44-0	4	µg/kg	15	180	79	100	56
Pyrene	129-00-0	4	µg/kg	14	160	70	86	50
Benz(a)anthracene	56-55-3	4	µg/kg	7	94	48	55	36
Chrysene	218-01-9	4	µg/kg	6	81	37	40	24
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	11	125	61	70	40
Benzo(k)fluoranthene	207-08-9	4	µg/kg	6	58	30	29	20
Benzo(e)pyrene	192-97-2	4	µg/kg	6	57	29	32	18
Benzo(a)pyrene	50-32-8	4	µg/kg	8	94	46	53	39
Perylene	198-55-0	4	µg/kg	<5	21	10	13	9
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	5	59	30	31	19
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<5	17	8	8	4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<5	51	25	26	17
Coronene	191-07-1	5	µg/kg	<5	9	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	116	1160	532	608	373
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	10	145	71	80	55
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	13	145	71	80	55
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	15	145	71	80	55
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	70.6	75.8	94.9	108	106
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	97.9	77.5	89.7	87.3	76.4
Anthracene-d10	1719-06-8	10	%	76.4	75.3	79.7	81.1	71.5
4-Terphenyl-d14	1718-51-0	10	%	93.9	101	93.8	102	78.4



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				TB1-2	TB1-3	CS1-1	CS1-2	CS1-3
Client sampling date / time				18-Feb-2020 13:05	18-Feb-2020 13:10	18-Feb-2020 01:50	18-Feb-2020 15:10	18-Feb-2020 15:15
Compound	CAS Number	LOR	Unit	EP2001971-041	EP2001971-042	EP2001971-043	EP2001971-044	EP2001971-045
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	31.8	30.2	27.4	29.0	26.5
EA150: Particle Sizing								
Clay (<4 µm)	----	1	%	4	3	<1	1	2
Silt (4-62 µm)	----	1	%	6	5	<1	1	<1
Fine Sand (62-250 µm)	----	1	%	55	62	11	4	9
Medium Sand (250-500 µm)	----	1	%	9	11	56	46	57
Coarse Sand (500-2000 µm)	----	1	%	20	14	27	48	29
Gravel (2000-10000 µm)	----	1	%	6	5	6	1	4
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.65	2.44	2.53	2.45	2.51
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	500	560	420	430	400
Iron	7439-89-6	50	mg/kg	920	930	830	800	770
Vanadium	7440-62-2	2	mg/kg	3	3	4	4	4
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	2.09	2.14	2.46	2.62	2.38
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.2	0.5	0.1
Copper	7440-50-8	1.0	mg/kg	7.1	7.4	<1.0	<1.0	<1.0
Lead	7439-92-1	1.0	mg/kg	5.2	5.5	1.8	1.7	1.7
Manganese	7439-96-5	10	mg/kg	22	22	30	28	28
Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Zinc	7440-66-6	1.0	mg/kg	20.4	16.8	3.7	14.1	2.7
EG020T: Total Metals by ICP-MS								
Lithium	7439-93-2	0.1	mg/kg	1.9	1.9	1.6	1.5	1.4
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.02	0.05	<0.01	<0.01	<0.01
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.46	0.18	0.14	0.15	0.12
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	12	6	<5	<5	5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				TB1-2	TB1-3	CS1-1	CS1-2	CS1-3
Client sampling date / time				18-Feb-2020 13:05	18-Feb-2020 13:10	18-Feb-2020 01:50	18-Feb-2020 15:10	18-Feb-2020 15:15
Compound	CAS Number	LOR	Unit	EP2001971-041	EP2001971-042	EP2001971-043	EP2001971-044	EP2001971-045
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<4	4
Phenanthrene	85-01-8	4	µg/kg	<10	<4	<4	<4	6
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	<4	6
Fluoranthene	206-44-0	4	µg/kg	6	4	<4	<4	10
Pyrene	129-00-0	4	µg/kg	5	12	<4	<4	12
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	<4	14
Chrysene	218-01-9	4	µg/kg	<4	6	<4	<4	15
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	4	4	<4	5	17
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	7	18
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	4	<4	<4	<20
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	<4	<4	9
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	5	11
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	6	10
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	27	36	<4	23	137
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<4	4	<4	7	17
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	5	7	5	9	19
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	10	10	11	21
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	101	87.4	58.8	98.3	98.2
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	78.8	70.3	73.2	76.8	73.7
Anthracene-d10	1719-06-8	10	%	72.2	99.5	83.1	77.4	95.4
4-Terphenyl-d14	1718-51-0	10	%	76.3	88.0	108	92.6	91.8



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	CS2-1	CS2-2	CS2-3	CH7-1	CH7-2
Client sampling date / time					18-Feb-2020 15:30	18-Feb-2020 15:35	18-Feb-2020 15:45	19-Feb-2020 10:00	19-Feb-2020 10:05
Compound	CAS Number	LOR	Unit		EP2001971-046	EP2001971-047	EP2001971-048	EP2001971-049	EP2001971-050
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		19.8	20.6	21.4	40.2	42.4
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		1	1	<1	18	23
Silt (4-62 µm)	----	1	%		1	<1	1	17	14
Fine Sand (62-250 µm)	----	1	%		1	3	1	47	45
Medium Sand (250-500 µm)	----	1	%		56	59	53	13	13
Coarse Sand (500-2000 µm)	----	1	%		41	35	42	5	4
Gravel (2000-10000 µm)	----	1	%		1	1	3	<1	<1
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.55	2.62	2.62	2.59	2.44
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		420	460	440	1650	1660
Iron	7439-89-6	50	mg/kg		900	990	1010	4350	4440
Vanadium	7440-62-2	2	mg/kg		5	5	6	13	13
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		3.81	4.24	4.25	5.47	5.48
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	0.1	0.9	0.8
Copper	7440-50-8	1.0	mg/kg		<1.0	<1.0	<1.0	140	140
Lead	7439-92-1	1.0	mg/kg		1.6	1.6	1.6	25.7	28.6
Manganese	7439-96-5	10	mg/kg		31	33	38	52	50
Nickel	7440-02-0	1.0	mg/kg		<1.0	<1.0	<1.0	3.5	3.0
Silver	7440-22-4	0.1	mg/kg		<0.1	<0.1	<0.1	0.5	0.5
Zinc	7440-66-6	1.0	mg/kg		1.9	2.1	3.0	288	252
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		1.5	1.5	1.5	3.6	3.8
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	<0.01	0.04	0.04
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.11	0.12	0.11	0.94	0.76
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	<0.5	2.5	2.4
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	<5	<5	8	7
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CS2-1	CS2-2	CS2-3	CH7-1	CH7-2
Client sampling date / time				18-Feb-2020 15:30	18-Feb-2020 15:35	18-Feb-2020 15:45	19-Feb-2020 10:00	19-Feb-2020 10:05
Compound	CAS Number	LOR	Unit	EP2001971-046	EP2001971-047	EP2001971-048	EP2001971-049	EP2001971-050
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	5	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	5	<4
Phenanthrene	85-01-8	4	µg/kg	<4	<4	<4	48	11
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	7	<4
Fluoranthene	206-44-0	4	µg/kg	<4	<4	<4	97	18
Pyrene	129-00-0	4	µg/kg	<4	<4	<4	65	16
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	30	9
Chrysene	218-01-9	4	µg/kg	<4	<4	<4	22	6
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	<4	<4	31	11
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	16	7
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	18	7
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	<4	21	7
Perylene	198-55-0	4	µg/kg	<4	<4	<4	5	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	<4	10	5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	<4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	8	<4
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	<4	<4	<4	396	104
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<4	<4	<4	30	10
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	5	5	5	32	12
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	10	10	34	14
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	93.8	63.8	61.4	80.8	76.7
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	71.4	72.7	70.3	88.4	81.0
Anthracene-d10	1719-06-8	10	%	73.6	76.4	87.4	82.7	71.9
4-Terphenyl-d14	1718-51-0	10	%	80.6	80.9	93.4	119	90.2



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	CH7-3	CH8-1	CH8-2	CH8-3	DUP-1
Client sampling date / time					19-Feb-2020 10:15	19-Feb-2020 09:20	19-Feb-2020 09:30	19-Feb-2020 09:35	18-Feb-2020 00:00
Compound	CAS Number	LOR	Unit		EP2001971-051	EP2001971-052	EP2001971-053	EP2001971-054	EP2001971-055
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		41.3	38.3	37.6	38.3	42.9
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		16	14	14	13	----
Silt (4-62 µm)	----	1	%		18	11	11	10	----
Fine Sand (62-250 µm)	----	1	%		49	42	43	42	----
Medium Sand (250-500 µm)	----	1	%		12	17	16	19	----
Coarse Sand (500-2000 µm)	----	1	%		4	10	8	10	----
Gravel (2000-10000 µm)	----	1	%		1	6	7	6	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.51	2.44	2.47	2.45	----
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		1950	1230	1460	1780	2020
Iron	7439-89-6	50	mg/kg		4930	3120	3250	3830	4200
Vanadium	7440-62-2	2	mg/kg		13	9	10	10	9
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		5.55	3.86	3.87	3.96	4.30
Cadmium	7440-43-9	0.1	mg/kg		1.0	0.6	0.6	0.7	0.2
Copper	7440-50-8	1.0	mg/kg		154	98.3	99.2	107	218
Lead	7439-92-1	1.0	mg/kg		27.4	19.3	16.5	18.6	16.4
Manganese	7439-96-5	10	mg/kg		52	36	41	37	19
Nickel	7440-02-0	1.0	mg/kg		3.2	2.4	2.5	2.8	2.8
Silver	7440-22-4	0.1	mg/kg		0.3	0.2	0.2	0.4	0.2
Zinc	7440-66-6	1.0	mg/kg		302	173	187	199	180
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		4.1	3.1	3.5	3.6	4.4
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.04	0.03	0.02	0.03	0.07
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.71	0.72	0.58	0.60	0.97
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		1.2	2.4	1.0	1.0	15.8
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		6	9	6	8	8
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH7-3	CH8-1	CH8-2	CH8-3	DUP-1
Client sampling date / time				19-Feb-2020 10:15	19-Feb-2020 09:20	19-Feb-2020 09:30	19-Feb-2020 09:35	18-Feb-2020 00:00
Compound	CAS Number	LOR	Unit	EP2001971-051	EP2001971-052	EP2001971-053	EP2001971-054	EP2001971-055
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	5
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	22	14	12	10	27
Anthracene	120-12-7	4	µg/kg	4	<4	<4	<4	7
Fluoranthene	206-44-0	4	µg/kg	32	26	14	10	51
Pyrene	129-00-0	4	µg/kg	29	24	12	11	48
Benz(a)anthracene	56-55-3	4	µg/kg	12	13	6	4	24
Chrysene	218-01-9	4	µg/kg	10	11	5	<4	22
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	15	16	10	5	39
Benzo(k)fluoranthene	207-08-9	4	µg/kg	9	10	4	4	19
Benzo(e)pyrene	192-97-2	4	µg/kg	10	11	5	<4	23
Benzo(a)pyrene	50-32-8	4	µg/kg	10	11	4	<4	27
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<4	6
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	6	7	<4	<4	19
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	4
Indeno(1,2,3,cd)pyrene	193-39-5	4	µg/kg	<4	5	<4	<4	13
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	165	157	78	52	342
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	14	16	6	<4	41
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	16	18	8	6	41
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	18	20	10	10	41
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	50.7	70.3	44.0	66.9	40.5
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	74.3	80.8	79.2	78.3	96.5
Anthracene-d10	1719-06-8	10	%	70.3	74.6	71.8	82.0	86.0
4-Terphenyl-d14	1718-51-0	10	%	79.5	90.8	86.7	90.6	121



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				DUP-2	DUP-3	DUP-4	DUP-5	TRIP-P1
Client sampling date / time				18-Feb-2020 00:00	19-Feb-2020 00:00	20-Feb-2020 00:00	20-Feb-2020 00:00	18-Feb-2020 00:00
Compound	CAS Number	LOR	Unit	EP2001971-056	EP2001971-057	EP2001971-058	EP2001971-059	EP2001971-060
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	38.0	42.6	45.3	32.8	36.6
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	1730	2000	1770	250	1610
Iron	7439-89-6	50	mg/kg	4680	4780	5470	430	4140
Vanadium	7440-62-2	2	mg/kg	12	14	14	<2	12
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	5.14	5.28	6.27	1.92	4.71
Cadmium	7440-43-9	0.1	mg/kg	1.0	0.9	1.5	<0.1	0.8
Copper	7440-50-8	1.0	mg/kg	141	153	209	<1.0	124
Lead	7439-92-1	1.0	mg/kg	30.4	26.4	48.1	1.0	24.4
Manganese	7439-96-5	10	mg/kg	59	55	48	17	46
Nickel	7440-02-0	1.0	mg/kg	3.4	3.6	3.3	<1.0	3.4
Silver	7440-22-4	0.1	mg/kg	0.4	0.3	0.6	<0.1	0.3
Zinc	7440-66-6	1.0	mg/kg	299	276	472	2.5	253
EG020T: Total Metals by ICP-MS								
Lithium	7439-93-2	0.1	mg/kg	3.9	4.4	4.0	2.3	3.7
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.04	0.04	0.06	<0.01	0.04
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.72	0.99	1.17	0.23	0.71
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	2.3	2.4	3.2	<0.5	2.8
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	8	10	10	5	7
2-Methylnaphthalene	91-57-6	5	µg/kg	6	<5	6	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	12	15	22	<4	20
Anthracene	120-12-7	4	µg/kg	<4	<4	5	<4	<4
Fluoranthene	206-44-0	4	µg/kg	19	24	35	<4	23
Pyrene	129-00-0	4	µg/kg	22	24	32	<4	29
Benz(a)anthracene	56-55-3	4	µg/kg	11	13	16	<4	12
Chrysene	218-01-9	4	µg/kg	9	11	13	<4	9



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				DUP-2	DUP-3	DUP-4	DUP-5	TRIP-P1
Client sampling date / time				18-Feb-2020 00:00	19-Feb-2020 00:00	20-Feb-2020 00:00	20-Feb-2020 00:00	18-Feb-2020 00:00
Compound	CAS Number	LOR	Unit	EP2001971-056	EP2001971-057	EP2001971-058	EP2001971-059	EP2001971-060
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	15	26	23	<4	15
Benzo(k)fluoranthene	207-08-9	4	µg/kg	8	13	9	<4	7
Benzo(e)pyrene	192-97-2	4	µg/kg	11	18	14	<4	11
Benzo(a)pyrene	50-32-8	4	µg/kg	12	16	14	<4	10
Perylene	198-55-0	4	µg/kg	<4	5	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	7	13	10	<4	6
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	<4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	5	9	6	<4	<4
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	145	197	215	5	149
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	16	22	20	<4	14
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	18	24	22	5	16
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	20	26	24	10	18
EP090S: Organotin Surrogate								
Tripopyltin	----	0.5	%	71.2	65.0	53.0	91.4	59.7
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	91.1	89.9	88.1	89.3	86.2
Anthracene-d10	1719-06-8	10	%	80.7	80.8	78.0	90.2	79.0
4-Terphenyl-d14	1718-51-0	10	%	101	108	94.7	112	71.6



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				TRIP-P2	TRIP-P3	----	----	----
Client sampling date / time				19-Feb-2020 00:00	20-Feb-2020 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP2001971-061	EP2001971-062	-----	-----	-----
				Result	Result	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	52.3	41.1	----	----	----
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	2330	1310	----	----	----
Iron	7439-89-6	50	mg/kg	6220	4370	----	----	----
Vanadium	7440-62-2	2	mg/kg	17	13	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	7.20	5.55	----	----	----
Cadmium	7440-43-9	0.1	mg/kg	1.0	1.3	----	----	----
Copper	7440-50-8	1.0	mg/kg	186	166	----	----	----
Lead	7439-92-1	1.0	mg/kg	35.4	44.4	----	----	----
Manganese	7439-96-5	10	mg/kg	54	49	----	----	----
Nickel	7440-02-0	1.0	mg/kg	4.4	2.8	----	----	----
Silver	7440-22-4	0.1	mg/kg	0.5	0.4	----	----	----
Zinc	7440-66-6	1.0	mg/kg	332	392	----	----	----
EG020T: Total Metals by ICP-MS								
Lithium	7439-93-2	0.1	mg/kg	5.2	3.4	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.07	0.05	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.63	0.83	----	----	----
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	1.3	4.6	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	15	7	----	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg	6	<5	----	----	----
Acenaphthylene	208-96-8	4	µg/kg	<5	<4	----	----	----
Acenaphthene	83-32-9	4	µg/kg	<5	<4	----	----	----
Fluorene	86-73-7	4	µg/kg	<5	<4	----	----	----
Phenanthrene	85-01-8	4	µg/kg	14	11	----	----	----
Anthracene	120-12-7	4	µg/kg	<5	<4	----	----	----
Fluoranthene	206-44-0	4	µg/kg	29	<20	----	----	----
Pyrene	129-00-0	4	µg/kg	28	14	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg	16	7	----	----	----
Chrysene	218-01-9	4	µg/kg	11	5	----	----	----



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				TRIP-P2	TRIP-P3	----	----	----
Client sampling date / time				19-Feb-2020 00:00	20-Feb-2020 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP2001971-061	EP2001971-062	-----	-----	-----
				Result	Result	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	22	10	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg	11	4	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg	15	6	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg	14	6	----	----	----
Perylene	198-55-0	4	µg/kg	<5	<4	----	----	----
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	10	4	----	----	----
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<5	<4	----	----	----
Indeno(1,2,3,cd)pyrene	193-39-5	4	µg/kg	7	<4	----	----	----
Coronene	191-07-1	5	µg/kg	<5	<5	----	----	----
^ Sum of PAHs	----	4	µg/kg	198	74	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	20	8	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	22	10	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	24	12	----	----	----
EP090S: Organotin Surrogate								
Tripopyltin	----	0.5	%	62.7	95.7	----	----	----
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	87.1	72.4	----	----	----
Anthracene-d10	1719-06-8	10	%	75.6	74.2	----	----	----
4-Terphenyl-d14	1718-51-0	10	%	92.1	89.3	----	----	----



Analytical Results

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

Client sample ID

				Elutriate Water	----	----	----	----
				Client sampling date / time	20-Feb-2020 09:30	----	----	----
Compound	CAS Number	LOR	Unit	EP2001971-064	-----	-----	-----	-----
				Result	----	----	----	----
EN68: Seawater Elutriate Testing Procedure								
Seawater Sampling Date	----	-	-	27/02/2020	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RINSB	----	----	----	----
Client sampling date / time				19-Feb-2020 00:00	----	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2001971-063	-----	-----	-----	-----	-----
Result				----	----	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	<0.01	----	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	<0.001	----	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----	----
Silver	7440-22-4	0.001	mg/L	<0.001	----	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L	<1.0	----	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	----	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	----	----	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	----	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	----	----	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	----	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	----	----	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(a)anthracene	56-55-3	1.0	µg/L	<1.0	----	----	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	----	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	----	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	----	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	----	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	----	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%	23.9	----	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RINSB	----	----	----	----
				Client sampling date / time	19-Feb-2020 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2001971-063	-----	-----	-----	-----
				Result	----	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
2-Chlorophenol-D4	93951-73-6	1.0	%		60.6	----	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		69.6	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		70.6	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%		93.9	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		86.4	----	----	----	----



Surrogate Control Limits

Sub-Matrix: ELUTRIATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP090S: Organotin Surrogate			
Tripopyltin	----	24	116

Sub-Matrix: MARINE SEDIMENT		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP090S: Organotin Surrogate			
Tripopyltin	----	35	130
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	70	130
Anthracene-d10	1719-06-8	70	130
4-Terphenyl-d14	1718-51-0	70	130

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	67
2-Chlorophenol-D4	93951-73-6	29	120
2,4,6-Tribromophenol	118-79-6	10	131
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	34	131
Anthracene-d10	1719-06-8	43	126
4-Terphenyl-d14	1718-51-0	41	142

LABORATORY REPORT

ADDRESS: **O2 Marine**
Suite 2, 4B Mews Rd
Fremantle WA 6160

ATTENTION: Russell Stevens

DATE RECEIVED: 25/04/2021

YOUR REFERENCE: 18WAU-0004 Geraldton Port Baseline Sediment Characterisation Sampling 2021

PURCHASE ORDER:

APPROVALS:


Sean Sangster
Inorganics Supervisor


Douglas Todd
Laboratory Manager


Andrew Harvey
Resources Manager

REPORT COMMENTS:

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Samples are analysed on an as received basis unless otherwise noted.

Tributyl tin in Soil analysis subcontracted to MPL, NATA Accred No. 2901, Report Number 259526
Nitrate, Nitrite, ammonia and FRP tests were conducted on a porewater sample.

METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377
Methods prefixed with "PM" and "EDP" are covered under NATA Accreditation Number: 2561

Method ID	Method Description
ARL No. 401/403	Metals in Soil and Sediment by ICPOES/MS
ARL No. 030	Metals in Soil and Sediment by AAS
ARL No. 406	Mercury by Cold Vapour Atomic Absorption Spectrophotometry
ARL No. 135	Moisture
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 118	Total Phosphorus and TKN in Soil and Biosolids
ARL No. 314	NOx in Soil and Sediment by Discrete Analyser
ARL No. 064	Total Organic Carbon in Sediment
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
Subcontracting	See Report Comments section for more information.



**WORLD RECOGNISED
ACCREDITATION**

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY REPORT

Metals in Soil and Sediment			Sample No	21-05631-1	21-05631-2	21-05631-3	21-05631-4	21-05631-5
Sample Description				NC17-1	NC17-2	NC17-3	NC18	NC19
Sample Date				24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Aluminium	1	mg/kg	420	420	410	250	320	
Arsenic	0.1	mg/kg	2.8	3.1	6.0	1.4	1.5	
Cadmium	0.1	mg/kg	0.1	0.1	0.2	<0.1	<0.1	
Chromium	0.2	mg/kg	11	13	24	13	13	
Copper	1	mg/kg	12	12	14	10	11	
Lead	1	mg/kg	1	2	1	<1	<1	
Manganese	1	mg/kg	25	26	27	17	15	
Nickel	1	mg/kg	<1	<1	<1	<1	<1	
Zinc	1	mg/kg	15	14	16	5	8	
Silver	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	
Iron	1	mg/kg	1,100	1,100	1,200	650	720	
Vanadium	2	mg/kg	3	3	4	2	2	
Mercury	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	

Metals in Soil and Sediment			Sample No	21-05631-6	21-05631-7	21-05631-8	21-05631-9	21-05631-10
Sample Description				CH16	CH17	CH18	CH19	CH1-1
Sample Date				24/03/2021	23/03/2021	23/03/2021	23/03/2021	24/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Aluminium	1	mg/kg	2,700	1,600	2,300	2,000		
Arsenic	0.1	mg/kg	6.9	4.1	6.2	5.9		
Cadmium	0.1	mg/kg	0.8	0.4	0.7	0.6		
Chromium	0.2	mg/kg	25	19	23	20		
Copper	1	mg/kg	250	120	170	150		
Lead	1	mg/kg	33	17	22	19		
Manganese	1	mg/kg	54	34	43	38		
Nickel	1	mg/kg	5	3	4	3		
Zinc	1	mg/kg	370	170	260	240		
Silver	0.1	mg/kg	0.3	0.1	0.2	0.2		
Iron	1	mg/kg	11,000	5,700	8,200	7,200		
Vanadium	2	mg/kg	21	12	16	14		
Mercury	0.01	mg/kg	0.06	0.03	0.04	0.05		
Phosphorus	1	mg/kg						710

Metals in Soil and Sediment			Sample No	21-05631-11	21-05631-12	21-05631-13	21-05631-14	21-05631-15
Sample Description				CH2-1	CH3-1	CH3-2	CH3-3	CH4-1
Sample Date				24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Phosphorus	1	mg/kg	610	490	480	500	450	

Metals in Soil and Sediment			Sample No	21-05631-16	21-05631-17	21-05631-18	21-05631-19	21-05631-20
Sample Description				CH5-1	CH6-1	CH7-1	CH8-1	SPLIT-P4
Sample Date				24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Phosphorus	1	mg/kg	400	380	370	380	390	

LABORATORY REPORT

Soil Parameters			Sample No	21-05631-1	21-05631-2	21-05631-3	21-05631-4	21-05631-5
Sample Description				NC17-1	NC17-2	NC17-3	NC18	NC19
Sample Date				24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Moisture	0.1	%w/w	43.9	43.5	44.3	36.6	39.8	

Soil Parameters			Sample No	21-05631-6	21-05631-7	21-05631-8	21-05631-9	21-05631-10
Sample Description				CH16	CH17	CH18	CH19	CH1-1
Sample Date				24/03/2021	23/03/2021	23/03/2021	23/03/2021	24/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Moisture	0.1	%w/w	53.6	46.6	55.4	54.6	53.0	

Soil Parameters			Sample No	21-05631-11	21-05631-12	21-05631-13	21-05631-14	21-05631-15
Sample Description				CH2-1	CH3-1	CH3-2	CH3-3	CH4-1
Sample Date				24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Moisture	0.1	%w/w	53.0	47.0	52.2	49.1	40.6	

Soil Parameters			Sample No	21-05631-16	21-05631-17	21-05631-18	21-05631-19	21-05631-20
Sample Description				CH5-1	CH6-1	CH7-1	CH8-1	SPLIT-P4
Sample Date				24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Moisture	0.1	%w/w	34.9	35.8	43.7	38.6	38.8	

Nutrients in Soil			Sample No	21-05631-10	21-05631-11	21-05631-12	21-05631-13	21-05631-14
Sample Description				CH1-1	CH2-1	CH3-1	CH3-2	CH3-3
Sample Date				24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Nitrogen	10	mg/kg	2,300	2,300	1,400	2,100	2,000	
Total Kjeldahl Nitrogen	10	mg/kg	2,300	2,300	1,400	2,100	2,000	
NOx-N	1	mg/kg	<1	<1	<1	<1	<1	

Nutrients in Soil			Sample No	21-05631-15	21-05631-16	21-05631-17	21-05631-18	21-05631-19
Sample Description				CH4-1	CH5-1	CH6-1	CH7-1	CH8-1
Sample Date				24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Nitrogen	10	mg/kg	1,300	910	870	1,400	1,200	
Total Kjeldahl Nitrogen	10	mg/kg	1,300	910	870	1,400	1,200	
NOx-N	1	mg/kg	<1	<1	<1	<1	<1	

Nutrients in Soil			Sample No	21-05631-20
Sample Description				SPLIT-P4
Sample Date				24/03/2021
ANALYTE	LOR	Units	Result	
Total Nitrogen	10	mg/kg	2,000	
Total Kjeldahl Nitrogen	10	mg/kg	2,000	
NOx-N	1	mg/kg	<1	

LABORATORY REPORT

Misc. Inorganics in Soil			Sample No	21-05631-6	21-05631-7	21-05631-8	21-05631-9
Sample Description				CH16	CH17	CH18	CH19
Sample Date				24/03/2021	23/03/2021	23/03/2021	23/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result
TOC	0.1	%	2.8	1.5	2.4	2.4	

Ions by Discrete Analyser			Sample No	21-05631-10	21-05631-11	21-05631-12	21-05631-13	21-05631-14
Sample Description				CH1-1	CH2-1	CH3-1	CH3-2	CH3-3
Sample Date				24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Nitrite-N	0.01	mg/L	<0.01	0.44	<0.01	0.02	0.07	
Nitrate-N	0.01	mg/L	<0.01	0.35	<0.01	0.34	0.05	
Ammonia-N	0.02	mg/L	29	0.79	11	0.09	13	
Filterable Reactive Phosphorus	0.01	mg/L	0.94	0.04	0.15	0.01	0.30	

Ions by Discrete Analyser			Sample No	21-05631-15	21-05631-16	21-05631-17	21-05631-18	21-05631-19
Sample Description				CH4-1	CH5-1	CH6-1	CH7-1	CH8-1
Sample Date				24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Nitrite-N	0.01	mg/L	<0.01	<0.01	0.04	0.01	0.04	
Nitrate-N	0.01	mg/L	<0.01	0.04	0.05	0.34	0.16	
Ammonia-N	0.02	mg/L	7.5	7.9	3.9	0.06	1.2	
Filterable Reactive Phosphorus	0.01	mg/L	0.11	0.15	0.06	0.03	0.24	

Ions by Discrete Analyser			Sample No	21-05631-20
Sample Description				SPLIT-P4
Sample Date				24/03/2021
ANALYTE	LOR	Units	Result	Result
Nitrite-N	0.01	mg/L	0.05	
Nitrate-N	0.01	mg/L	0.08	
Ammonia-N	0.02	mg/L	5.0	
Filterable Reactive Phosphorus	0.01	mg/L	0.08	

Subcontracting			Sample No	21-05631-6	21-05631-7	21-05631-8	21-05631-9
Sample Description				CH16	CH17	CH18	CH19
Sample Date				24/03/2021	23/03/2021	23/03/2021	23/03/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result
Tributyl tin	0.5	µg Sn/kg	2.0	2.0	1.0	1.0	

Result Definitions

LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting
 * Denotes test not covered by NATA Accreditation

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-05631-9 CH19
Job ID: 21_0521
Lab ID: 21_0521_12
Revision No. : 0

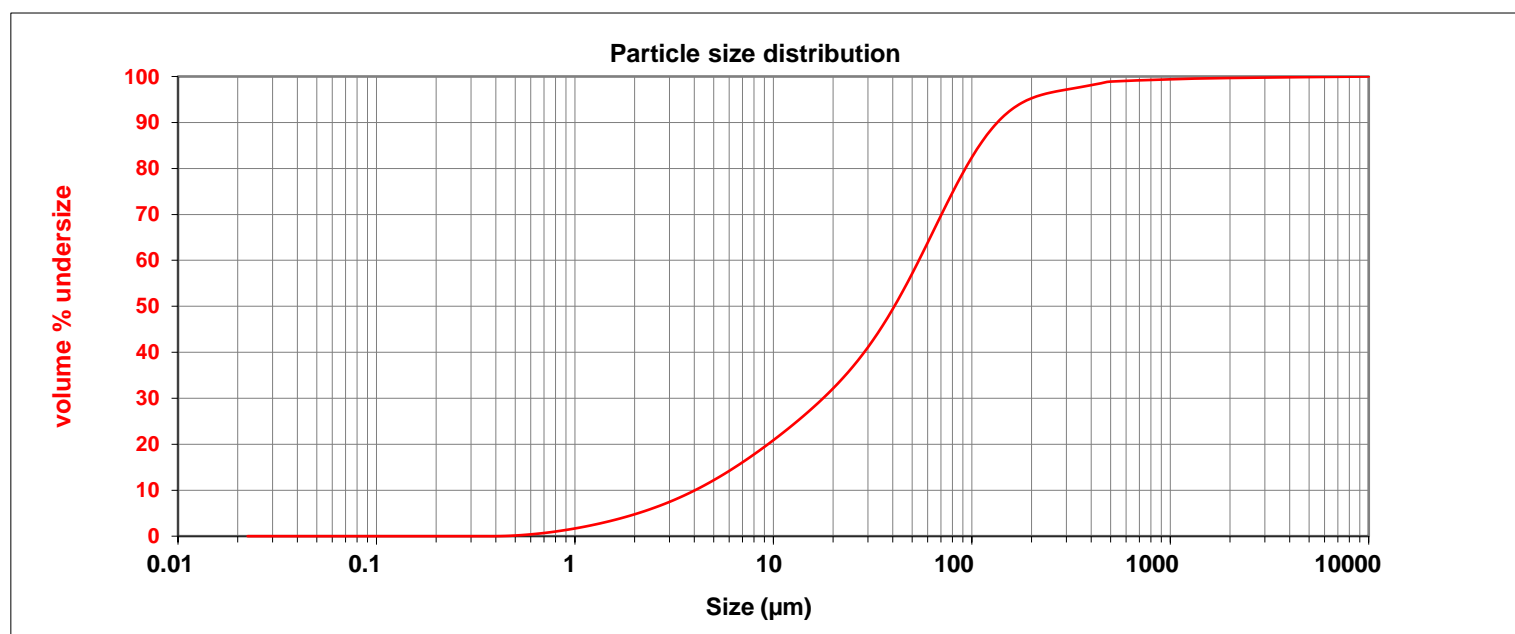
Date received: 29/3/2021
Date analysed: 14/4/2021
Date reported: 14/4/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 20 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 4.03 μm **d(0.5)** 40.72 μm **d(0.9)** 135.11 μm



Wentworth Scale

Size (μm)	Vol In %
0.020	9.91
3.991	
Clay	

Size (µm)	Vol In %
3.991	56.02
63.246	
Silt	

Size (μm)	Vol In %
63.246	30.61
251.785	
Fine sand	

Size (μm)	Vol In %
251.785	2.36
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	0.79
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	0.32
10000.000	
Gravel	

Note 1: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: James Nicolas, B.A.
Reported: James Nicolas, B.A.
Approved: Ian Davies, B.Sc.(Chemistry)

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-05631-1 NC17-1
Job ID: 21_0521
Lab ID: 21_0521_06
Revision No. : 0

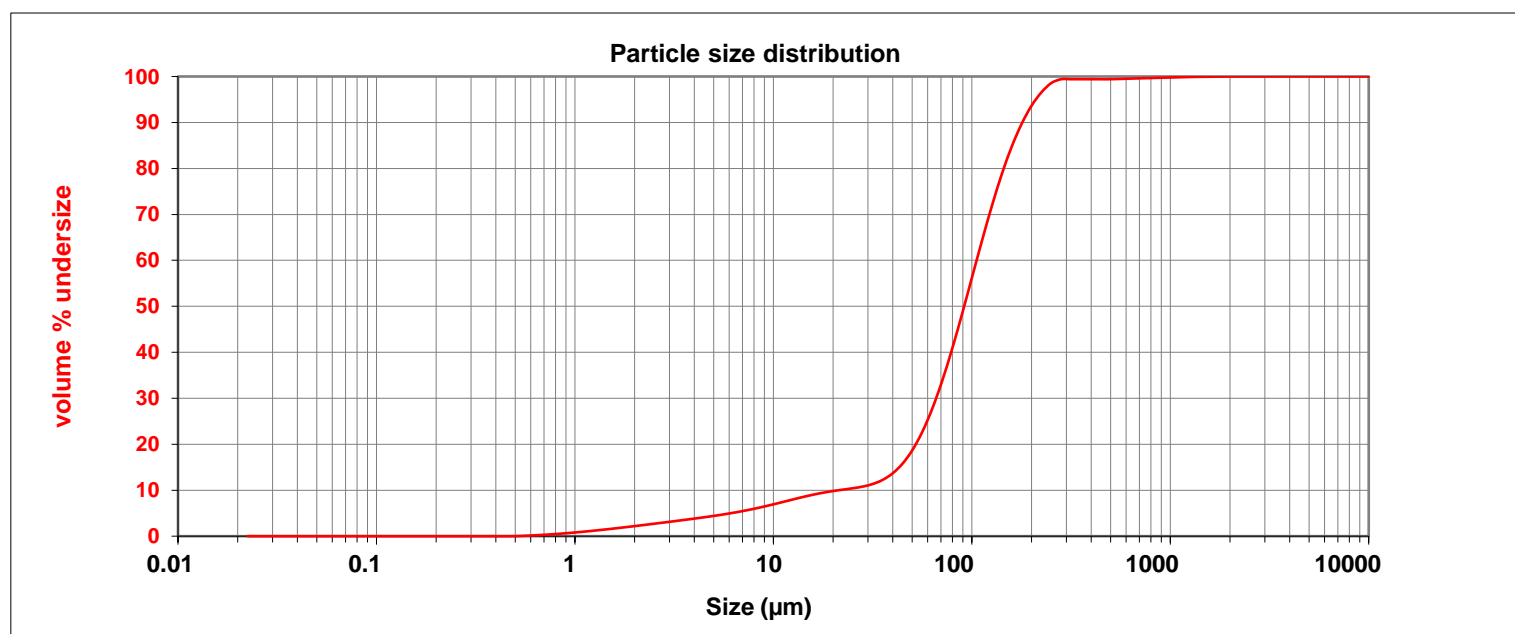
Date received: 29/3/2021
Date analysed: 14/4/2021
Date reported: 14/4/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 20 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 21.43 μm **d(0.5)** 91.59 μm **d(0.9)** 179.97 μm



Wentworth Scale

Size (μm)	Vol In %
0.020	3.82
3.991	
Clay	

Size (µm)	Vol In %
3.991	23.96
63.246	
Silt	

Size (μm)	Vol In %
63.246	70.80
251.785	
Fine sand	

Size (μm)	Vol In %
251.785	0.83
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	0.59
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	0.00
10000.000	
Gravel	

Note 1: Data from 500 μm to 10000 μm by wet screening, from 0.02 μm to 500 μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: James Nicolas, B.A.
Reported: James Nicolas, B.A.
Approved: Ian Davies, B.Sc.(Chemistry)

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-05631-4 NC18
Job ID: 21_0521
Lab ID: 21_0521_07
Revision No. : 0

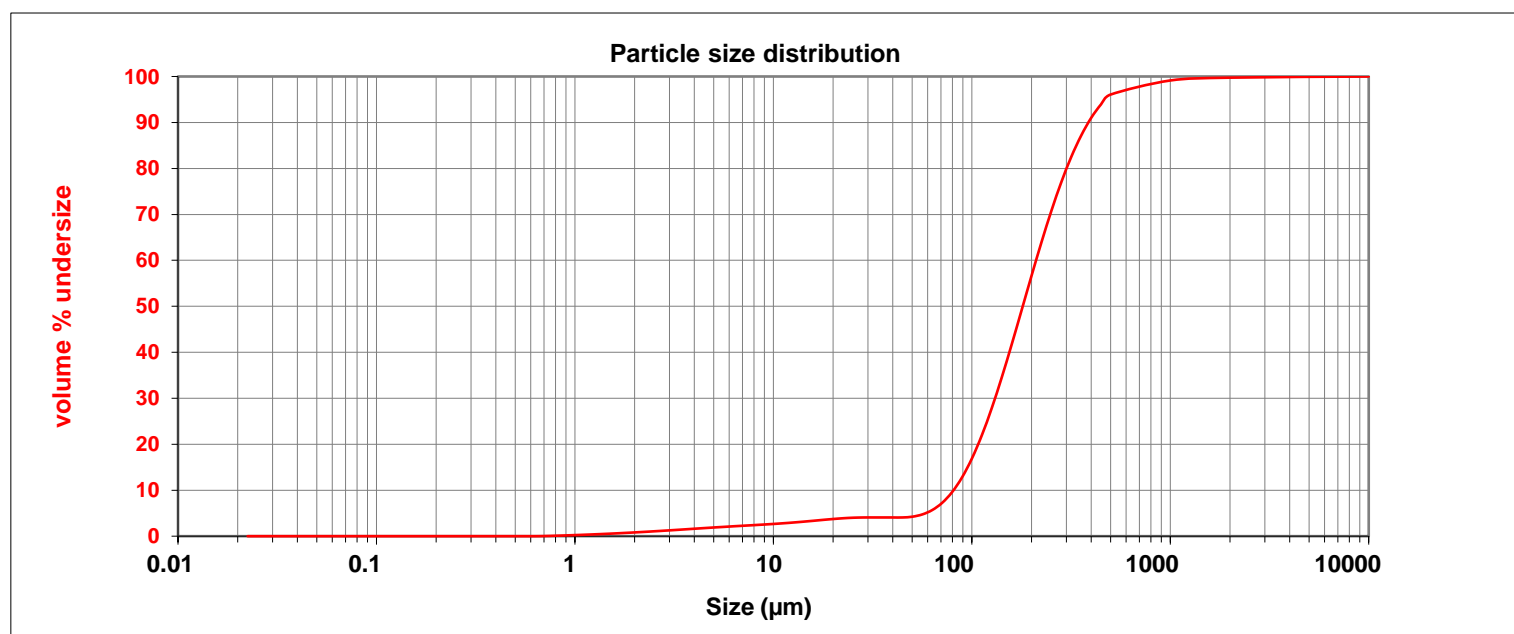
Date received: 29/3/2021
Date analysed: 14/4/2021
Date reported: 14/4/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 20 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 80.82 μm **d(0.5)** 180.69 μm **d(0.9)** 388.14 μm



Wentworth Scale

Size (μm)	Vol In %
0.020	1.61
3.991	
Clay	

Size (µm)	Vol In %
3.991	4.08
63.246	
Silt	

Size (μm)	Vol In %
63.246	65.09
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	25.28
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	3.68
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	0.26
10000.000	
Gravel	

Note 1: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: James Nicolas, B.A.
Reported: James Nicolas, B.A.
Approved: Ian Davies, B.Sc.(Chemistry)

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-05631-5 NC19
Job ID: 21_0521
Lab ID: 21_0521_08
Revision No. : 0

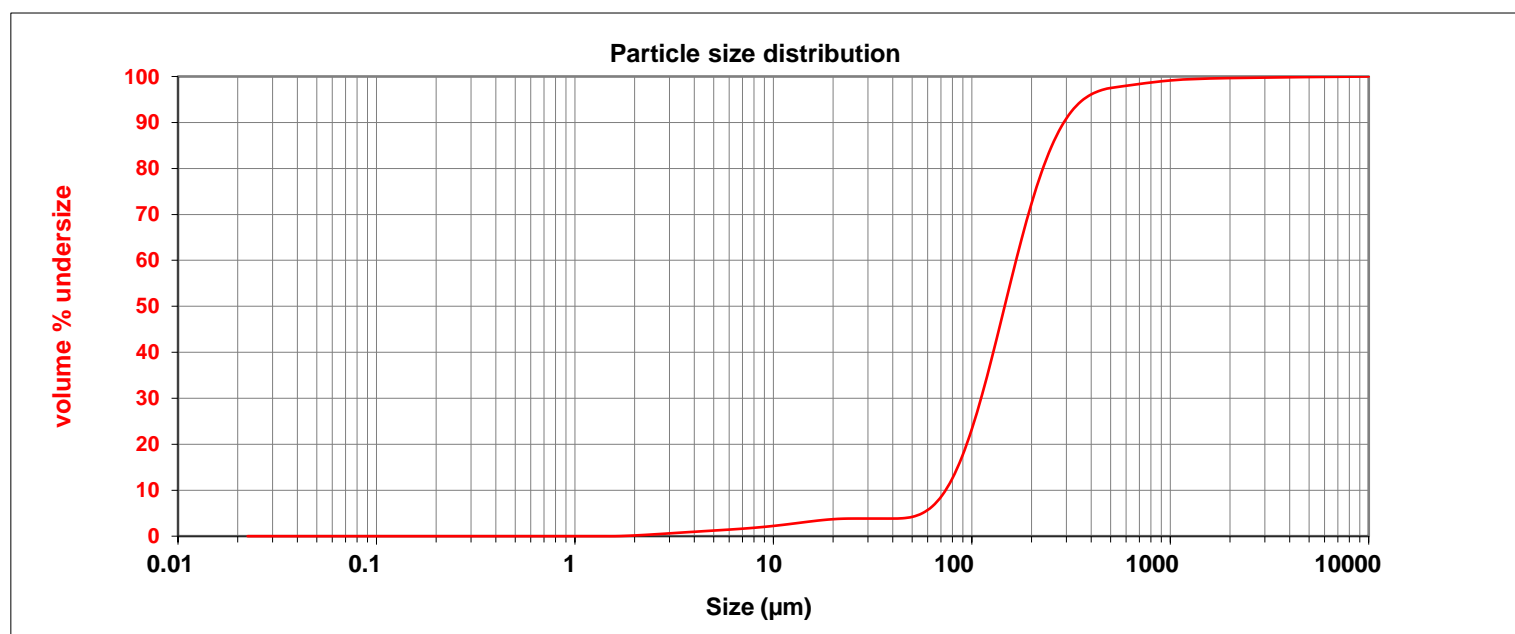
Date received: 29/3/2021
Date analysed: 14/4/2021
Date reported: 14/4/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 20 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 73.59 μm **d(0.5)** 146.61 μm **d(0.9)** 292.27 μm



Wentworth Scale

Size (μm)	Vol In %
0.020	0.96
3.991	
Clay	

Size (μm)	Vol In %
3.991	5.53
63.246	
Silt	

Size (μm)	Vol In %
63.246	78.21
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	12.80
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	2.16
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	0.34
10000.000	
Gravel	

Note 1: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: James Nicolas, B.A.
Reported: James Nicolas, B.A.
Approved: Ian Davies, B.Sc.(Chemistry)

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-05631-6 CH16
Job ID: 21_0521
Lab ID: 21_0521_09
Revision No. : 0

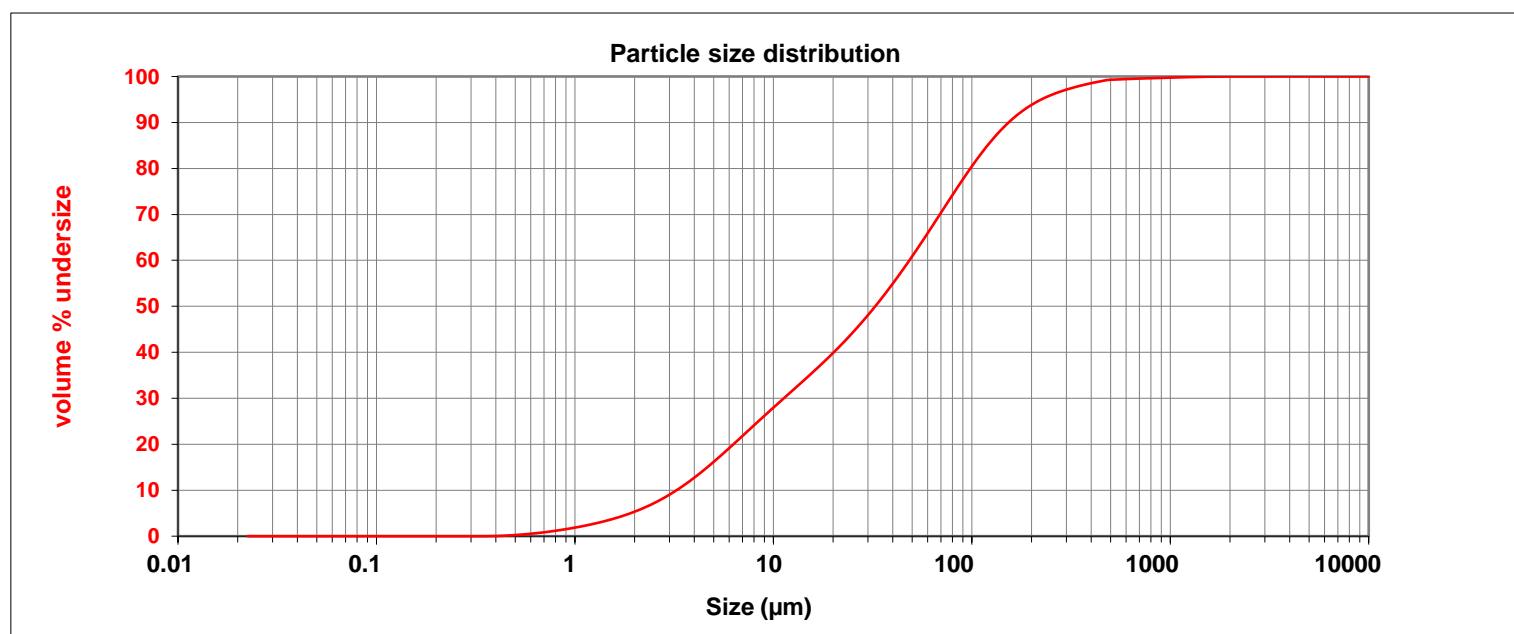
Date received: 29/3/2021
Date analysed: 14/4/2021
Date reported: 14/4/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 20 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 3.25 μm **d(0.5)** 32.63 μm **d(0.9)** 153.79 μm



Wentworth Scale

Size (μm)	Vol In %
0.020	12.71
3.991	
Clay	

Size (µm)	Vol In %
3.991	54.76
63.246	
Silt	

Size (μm)	Vol In %
63.246	28.52
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	3.30
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	0.71
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	0.00
10000.000	
Gravel	

Note 1: Data from 500 μm to 10000 μm by wet screening, from 0.02 μm to 500 μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: James Nicolas, B.A.
Reported: James Nicolas, B.A.
Approved: Ian Davies, B.Sc.(Chemistry)

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-05631-7 CH17
Job ID: 21_0521
Lab ID: 21_0521_10
Revision No. : 0

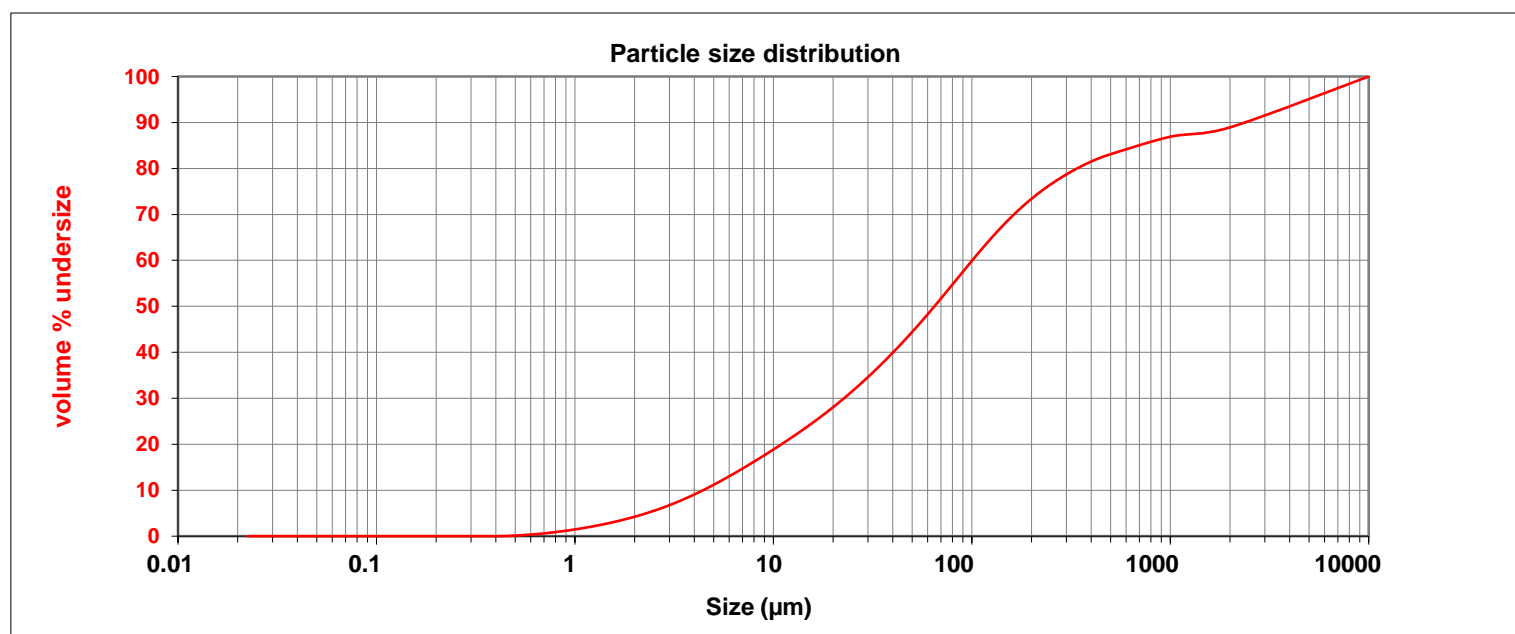
Date received: 29/3/2021
Date analysed: 14/4/2021
Date reported: 14/4/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 20 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 4.43 μm **d(0.5)** 64.84 μm **d(0.9)** 2769.84 μm



Wentworth Scale

Size (µm)	Vol In %
0.020	9.06
3.991	
Clay	

Size (µm)	Vol In %
3.991	40.40
63.246	
Silt	

Size (µm)	Vol In %
63.246	27.17
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	6.46
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	5.84
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	11.06
10000.000	
Gravel	

Note 1: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: James Nicolas, B.A.
Reported: James Nicolas, B.A.
Approved: Ian Davies, B.Sc.(Chemistry)

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-05631-8 CH18
Job ID: 21_0521
Lab ID: 21_0521_11
Revision No. : 0

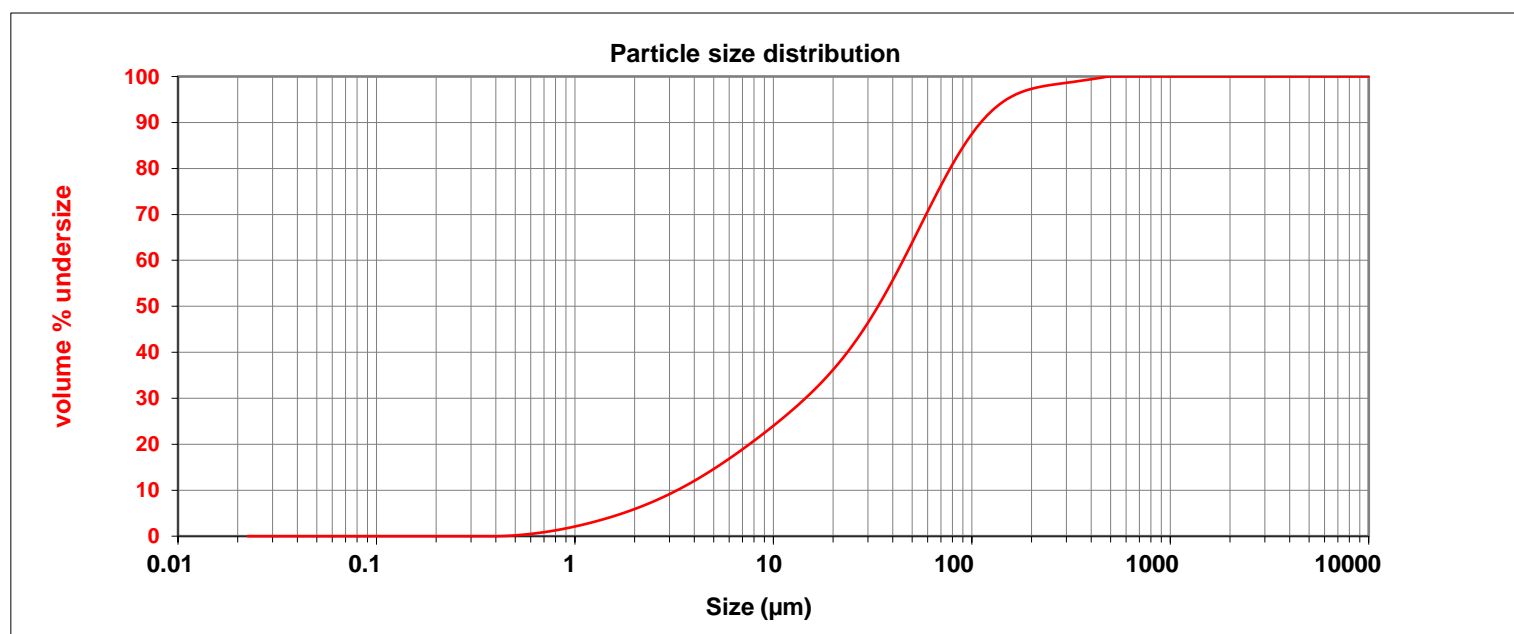
Date received: 29/3/2021
Date analysed: 14/4/2021
Date reported: 14/4/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 20 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 3.28 μm **d(0.5)** 33.70 μm **d(0.9)** 111.21 μm



Wentworth Scale

Size (µm)	Vol In %
0.020	12.02
3.991	
Clay	

Size (µm)	Vol In %
3.991	60.64
63.246	
Silt	

Size (µm)	Vol In %
63.246	25.51
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	1.83
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	0.00
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	0.00
10000.000	
Gravel	

Note 1: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: James Nicolas, B.A.
Reported: James Nicolas, B.A.
Approved: Ian Davies, B.Sc.(Chemistry)

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LABORATORY REPORT

ADDRESS: **O2 Marine**
Suite 2, 4B Mews Rd
Fremantle WA 6160

ATTENTION: Russell Stevens

DATE RECEIVED: 14/05/2021

YOUR REFERENCE: 18WAU-0004 Geraldton Port Baseline Sediment Characterisation Sampling 20

PURCHASE ORDER:

APPROVALS:



**WORLD RECOGNISED
ACCREDITATION**
Accredited for compliance with
ISO/IEC 17025 - Testing


Douglas Todd
Laboratory Manager

REPORT COMMENTS:

This report is issued by Eurofins ARL Pty Ltd. The report shall not be reproduced except in full without written approval from the laboratory.

Samples are analysed on an as received basis unless otherwise noted.

All analysis was conducted on a dry weight basis.

Tributyl tin in Soil analysis subcontracted to MPL, NATA Accred No. 2901, Report Number 261972

METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377
Methods prefixed with "PM" and "EDP" are covered under NATA Accreditation Number: 2561

Method ID	Method Description
ARL No. 401/403	Metals in Soil and Sediment by ICPOES/MS
ARL No. 030	Metals in Soil and Sediment by AAS
ARL No. 406	Mercury by Cold Vapour Atomic Absorption Spectrophotometry
ARL No. 064	Total Organic Carbon in Sediment
Subcontracting	See Report Comments section for more information.

LABORATORY REPORT

Metals in Soil and Sediment			Sample No	21-08919-1	21-08919-2	21-08919-3	21-08919-4	21-08919-5
Sample Description				NPA1-A	NPA1-B	NPA1-C	NPA2	NPA3
Sample Date				12/05/2021 2:55:00	12/05/2021 2:55:00	12/05/2021 2:55:00	12/05/2021 2:40:00	12/05/2021 2:20:00
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Aluminium	1	mg/kg	480	490	510	440	400	
Arsenic	0.1	mg/kg	2.0	2.3	2.3	2.4	2.3	
Cadmium	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	
Chromium	0.2	mg/kg	12	12	12	11	10	
Copper	1	mg/kg	6	6	6	7	5	
Lead	1	mg/kg	1	1	1	1	1	
Manganese	1	mg/kg	25	26	29	24	25	
Nickel	1	mg/kg	<1	<1	<1	<1	<1	
Zinc	1	mg/kg	3	3	2	2	2	
Silver	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	
Iron	1	mg/kg	600	600	690	520	510	
Vanadium	2	mg/kg	3	3	3	2	3	
Mercury	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	

Metals in Soil and Sediment			Sample No	21-08919-6	21-08919-7	21-08919-8
Sample Description				NPA4	NPA5	DUP1
Sample Date				12/05/2021 3:05:00	12/05/2021 3:15:00	12/05/2021
ANALYTE	LOR	Units	Result	Result	Result	Result
Aluminium	1	mg/kg	360	460	400	
Arsenic	0.1	mg/kg	2.2	2.3	2.4	
Cadmium	0.1	mg/kg	<0.1	<0.1	<0.1	
Chromium	0.2	mg/kg	9.0	11	11	
Copper	1	mg/kg	5	6	6	
Lead	1	mg/kg	1	1	1	
Manganese	1	mg/kg	25	29	32	
Nickel	1	mg/kg	<1	<1	<1	
Zinc	1	mg/kg	2	2	2	
Silver	0.1	mg/kg	<0.1	<0.1	<0.1	
Iron	1	mg/kg	480	610	520	
Vanadium	2	mg/kg	3	3	3	
Mercury	0.01	mg/kg	<0.01	<0.01	<0.01	

Misc. Inorganics in Soil			Sample No	21-08919-1	21-08919-2	21-08919-3	21-08919-4	21-08919-5
Sample Description				NPA1-A	NPA1-B	NPA1-C	NPA2	NPA3
Sample Date				12/05/2021 2:55:00	12/05/2021 2:55:00	12/05/2021 2:55:00	12/05/2021 2:40:00	12/05/2021 2:20:00
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
TOC	0.1	%	0.2	0.2	0.2	0.2	0.2	0.2

Misc. Inorganics in Soil			Sample No	21-08919-6	21-08919-7	21-08919-8
Sample Description				NPA4	NPA5	DUP1
Sample Date				12/05/2021 3:05:00	12/05/2021 3:15:00	12/05/2021
ANALYTE	LOR	Units	Result	Result	Result	Result
TOC	0.1	%	0.2	0.2	0.2	

LABORATORY REPORT

Subcontracting			Sample No	21-08919-1	21-08919-2	21-08919-3	21-08919-4	21-08919-5
			Sample Description	NPA1-A	NPA1-B	NPA1-C	NPA2	NPA3
			Sample Date	12/05/2021 2:55:00	12/05/2021 2:55:00	12/05/2021 2:55:00	12/05/2021 2:40:00	12/05/2021 2:20:00
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Tributyl tin	0.5	µg Sn/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Subcontracting			Sample No	21-08919-6	21-08919-7	21-08919-8
			Sample Description	NPA4	NPA5	DUP1
			Sample Date	12/05/2021 3:05:00	12/05/2021 3:15:00	12/05/2021
ANALYTE	LOR	Units	Result	Result	Result	Result
Tributyl tin	0.5	µg Sn/kg	<0.5	<0.5	<0.5	<0.5

Result Definitions

LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting

* Denotes test not covered by NATA Accreditation

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-08919-7 NPA5
Job ID: 21_0804
Lab ID: 21_0804_07
Revision No. : 0

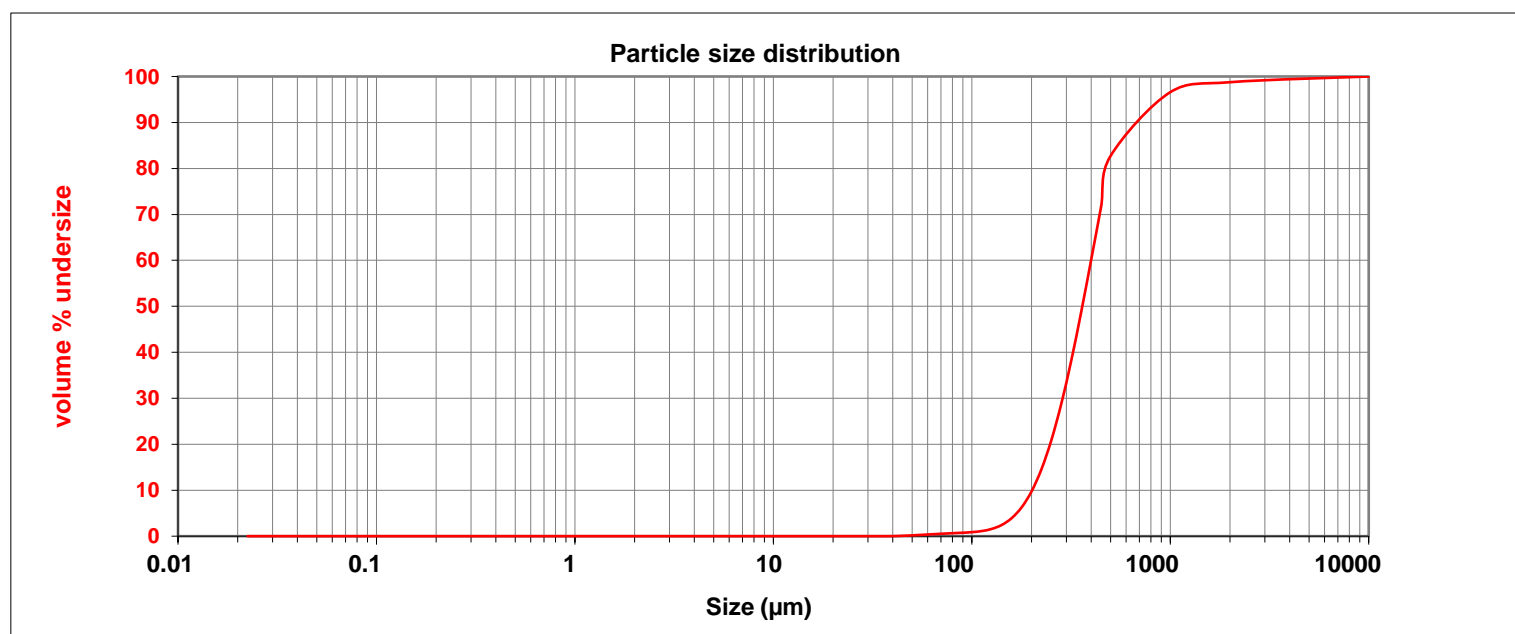
Date received: 17/05/2021
Date analysed: 31/05/2021
Date reported: 31/05/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 18 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 201.31 μm **d(0.5)** 360.59 μm **d(0.9)** 762.94 μm



Wentworth Scale

Size (µm)	Vol In %
0.020	0.00
3.991	
Clay	

Size (µm)	Vol In %
3.991	0.42
63.246	
Silt	

Size (µm)	Vol In %
63.246	20.49
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	61.79
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	16.06
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	1.24
10000.000	
Gravel	

Note 1: Data from 500 μm to 10000 μm by wet screening, from 0.02 μm to 500 μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: Beau Duval-Jenner
Reported: Beau Duval-Jenner
Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-08919-1 NPA1-A
Job ID: 21_0804
Lab ID: 21_0804_01
Revision No. : 0

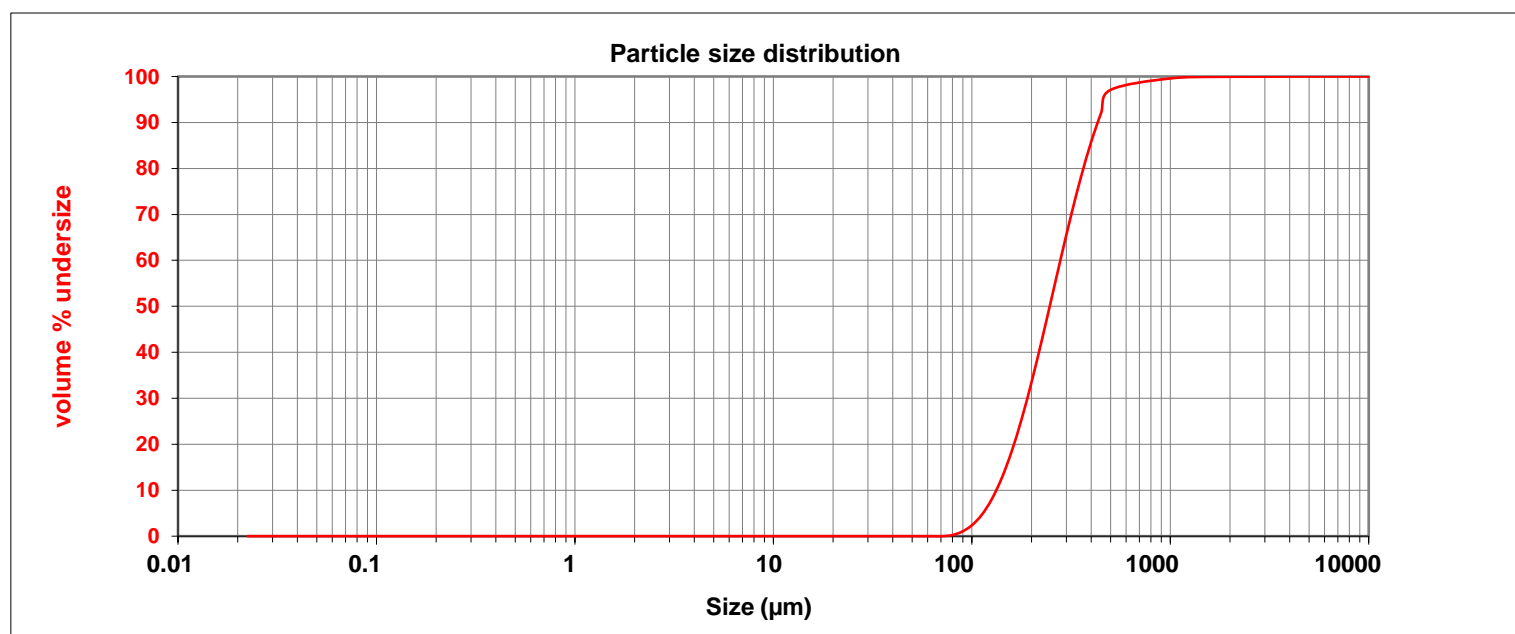
Date received: 17/05/2021
Date analysed: 31/05/2021
Date reported: 31/05/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 17 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 132.66 μm **d(0.5)** 247.14 μm **d(0.9)** 432.37 μm



Wentworth Scale

Size (μm)	Vol In %
0.020	0.00
3.991	
Clay	

Size (µm)	Vol In %
3.991	0.00
63.246	
Silt	

Size (μm)	Vol In %
63.246	51.57
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	45.51
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	2.86
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	0.06
10000.000	
Gravel	

Note 1: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: Beau Duval-Jenner
Reported: Beau Duval-Jenner
Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-08919-2 NPA1-B
Job ID: 21_0804
Lab ID: 21_0804_02
Revision No. : 0

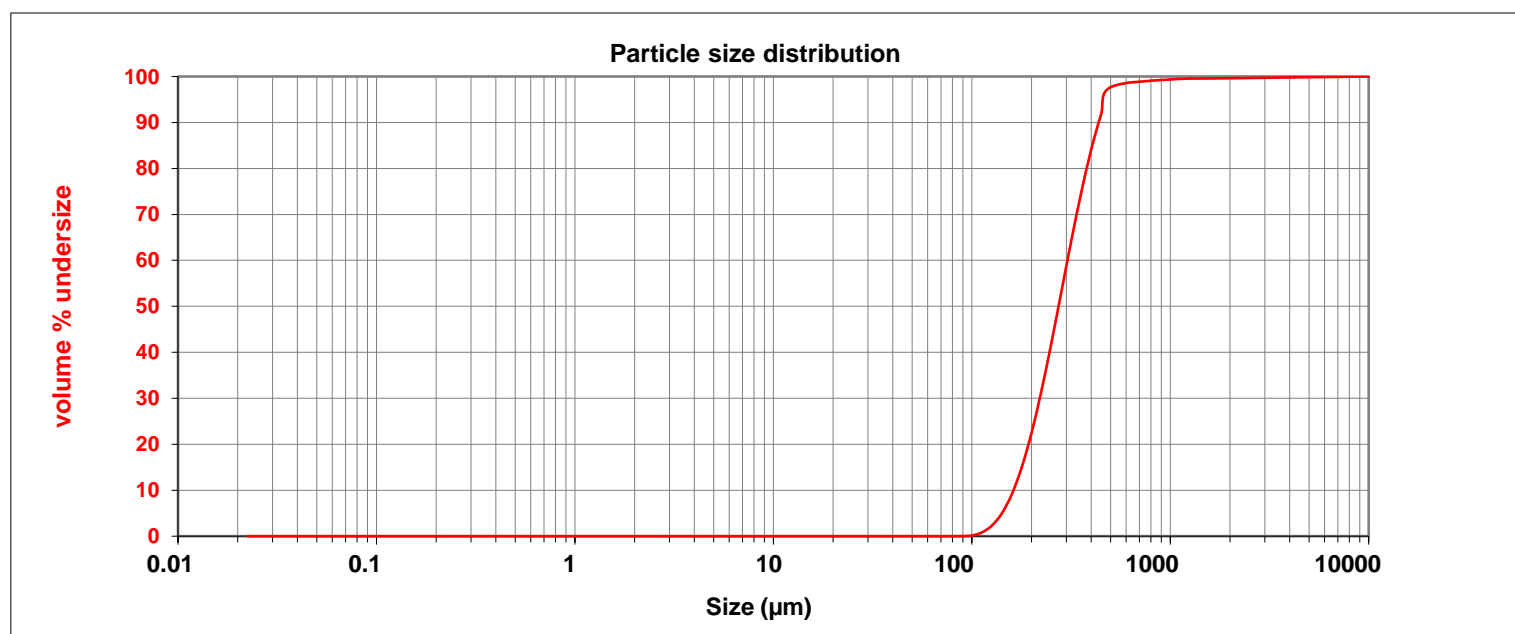
Date received: 17/05/2021
Date analysed: 31/05/2021
Date reported: 31/05/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 19 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 161.95 μm **d(0.5)** 273.90 μm **d(0.9)** 437.12 μm



Wentworth Scale

Size (µm)	Vol In %
0.020	0.00
3.991	
Clay	

Size (µm)	Vol In %
3.991	0.00
63.246	
Silt	

Size (µm)	Vol In %
63.246	42.03
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	55.62
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	1.96
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	0.38
10000.000	
Gravel	

Note 1: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: Beau Duval-Jenner
Reported: Beau Duval-Jenner
Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-08919-3 NPA1-C
Job ID: 21_0804
Lab ID: 21_0804_03
Revision No. : 0

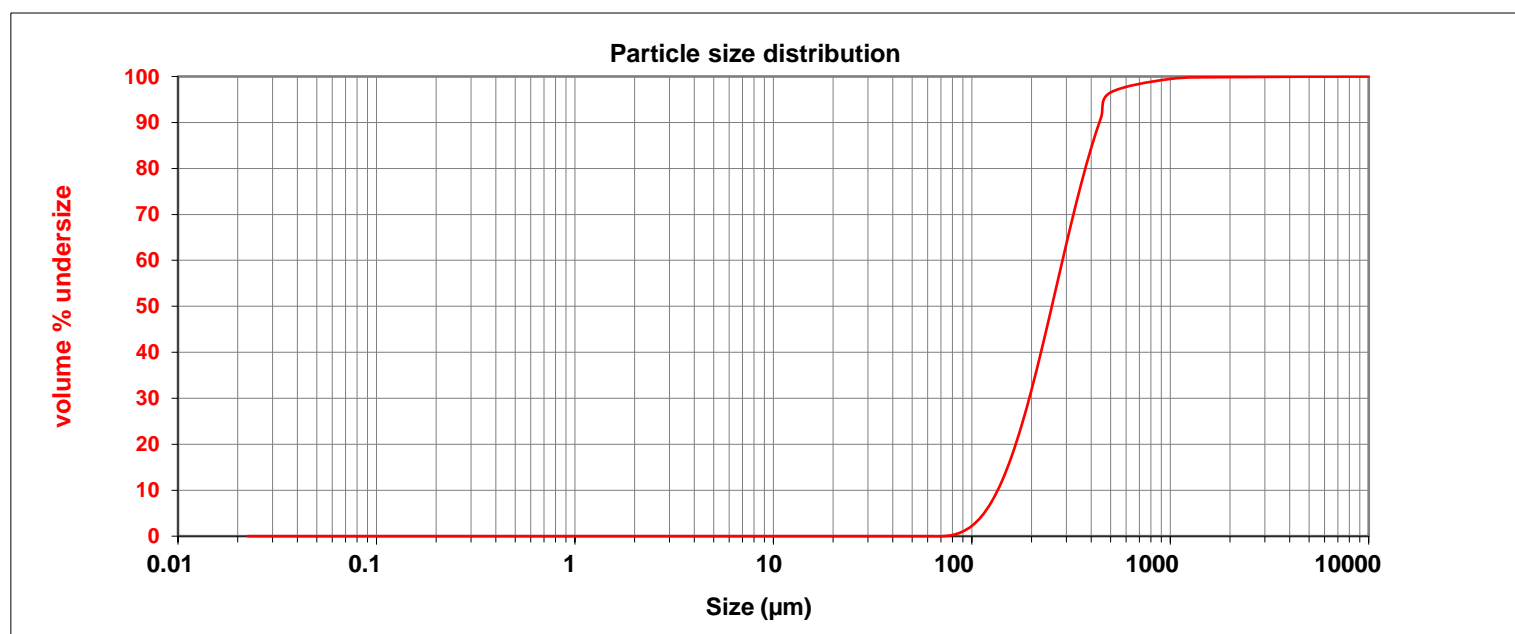
Date received: 17/05/2021
Date analysed: 31/05/2021
Date reported: 31/05/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 18 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 134.79 μm **d(0.5)** 253.19 μm **d(0.9)** 440.18 μm



Wentworth Scale

Size (μm)	Vol In %
0.020	0.00
3.991	
Clay	

Size (μm)	Vol In %
3.991	0.00
63.246	
Silt	

Size (μm)	Vol In %
63.246	49.57
251.785	
Fine sand	

Size (μm)	Vol In %
251.785	46.94
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	3.34
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	0.14
10000.000	
Gravel	

Note 1: Data from 500 μm to 10000 μm by wet screening, from 0.02 μm to 500 μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: Beau Duval-Jenner
Reported: Beau Duval-Jenner
Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-08919-4 NPA2
Job ID: 21_0804
Lab ID: 21_0804_04
Revision No. : 0

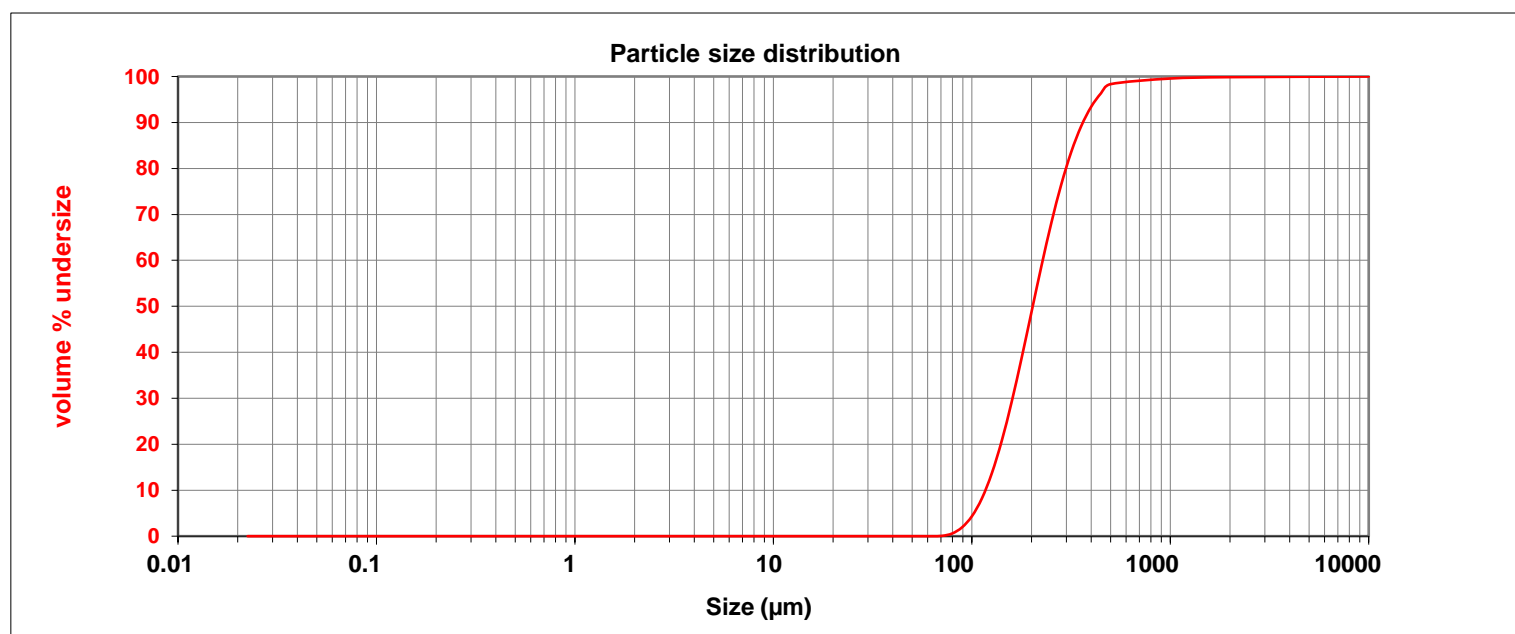
Date received: 17/05/2021
Date analysed: 31/05/2021
Date reported: 31/05/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 17 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 116.90 μm **d(0.5)** 202.92 μm **d(0.9)** 364.25 μm



Wentworth Scale

Size (μm)	Vol In %
0.020	0.00
3.991	
Clay	

Size (µm)	Vol In %
3.991	0.00
63.246	
Silt	

Size (μm)	Vol In %
63.246	68.19
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	30.14
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	1.53
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	0.14
10000.000	
Gravel	

Note 1: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: Beau Duval-Jenner
Reported: Beau Duval-Jenner
Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-08919-5 NPA3
Job ID: 21_0804
Lab ID: 21_0804_05
Revision No. : 0

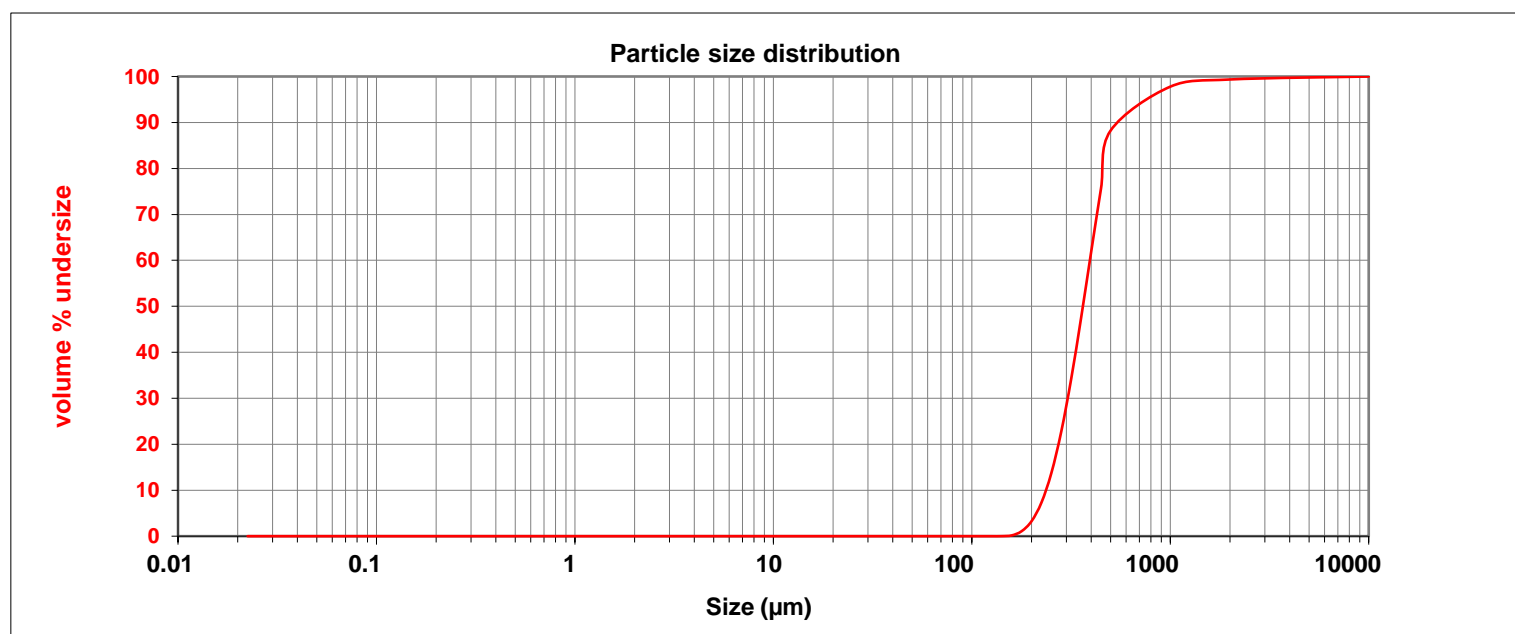
Date received: 17/05/2021
Date analysed: 31/05/2021
Date reported: 31/05/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 19 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 235.81 μm **d(0.5)** 363.16 μm **d(0.9)** 593.67 μm



Wentworth Scale

Size (μm)	Vol In %
0.020	0.00
3.991	
Clay	

Size (µm)	Vol In %
3.991	0.00
63.246	
Silt	

Size (μm)	Vol In %
63.246	13.75
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	74.45
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	11.14
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	0.65
10000.000	
Gravel	

Note 1: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: Beau Duval-Jenner
Reported: Beau Duval-Jenner
Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road WELSHPOOL WA 6106
Client ID: 21-08919-6 NPA4
Job ID: 21_0804
Lab ID: 21_0804_06
Revision No. : 0

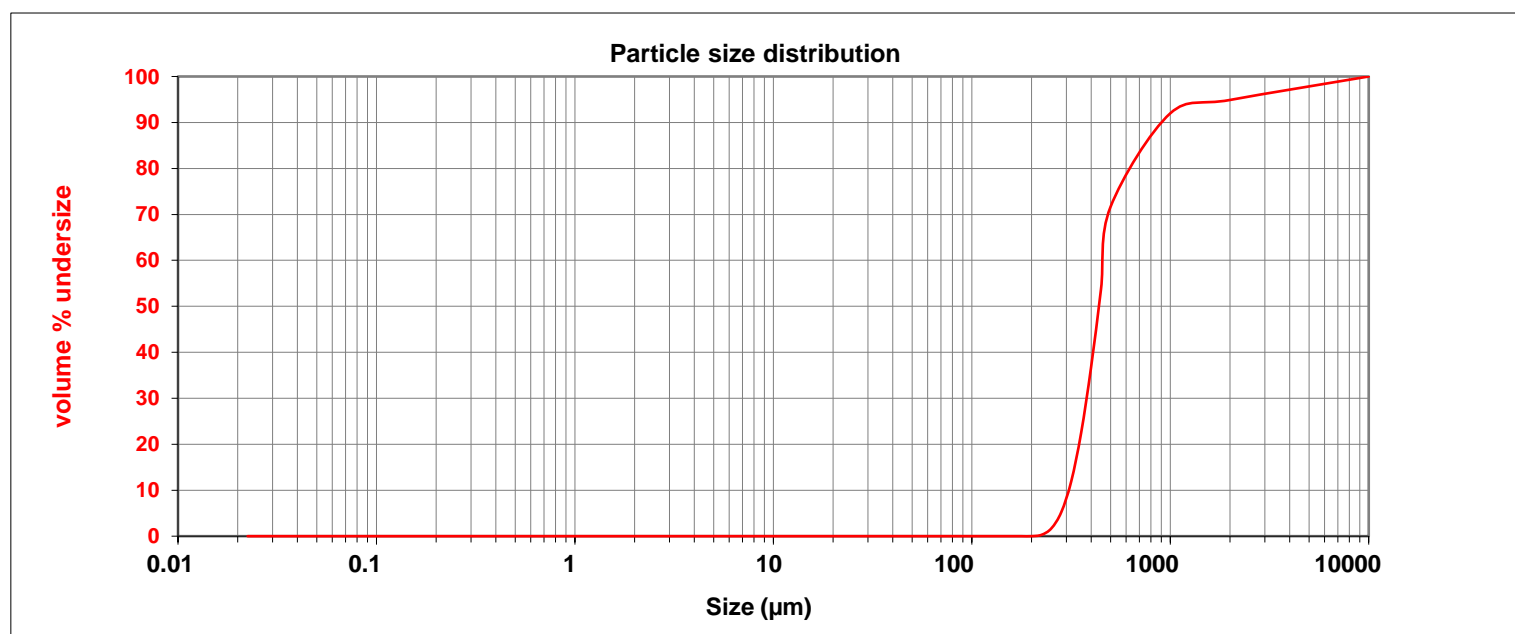
Date received: 17/05/2021
Date analysed: 31/05/2021
Date reported: 31/05/2021

Comment: None

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant: Water
Additives: 10 millilitres sodium hexametaphosphate
Sonication: 16 min sonication

Result units: Volume
Analysis model: General purpose

d(0.1) 307.08 μm **d(0.5)** 437.08 μm **d(0.9)** 951.36 μm



Wentworth Scale

Size (µm)	Vol In %
0.020	0.00
3.991	
Clay	

Size (µm)	Vol In %
3.991	0.00
63.246	
Silt	

Size (µm)	Vol In %
63.246	1.71
251.785	
Fine sand	

Size (µm)	Vol In %
251.785	69.93
500.000	
Medium sand	

Size (µm)	Vol In %
500.000	23.27
2000.000	
Coarse sand	

Size (µm)	Vol In %
2000.000	5.10
10000.000	
Gravel	

Note 1: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: Beau Duval-Jenner
Reported: Beau Duval-Jenner
Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

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Appendix C

Secondary Laboratory Analytical Reports

CERTIFICATE OF ANALYSIS

Work Order : **EP2001971**
Client : **WA MARINE PTY LTD**
Contact : Russell Stevens
Address : SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370
DUNSBOROUGH, PERTH WA, AUSTRALIA 6281
Telephone : ----
Project : 18WAU-0004 Geraldton Port Compliance Sediment Sampling
2020
Order number : ----
C-O-C number : ----
Sampler : Russell Stevens
Site : ----
Quote number : EP/101/20
No. of samples received : 64
No. of samples analysed : 64

Page : 1 of 33
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 25-Feb-2020 13:00
Date Analysis Commenced : 26-Feb-2020
Issue Date : 13-Mar-2020 15:57



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	Position	Accreditation Category
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
David Viner	SENIOR LAB TECH	Perth Organics, Wangara, WA
Matt Frost	Assistant Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Matt Frost	Assistant Laboratory Manager	Brisbane Organics, Stafford, QLD



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- TOC and TBT conducted by ALS Brisbane, NATA Site No. 818.
- PSD conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- EG020-SD: Poor matrix spike recovery was obtained for copper, zinc on sample EP2001971-055 due to possible matrix interference. Results have been confirmed by re-extraction and re-analysis.
- EP132B-SD: Poor duplicate precision due to high moisture content and sample heterogeneity. Chromatogram profiles have been reviewed.
- EP132B-SD: Poor matrix spike recovery due to high moisture content and sample heterogeneity. Chromatogram profiles have been reviewed.
- EP132B-SD: LOR has been raised for various analytes on various samples due to high moisture content and/or matrix interferences.
- EP090 Organotin Analysis: The LOR for Tributyltin in sample ORA2-1 has been raised due to matrix interference.
- EN68: This analysis in accordance with National Ocean Disposal Guidelines, Commonwealth of Australia, 2002 - (modified). Results reported are those determined on a 1:4 sediment/seawater elutriate without blank correction.



Analytical Results

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

Client sample ID

				CH3-1	CH4-1	CH6-1	Elutriate Water	----
Client sampling date / time				20-Feb-2020 09:40	20-Feb-2020 09:00	18-Feb-2020 16:30	20-Feb-2020 09:30	----
Compound	CAS Number	LOR	Unit	EP2001971-019	EP2001971-022	EP2001971-028	EP2001971-064	-----
				Result	Result	Result	Result	----
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	<2	<2	<2	<2	----
EP090S: Organotin Surrogate								
Tripopyltin	----	5	%	46.1	39.8	56.5	91.5	----

CERTIFICATE OF ANALYSIS

Work Order : **EP2103295**
Client : **WA MARINE PTY LTD**
Contact : Russell Stevens
Address : SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370
 DUNSBOROUGH, PERTH WA, AUSTRALIA 6281
Telephone : ----
Project : 18WAU-0004 Geraldton Port Sediment Sampling 2021
Order number : ----
C-O-C number : ----
Sampler : Russell Stevens
Site : ----
Quote number : EN/222
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 3
Laboratory : Environmental Division Perth
Contact : Nick Courts
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : +61-8-9406 1301
Date Samples Received : 25-Mar-2021 15:35
Date Analysis Commenced : 30-Mar-2021
Issue Date : 01-Apr-2021 14:54



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

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

Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Sample ID

				SPLIT-S4	----	----	----	----
Sampling date / time				24-Mar-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2103295-001	-----	-----	-----	-----
Result				----	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	37.2	----	----	----	----
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	<0.1	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	660	----	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	660	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	378	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	0.2	----	----	----	----



CERTIFICATE OF ANALYSIS 262074**Client Details**

Client	O2 Marine
Attention	Russell Stevens
Address	Suite 2, 4B Mews Road, FREMANTLE, WA, 6160

Sample Details

Your Reference	<u>18WAU-0004 - Geraldton Port Baseline</u>
Number of Samples	1 Sediment
Date samples received	18/05/2021
Date completed instructions received	18/05/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	26/05/2021
Date of Issue	26/05/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By

Heram Halim, Operations Manager
Travis Carey, Organics - Team Leader

Authorised By

Michael Kubiak, Laboratory Manager

Metals in sediment		
Our Reference		262074-1
Your Reference	UNITS	DUP2
Type of sample		Marine Sediment
Date digested	-	24/05/2021
Date analysed	-	24/05/2021
Aluminium	mg/kg	370
Arsenic	mg/kg	2.2
Cadmium	mg/kg	<0.1
Chromium	mg/kg	11
Copper	mg/kg	<0.5
Lead	mg/kg	1.4
Manganese	mg/kg	28
Nickel	mg/kg	0.7
Zinc	mg/kg	2.0
Silver	mg/kg	<0.1
Iron	mg/kg	570
Vanadium	mg/kg	2.6
Mercury	mg/kg	<0.01

Organotin Compounds in Soil		
Our Reference		262074-1
Your Reference	UNITS	DUP2
Type of sample		Marine Sediment
Date extracted	-	21/05/2021
Date analysed	-	25/05/2021
Monobutyltin as Sn	µg Sn/kg	<0.5
Dibutyltin as Sn	µg Sn/kg	<0.5
Tributyltin as Sn	µg Sn/kg	<0.5
Surrogate Triphenyltin	%	110

External Testing		
Our Reference	UNITS	262074-1
Your Reference		DUP2
Type of sample		Marine Sediment
Total Organic Carbon by Combustion	mg/kg	2,100

Moisture		
Our Reference	UNITS	262074-1
Your Reference		DUP2
Type of sample		Marine Sediment
Date prepared	-	24/05/2021
Date analysed	-	25/05/2021
Moisture	%	24

Method ID	Methodology Summary
Ext-054	Analysed by Envirolab Services Sydney, accreditation number 2901
INORG-008	Moisture content determined by heating at 105 deg C for a minimum of 12 hours.
METALS-020	Determination of various metals by ICP-AES.
METALS-021	Determination of Mercury by Cold Vapour AAS. For urine samples total Mercury is determined, however, mercury in urine is almost entirely in the inorganic form (CDC).
METALS-022	Determination of various metals by ICP-MS.
Org-025/026	Water extracts are derivatised and extracted. Soils are extracted with a mix of water and methanolic KOH solution, neutralised and then derivatised and further extracted. The extracts are analysed by GC-MSMS. Alternatively, analyse directly by HS-GC-MSMS.

Client Reference: 18WAU-0004 - Geraldton Port Baseline

QUALITY CONTROL: Metals in sediment						Duplicate		Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date digested	-			24/05/2021	[NT]	[NT]	[NT]	[NT]	24/05/2021	[NT]
Date analysed	-			24/05/2021	[NT]	[NT]	[NT]	[NT]	24/05/2021	[NT]
Aluminium	mg/kg	1	METALS-020	<1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Arsenic	mg/kg	0.5	METALS-022	<0.5	[NT]	[NT]	[NT]	[NT]	101	[NT]
Cadmium	mg/kg	0.1	METALS-022	<0.1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Chromium	mg/kg	0.2	METALS-022	<0.2	[NT]	[NT]	[NT]	[NT]	100	[NT]
Copper	mg/kg	0.5	METALS-022	<0.5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Lead	mg/kg	0.5	METALS-022	<0.5	[NT]	[NT]	[NT]	[NT]	104	[NT]
Manganese	mg/kg	1	METALS-022	<1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Nickel	mg/kg	0.5	METALS-022	<0.5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Zinc	mg/kg	0.5	METALS-022	<0.5	[NT]	[NT]	[NT]	[NT]	100	[NT]
Silver	mg/kg	0.1	METALS-022	<0.1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Iron	mg/kg	1	METALS-020	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Vanadium	mg/kg	0.5	METALS-022	<0.5	[NT]	[NT]	[NT]	[NT]	101	[NT]
Mercury	mg/kg	0.01	METALS-021	<0.01	[NT]	[NT]	[NT]	[NT]	102	[NT]

Client Reference: 18WAU-0004 - Geraldton Port Baseline

QUALITY CONTROL: Organotin Compounds in Soil					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	262074-1
Date extracted	-			21/05/2021	[NT]	[NT]	[NT]	[NT]	21/05/2021	21/05/2021
Date analysed	-			25/05/2021	[NT]	[NT]	[NT]	[NT]	25/05/2021	25/05/2021
Monobutyltin as Sn	µg Sn/kg	0.5	Org-025/026	<0.5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibutyltin as Sn	µg Sn/kg	0.5	Org-025/026	<0.5	[NT]	[NT]	[NT]	[NT]	70	70
Tributyltin as Sn	µg Sn/kg	0.5	Org-025/026	<0.5	[NT]	[NT]	[NT]	[NT]	80	81
Surrogate Triphenyltin	%		Org-025/026	110	[NT]	[NT]	[NT]	[NT]	112	118

QUALITY CONTROL: External Testing						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Total Organic Carbon by Combustion	mg/kg	100	Ext-054	<100	[NT]	[NT]	[NT]	[NT]	103	[NT]

Client Reference: 18WAU-0004 - Geraldton Port Baseline

QUALITY CONTROL: Moisture						Duplicate		Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			24/05/2021	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Date analysed	-			25/05/2021	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Moisture	%	0.1	INORG-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

TOC analysed by Envirolab Services Pty Ltd, NSW, report reference 269471.

Appendix D Laboratory QA/QC Reports

Quality Control Report

Job Number: 19-09631-A

Date: 9/09/2019



This report must not be reproduced except in full without prior written consent.

This Quality Control Report is issued in accordance with Section 18 of the ARL Quality Management Manual. All QC parameters are contained within the relevant ARL Method as indicated by the method reference, either on this report or the Laboratory Report.

Acceptance of Holding Times, Duplicate RPD, Spike, LCS and CRM Recoveries are determined at the time of analysis by the Signatory indicated on the Laboratory Report.

DEFINITIONS

Duplicate Analysis

A sample, chosen randomly by the analyst at the time of sample preparation, analysed in duplicate.

RPD

Relative Percent Difference is the absolute difference between the sample and a duplicate analysis compared to the average of the two analytical results. Acceptance Limits can be exceeded by matrix interference or when the result is less than 5 times the LOR.

Matrix Spike

An additional portion of sample to which known amounts of the target analytes are added before sample preparation. Acceptance Limits can be exceeded by matrix interference or when the target analytes are present in the sample.

Certified Reference Material (CRM)

A commercially available certified solution/mixture of the target analyte of known concentration.

Laboratory Control Sample (LCS)

An in-house certified solution/mixture of the target analyte of known concentration.

Quality Control Report

Job Number: 19-09631-A

Date: 9/09/2019

Metals in Soil and Sediment

Holding Time Criteria	Date
Extracted	25/07/2019
Analysed	25/07/2019

Duplicate Analysis (19-11434-2)	RPD (%)	Limits (%)
Copper	0	25
Zinc	4	25

Duplicate Analysis (19-11526-30)	RPD (%)	Limits (%)
Cadmium	0	200
Copper	0	50
Lead	0	200
Zinc	0	200

Blank Analysis	Result (mg/kg)	Limit (mg/kg)
Cadmium	<0.1	0.1
Copper	<1	1
Lead	<1	1
Zinc	<1	1

Matrix Spike (19-11526-30)	Recovery (%)	Limits (%)
Cadmium	94	80 - 120
Copper	86	80 - 120
Zinc	92	80 - 120

Certified Reference Material	Recovery (%)	Limits (%)
Cadmium	106	80 - 120
Copper	118	80 - 120
Lead	104	80 - 120
Zinc	102	80 - 120

Soil Parameters

Holding Time Criteria	Date
Analysed	23/07/19

QUALITY CONTROL REPORT

Work Order	: EP1905988	Page	: 1 of 4
Client	: WA MARINE PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Russell Stevens	Contact	: Customer Services EP
Address	: SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370 DUNSBOROUGH, PERTH WA, AUSTRALIA 6281	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: 18WAU-0004 Geraldton Port Sediment Sampling 2019	Date Samples Received	: 20-Jun-2019
Order number	: ----	Date Analysis Commenced	: 21-Jun-2019
C-O-C number	: ----	Issue Date	: 28-Jun-2019
Sampler	: Russell Stevens		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 3		
No. of samples analysed	: 3		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Sarah Ashworth	Laboratory Manager - Brisbane	Brisbane Organics, Stafford, QLD



General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES (QC Lot: 2424526)									
EP1905988-001	TRIP-S1	EG005-SD: Aluminium	7429-90-5	50	mg/kg	1460	1460	0.00	0% - 20%
		EG005-SD: Iron	7439-89-6	50	mg/kg	3170	3060	3.53	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 2424524)									
EP1905988-001	TRIP-S1	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.02	0.02	0.00	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2419014)									
EP1905806-004	Anonymous	EA055: Moisture Content	----	0.1	%	13.2	13.2	0.00	0% - 50%
EP1905984-002	Anonymous	EA055: Moisture Content	----	0.1	%	7.8	8.5	8.27	No Limit
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 2424525)									
EP1905988-001	TRIP-S1	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	0.5	0.5	0.00	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	0.2	0.2	0.00	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	3.74	3.93	4.95	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	14.4	16.6	14.4	0% - 50%
		EG020-SD: Copper	7440-50-8	1	mg/kg	74.8	82.2	9.42	0% - 20%
		EG020-SD: Lead	7439-92-1	1	mg/kg	13.6	15.3	12.1	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	2.3	2.1	9.36	No Limit
		EG020-SD: Zinc	7440-66-6	1	mg/kg	147	154	4.30	0% - 20%
		EG020-SD: Manganese	7439-96-5	10	mg/kg	37	34	8.59	No Limit
		EG020-SD: Vanadium	7440-62-2	2	mg/kg	9.5	13.6	35.4	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2427108)									
EP1905659-002	Anonymous	EP003: Total Organic Carbon	----	0.02	%	0.36	0.39	6.90	0% - 50%
EP090: Organotin Compounds (QC Lot: 2420559)									
EM1909558-001	Anonymous	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.00	No Limit
EP1905988-002	TRIP-S2	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	3.2	4.7	38.4	No Limit

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

Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
	Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
<50	----	----	----	----
<50	----	----	----	----
<0.01	2.154 mg/kg	102	80	120
<1.00	21.62091 mg/kg	98.8	74	130
<0.1	4.6838 mg/kg	99.0	97	113
<1.0	42.2 mg/kg	93.1	72	152
<1.0	33.782 mg/kg	93.7	76	116
<1.0	40.33169 mg/kg	89.8	74	124
<10	----	----	----	----
<1.0	51.10088 mg/kg	112	81	135
<0.1	----	----	----	----
<2.0	----	----	----	----
<1.0	61.70999 mg/kg	113	81	143
<0.02	0.44 %	96.9	70	130
<0.5	1.25 µgSn/kg	92.9	52	139

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

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES (QCLot: 2424526)							
EP1905988-002	TRIP-S2	EG005-SD: Aluminium	7429-90-5	50 mg/kg	# Not Determined	70	130
		EG005-SD: Iron	7439-89-6	50 mg/kg	# Not Determined	70	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 2424524)							

Page : 4 of 4
 Work Order : EP1905988
 Client : WA MARINE PTY LTD
 Project : 18WAU-0004 Geraldton Port Sediment Sampling 2019



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 2424524) - continued							
EP1905988-002	TRIP-S2	EG035T-LL: Mercury	7439-97-6	10 mg/kg	91.5	70	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 2424525)							
EP1905988-002	TRIP-S2	EG020-SD: Arsenic	7440-38-2	50 mg/kg	97.5	70	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	97.7	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	87.5	70	130
		EG020-SD: Copper	7440-50-8	50 mg/kg	71.8	70	130
		EG020-SD: Lead	7439-92-1	50 mg/kg	81.4	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	93.6	70	130
		EG020-SD: Zinc	7440-66-6	50 mg/kg	110	70	130
EP090: Organotin Compounds (QCLot: 2420559)							
EM1909558-002	Anonymous	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	98.0	20	130

CERTIFICATE OF ANALYSIS

Work Order : **EP2001971**
Client : **WA MARINE PTY LTD**
Contact : Russell Stevens
Address : SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370
DUNSBOROUGH, PERTH WA, AUSTRALIA 6281
Telephone : ----
Project : 18WAU-0004 Geraldton Port Compliance Sediment Sampling
2020
Order number : ----
C-O-C number : ----
Sampler : Russell Stevens
Site : ----
Quote number : EP/101/20
No. of samples received : 64
No. of samples analysed : 64

Page : 1 of 33
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 25-Feb-2020 13:00
Date Analysis Commenced : 26-Feb-2020
Issue Date : 13-Mar-2020 15:57



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
David Viner	SENIOR LAB TECH	Perth Organics, Wangara, WA
Matt Frost	Assistant Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Matt Frost	Assistant Laboratory Manager	Brisbane Organics, Stafford, QLD



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenzo(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- TOC and TBT conducted by ALS Brisbane, NATA Site No. 818.
- PSD conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- EG020-SD: Poor matrix spike recovery was obtained for copper, zinc on sample EP2001971-055 due to possible matrix interference. Results have been confirmed by re-extraction and re-analysis.
- EP132B-SD: Poor duplicate precision due to high moisture content and sample heterogeneity. Chromatogram profiles have been reviewed.
- EP132B-SD: Poor matrix spike recovery due to high moisture content and sample heterogeneity. Chromatogram profiles have been reviewed.
- EP132B-SD: LOR has been raised for various analytes on various samples due to high moisture content and/or matrix interferences.
- EP090 Organotin Analysis: The LOR for Tributyltin in sample ORA2-1 has been raised due to matrix interference.
- EN68: This analysis in accordance with National Ocean Disposal Guidelines, Commonwealth of Australia, 2002 - (modified). Results reported are those determined on a 1:4 sediment/seawater elutriate without blank correction.



Analytical Results

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

Client sample ID

				CH3-1	CH4-1	CH6-1	Elutriate Water	----
Client sampling date / time				20-Feb-2020 09:40	20-Feb-2020 09:00	18-Feb-2020 16:30	20-Feb-2020 09:30	----
Compound	CAS Number	LOR	Unit	EP2001971-019	EP2001971-022	EP2001971-028	EP2001971-064	-----
				Result	Result	Result	Result	----
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	<2	<2	<2	<2	----
EP090S: Organotin Surrogate								
Tripopyltin	----	5	%	46.1	39.8	56.5	91.5	----



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	ORA1-1	ORA1-2	ORA1-3	ORA2-1	ORA2-2
Client sampling date / time					20-Feb-2020 11:25	20-Feb-2020 11:30	20-Feb-2020 11:40	20-Feb-2020 12:00	20-Feb-2020 12:05
Compound	CAS Number	LOR	Unit		EP2001971-001	EP2001971-002	EP2001971-003	EP2001971-004	EP2001971-005
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		31.8	34.2	37.0	61.3	54.9
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		3	2	2	12	10
Silt (4-62 µm)	----	1	%		1	1	2	10	9
Fine Sand (62-250 µm)	----	1	%		66	76	71	63	60
Medium Sand (250-500 µm)	----	1	%		24	18	21	11	18
Coarse Sand (500-2000 µm)	----	1	%		6	3	5	4	3
Gravel (2000-10000 µm)	----	1	%		1	<1	<1	1	<1
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.65	2.68	2.65	2.60	2.62
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		200	150	110	360	320
Iron	7439-89-6	50	mg/kg		390	330	260	1080	990
Vanadium	7440-62-2	2	mg/kg		<2	<2	<2	3	<2
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		1.91	1.93	1.37	2.86	3.28
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	0.3	0.2
Copper	7440-50-8	1.0	mg/kg		<1.0	1.8	<1.0	31.3	28.7
Lead	7439-92-1	1.0	mg/kg		1.1	<1.0	<1.0	2.3	2.5
Manganese	7439-96-5	10	mg/kg		19	16	12	17	17
Nickel	7440-02-0	1.0	mg/kg		<1.0	<1.0	<1.0	1.4	1.2
Silver	7440-22-4	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	7440-66-6	1.0	mg/kg		2.6	3.2	3.6	53.2	52.5
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		2.2	2.3	2.0	3.1	3.2
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.38	0.18	0.20	2.21	1.07
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	<0.5	<1.0	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	<5	<5	12	18
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				ORA1-1	ORA1-2	ORA1-3	ORA2-1	ORA2-2
Client sampling date / time				20-Feb-2020 11:25	20-Feb-2020 11:30	20-Feb-2020 11:40	20-Feb-2020 12:00	20-Feb-2020 12:05
Compound	CAS Number	LOR	Unit	EP2001971-001	EP2001971-002	EP2001971-003	EP2001971-004	EP2001971-005
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	10	11
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<5	<5
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<5	<5
Phenanthrene	85-01-8	4	µg/kg	<4	<4	<4	<5	6
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	<5	6
Fluoranthene	206-44-0	4	µg/kg	<4	<4	<4	<5	<5
Pyrene	129-00-0	4	µg/kg	<4	<4	<4	<5	<5
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	<5	<5
Chrysene	218-01-9	4	µg/kg	<4	<4	<4	<5	<5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	<4	<4	<5	<5
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	<5	<5
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	<5	<5
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	<4	<5	<5
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<5	<5
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	<4	<5	<5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<5	<5
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	<5	<5
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	<4	<4	<4	22	41
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<4	<4	<4	<5	<5
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	5	5	5	<5	<5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	10	10	10	10
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	74.5	66.5	79.9	92.6	60.3
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	78.9	81.2	84.1	90.4	85.2
Anthracene-d10	1719-06-8	10	%	71.2	77.3	75.5	75.0	71.7
4-Terphenyl-d14	1718-51-0	10	%	85.1	73.6	93.7	119	111



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				ORA2-3	FBH1-1	FBH1-2	FBH1-3	FBH2-1
Client sampling date / time				20-Feb-2020 12:10	18-Feb-2020 11:00	18-Feb-2020 11:10	18-Feb-2020 11:20	18-Feb-2020 10:30
Compound	CAS Number	LOR	Unit	EP2001971-006	EP2001971-007	EP2001971-008	EP2001971-009	EP2001971-010
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	47.4	40.5	40.7	39.9	42.9
EA150: Particle Sizing								
Clay (<4 µm)	----	1	%	5	15	13	13	13
Silt (4-62 µm)	----	1	%	1	12	13	12	15
Fine Sand (62-250 µm)	----	1	%	80	54	56	53	68
Medium Sand (250-500 µm)	----	1	%	13	8	8	8	2
Coarse Sand (500-2000 µm)	----	1	%	1	7	7	8	1
Gravel (2000-10000 µm)	----	1	%	<1	3	4	5	<1
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.62	2.62	2.63	2.64	2.54
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	190	1750	1920	2010	2850
Iron	7439-89-6	50	mg/kg	460	5030	5160	5330	6070
Vanadium	7440-62-2	2	mg/kg	<2	12	12	11	12
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	2.06	5.82	6.26	5.42	6.68
Cadmium	7440-43-9	0.1	mg/kg	0.2	0.2	0.2	0.3	0.3
Copper	7440-50-8	1.0	mg/kg	8.9	373	460	371	349
Lead	7439-92-1	1.0	mg/kg	1.3	28.3	29.3	27.4	24.2
Manganese	7439-96-5	10	mg/kg	16	26	26	26	31
Nickel	7440-02-0	1.0	mg/kg	<1.0	3.0	3.1	3.2	4.0
Silver	7440-22-4	0.1	mg/kg	<0.1	0.2	0.2	0.2	0.4
Zinc	7440-66-6	1.0	mg/kg	18.0	320	313	287	284
EG020T: Total Metals by ICP-MS								
Lithium	7439-93-2	0.1	mg/kg	2.9	4.4	4.6	4.8	5.8
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	<0.01	0.09	0.10	0.09	0.09
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.32	0.79	0.84	0.86	1.03
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	27.1	27.2	27.2	16.9
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	8	9	12	10	8
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				ORA2-3	FBH1-1	FBH1-2	FBH1-3	FBH2-1
Client sampling date / time				20-Feb-2020 12:10	18-Feb-2020 11:00	18-Feb-2020 11:10	18-Feb-2020 11:20	18-Feb-2020 10:30
Compound	CAS Number	LOR	Unit	EP2001971-006	EP2001971-007	EP2001971-008	EP2001971-009	EP2001971-010
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	6	5	5
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	<4	24	29	23	21
Anthracene	120-12-7	4	µg/kg	<4	6	9	6	6
Fluoranthene	206-44-0	4	µg/kg	<4	47	62	49	50
Pyrene	129-00-0	4	µg/kg	<4	43	61	45	49
Benz(a)anthracene	56-55-3	4	µg/kg	<4	21	28	22	24
Chrysene	218-01-9	4	µg/kg	<4	18	25	21	22
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	33	42	36	36
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	15	22	16	17
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	17	25	19	22
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	23	31	25	27
Perylene	198-55-0	4	µg/kg	<4	5	7	5	6
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	23	30	26	28
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	4	5	4	5
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	18	24	20	22
Coronene	191-07-1	5	µg/kg	<5	7	7	8	8
^ Sum of PAHs	----	4	µg/kg	8	313	429	340	356
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<4	36	48	39	42
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	5	36	48	39	42
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	36	48	39	42
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	82.8	82.0	75.0	61.6	89.4
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	76.6	74.6	86.1	83.9	80.1
Anthracene-d10	1719-06-8	10	%	71.7	72.2	76.3	74.8	74.3
4-Terphenyl-d14	1718-51-0	10	%	86.9	97.1	110	91.8	91.9



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	FBH2-2	FBH2-3	CH1-1	CH1-2	CH1-3
Client sampling date / time					18-Feb-2020 10:40	18-Feb-2020 10:50	19-Feb-2020 10:50	19-Feb-2020 11:00	19-Feb-2020 11:15
Compound	CAS Number	LOR	Unit		EP2001971-011	EP2001971-012	EP2001971-013	EP2001971-014	EP2001971-015
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		43.9	44.7	51.7	53.6	49.6
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		10	12	21	25	19
Silt (4-62 µm)	----	1	%		19	16	28	26	27
Fine Sand (62-250 µm)	----	1	%		68	69	45	45	47
Medium Sand (250-500 µm)	----	1	%		2	2	5	1	4
Coarse Sand (500-2000 µm)	----	1	%		1	1	2	2	2
Gravel (2000-10000 µm)	----	1	%		<1	<1	<1	1	<1
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.51	2.51	2.53	2.52	2.54
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		2200	3100	2760	2310	2820
Iron	7439-89-6	50	mg/kg		4760	6440	6770	6060	6800
Vanadium	7440-62-2	2	mg/kg		10	13	17	16	17
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		5.83	7.18	7.49	7.45	7.13
Cadmium	7440-43-9	0.1	mg/kg		0.2	0.3	1.1	0.9	1.0
Copper	7440-50-8	1.0	mg/kg		286	370	206	184	198
Lead	7439-92-1	1.0	mg/kg		22.7	27.1	34.4	33.6	37.5
Manganese	7439-96-5	10	mg/kg		26	32	55	52	109
Nickel	7440-02-0	1.0	mg/kg		4.2	4.5	4.8	4.9	5.2
Silver	7440-22-4	0.1	mg/kg		0.2	0.3	0.4	0.4	0.5
Zinc	7440-66-6	1.0	mg/kg		265	303	342	308	336
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		4.4	6.3	5.6	5.0	5.5
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.05	0.10	0.06	0.05	0.05
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		1.08	1.19	1.67	1.85	1.84
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		17.9	21.7	2.1	2.0	1.4
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		8	8	12	10	9
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	7	6	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				FBH2-2	FBH2-3	CH1-1	CH1-2	CH1-3
Client sampling date / time				18-Feb-2020 10:40	18-Feb-2020 10:50	19-Feb-2020 10:50	19-Feb-2020 11:00	19-Feb-2020 11:15
Compound	CAS Number	LOR	Unit	EP2001971-011	EP2001971-012	EP2001971-013	EP2001971-014	EP2001971-015
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	4	4	<5	<5	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<5	<5	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<5	<5	<4
Phenanthrene	85-01-8	4	µg/kg	21	20	21	17	18
Anthracene	120-12-7	4	µg/kg	7	7	5	8	5
Fluoranthene	206-44-0	4	µg/kg	45	44	32	26	29
Pyrene	129-00-0	4	µg/kg	44	43	30	26	28
Benz(a)anthracene	56-55-3	4	µg/kg	21	21	14	13	14
Chrysene	218-01-9	4	µg/kg	20	18	12	10	12
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	34	33	21	19	19
Benzo(k)fluoranthene	207-08-9	4	µg/kg	16	18	10	8	10
Benzo(e)pyrene	192-97-2	4	µg/kg	19	20	12	12	12
Benzo(a)pyrene	50-32-8	4	µg/kg	24	25	17	16	17
Perylene	198-55-0	4	µg/kg	5	6	<5	<5	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	24	25	15	14	14
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	4	4	<5	<5	<4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	19	20	12	10	10
Coronene	191-07-1	5	µg/kg	8	7	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	323	323	220	195	197
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	37	39	23	21	22
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	37	39	25	23	24
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	37	39	27	25	26
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	88.9	97.2	75.5	79.7	73.1
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	73.3	70.5	92.6	82.1	81.6
Anthracene-d10	1719-06-8	10	%	71.6	70.1	78.9	71.6	71.2
4-Terphenyl-d14	1718-51-0	10	%	94.6	81.1	126	85.9	84.4



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	CH2-1	CH2-2	CH2-3	CH3-1	CH3-2
Client sampling date / time					20-Feb-2020 10:50	20-Feb-2020 10:55	20-Feb-2020 11:00	20-Feb-2020 09:40	20-Feb-2020 09:50
Compound	CAS Number	LOR	Unit		EP2001971-016	EP2001971-017	EP2001971-018	EP2001971-019	EP2001971-020
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		40.0	43.0	44.2	37.3	38.4
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		20	19	23	17	13
Silt (4-62 µm)	----	1	%		16	19	20	11	19
Fine Sand (62-250 µm)	----	1	%		49	46	46	41	37
Medium Sand (250-500 µm)	----	1	%		6	9	8	18	17
Coarse Sand (500-2000 µm)	----	1	%		7	4	3	9	10
Gravel (2000-10000 µm)	----	1	%		2	2	<1	3	5
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.59	2.58	2.58	2.68	2.64
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		1440	1910	2220	1630	1870
Iron	7439-89-6	50	mg/kg		4350	5540	6190	4730	5410
Vanadium	7440-62-2	2	mg/kg		11	13	15	12	12
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		5.11	6.31	6.88	5.47	5.53
Cadmium	7440-43-9	0.1	mg/kg		1.7	2.3	3.5	1.3	1.7
Copper	7440-50-8	1.0	mg/kg		196	252	327	171	208
Lead	7439-92-1	1.0	mg/kg		50.9	62.6	85.2	42.5	48.4
Manganese	7439-96-5	10	mg/kg		48	55	77	49	54
Nickel	7440-02-0	1.0	mg/kg		3.6	3.8	3.8	3.5	3.8
Silver	7440-22-4	0.1	mg/kg		0.5	0.8	0.8	0.5	0.5
Zinc	7440-66-6	1.0	mg/kg		517	658	972	435	540
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		3.5	4.1	4.6	3.6	4.0
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.04	0.05	0.06	0.04	0.04
EN68: Seawater Elutriate Testing Procedure									
Seawater Sampling Date	----	-	-		----	----	----	27/02/2020	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		1.19	1.29	1.29	0.90	0.88
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		2.9	2.7	3.2	5.3	2.4



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH2-1	CH2-2	CH2-3	CH3-1	CH3-2
Client sampling date / time				20-Feb-2020 10:50	20-Feb-2020 10:55	20-Feb-2020 11:00	20-Feb-2020 09:40	20-Feb-2020 09:50
Compound	CAS Number	LOR	Unit	EP2001971-016	EP2001971-017	EP2001971-018	EP2001971-019	EP2001971-020
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	17	10	43	41	7
2-Methylnaphthalene	91-57-6	5	µg/kg	19	<5	20	9	<5
Acenaphthylene	208-96-8	4	µg/kg	6	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	75	<4	36	4	<4
Fluorene	86-73-7	4	µg/kg	54	<4	39	5	<4
Phenanthrene	85-01-8	4	µg/kg	387	37	283	50	33
Anthracene	120-12-7	4	µg/kg	48	6	26	8	8
Fluoranthene	206-44-0	4	µg/kg	340	69	193	49	76
Pyrene	129-00-0	4	µg/kg	320	58	154	44	66
Benz(a)anthracene	56-55-3	4	µg/kg	125	31	58	16	38
Chrysene	218-01-9	4	µg/kg	90	26	46	13	31
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	123	43	56	19	43
Benzo(k)fluoranthene	207-08-9	4	µg/kg	66	21	26	8	20
Benzo(e)pyrene	192-97-2	4	µg/kg	78	30	35	10	23
Benzo(a)pyrene	50-32-8	4	µg/kg	107	33	48	14	31
Perylene	198-55-0	4	µg/kg	25	9	11	<4	8
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	87	32	34	11	22
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	17	8	8	<4	6
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	68	25	27	8	18
Coronene	191-07-1	5	µg/kg	20	6	7	<5	<5
^ Sum of PAHs	----	4	µg/kg	2070	444	1150	309	430
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	164	54	74	19	49
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	164	54	74	21	49
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	164	54	74	23	49
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	97.5	80.3	73.9	87.2	68.4
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	98.0	93.0	86.2	78.1	92.2
Anthracene-d10	1719-06-8	10	%	83.0	79.6	72.8	71.5	80.6
4-Terphenyl-d14	1718-51-0	10	%	103	98.9	89.4	89.2	102



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	CH3-3	CH4-1	CH4-2	CH4-3	CH5-1
Client sampling date / time					20-Feb-2020 10:00	20-Feb-2020 09:00	20-Feb-2020 09:15	20-Feb-2020 09:20	18-Feb-2020 17:10
Compound	CAS Number	LOR	Unit		EP2001971-021	EP2001971-022	EP2001971-023	EP2001971-024	EP2001971-025
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		37.4	44.6	44.4	36.1	37.1
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		14	23	16	11	18
Silt (4-62 µm)	----	1	%		18	23	29	12	13
Fine Sand (62-250 µm)	----	1	%		39	38	42	16	33
Medium Sand (250-500 µm)	----	1	%		17	10	8	12	16
Coarse Sand (500-2000 µm)	----	1	%		10	5	4	16	15
Gravel (2000-10000 µm)	----	1	%		3	1	1	33	5
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.64	2.60	2.55	2.62	2.56
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		1670	1840	2480	1790	1720
Iron	7439-89-6	50	mg/kg		4570	5400	6560	14800	4590
Vanadium	7440-62-2	2	mg/kg		12	14	16	13	12
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		5.07	6.14	6.60	7.72	5.43
Cadmium	7440-43-9	0.1	mg/kg		1.7	1.3	1.7	1.0	0.9
Copper	7440-50-8	1.0	mg/kg		182	198	251	161	135
Lead	7439-92-1	1.0	mg/kg		40.4	46.6	46.8	35.7	27.9
Manganese	7439-96-5	10	mg/kg		53	50	55	159	46
Nickel	7440-02-0	1.0	mg/kg		3.3	3.8	4.1	7.1	3.2
Silver	7440-22-4	0.1	mg/kg		0.6	0.6	0.6	0.4	0.4
Zinc	7440-66-6	1.0	mg/kg		512	431	557	372	296
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		3.6	4.2	4.7	3.9	3.6
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.04	0.04	0.06	0.05	0.05
EN68: Seawater Elutriate Testing Procedure									
Seawater Sampling Date	----	-	-		----	27/02/2020	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.72	1.03	0.93	0.63	0.73
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		3.8	3.0	3.2	4.9	2.1



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH3-3	CH4-1	CH4-2	CH4-3	CH5-1
Client sampling date / time				20-Feb-2020 10:00	20-Feb-2020 09:00	20-Feb-2020 09:15	20-Feb-2020 09:20	18-Feb-2020 17:10
Compound	CAS Number	LOR	Unit	EP2001971-021	EP2001971-022	EP2001971-023	EP2001971-024	EP2001971-025
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	6	11	9	7	8
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	6	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<4	4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	9	5	<4	14
Fluorene	86-73-7	4	µg/kg	<4	8	5	<4	12
Phenanthrene	85-01-8	4	µg/kg	14	153	63	11	131
Anthracene	120-12-7	4	µg/kg	4	15	10	<4	21
Fluoranthene	206-44-0	4	µg/kg	22	176	79	20	195
Pyrene	129-00-0	4	µg/kg	23	142	66	20	121
Benz(a)anthracene	56-55-3	4	µg/kg	10	51	28	12	51
Chrysene	218-01-9	4	µg/kg	9	41	23	10	36
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	13	53	30	18	46
Benzo(k)fluoranthene	207-08-9	4	µg/kg	7	27	17	9	22
Benzo(e)pyrene	192-97-2	4	µg/kg	8	28	20	11	25
Benzo(a)pyrene	50-32-8	4	µg/kg	11	39	25	14	38
Perylene	198-55-0	4	µg/kg	<4	8	6	4	10
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	9	23	18	13	22
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	6	4	<4	8
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	6	18	13	9	19
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	142	818	421	158	779
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	15	60	38	19	60
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	17	60	38	21	60
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	19	60	38	23	60
EP090S: Organotin Surrogate								
Tripopyltin	----	0.5	%	79.4	96.0	104	92.5	88.3
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	82.0	77.2	82.9	85.8	80.6
Anthracene-d10	1719-06-8	10	%	70.6	70.6	73.5	77.3	76.2
4-Terphenyl-d14	1718-51-0	10	%	118	83.7	93.4	93.6	96.4



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	CH5-2	CH5-3	CH6-1	CH6-2	CH6-3
Client sampling date / time					18-Feb-2020 17:15	18-Feb-2020 17:20	18-Feb-2020 16:30	18-Feb-2020 16:40	18-Feb-2020 16:45
Compound	CAS Number	LOR	Unit		EP2001971-026	EP2001971-027	EP2001971-028	EP2001971-029	EP2001971-030
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		32.7	32.9	37.6	39.2	34.8
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		13	16	17	19	13
Silt (4-62 µm)	----	1	%		12	9	12	10	13
Fine Sand (62-250 µm)	----	1	%		31	36	38	38	33
Medium Sand (250-500 µm)	----	1	%		19	19	19	18	23
Coarse Sand (500-2000 µm)	----	1	%		18	15	13	13	15
Gravel (2000-10000 µm)	----	1	%		7	5	1	1	3
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.57	2.57	2.60	2.57	2.56
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		1620	1490	1230	1700	1580
Iron	7439-89-6	50	mg/kg		5110	4600	3600	4360	4090
Vanadium	7440-62-2	2	mg/kg		11	10	11	12	11
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		5.54	4.68	4.98	5.47	4.98
Cadmium	7440-43-9	0.1	mg/kg		1.1	0.9	0.7	1.0	0.9
Copper	7440-50-8	1.0	mg/kg		145	117	124	142	131
Lead	7439-92-1	1.0	mg/kg		27.6	22.5	28.1	27.6	25.6
Manganese	7439-96-5	10	mg/kg		46	44	44	49	55
Nickel	7440-02-0	1.0	mg/kg		3.2	2.8	2.5	3.0	2.9
Silver	7440-22-4	0.1	mg/kg		0.4	0.3	0.4	0.3	0.3
Zinc	7440-66-6	1.0	mg/kg		327	282	233	309	285
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		3.6	3.2	3.1	3.8	3.6
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.03	0.03	0.03	0.04	0.03
EN68: Seawater Elutriate Testing Procedure									
Seawater Sampling Date	----	-	-		----	----	27/02/2020	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.71	0.48	0.59	0.73	0.62
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		1.4	1.7	8.2	2.2	1.6



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH5-2	CH5-3	CH6-1	CH6-2	CH6-3
Client sampling date / time				18-Feb-2020 17:15	18-Feb-2020 17:20	18-Feb-2020 16:30	18-Feb-2020 16:40	18-Feb-2020 16:45
Compound	CAS Number	LOR	Unit	EP2001971-026	EP2001971-027	EP2001971-028	EP2001971-029	EP2001971-030
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	6	7	11	10	6
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	10	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	5	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	31	16	13	15	5
Anthracene	120-12-7	4	µg/kg	20	<4	<4	8	<4
Fluoranthene	206-44-0	4	µg/kg	58	19	17	23	7
Pyrene	129-00-0	4	µg/kg	52	17	16	21	6
Benzo(a)anthracene	56-55-3	4	µg/kg	52	8	8	10	<4
Chrysene	218-01-9	4	µg/kg	37	6	7	8	<4
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	90	10	12	13	5
Benzo(k)fluoranthene	207-08-9	4	µg/kg	37	5	6	8	<4
Benzo(e)pyrene	192-97-2	4	µg/kg	47	6	7	8	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	68	9	9	10	<4
Perylene	198-55-0	4	µg/kg	16	<4	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	47	6	6	7	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	15	<4	<4	<4	<4
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	39	5	4	5	<4
Coronene	191-07-1	5	µg/kg	6	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	636	114	116	146	29
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	106	12	12	14	<4
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	106	14	14	16	5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	106	16	16	18	10
EP090S: Organotin Surrogate								
Tripopyltn	----	0.5	%	57.4	87.2	97.8	104	95.4
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	88.8	97.6	82.8	87.0	74.2
Anthracene-d10	1719-06-8	10	%	79.9	82.6	73.5	76.5	73.0
4-Terphenyl-d14	1718-51-0	10	%	108	101	87.8	72.1	76.5



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	CH9-1	CH9-2	CH9-3	CH10-1	CH10-2
Client sampling date / time					18-Feb-2020 17:45	18-Feb-2020 18:00	18-Feb-2020 18:10	19-Feb-2020 11:40	19-Feb-2020 11:45
Compound	CAS Number	LOR	Unit		EP2001971-031	EP2001971-032	EP2001971-033	EP2001971-034	EP2001971-035
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		37.9	28.9	28.7	56.2	56.2
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		14	7	8	15	17
Silt (4-62 µm)	----	1	%		11	7	4	20	15
Fine Sand (62-250 µm)	----	1	%		19	12	11	49	41
Medium Sand (250-500 µm)	----	1	%		10	12	11	10	8
Coarse Sand (500-2000 µm)	----	1	%		19	28	23	5	11
Gravel (2000-10000 µm)	----	1	%		29	34	43	1	8
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.55	2.55	2.55	2.35	2.35
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		2440	1120	980	1720	1440
Iron	7439-89-6	50	mg/kg		4660	2920	2620	4220	3460
Vanadium	7440-62-2	2	mg/kg		14	13	10	11	12
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		6.51	5.15	4.41	6.00	6.35
Cadmium	7440-43-9	0.1	mg/kg		0.9	0.5	0.4	0.5	0.5
Copper	7440-50-8	1.0	mg/kg		146	47.4	50.6	74.5	50.6
Lead	7439-92-1	1.0	mg/kg		37.6	10.5	11.1	14.3	10.0
Manganese	7439-96-5	10	mg/kg		67	69	69	37	54
Nickel	7440-02-0	1.0	mg/kg		3.5	2.1	1.7	3.7	3.0
Silver	7440-22-4	0.1	mg/kg		0.5	0.2	0.1	0.3	0.1
Zinc	7440-66-6	1.0	mg/kg		305	111	122	147	101
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		4.4	3.1	2.8	3.7	3.8
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.04	0.01	0.02	0.03	0.02
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.38	0.36	0.23	2.16	1.64
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		1.3	1.4	0.9	1.4	0.9
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		6	6	<5	16	23
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	7	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH9-1	CH9-2	CH9-3	CH10-1	CH10-2
Client sampling date / time				18-Feb-2020 17:45	18-Feb-2020 18:00	18-Feb-2020 18:10	19-Feb-2020 11:40	19-Feb-2020 11:45
Compound	CAS Number	LOR	Unit	EP2001971-031	EP2001971-032	EP2001971-033	EP2001971-034	EP2001971-035
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<5	6
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<5	<5
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<5	<5
Phenanthrene	85-01-8	4	µg/kg	12	10	<4	19	8
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	<5	<5
Fluoranthene	206-44-0	4	µg/kg	16	11	4	25	18
Pyrene	129-00-0	4	µg/kg	16	9	5	21	16
Benz(a)anthracene	56-55-3	4	µg/kg	8	<4	<4	11	9
Chrysene	218-01-9	4	µg/kg	6	<4	<4	9	8
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	10	5	<4	15	10
Benzo(k)fluoranthene	207-08-9	4	µg/kg	5	<4	<4	10	6
Benzo(e)pyrene	192-97-2	4	µg/kg	6	<4	<4	8	7
Benzo(a)pyrene	50-32-8	4	µg/kg	8	<4	<4	10	8
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<5	<5
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	5	<4	<4	8	5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<5	<5
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	8	7
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	98	41	9	167	131
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	10	<4	<4	14	11
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	13	5	5	16	13
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	15	10	10	18	15
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	86.4	89.2	97.0	91.6	76.3
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	78.9	85.4	78.7	77.2	86.7
Anthracene-d10	1719-06-8	10	%	72.2	75.0	72.2	85.6	74.5
4-Terphenyl-d14	1718-51-0	10	%	88.3	89.3	86.2	73.4	96.2



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	CH10-3	YM1-1	YM1-2	YM1-3	TB1-1
Client sampling date / time					19-Feb-2020 11:50	18-Feb-2020 12:00	18-Feb-2020 12:10	18-Feb-2020 12:15	18-Feb-2020 13:00
Compound	CAS Number	LOR	Unit		EP2001971-036	EP2001971-037	EP2001971-038	EP2001971-039	EP2001971-040
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		55.8	39.1	31.7	29.0	29.6
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		18	17	13	10	6
Silt (4-62 µm)	----	1	%		22	17	4	10	4
Fine Sand (62-250 µm)	----	1	%		47	24	23	30	59
Medium Sand (250-500 µm)	----	1	%		8	7	9	15	13
Coarse Sand (500-2000 µm)	----	1	%		4	9	15	21	15
Gravel (2000-10000 µm)	----	1	%		1	27	36	14	4
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.33	2.65	2.69	2.69	2.66
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		1260	2920	2010	1880	590
Iron	7439-89-6	50	mg/kg		3480	7180	4980	3780	1120
Vanadium	7440-62-2	2	mg/kg		10	18	10	11	4
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		6.12	5.63	4.56	3.46	2.62
Cadmium	7440-43-9	0.1	mg/kg		0.4	0.2	0.1	0.1	0.1
Copper	7440-50-8	1.0	mg/kg		62.6	116	162	43.7	7.6
Lead	7439-92-1	1.0	mg/kg		12.9	32.6	70.4	11.8	5.8
Manganese	7439-96-5	10	mg/kg		30	46	40	28	23
Nickel	7440-02-0	1.0	mg/kg		3.3	4.8	3.1	2.6	1.0
Silver	7440-22-4	0.1	mg/kg		0.2	0.1	<0.1	<0.1	<0.1
Zinc	7440-66-6	1.0	mg/kg		113	113	53.5	53.9	21.6
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		3.3	5.0	3.8	3.6	1.8
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.02	0.14	0.08	0.05	0.03
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		2.34	0.96	0.68	0.43	0.44
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		1.1	73.5	51.5	19.8	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		22	15	11	7	9
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH10-3	YM1-1	YM1-2	YM1-3	TB1-1
Client sampling date / time				19-Feb-2020 11:50	18-Feb-2020 12:00	18-Feb-2020 12:10	18-Feb-2020 12:15	18-Feb-2020 13:00
Compound	CAS Number	LOR	Unit	EP2001971-036	EP2001971-037	EP2001971-038	EP2001971-039	EP2001971-040
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	6	14	9	6	10
Acenaphthene	83-32-9	4	µg/kg	<5	14	4	<4	<4
Fluorene	86-73-7	4	µg/kg	<5	9	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	10	79	26	42	10
Anthracene	120-12-7	4	µg/kg	<5	20	9	10	12
Fluoranthene	206-44-0	4	µg/kg	15	180	79	100	56
Pyrene	129-00-0	4	µg/kg	14	160	70	86	50
Benz(a)anthracene	56-55-3	4	µg/kg	7	94	48	55	36
Chrysene	218-01-9	4	µg/kg	6	81	37	40	24
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	11	125	61	70	40
Benzo(k)fluoranthene	207-08-9	4	µg/kg	6	58	30	29	20
Benzo(e)pyrene	192-97-2	4	µg/kg	6	57	29	32	18
Benzo(a)pyrene	50-32-8	4	µg/kg	8	94	46	53	39
Perylene	198-55-0	4	µg/kg	<5	21	10	13	9
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	5	59	30	31	19
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<5	17	8	8	4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<5	51	25	26	17
Coronene	191-07-1	5	µg/kg	<5	9	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	116	1160	532	608	373
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	10	145	71	80	55
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	13	145	71	80	55
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	15	145	71	80	55
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	70.6	75.8	94.9	108	106
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	97.9	77.5	89.7	87.3	76.4
Anthracene-d10	1719-06-8	10	%	76.4	75.3	79.7	81.1	71.5
4-Terphenyl-d14	1718-51-0	10	%	93.9	101	93.8	102	78.4



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				TB1-2	TB1-3	CS1-1	CS1-2	CS1-3
Client sampling date / time				18-Feb-2020 13:05	18-Feb-2020 13:10	18-Feb-2020 01:50	18-Feb-2020 15:10	18-Feb-2020 15:15
Compound	CAS Number	LOR	Unit	EP2001971-041	EP2001971-042	EP2001971-043	EP2001971-044	EP2001971-045
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	31.8	30.2	27.4	29.0	26.5
EA150: Particle Sizing								
Clay (<4 µm)	----	1	%	4	3	<1	1	2
Silt (4-62 µm)	----	1	%	6	5	<1	1	<1
Fine Sand (62-250 µm)	----	1	%	55	62	11	4	9
Medium Sand (250-500 µm)	----	1	%	9	11	56	46	57
Coarse Sand (500-2000 µm)	----	1	%	20	14	27	48	29
Gravel (2000-10000 µm)	----	1	%	6	5	6	1	4
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.65	2.44	2.53	2.45	2.51
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	500	560	420	430	400
Iron	7439-89-6	50	mg/kg	920	930	830	800	770
Vanadium	7440-62-2	2	mg/kg	3	3	4	4	4
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	2.09	2.14	2.46	2.62	2.38
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.2	0.5	0.1
Copper	7440-50-8	1.0	mg/kg	7.1	7.4	<1.0	<1.0	<1.0
Lead	7439-92-1	1.0	mg/kg	5.2	5.5	1.8	1.7	1.7
Manganese	7439-96-5	10	mg/kg	22	22	30	28	28
Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Zinc	7440-66-6	1.0	mg/kg	20.4	16.8	3.7	14.1	2.7
EG020T: Total Metals by ICP-MS								
Lithium	7439-93-2	0.1	mg/kg	1.9	1.9	1.6	1.5	1.4
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.02	0.05	<0.01	<0.01	<0.01
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.46	0.18	0.14	0.15	0.12
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	12	6	<5	<5	5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				TB1-2	TB1-3	CS1-1	CS1-2	CS1-3
Client sampling date / time				18-Feb-2020 13:05	18-Feb-2020 13:10	18-Feb-2020 01:50	18-Feb-2020 15:10	18-Feb-2020 15:15
Compound	CAS Number	LOR	Unit	EP2001971-041	EP2001971-042	EP2001971-043	EP2001971-044	EP2001971-045
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<4	4
Phenanthrene	85-01-8	4	µg/kg	<10	<4	<4	<4	6
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	<4	6
Fluoranthene	206-44-0	4	µg/kg	6	4	<4	<4	10
Pyrene	129-00-0	4	µg/kg	5	12	<4	<4	12
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	<4	14
Chrysene	218-01-9	4	µg/kg	<4	6	<4	<4	15
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	4	4	<4	5	17
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	7	18
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	4	<4	<4	<20
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	<4	<4	9
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	5	11
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	6	10
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	27	36	<4	23	137
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<4	4	<4	7	17
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	5	7	5	9	19
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	10	10	11	21
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	101	87.4	58.8	98.3	98.2
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	78.8	70.3	73.2	76.8	73.7
Anthracene-d10	1719-06-8	10	%	72.2	99.5	83.1	77.4	95.4
4-Terphenyl-d14	1718-51-0	10	%	76.3	88.0	108	92.6	91.8



Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)				Client sample ID	CS2-1	CS2-2	CS2-3	CH7-1	CH7-2
Client sampling date / time					18-Feb-2020 15:30	18-Feb-2020 15:35	18-Feb-2020 15:45	19-Feb-2020 10:00	19-Feb-2020 10:05
Compound	CAS Number	LOR	Unit		EP2001971-046	EP2001971-047	EP2001971-048	EP2001971-049	EP2001971-050
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		19.8	20.6	21.4	40.2	42.4
EA150: Particle Sizing									
Clay (<4 µm)	----	1	%		1	1	<1	18	23
Silt (4-62 µm)	----	1	%		1	<1	1	17	14
Fine Sand (62-250 µm)	----	1	%		1	3	1	47	45
Medium Sand (250-500 µm)	----	1	%		56	59	53	13	13
Coarse Sand (500-2000 µm)	----	1	%		41	35	42	5	4
Gravel (2000-10000 µm)	----	1	%		1	1	3	<1	<1
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.55	2.62	2.62	2.59	2.44
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		420	460	440	1650	1660
Iron	7439-89-6	50	mg/kg		900	990	1010	4350	4440
Vanadium	7440-62-2	2	mg/kg		5	5	6	13	13
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		3.81	4.24	4.25	5.47	5.48
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	0.1	0.9	0.8
Copper	7440-50-8	1.0	mg/kg		<1.0	<1.0	<1.0	140	140
Lead	7439-92-1	1.0	mg/kg		1.6	1.6	1.6	25.7	28.6
Manganese	7439-96-5	10	mg/kg		31	33	38	52	50
Nickel	7440-02-0	1.0	mg/kg		<1.0	<1.0	<1.0	3.5	3.0
Silver	7440-22-4	0.1	mg/kg		<0.1	<0.1	<0.1	0.5	0.5
Zinc	7440-66-6	1.0	mg/kg		1.9	2.1	3.0	288	252
EG020T: Total Metals by ICP-MS									
Lithium	7439-93-2	0.1	mg/kg		1.5	1.5	1.5	3.6	3.8
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	<0.01	0.04	0.04
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.11	0.12	0.11	0.94	0.76
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	<0.5	2.5	2.4
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	<5	<5	8	7
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CS2-1	CS2-2	CS2-3	CH7-1	CH7-2
Client sampling date / time				18-Feb-2020 15:30	18-Feb-2020 15:35	18-Feb-2020 15:45	19-Feb-2020 10:00	19-Feb-2020 10:05
Compound	CAS Number	LOR	Unit	EP2001971-046	EP2001971-047	EP2001971-048	EP2001971-049	EP2001971-050
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	5	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	5	<4
Phenanthrene	85-01-8	4	µg/kg	<4	<4	<4	48	11
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	7	<4
Fluoranthene	206-44-0	4	µg/kg	<4	<4	<4	97	18
Pyrene	129-00-0	4	µg/kg	<4	<4	<4	65	16
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	30	9
Chrysene	218-01-9	4	µg/kg	<4	<4	<4	22	6
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	<4	<4	31	11
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	16	7
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	18	7
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	<4	21	7
Perylene	198-55-0	4	µg/kg	<4	<4	<4	5	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	<4	10	5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	<4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	8	<4
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	<4	<4	<4	396	104
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<4	<4	<4	30	10
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	5	5	5	32	12
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	10	10	34	14
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	93.8	63.8	61.4	80.8	76.7
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	71.4	72.7	70.3	88.4	81.0
Anthracene-d10	1719-06-8	10	%	73.6	76.4	87.4	82.7	71.9
4-Terphenyl-d14	1718-51-0	10	%	80.6	80.9	93.4	119	90.2



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH7-3	CH8-1	CH8-2	CH8-3	DUP-1
Client sampling date / time				19-Feb-2020 10:15	19-Feb-2020 09:20	19-Feb-2020 09:30	19-Feb-2020 09:35	18-Feb-2020 00:00
Compound	CAS Number	LOR	Unit	EP2001971-051	EP2001971-052	EP2001971-053	EP2001971-054	EP2001971-055
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	41.3	38.3	37.6	38.3	42.9
EA150: Particle Sizing								
Clay (<4 µm)	----	1	%	16	14	14	13	----
Silt (4-62 µm)	----	1	%	18	11	11	10	----
Fine Sand (62-250 µm)	----	1	%	49	42	43	42	----
Medium Sand (250-500 µm)	----	1	%	12	17	16	19	----
Coarse Sand (500-2000 µm)	----	1	%	4	10	8	10	----
Gravel (2000-10000 µm)	----	1	%	1	6	7	6	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.51	2.44	2.47	2.45	----
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	1950	1230	1460	1780	2020
Iron	7439-89-6	50	mg/kg	4930	3120	3250	3830	4200
Vanadium	7440-62-2	2	mg/kg	13	9	10	10	9
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	5.55	3.86	3.87	3.96	4.30
Cadmium	7440-43-9	0.1	mg/kg	1.0	0.6	0.6	0.7	0.2
Copper	7440-50-8	1.0	mg/kg	154	98.3	99.2	107	218
Lead	7439-92-1	1.0	mg/kg	27.4	19.3	16.5	18.6	16.4
Manganese	7439-96-5	10	mg/kg	52	36	41	37	19
Nickel	7440-02-0	1.0	mg/kg	3.2	2.4	2.5	2.8	2.8
Silver	7440-22-4	0.1	mg/kg	0.3	0.2	0.2	0.4	0.2
Zinc	7440-66-6	1.0	mg/kg	302	173	187	199	180
EG020T: Total Metals by ICP-MS								
Lithium	7439-93-2	0.1	mg/kg	4.1	3.1	3.5	3.6	4.4
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.04	0.03	0.02	0.03	0.07
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.71	0.72	0.58	0.60	0.97
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	1.2	2.4	1.0	1.0	15.8
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	6	9	6	8	8
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				CH7-3	CH8-1	CH8-2	CH8-3	DUP-1
Client sampling date / time				19-Feb-2020 10:15	19-Feb-2020 09:20	19-Feb-2020 09:30	19-Feb-2020 09:35	18-Feb-2020 00:00
Compound	CAS Number	LOR	Unit	EP2001971-051	EP2001971-052	EP2001971-053	EP2001971-054	EP2001971-055
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	5
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	22	14	12	10	27
Anthracene	120-12-7	4	µg/kg	4	<4	<4	<4	7
Fluoranthene	206-44-0	4	µg/kg	32	26	14	10	51
Pyrene	129-00-0	4	µg/kg	29	24	12	11	48
Benz(a)anthracene	56-55-3	4	µg/kg	12	13	6	4	24
Chrysene	218-01-9	4	µg/kg	10	11	5	<4	22
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	15	16	10	5	39
Benzo(k)fluoranthene	207-08-9	4	µg/kg	9	10	4	4	19
Benzo(e)pyrene	192-97-2	4	µg/kg	10	11	5	<4	23
Benzo(a)pyrene	50-32-8	4	µg/kg	10	11	4	<4	27
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<4	6
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	6	7	<4	<4	19
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	5	<4	<4	13
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	165	157	78	52	342
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	14	16	6	<4	41
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	16	18	8	6	41
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	18	20	10	10	41
EP090S: Organotin Surrogate								
Tripolytin	----	0.5	%	50.7	70.3	44.0	66.9	40.5
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	74.3	80.8	79.2	78.3	96.5
Anthracene-d10	1719-06-8	10	%	70.3	74.6	71.8	82.0	86.0
4-Terphenyl-d14	1718-51-0	10	%	79.5	90.8	86.7	90.6	121



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				DUP-2	DUP-3	DUP-4	DUP-5	TRIP-P1
Client sampling date / time				18-Feb-2020 00:00	19-Feb-2020 00:00	20-Feb-2020 00:00	20-Feb-2020 00:00	18-Feb-2020 00:00
Compound	CAS Number	LOR	Unit	EP2001971-056	EP2001971-057	EP2001971-058	EP2001971-059	EP2001971-060
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	38.0	42.6	45.3	32.8	36.6
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	1730	2000	1770	250	1610
Iron	7439-89-6	50	mg/kg	4680	4780	5470	430	4140
Vanadium	7440-62-2	2	mg/kg	12	14	14	<2	12
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	5.14	5.28	6.27	1.92	4.71
Cadmium	7440-43-9	0.1	mg/kg	1.0	0.9	1.5	<0.1	0.8
Copper	7440-50-8	1.0	mg/kg	141	153	209	<1.0	124
Lead	7439-92-1	1.0	mg/kg	30.4	26.4	48.1	1.0	24.4
Manganese	7439-96-5	10	mg/kg	59	55	48	17	46
Nickel	7440-02-0	1.0	mg/kg	3.4	3.6	3.3	<1.0	3.4
Silver	7440-22-4	0.1	mg/kg	0.4	0.3	0.6	<0.1	0.3
Zinc	7440-66-6	1.0	mg/kg	299	276	472	2.5	253
EG020T: Total Metals by ICP-MS								
Lithium	7439-93-2	0.1	mg/kg	3.9	4.4	4.0	2.3	3.7
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.04	0.04	0.06	<0.01	0.04
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.72	0.99	1.17	0.23	0.71
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	2.3	2.4	3.2	<0.5	2.8
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	8	10	10	5	7
2-Methylnaphthalene	91-57-6	5	µg/kg	6	<5	6	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	12	15	22	<4	20
Anthracene	120-12-7	4	µg/kg	<4	<4	5	<4	<4
Fluoranthene	206-44-0	4	µg/kg	19	24	35	<4	23
Pyrene	129-00-0	4	µg/kg	22	24	32	<4	29
Benz(a)anthracene	56-55-3	4	µg/kg	11	13	16	<4	12
Chrysene	218-01-9	4	µg/kg	9	11	13	<4	9



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				DUP-2	DUP-3	DUP-4	DUP-5	TRIP-P1
Client sampling date / time				18-Feb-2020 00:00	19-Feb-2020 00:00	20-Feb-2020 00:00	20-Feb-2020 00:00	18-Feb-2020 00:00
Compound	CAS Number	LOR	Unit	EP2001971-056	EP2001971-057	EP2001971-058	EP2001971-059	EP2001971-060
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	15	26	23	<4	15
Benzo(k)fluoranthene	207-08-9	4	µg/kg	8	13	9	<4	7
Benzo(e)pyrene	192-97-2	4	µg/kg	11	18	14	<4	11
Benzo(a)pyrene	50-32-8	4	µg/kg	12	16	14	<4	10
Perylene	198-55-0	4	µg/kg	<4	5	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	7	13	10	<4	6
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	<4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	5	9	6	<4	<4
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	145	197	215	5	149
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	16	22	20	<4	14
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	18	24	22	5	16
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	20	26	24	10	18
EP090S: Organotin Surrogate								
Tripopyltin	----	0.5	%	71.2	65.0	53.0	91.4	59.7
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	91.1	89.9	88.1	89.3	86.2
Anthracene-d10	1719-06-8	10	%	80.7	80.8	78.0	90.2	79.0
4-Terphenyl-d14	1718-51-0	10	%	101	108	94.7	112	71.6



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				TRIP-P2	TRIP-P3	----	----	----
Client sampling date / time				19-Feb-2020 00:00	20-Feb-2020 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP2001971-061	EP2001971-062	-----	-----	-----
				Result	Result	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	52.3	41.1	----	----	----
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	2330	1310	----	----	----
Iron	7439-89-6	50	mg/kg	6220	4370	----	----	----
Vanadium	7440-62-2	2	mg/kg	17	13	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	7.20	5.55	----	----	----
Cadmium	7440-43-9	0.1	mg/kg	1.0	1.3	----	----	----
Copper	7440-50-8	1.0	mg/kg	186	166	----	----	----
Lead	7439-92-1	1.0	mg/kg	35.4	44.4	----	----	----
Manganese	7439-96-5	10	mg/kg	54	49	----	----	----
Nickel	7440-02-0	1.0	mg/kg	4.4	2.8	----	----	----
Silver	7440-22-4	0.1	mg/kg	0.5	0.4	----	----	----
Zinc	7440-66-6	1.0	mg/kg	332	392	----	----	----
EG020T: Total Metals by ICP-MS								
Lithium	7439-93-2	0.1	mg/kg	5.2	3.4	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.07	0.05	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.63	0.83	----	----	----
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	1.3	4.6	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	15	7	----	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg	6	<5	----	----	----
Acenaphthylene	208-96-8	4	µg/kg	<5	<4	----	----	----
Acenaphthene	83-32-9	4	µg/kg	<5	<4	----	----	----
Fluorene	86-73-7	4	µg/kg	<5	<4	----	----	----
Phenanthrene	85-01-8	4	µg/kg	14	11	----	----	----
Anthracene	120-12-7	4	µg/kg	<5	<4	----	----	----
Fluoranthene	206-44-0	4	µg/kg	29	<20	----	----	----
Pyrene	129-00-0	4	µg/kg	28	14	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg	16	7	----	----	----
Chrysene	218-01-9	4	µg/kg	11	5	----	----	----



Analytical Results

Sub-Matrix: MARINE SEDIMENT
 (Matrix: SOIL)

Client sample ID

				TRIP-P2	TRIP-P3	----	----	----
Client sampling date / time				19-Feb-2020 00:00	20-Feb-2020 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP2001971-061	EP2001971-062	-----	-----	-----
				Result	Result	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	22	10	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg	11	4	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg	15	6	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg	14	6	----	----	----
Perylene	198-55-0	4	µg/kg	<5	<4	----	----	----
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	10	4	----	----	----
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<5	<4	----	----	----
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	7	<4	----	----	----
Coronene	191-07-1	5	µg/kg	<5	<5	----	----	----
^ Sum of PAHs	----	4	µg/kg	198	74	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	20	8	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	22	10	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	24	12	----	----	----
EP090S: Organotin Surrogate								
Tripopyltin	----	0.5	%	62.7	95.7	----	----	----
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	87.1	72.4	----	----	----
Anthracene-d10	1719-06-8	10	%	75.6	74.2	----	----	----
4-Terphenyl-d14	1718-51-0	10	%	92.1	89.3	----	----	----



Analytical Results

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

Client sample ID

				Elutriate Water	----	----	----	----
				Client sampling date / time	20-Feb-2020 09:30	----	----	----
Compound	CAS Number	LOR	Unit	EP2001971-064	-----	-----	-----	-----
				Result	----	----	----	----
EN68: Seawater Elutriate Testing Procedure								
Seawater Sampling Date	----	-	-	27/02/2020	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RINSB	----	----	----	----
Client sampling date / time				19-Feb-2020 00:00	----	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2001971-063	-----	-----	-----	-----	-----
Result				----	----	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	<0.01	----	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	<0.001	----	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----	----
Silver	7440-22-4	0.001	mg/L	<0.001	----	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L	<1.0	----	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	----	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	----	----	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	----	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	----	----	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	----	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	----	----	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(a)anthracene	56-55-3	1.0	µg/L	<1.0	----	----	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	----	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	----	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	----	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	----	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	----	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%	23.9	----	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RINSB	----	----	----	----
				Client sampling date / time	19-Feb-2020 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2001971-063	-----	-----	-----	-----
				Result	----	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
2-Chlorophenol-D4	93951-73-6	1.0	%		60.6	----	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		69.6	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		70.6	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%		93.9	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		86.4	----	----	----	----



Surrogate Control Limits

Sub-Matrix: ELUTRIATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP090S: Organotin Surrogate			
Tripopyltin	----	24	116

Sub-Matrix: MARINE SEDIMENT		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP090S: Organotin Surrogate			
Tripopyltin	----	35	130
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	70	130
Anthracene-d10	1719-06-8	70	130
4-Terphenyl-d14	1718-51-0	70	130

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	67
2-Chlorophenol-D4	93951-73-6	29	120
2,4,6-Tribromophenol	118-79-6	10	131
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	34	131
Anthracene-d10	1719-06-8	43	126
4-Terphenyl-d14	1718-51-0	41	142

QUALITY CONTROL REPORT

Work Order	: EP2103295	Page	: 1 of 3
Client	: WA MARINE PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Russell Stevens	Contact	: Nick Courts
Address	: SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370 DUNSBOROUGH, PERTH WA, AUSTRALIA 6281	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: 18WAU-0004 Geraldton Port Sediment Sampling 2021	Date Samples Received	: 25-Mar-2021
Order number	: ----	Date Analysis Commenced	: 30-Mar-2021
C-O-C number	: ----	Issue Date	: 01-Apr-2021
Sampler	: Russell Stevens		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3593554)									
EP2103295-001	SPLIT-S4	EA055: Moisture Content	----	0.1	%	37.2	38.2	2.63	0% - 20%
EK055: Ammonia as N (QC Lot: 3593775)									
EP2103283-002	Anonymous	EK055: Ammonia as N	7664-41-7	20	mg/kg	20	40	58.2	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3593520)									
EP2103295-001	SPLIT-S4	EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3593521)									
EP2103295-001	SPLIT-S4	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 3592282)									
EP2102975-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	8430	9720	14.2	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 3592281)									
EP2102975-001	Anonymous	EK067G: Total Phosphorus as P	----	2	mg/kg	2010	2220	9.94	0% - 20%
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 3593522)									
EP2103295-001	SPLIT-S4	EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	0.2	0.2	0.00	No Limit



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

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

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EK055: Ammonia as N (QCLot: 3593775)								
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	50 mg/kg	93.2	70.0	116
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3593520)								
EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	2.5 mg/kg	106	94.7	106
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3593521)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	95.2	89.8	109
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3592282)								
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	1000 mg/kg	84.2	78.0	112
				<20	100 mg/kg	70.3	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3592281)								
EK067G: Total Phosphorus as P	----	2	mg/kg	<2	440 mg/kg	83.4	78.0	108
				<2	44 mg/kg	86.4	70.0	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 3593522)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	<0.1	2.5 mg/kg	99.9	89.7	108

Matrix Spike (MS) Report



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




Sub-Matrix: **SOIL**


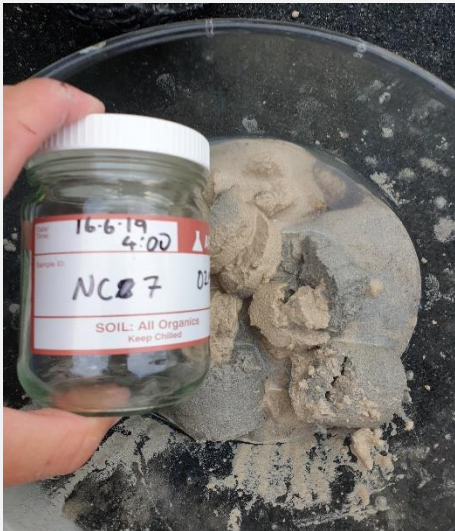
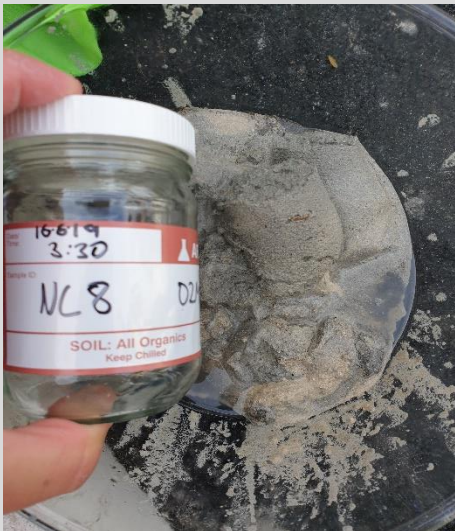
				Matrix Spike (MS) Report			
				Spike Concentration	SpikeRecovery(%) MS	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number			Low	High
EK055: Ammonia as N (QCLot: 3593775)							
EP2103295-001	SPLIT-S4	EK055: Ammonia as N	7664-41-7	50 mg/kg	91.4	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3592282)							
EP2102975-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	105	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3592281)							
EP2102975-002	Anonymous	EK067G: Total Phosphorus as P	----	100 mg/kg	93.9	70.0	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 3593522)							
EP2103349-001	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	2.5 mg/kg	96.6	70.0	130




Appendix E Sample photographs and descriptions



Table E-1 Description of the characteristics of sediment samples taken from the navigation channel 'Probably Clean' sediments.

Location	Depth Interval (m)	Sediment Description	Photograph
NC1	0-0.5	Soft grey/yellow medium to fine sand – some organic matter at surface 1cm.	
NC2	0-0.5	Soft grey/yellow medium to fine sand – some organic matter at surface 1cm	

Location	Depth Interval (m)	Sediment Description	Photograph
NC3	0-0.5	Loose grey/yellow medium to fine sand – some organic matter at surface 1cm	
NC4	0-0.5	Dense grey/yellow medium to fine sand – some organic matter at surface 1cm	
NC5	0-0.5	Soft grey/yellow medium to fine sand – some organic matter at surface 1cm	


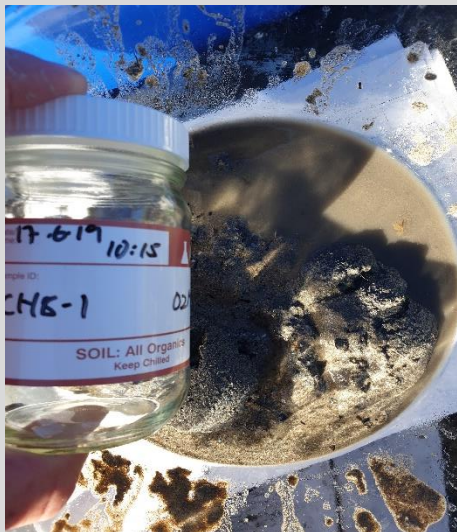
Location	Depth Interval (m)	Sediment Description	Photograph
NC6	0-0.5	Soft yellow/grey medium to fine sand – some organic matter at surface 1cm	 A hand holds a clear plastic jar with a white lid and a label. The label has handwritten text: '16-6-19', '3:45', 'NC6', and '021'. Below the handwritten text, it says 'SOIL: All Organics' and 'Keep Chilled'. The jar is filled with a light-colored, sandy sediment. In the background, a black bucket contains more of the same sediment, with a wooden stick resting inside.
NC7	0-0.5	Soft yellow/grey medium to fine sand – some organic matter at surface 1cm	 A hand holds a clear plastic jar with a white lid and a label. The label has handwritten text: '16-6-19', '4:00', 'NC7', and '021'. Below the handwritten text, it says 'SOIL: All Organics' and 'Keep Chilled'. The jar is filled with a light-colored, sandy sediment. In the background, a black bucket contains more of the same sediment, with a wooden stick resting inside.
NC8	0-0.5	Soft yellow/grey medium to fine sand – some organic matter at surface 1cm	 A hand holds a clear plastic jar with a white lid and a label. The label has handwritten text: '16-6-19', '3:30', 'NC8', and '021'. Below the handwritten text, it says 'SOIL: All Organics' and 'Keep Chilled'. The jar is filled with a light-colored, sandy sediment. In the background, a black bucket contains more of the same sediment, with a wooden stick resting inside.




Location	Depth Interval (m)	Sediment Description	Photograph
NC9	0-0.5	Soft yellow/grey medium to fine sand – some organic matter at surface 1cm	
NC10	0-0.5	Soft yellow/grey medium to fine sand – some organic matter at surface 1cm	
NC11	0-0.5	Soft grey/yellow medium to fine sand – some organic matter at surface 1cm.	




Location	Depth Interval (m)	Sediment Description	Photograph
NC12	0-0.5	Soft grey/yellow medium to fine sand – some organic matter at surface 1cm.	
NC13	0-0.5	Soft yellow/grey medium to fine sand – some organic matter at surface 1cm.	
NC14	0-0.5	Soft grey/yellow medium to fine sand – some organic matter at surface 1cm.	




Location	Depth Interval (m)	Sediment Description	Photograph
NC17	0-0.5	Soft, Grey medium sand – no organic matter or shell fragments present. Presence of an odour	
NC18	0-0.5	Dense, Grey medium sand – no organic matter or shell fragments present. Presence of an odour	
NC19	0-0.5	Soft, Grey medium sand – no organic matter or shell fragments present. Presence of an odour	

Table E-2 Description of the characteristics of sediment samples taken from the inner harbour and Berth 6/7 berth pocket 'Suspect' sediments.

Location	Depth Interval (m)	Sediment Description	Photograph
CH7	0-0.5	Soft, fine silty sand – grey, organic smell. Foreign material and shell grit present.	 A photograph showing a clear plastic jar with a white cap and a label. The label has handwritten text: '17-6-19 9:55', 'CH7-1', and 'O2'. Below this, it says 'SOIL: All Organics Keep Chilled'. The jar is being held next to a metal bowl containing a grey, silty sand sediment. The sediment is soft and has a fine texture. There are some darker, organic-looking clumps and small pieces of shell grit visible in the sediment.
CH8-S	0-0.5	Soft, fine silty sand – grey/brown, organic smell. Foreign material and a medium level of shell grit present.	 A photograph showing a clear plastic jar with a white cap and a label. The label has handwritten text: '17-6-19 10:15', 'CH8-S-1', and 'O2'. Below this, it says 'SOIL: All Organics Keep Chilled'. The jar is being held next to a metal bowl containing a grey/brown, silty sand sediment. The sediment is soft and has a fine texture. There are some darker, organic-looking clumps and a medium level of shell grit visible in the sediment.

Location	Depth Interval (m)	Sediment Description	Photograph
CH8-D	0.5-0.8	Soft, fine silty sand – grey, organic smell. Foreign material and shell grit present.	
CH10	0-0.5	Soft, medium fine sand – grey/brown, with some fine shell grit	
CH11	0-0.5	Soft, fine silty sand – grey/brown with some foreign material and shell fragments.	

Location	Depth Interval (m)	Sediment Description	Photograph
CH12-S	0-0.5	Soft, fine silty sand – grey/brown, with some foreign material and shell fragments	 A hand holds a clear glass jar with a white cap and a label. The label has handwritten text: '17-6-19 1:10', 'CH12-S', and '02M'. Below the handwritten text, it says 'SOIL: All Organics Keep Chilled'. The jar is filled with a greyish-brown sediment. In the background, a clear plastic bucket contains more of the same sediment, with some larger, irregular clumps visible.
CH12-D	0.5-0.7	Soft, fine silty sand – grey, with some foreign material and shell fragments	 A hand holds a clear glass jar with a white cap and a label. The label has handwritten text: '17-6-19 4:20', 'CH12-D', and '02M'. Below the handwritten text, it says 'SOIL: All Organics Keep Chilled'. The jar is filled with a grey sediment. In the background, a clear plastic bucket contains more of the same sediment, with some larger, irregular clumps visible.
CH13	0-0.5	Soft, fine silty sand – grey with some shell fragments	 A hand holds a clear glass jar with a white cap and a label. The label has handwritten text: '17-6-19 4:00', 'CH13', and '02M'. Below the handwritten text, it says 'SOIL: All Organics Keep Chilled'. The jar is filled with a grey sediment. In the background, a clear plastic bucket contains more of the same sediment, with some larger, irregular clumps visible.

Location	Depth Interval (m)	Sediment Description	Photograph
CH14-S	0-0.5	Dense, fine silty sand – grey with some foreign material and shell fragments	
CH14-D	0.5-0.9	Dense, fine silty sand – grey with some foreign material and shell fragments	
CH15	0-0.5	Soft, fine silty sand – dark grey, with some foreign material and shell fragments	

Location	Depth Interval (m)	Sediment Description	Photograph
CH16	0-0.5	Soft, Fine silty sand – Dark grey, no foreign material or shell fragments	
CH17	0-0.5	Soft, Medium fine sand – Grey, no foreign material or shell fragments	
CH18	0-0.5	Soft, Medium fine sand – Grey, no foreign material or shell fragments	







Location	Depth Interval (m)	Sediment Description	Photograph
CH19	0-0.5	Soft, Medium fine sand – Grey, no foreign material or shell fragments	

Table E-3 Description of the characteristics of sediment samples taken from the Berth 3, 4 and 5 berth pocket 'Probably Contaminated' sediments.

Location	Depth Interval (m)	Sediment Description	Photograph
CH1	0-0.5	Soft, medium fine sand – grey/brown, with high levels of foreign material and some shell grit present.	 A photograph showing a sediment sample in a clear plastic jar. The jar has a white label with handwritten text: '18-6-19 8:50', 'CH1-1', and 'SOIL: All Organisms Keep Cool'. The sediment inside the jar is a greyish-brown, medium-fine sand with some darker, clumpy material and small shell fragments. The jar is being held next to a larger, dark, circular container filled with similar sediment.
CH2	0-0.5	Soft, fine silty sand – dark grey, with medium levels of foreign material and some shell grit present.	 A photograph showing a sediment sample in a clear plastic jar. The jar has a white label with handwritten text: '18-6-19 9:15', 'CH2-1', and 'SOIL: All Organisms Keep Cool'. The sediment inside the jar is a dark grey, fine silty sand with some clumpy material and small shell fragments. The jar is being held next to a larger, dark, circular container filled with similar sediment.

Location	Depth Interval (m)	Sediment Description	Photograph
CH3	0-0.5	Soft, medium fine sand – dark grey, with a medium level of foreign material and some shell grit present.	
CH4	0-0.5	Soft, medium fine sand – grey, with some foreign material and shell grit present.	
CH5	0-0.5	Soft, medium fine sand – grey, with some foreign material and a medium level of shell grit and fragments present.	



Location	Depth Interval (m)	Sediment Description	Photograph
CH6	0-0.5	Soft, fine sand – grey, with some foreign material and shell grit present.	

Table E-4 Description of the characteristics of sediment samples taken from the Nearshore Material Placement Areas.

Location	Depth Interval (m)	Sediment Description	Photograph
NPA1	0-0.5	Soft, medium fine sand – brown, with some shell grit present.	

Location	Depth Interval (m)	Sediment Description	Photograph
NPA2	0-0.5	Soft, medium fine sand – brown, with some shell grit present.	 A photograph of a sediment sample labeled NPA2. The sample is a brown, medium-fine sand with some shell grit. It is shown in a clear plastic jar with a white lid. The jar has a label that reads "12-5-21", "NPA2", "02M", and "SOIL: Organics and Inorganics Keep Chilled". The jar is placed on a dark, circular surface.
NPA3	0-0.5	Soft, medium fine sand – brown, with some shell grit present.	 A photograph of a sediment sample labeled NPA3. The sample is a brown, medium-fine sand with some shell grit. It is shown in a clear plastic jar with a white lid. The jar has a label that reads "12-5-21", "NPA3", "02M", and "SOIL: Organics and Inorganics Keep Chilled". The jar is placed on a dark, circular surface.
NPA4	0-0.5	Soft, medium fine sand – brown, with some shell grit present.	 A photograph of a sediment sample labeled NPA4. The sample is a brown, medium-fine sand with some shell grit. It is shown in a clear plastic jar with a white lid. The jar has a label that reads "12-5-21", "NPA4", "02M", and "SOIL: Organics and Inorganics Keep Chilled". The jar is placed on a dark, circular surface.

Location	Depth Interval (m)	Sediment Description	Photograph
NPA5	0-0.5	Soft, medium fine sand – brown, with some shell grit present.	No Photo Available

Appendix F Field QA/QC Results

Table F-1 Relative Standard Deviation (RSD) for Metals, TBTs and TOC in field split inter-laboratory sediment samples

Sample ID	Al	As	Cd	Cu	Pb	Mn	Ni	Zn	Ag	Fe	V	Hg	TBT	TOC
Units	mg/kg											ugSn/kg	%	
LoR	1	0.1	0.1	1	1	1	1	1	1	1	2	0.02		
CH8-S	1900	3.9	0.6	110	17	34	3	170	0.5	5200	12	0.06	2.8	1.2
SPLIT-1 (P)	1400	3.7	0.5	86	13	33	2	130	0.5	3900	9	0.04	-	-
SPLIT-1 (S)	1460	3.74	0.5	74.8	13.6	37	2.3	147	0.2	3170	9.5	0.02	<0.5	<1
RSD (%)	17%	3%	11%	20%	15%	6%	28%	13%	43%	25%	16%	50%	167%	82%
CH2	2400.00	6	1.10	200.00	31	47.00	4.00	360.00	0.50	8100.00	17.00	0.09	-	-
SPLIT-2 (P)	3100	6.9	1.3	200	31	50	5	350	0.5	8400	18	0.09	-	-
SPLIT-2 (S)	2120	6.22	1.2	190	36.1	57	4.8	377	0.6	6020	16.8	0.05	-	-
RSD (%)	20%	7%	8%	3%	9%	10%	16%	4%	11%	17%	4%	30%		
CH3	2800	7.1	3.4	340	65	59	5	950	1	9600	19	0.11	12	1.9
SPLIT-3 (P)	2900	6.1	3.5	320	65	50	4	940	0.5	8700	18	0.1	-	-
SPLIT-3 (S)	2160	6.33	3.8	279	76.8	52	4.2	941	1	6290	16.8	0.06	2.2	1.11
RSD (%)	15%	8%	6%	10%	10%	9%	16%	1%	35%	21%	6%	29%	138%	52%

(**RSD>50%**).

Table F-2 Relative Standard Deviation (RSD) for nutrients in field split inter-laboratory sediment samples

Sample ID	TP	TN	TKN	NOx
Units	mg/kg			
LoR	1	10	10	1
CH3-1	490	1400	1400	<1
SPLIT-P4	390	2,000	2,000	<1
SPLIT-S4	378	660	660	<1

Sample ID	TP	TN	TKN	NO _x
<i>RSD (%)</i>	<i>15%</i>	<i>50%</i>	<i>50%</i>	<i>0%</i>

(*RSD>35%*).

Table F-3 Relative Standard Deviation (RSD) for Metals in field triplicate sediment samples

Sample ID	Al	As	Cd	Cu	Pb	Mn	Ni	Zn	Ag	Fe	V	Hg
Units	mg/kg											
LoR	1	0.1	0.1	1	1	1	1	1	1	1	2	0.02
CH1-1	2000	6.3	0.80	99	16	59	3.0	180	0.5	5400	14	0.07
CH1-2	2400	6.6	1.30	120	19	53	4.0	200	0.5	5900	16	0.03
CH1-3	2500	6.3	0.8	110	21	57	4	190	0.5	6000	15	0.06
RSD (%)	12%	3%	30%	10%	13%	5%	16%	5%	0%	6%	7%	39%
CH5-1	1200	4.1	0.6	81	15	35	2	210	0.5	4900	10	0.04
CH5-2	1300	4.1	0.6	83	15	36	2	230	0.5	5300	11	0.04
CH5-3	1100	4.6	0.50	67	12	33	2	140	0.5	4300	9	0.03
RSD (%)	8%	7%	10%	11%	12%	4%	0%	24%	0%	10%	10%	16%
CH10-1	1500	4.1	0.4	53	8	30	3	83	0.5	4500	9	0.03
CH10-2	1700	4.9	0.5	61	9	29	3	94	0.5	5100	10	0.03

Sample ID	Al	As	Cd	Cu	Pb	Mn	Ni	Zn	Ag	Fe	V	Hg
CH10-3	1600	3.8	0.4	54	8	28	2	87	0.5	4600	9	0.04
RSD (%)	6%	13%	13%	8%	7%	3%	22%	6%	0%	7%	6%	17%
CH17-1	420	2.8	0.1	12	1	25	1	15	0.05	1100	3	0.005
CH17-2	420	3.1	0.1	12	2	26	1	14	0.05	1100	3	0.005
CH17-3	410	6.0	0.2	14	1	27	0.5	16	0.05	1200	4	0.005
RSD (%)	1%	45%	43%	9%	43%	4%	0%	7%	0%	5%	17%	0%

(**RSD>50%**).

Table F-4 Relative Standard Deviation (RSD) for nutrients in porewater for field triplicate sediment samples

Sample ID	TP	TN	TKN	NOx
LoR	1	10	10	1
CH3-1	490	1400	1400	<1
CH3-2	480	2100	2100	<1
CH3-3	500	2000	2000	<0.001
RSD (%)	2%	21%	21%	86%

(**RSD>50%**).