

SAP Implementation Report

New Marine Facilities to Service
Mandorah and Cox Peninsula

ZMD01890



Prepared for
Department of Infrastructure, Planning and
Logistics

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1 Introduction

1.1 Project Background

The existing Mandorah Jetty and Boat Ramp are key infrastructure facilities servicing the Mandorah, Wagait and Belyuen communities, as well as visitors to the area from Darwin and surrounds. Mandorah Jetty supports the only ferry service from Darwin to the Cox Peninsula. The Mandorah boat ramp is located just south of the jetty, with both facilities sharing a common onshore carpark facility.

Previous studies (e.g. Jacobs, 2016 and 2019) identified shortcomings in the design of the existing facilities, such as Disability Discrimination Act (DDA) non-compliance of the existing jetty, and investigated various options to improve the ferry berthing facility and boat ramp. The Department of Infrastructure, Planning and Logistics (DIPL) has assessed options for new marine facilities at Mandorah. The key project objectives included selection and design of a facility that:

- > Addresses issues faced by the existing Mandorah Jetty and boat ramp. These issues include the highly exposed nature of the site, DDA non-compliance, passenger safety issues and safety and sedimentation issues of the existing boat ramp;
- > Minimises construction and whole-of-life costs;
- > Allows for uninterrupted ferry service operation during construction; and
- > Provides a safe and enjoyable passenger experience.

The project has now developed, assessed and designed a preferred option for new marine facilities at Mandorah. The facilities comprise a dredged basin, two large breakwaters, boat ramp, gangway and pontoon, and onshore ferry terminal and parking facilities (**Figure 1-1**).

1.1.1 Project Location

A locality plan is presented in **Figure 1-1**, showing the proposed dredging area and disposal site. Further description of the site location is detailed in **Section 2**.

1.2 Purpose of this Document

Following review of a draft Sampling and Analysis Plan (SAP) provided by DIPL, Cardno prepared a subsequent SAP (Cardno, 2019), detailing the proposed locations and sampling and analysis methodologies for dredge material sampling within the project footprint. This SAP Implementation Report summarises the sampling activities and details their outcomes. It assesses the proposed dredge spoil's suitability for reuse/disposal, in line with relevant guidelines (NAGD, 2009; DWER, 2014). This will be used to inform referral of the project to the Northern Territory Environment Protection Authority (NT EPA) and inform any associated needs for management, treatment and/or placement of the material.

It should be noted that the proposed project has evolved since the development and implementation of the SAP. This report assesses the outcomes of the investigations with respect to latest project design. The results are still considered valid, particularly since a much smaller volume of dredge material is now known to require characterisation at the site.

1.2.1 Objectives

The objectives of this SAP Implementation Report include:

- > Provide an assessment of the reliability of the approved SAP's implementation (Quality assurance and quality control – QA/QC);
- > Characterisation of the unconsolidated ('non-geological') sediment portion of dredge spoil material, with respect to its acceptability for offshore disposal in line with relevant guidelines (NEPM 2013; DWER 2014; NAGD 2009);

- > Characterise the particle size distribution (PSD) of sediment within the project area to inform sediment transport modelling; and
- > Assessment of any risk to the environment posed by contaminants of potential concern necessary to inform the project's EPA referral as well as the accompanying Draft Dredging and Spoil Disposal Management Plan (DSDMP).

1.2.2 Document Structure

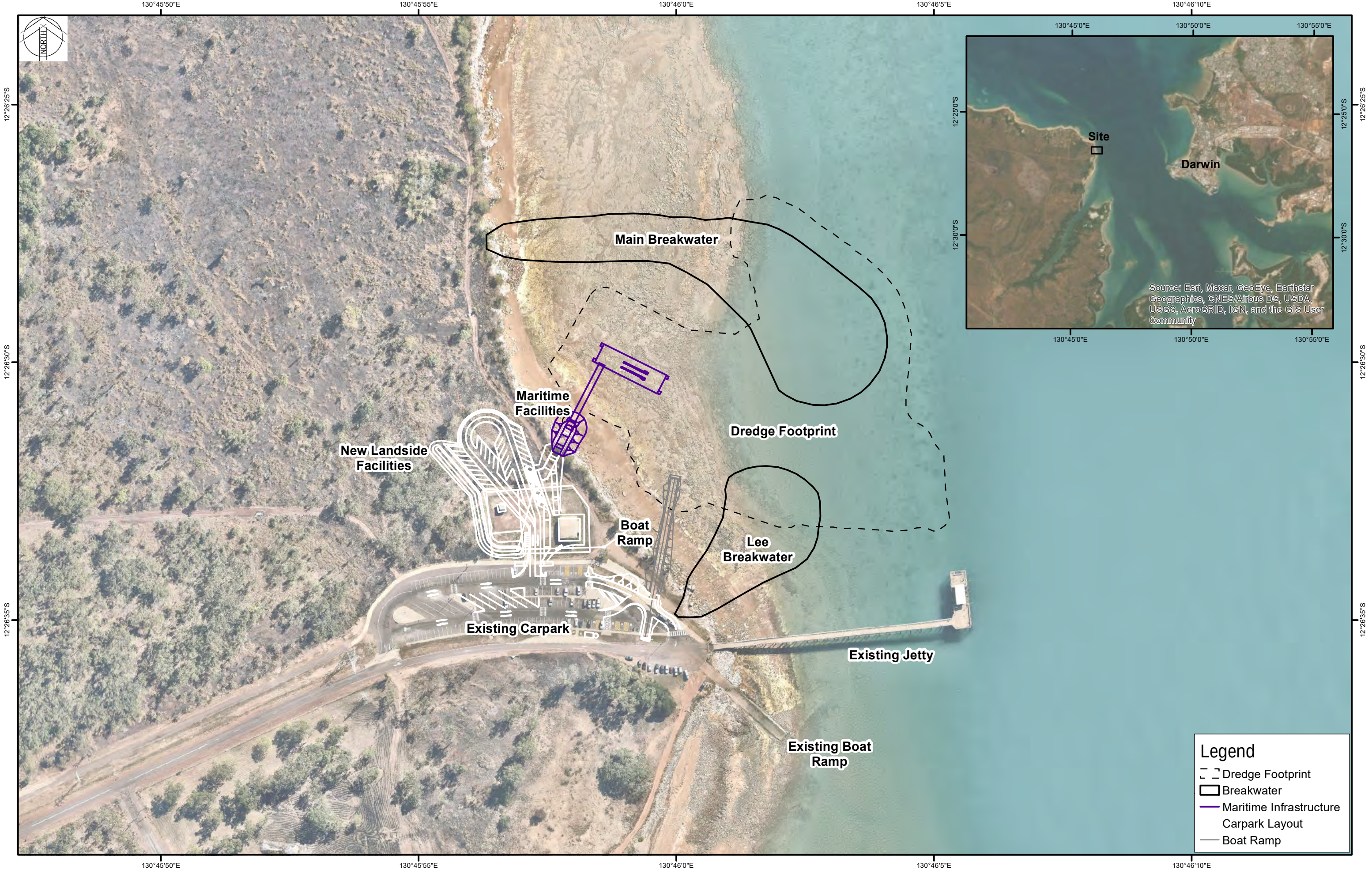
The document has been structured as follows:

- > This Section (1) introduces the project and context and purpose of this report;
- > **Section 2** provides an appreciation of the project site, outlines the proposed dredging activities, relevant historical data and contaminants of potential concern;
- > **Section 3** details the sampling methodology and results;
- > **Section 4** details a risk assessment, given the findings of the investigations; and
- > **Section 5** outlines the conclusions of the investigations and their implications in terms of the overall project.

1.3 Reference Documents

Various investigations and studies have been carried out as part of the overall development and design project to date. This report documents a component of these investigations. The following documents are referenced in, or should be given due consideration when reading, this report:

- > *Environmental Referral Report* (Cardno, 2022a): This document provides the necessary details to refer the project to the NT EPA. This *SAP Implementation Report* informs assessment of a component of the project's environmental risk, in terms of disturbance of contaminated material during dredging;
- > *Sediment Transport Report* (Cardno, 2022b): Details siltation, sedimentation and plume dispersion investigations associated with the project. The physical properties of sediment identified in this report are important to inform sediment transport modelling (i.e. PSD and density);
- > *Marine Environment Report* (Cardno, 2022c): Details investigation of the marine environment to inform assessment of associated environmental impacts of the project. This *SAP Implementation Report* is an Appendix of that report, detailing assessment of marine environmental (sediment) quality of the project site;
- > *Draft Dredging and Spoil Disposal Management Plan (DSDMP)* (Cardno, 2022d): Defines the dredging actions and necessary controls to avoid or minimise risk for, and impact to, the marine environment. The outcomes of this report inform dredging and disposal management;
- > *Design Report* (Cardno, 2022e): Details the design requirements, basis, inputs, calculations and outcomes for the new proposed infrastructure. Relevant in terms of detailed dredging design; and
- > *Geotechnical Report* (Cardno, 2022f): Details the geotechnical information and investigations for the project site that inform design of the new proposed infrastructure. Relevant as the geotechnical sampling was undertaken in conjunction with sediment quality sampling/testing. This report also details the geological composition of the dredging area.



2 Site Appreciation

The desktop review was undertaken with reference to published literature, technical reports, publicly accessible databases and mapping relevant to the Darwin Region, Project site and its surrounds. The desktop review provided background on the area's environmental status and informed the gap analysis and, therefore, required field investigations. Sources consulted during the desktop review included:

- > High-resolution aerial imagery sourced from Nearmap, Metromap and/or Google Earth;
- > Publicly available databases;
- > Relevant historical investigations at the site and in the surrounding region;
- > Environmental Management Register and Contaminated Land Register for the properties on which works are proposed; and
- > Technical reports applicable to the Project's activities and adjoining environment produced during the Ichthys Nearshore Environmental Monitoring Project.

2.1 Site Identification

The existing Mandorah Jetty and Boat Ramp are located at Picnic Point near the eastern tip of the Cox Peninsula and within the Wagait Shire boundaries approximately six kilometres to the west of Darwin. Access to Mandorah from Darwin is via a regular ferry service, or by driving approximately 128 km and 90 minutes from the Darwin CBD by road

The existing facilities support the single ferry service providing the quickest travel between Darwin and Cox Peninsula. Existing facilities associated with the Mandorah Jetty and Boat Ramp include:

- > The Mandorah Jetty;
- > Single lane concrete boat launch and retrieval ramp; and
- > Landside facilities and amenities including carparks and boat trailer parking.

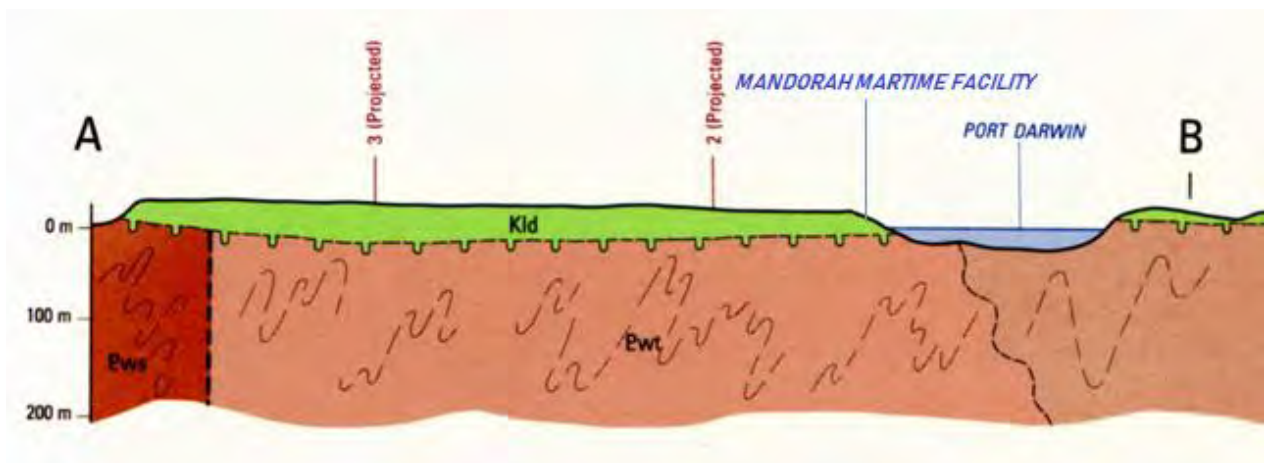
2.2 Regional Geology

The Mandorah area is characterised by a distinct wet-dry tropical monsoonal weather system, which has created the geological conditions as seen today. Generally, coastal regions of the Northern Territory display Cenozoic regolith consisting iron and aluminium rich weathered laterites overlying Cretaceous marine sediments. Refer to *Geotechnical Investigations Report* (Cardno, 2022f) for detailed geological assessments of the area.

In the Mandorah area, basement rock of quartz-rich gneiss is unconformably overlain by Cretaceous claystones, both montmorillonitic and kaolinitic (**Figure 2-1, Figure 2-2**)



Figure 2-1 Mandorah Regional Geology (Source: Darwin, NT Australia 1:250,000 Geological Series)



Qcr	Quaternary – sand; shelly sand; coralline sand.	Czs, Czl	Cenozoic – unconsolidated sand, ferruginous and clayey, sandy and gravelly soils: commonly containing limonite pisolites.
Qcl	Quaternary – sand; silt; clay.	Kld	Cretaceous – Kaolinitic claystone, commonly radiolaria-rich, montmorillonitic when fresh; minor silty claystone.
Pws	Proterozoic - marble, in places graphitic; ara-amphibolite; calc-silicate gneiss; quartz feldspar-biotite gneiss.	Pwt	Proterozoic - quartz-feldspar-biotite gneiss, commonly containing garnet and sillimanite; quartzitic gneiss; quartzite, minor quartz-feldspar-muscovite gneiss.

Figure 2-2 Cross Section of Mandorah Geology (Source: Darwin, NT Australia 1:250,000 Geological Series)

2.3 Potential Acid Sulfate Soils (PASS)

Available PASS mapping indicates ASS has a low potential risk to occur in onshore areas of the site, while the intertidal zones within the site have been mapped as having a high probability of ASS occurrence.

It should also be noted that a large portion of the investigation took place in an offshore setting that is not covered by traditional ASS maps. Refer to *Geotechnical Investigations Report* (Cardno, 2022f) for detailed assessments of ASS in the area.

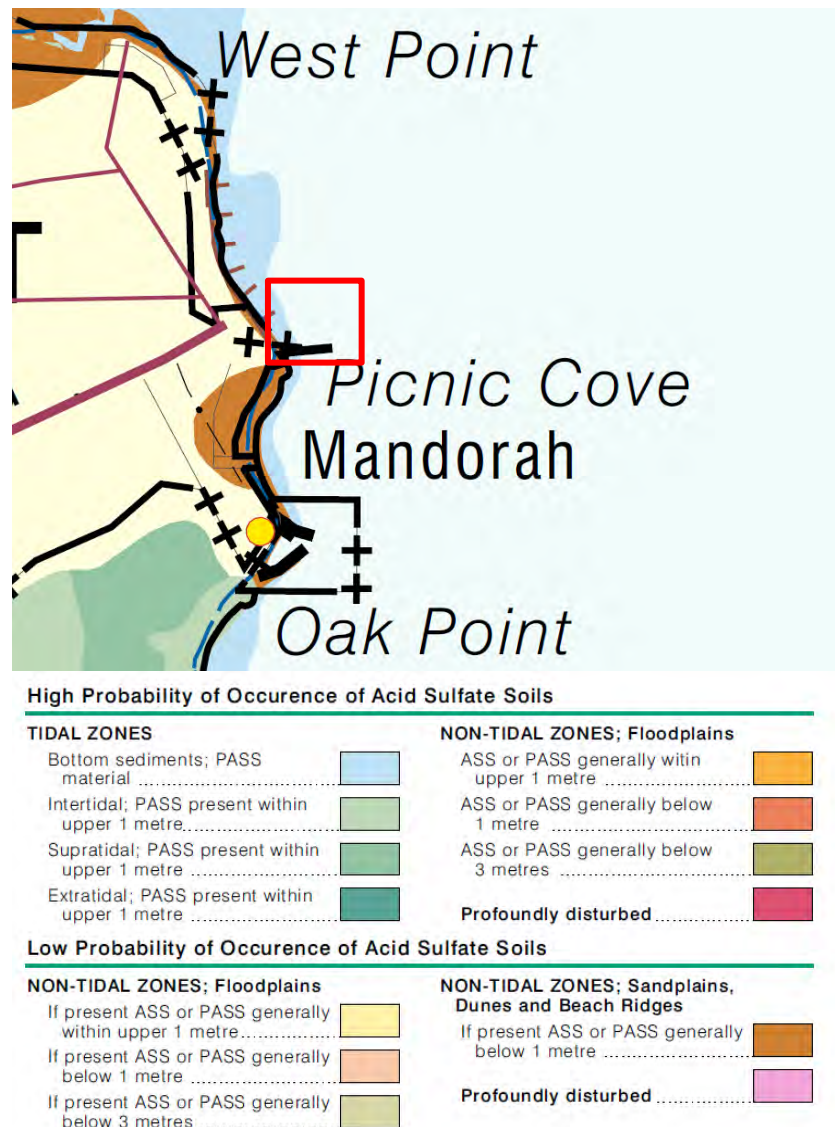


Figure 2-3 PASS with investigation area outlined in red (Source: Greater Darwin Region Acid Sulfate Soils Sheet 5073-2)

2.4 Surrounding Land Uses

The existing jetty and boat ramp comprise infrastructure and allow use within both the marine and terrestrial environment. Marine and onshore land uses within, and adjacent to, the Project area are summarised below.

2.4.1 Marine Uses

- > Recreational fishing – land-based and from boat;
- > Commercial ferry operations; and
- > Boat launching and retrieving.

2.4.2 Terrestrial Land Uses

- > Existing buildings (abandoned and in use), car parking, roads and paths;
- > Residential development;
- > Cox Country Club;
- > Aboriginal and WWII heritage sites; and
- > Wagait Beach recreational use and camping.

2.5 Proposed Dredging

The proposed dredging layout (**Figure 2-4**) comprises:

- > Approach channel ($\approx 5,700 \text{ m}^2$):
 - Dredge level: -6.8 m AHD
 - Average depth below seabed: 3.5m
- > Turning basin and ferry berth ($\approx 11,000 \text{ m}^2$):
 - Dredge level: -6.4 m AHD
 - Average depth below seabed: 5.0 m
- > Boat ramp access ($\approx 500 \text{ m}^2$):
 - Dredge level: -2.75 m AHD
 - Average depth below seabed: 1.5 m

The proposed sediment disturbance area also includes:

- > Main breakwater ($\approx 9,000 \text{ m}^2$);
- > Lee breakwater ($\approx 3,500 \text{ m}^2$);
- > Boat ramp ($\approx 900 \text{ m}^2$); and
- > Reclaimed, rock-armoured causeway connecting land to the gangway and/or access jetty ($\approx 600 \text{ m}^2$).
- > Many of these areas overlap the dredging footprint (i.e. due to battering and bed preparation). The areas do not add to the dredging volume, but it should be considered that surface sediments are likely to be disturbed in these areas.

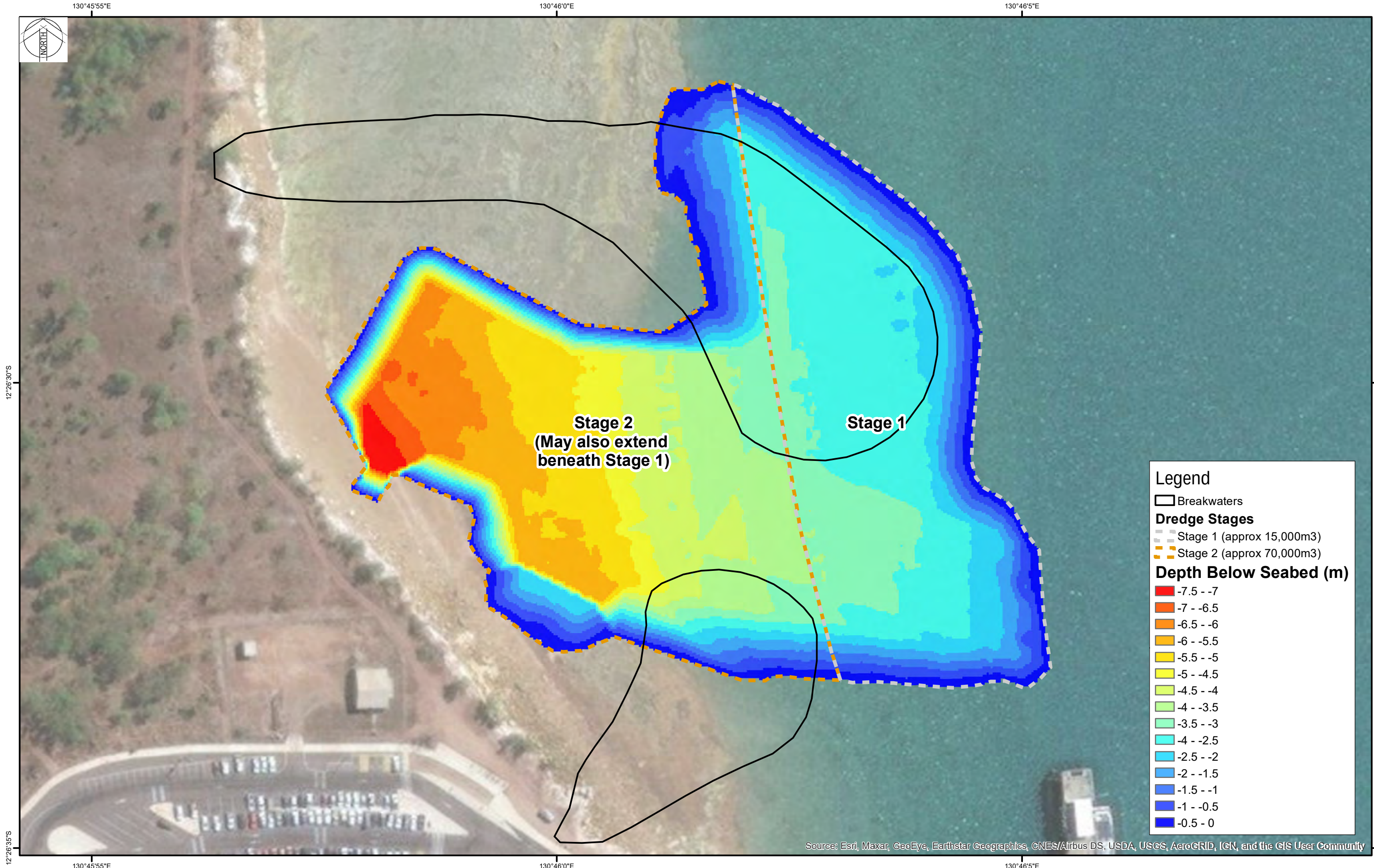
The total proposed dredging volume of approximately $85,000 \text{ m}^3$ comprises:

- > Approximately $15,000 \text{ m}^3$ of unconsolidated marine sediments; and
- > Approximately $70,000 \text{ m}^3$ of natural geological material (varied strength rock).
- > Unconsolidated dredge material (sediment) is proposed to be extracted first by cutter-suction dredge (CSD) (Stage 1), followed by a backhoe dredger that will remove rock material (Stage 2). The timing of these two dredging stages may overlap.

2.5.1 Reuse and Disposal

In accordance with NAGD, all soft sediments (approximately $15,000 \text{ m}^3$) are classified as suitable for offshore disposal (see **Section 5**) and are proposed to be piped offshore approximately 1km north of the project site (**Figure 2-5**). The proposed disposal method is by dispersal through the water column, with pipe outlet at the surface. This disposal action has been modelled in the *Sediment Transport Report* (Cardno, 2022b) with environmental controls outlined in the Draft *DSDMP* (Cardno, 2022d).

A portion of the rock material dredged (approximately $30,000$ to $35,000 \text{ m}^3$) will be placed into the core of the breakwater structures, as well as boat ramp and causeway. The remaining rock material will be transported offsite for use in other projects.



Legend

Breakwaters

Dredge Stages

Stage 1 (approx 15,000m3)

Stage 2 (approx 70,000m3)

Depth Below Seabed (m)

-7.5 - -7

-7 - -6.5

-6.5 - -6

-6 - -5.5

-5.5 - -5

-5 - -4.5

-4.5 - -4

-4 - -3.5

-3.5 - -3

-3 - -2.5

-2.5 - -2

-2 - -1.5

-1.5 - -1

-1 - -0.5

-0.5 - 0



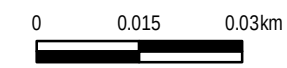
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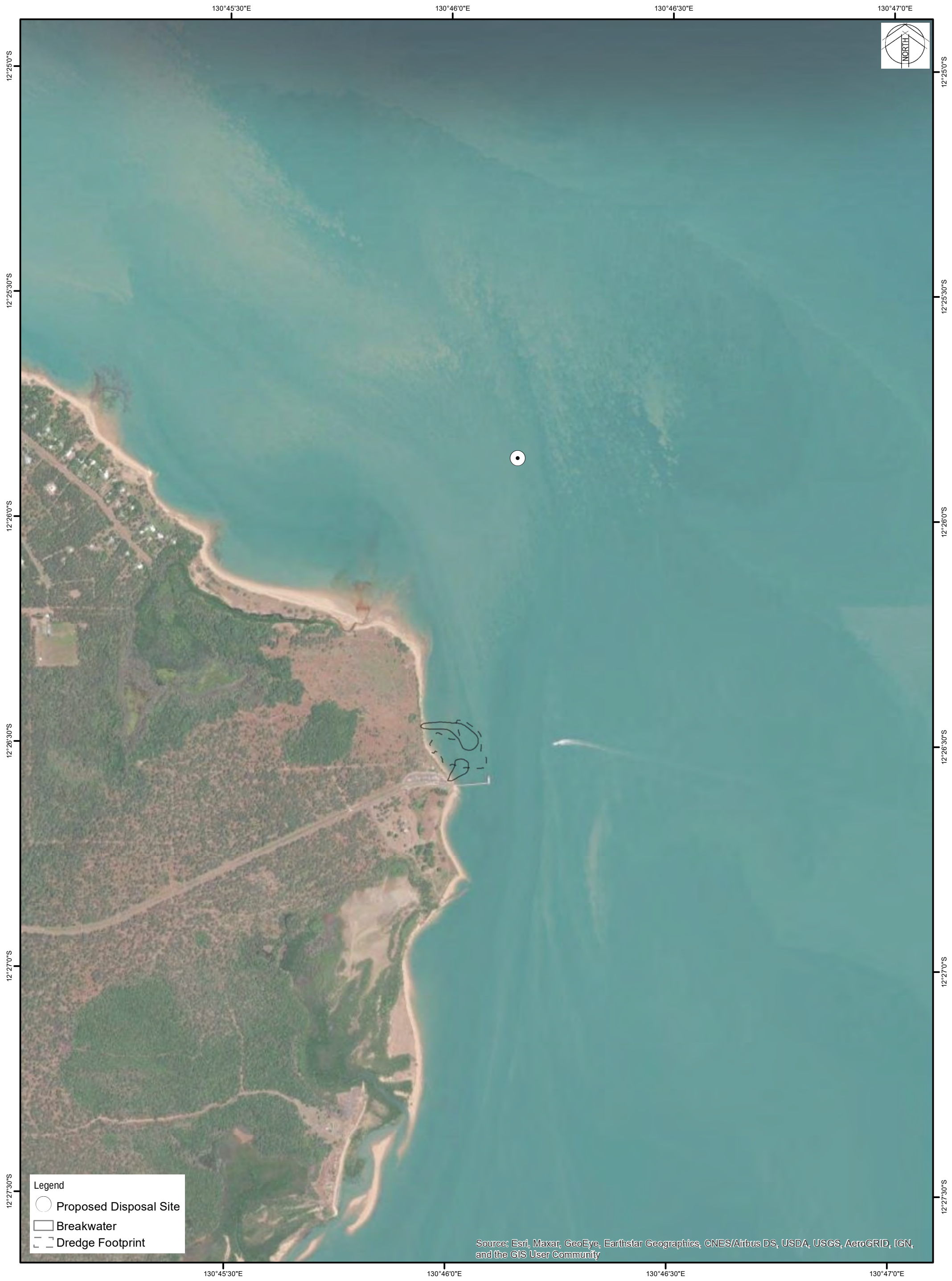
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Legend

- Proposed Disposal Site
- ▭ Breakwater
- - - Dredge Footprint

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



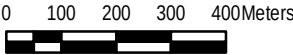
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PROPOSED DISPOSAL SITE

MANDORAH MARINE FACILITIES
SAP IMPLEMENTATION REPORT

FIGURE 2-5

2.6 Previous Investigations

2.6.1 Water Quality

2.6.1.1 Site Specific Data and Modelling

Baseline water quality, in terms of turbidity or suspended sediment concentration, is well understood at the project site, with monitoring being conducted continuously by Cardno for over 2 years during the INPEX Nearshore Environmental Monitoring Program. Changes to suspended sediment concentrations at the site are associated with tidal flow, wave action and seasonal rainfall runoff from Woods Inlet. The project has the potential to alter suspended sediment concentrations significantly during dredging and construction. The facility itself may also alter suspended sediment patterns in the area by changing the local hydrodynamic regime. These effects have been considered by modelling sediment transport processes and are detailed in the *Sediment Transport Report* (Cardno, 2022b).

2.6.1.2 Darwin Harbour Region Report Cards

Ongoing water quality monitoring of Darwin Harbour is undertaken by the Department of Environment, Parks and Water Security's (DEPaWS) Aquatic Health Unit. The water quality monitoring has been ongoing since 2009 and includes the following categories/parameters:

- > Algae – Chlorophyll-a;
- > Dissolved Oxygen;
- > Water Clarity – Turbidity (NTU); and
- > Nutrients – Filterable Reactive Phosphorus, Ammonia as N and NO_x.

Supplementary parameters include:

- > Salinity;
- > Temperature; and
- > pH.

Mandorah lies within 'Zone 5 – Middle Harbour' for the monitoring program, which was reported as 'very good' for all parameters except nutrients ('good') for the annual 2020 report card (DEPaWS, 2022). Historically, water quality has been reported as 'very good' overall for the zone, sporadically dropping to 'good'. None of the field monitoring locations are in close proximity to the project location.

2.6.2 Sediment Quality

2.6.2.1 Darwin Harbour

Numerous broadscale monitoring and research programs have been undertaken in Darwin Harbour to characterise its marine sediments (Munksgaard et al 2013; URS 2009; Fortune 2006). Results from these studies indicate that nearshore seabeds vary from mud, fine- to medium-grained muddy sand, shell grit, medium- to coarse-grained gravel, pebble and cobble, and rocky reef. Intertidal areas adjacent to the coast are mainly characterised by mud and muddy fine- to medium-grained sand. Sediments in channels are mainly comprised of shell grit and coarse-grained sand, with large cobbles also found in the channel adjacent to Cullen Bay.

Analysis of potential contaminants in Darwin Harbour such as metals (including metalloids) determined that arsenic concentrations commonly exceed the low (20 mg/kg) and high (70 mg/kg) interim sediment quality guidelines Screening Levels (ANZECC and ARMCANZ 2000a). However, these high concentrations have been attributed to local geology (weathering of arsenic rich coastal substrata) rather than anthropogenic sources (Fortune, 2006). Furthermore, previous bioavailability testing has indicated that only a small proportion is bioavailable indicating that it is unlikely to be toxic in the marine environment.

A range of other metals (e.g. chromium, mercury, nickel and silver) have also been recorded to exceed Screening Levels for individual samples; however, their mean concentrations have always remained below Screening Levels.

Few programs have analysed samples for other contaminants such as organic compounds. The sampling undertaken during the EIS phase of the Inpex Project (URS, 2009) is the most comprehensive in the area and found that tributyltin (TBT), BTEX, polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs) were all below the laboratories LOR. The majority of samples analysed for PAHs and TPHs have also been below LOR.

2.6.2.2 Mandorah

Existing data relating to sediment quality, including properties of surficial sediments within the proposed dredge area is limited. Only 4 samples were collected by Douglas Partners. These results indicate that sands and marine sediments (silts and gravelly sand) overlay very low to low strength (with some Medium strength bands) rocks of the Darwin Member and extremely low strength meta-siltstone (which underlies that Darwin Member at the landward end of the development). No previous sediment chemistry testing is understood to have occurred at the site.

2.7 Legislation and Guidance

The scope of works was undertaken in accordance with the following applicable industry standards and guidelines:

- > *National Assessment Guidelines for Dredging (NAGD)*. Department of the Environment, Water, Heritage and the Arts, 2009;
- > *Assessment and Management of Contaminated Sites*. Department of Water and Environmental Regulation, 2014;
- > *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018); and
- > *Handbook for Sediment Quality Assessment* (CSIRO, 2005).

2.8 Contaminated Sites

As defined by the NT EPA and in reference to the WMPC Act, *contaminated land is land (including the water and air on, above or under the land) which:*

- > contains a pollutant in a concentration above naturally occurring levels, which is causing a risk to human health or the environment; or
- > contains a pollutant in a concentration above naturally occurring levels, which has the potential to cause a risk to human health or the environment in the future if not managed appropriately.

The Project Area and adjacent waters are not known sites of contamination according to the NT Environment Protection Authority (EPA) Public Register for Contaminated Land Audits (NT EPA, 2021).

2.9 Contaminants of Potential Concern

The following activities were outlined as potential contamination sources based upon known site history and activities occurring at the site:

- > Ferry servicing and maintenance;
- > Port/dock/wharf activities (including dredge spoil and wharf constructions);
- > Recreational fishing vessel activities

The following contaminants of potential concern (CoPC) were identified, based on the low likelihood of contamination in the sediments and historical use, as well as the proposed disposal of the material:

- > Metals (Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb & Zn);

- > Monocyclic aromatic hydrocarbons (e.g. benzene, toluene, ethyl benzene and xylenes);
- > Polycyclic aromatic hydrocarbons (PAH) (e.g. creosote, naphthalene);
- > Tributyl tin (TBT);
- > Total recoverable hydrocarbons (TRH); and
- > Potential Acid Sulfate Soils (PASS).

3 Sediment Sampling and Analysis

3.1 Methodology

3.1.1 Sediment Quality Sampling Locations

The selection of sediment sample locations was based on the following guidance from NAGD (2009), assuming a dredging volume of 100,000 m³ at the time of the investigation. Sediment quality sampling locations are illustrated and tabulated in **Table 3-1** and shown in **Figure 3-1**. The rationale for the number of samples and their locations are as follows:

- > As this is the first intrusive investigation of marine sediments in the proposed dredge area all dredge material is conservatively considered to be '*probably contaminated*' (pg. 58);
- > A total potentially contaminated dredge volume of 100,000 – 141,000 m³ requires a total of 19 sampling locations (pg. 59). This larger dredge volume (than the proposed design) has been considered to account for over-dredging and avoid any need for additional sampling if additional volume is dredged;
- > There is no pre-existing sediment chemistry data for the area to be dredged, that could allow reduction of the number of sample locations (pg. 58);
- > Sample locations were selected by (pg. 61):
 - Laying a square grid over the dredge site, sized so that there are at least five times the number of grid squares as the number of sampling locations required. If the dredge site consists of a number of distinct locations, such as individual berth pockets, grid squares would be laid over each location pro rata to their proportion of the total dredging volume;
 - The grid squares were numbered and random numbers used to select the required number of sample locations; and
 - Samples were collected at the centre of each of the selected grid squares.

Table 3-1 Sample sites, sampling method and parameters sampled

Site ID	Easting	Northing	Method	Parameter(s)
BH2001	692145	8624011	Core	Sediment quality
BH2002	692117	8624054	Core	Sediment quality
BH2003	692116	8624000	Core	Sediment quality
BH2004	692165	8624011	Core	Sediment quality
BH2005	692096	8623984	Core	Sediment quality
BH2006	692148	8623975	Core	Sediment quality
BH2007	692110	8623970	Core	Sediment quality
BH2008	692189	8623960	Core	Sediment quality
BH2009	692088	8623937	Core	Sediment quality
BH2010	692133	8623920	Core	Sediment quality
BH2011	692106	8623898	Core	Sediment quality
BH2012	692189	8623900	Core	Sediment quality
BH2013	692157	8623929	Core	Sediment quality

BH2014	692133	8623885	Core	Sediment quality
BH2015	692143	8623844	Core	Sediment quality
BH2016	692187	8623854	Core	Sediment quality
BH2017	692236	8623845	Core	Sediment quality
BH2018	692159	8623873	Core	Sediment quality
BH2019	692168	8623821	Core	Sediment quality
BH101	692059	8623963	Core	PSD, Density, PASS
BH102	692123	8623947	Core	PSD, Density, PASS
BH103	692081	8623882	Core	PSD, Density, PASS
BH104	692153	8623862	Core	PSD, Density, PASS
MS1	691232	8624857	Surface Grab	PSD
MS2	691405	8624828	Surface Grab	PSD
MS3	692147	8623527	Surface Grab	PSD
MS4	692116	8623624	Surface Grab	PSD
MBS1	692014	8623599	Surface Grab	PSD
MBS2	692031	8623596	Surface Grab	PSD
MBS3	692031	8623544	Surface Grab	PSD
MBS4	692050	8623550	Surface Grab	PSD
MBS5	692071	8623471	Surface Grab	PSD
MBS6	692092	8623480	Surface Grab	PSD
MBS7	692068	8623400	Surface Grab	PSD
TBT01	692141	8623958	Surface Grab	TBC, TOC
TBT02	692152	8623958	Surface Grab	TBC, TOC
TBT03	692156	8623941	Surface Grab	TBC, TOC
TBT04	692135	8623935	Surface Grab	TBC, TOC
TBT05	692143	8623944	Surface Grab	TBC, TOC
TBT06	692167	8623923	Surface Grab	TBC, TOC
TBT07	692173	8623905	Surface Grab	TBC, TOC
TBT08	692158	8623909	Surface Grab	TBC, TOC
TBT09	692150	8623927	Surface Grab	TBC, TOC
TBT10	692143	8623923	Surface Grab	TBC, TOC
TBT11	692139	8623902	Surface Grab	TBC, TOC
TBT12	692154	8623894	Surface Grab	TBC, TOC



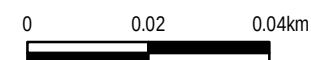
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Darwin, Northern Territory

Date
14/01/2022

Size
A3

Scale
1:1,250



SEDIMENT QUALITY SAMPLING LOCATIONS

MANDORAH MARINE FACILITIES
SAP IMPLEMENTATION REPORT

FIGURE 3-1

3.1.2 Physical Properties Sampling Locations

A combination of sediment boreholes and surface grab sampling was undertaken within, and adjacent to, the dredge footprint. The purpose of this sampling was to inform dredging design, and dredge plume dispersion and sediment transport investigations. All sites were tested for PSD, with sediment density parameters (bulk and particle density) tested at the borehole locations. Marine grab samples were collected by Ponar and beach samples were collected by hand corer. The details of sampling are listed in **Table 3-1** and locations are depicted in **Figure 3-2**.

Borehole locations within the dredge footprint (BH101-104) also underwent testing for the presence of potential and actual acid sulfate soils (PASS, ASS).

3.1.3 TBT Validation Sampling

The results of initial sediment quality sampling identified a potential TBT contamination hot spot within the dredge footprint, based on elevated TBT concentration at BH2013 (see **Section 3.2.2.3**). Further sampling and analysis for TBT (and associated total organic carbon [TOC]) was undertaken at multiple surrounding locations, with the aim of confirming and characterising any existing hotspot.

As one sample location within the dredge footprint was ranked as having 'significant contamination' as per NAGD (pg. 46) the following sampling was undertaken:

- > A total of 12 additional sampling locations to account for potential further scattered locations of TBT contamination; and
- > 'Step-out' sampling pattern surrounding the initial sampling location where contamination was found.

The details of the additional sampling are tabulated in **Table 3-1** and depicted in **Figure 3-3**.



Legend

 Sample Sites

 Dredge Footprint

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



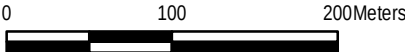
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PHYSICAL PROPERTIES SEDIMENT SAMPLING LOCATIONS
MANDORAH MARINE FACILITIES
SAP IMPLEMENTATION REPORT

FIGURE 3-2



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A3

Scale
1:400



TBT SAMPLING LOCATIONS
MANDORAH MARINE FACILITIES
SAP IMPLEMENTATION REPORT
FIGURE 3-3

3.1.4 Sampling Guidance

All monitoring procedures were conducted by Cardno's suitably qualified personnel adhering with site specific safe work method statement (SWMS) and standard operating procedures (SOP). SOP's ensure that samples are collected in a consistent, quality controlled, and safe manner, and follow best practice procedures in accordance with the following standards and guidelines:

- > Handbook for Sediment Quality Assessment. CSIRO, Bangor, NSW. Simpson et al. 2005
- > *National Assessment Guidelines for Dredging (NAGD)*. Department of the Environment, Water, Heritage and the Arts, 2009;
- > *National Environment Protection (Assessment of Site Contamination) Measure*. National Environmental Protection Council. 1999, as amended 2013 (NEPM, 2013);
- > *Assessment and Management of Contaminated Sites*. Department of Water and Environmental Regulation, 2014;
- > National Acid Sulfate Soils Guidance – National acid sulfate soils sampling and identification methods manual (DWER, 2018);
- > Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018);
- > Water Quality—Sampling. Part 9: Guidance on sampling from marine waters. Standards Australia. 1998. AS/NZS 5667.9:1998; and
- > Guide to the Sampling and Investigation of Potentially Contaminated Soil, Part 2: Volatile Compounds. Standards Australia. 1999. AS 4482.2.

Cardno's overall sampling and analysis method is outlined in the sections below.

3.1.5 Field Sampling

Initial sediment sampling was undertaken by Cardno's qualified Environmental Scientists between 26 September 2019 – 28 September 2019. Push core sampling was used to collect the sediment samples in accordance with NAGD (2009), ANZG (2018) and Simpson et al. (2013). Additional TBT samples were collected using a ponar grab sampler from small vessel by EcOz qualified Environmental Scientists on 15 December 2021. Sampling details are outlined below in **Table 3-1**.

Table 3-1 Sediment Sampling Details

Item	Description
Sample Sites	Nineteen (19) sediment quality sites were sampled across the dredging area. These sites had been selected as per the grid selection methodology outlined in NAGD. Fifteen (15) physical property sampling sites were sampled (4 within the project footprint and 11 reference sites) Twelve (12) sediment quality sites were sampled surrounding the potential TBT contamination hot spot. These sites were selected as per the 'step-out' site selection discussed in NAGD.
Collection Method	<u>Sediment quality</u>: Push coring – 100mm diameter, polycarbonate liners (decontaminated) <u>Physical properties</u>: Ponar grab sampling for offshore sites, and surface core sampling for beach locations <u>TBT sediment sampling</u>: Ponar grab sampling
Sampling Method	Sampling was undertaken by trained, experienced staff to ensure that the correct procedures are followed and documented. Sediment samples from each core was collected over 0.5 m intervals, from the surface. Depth of drilling refusal was less than 0.8m below bed level at all sites. Field log sheets are presented in Appendix B.
Sample Preservation and Holding Times	Samples were collected directly into appropriately labelled and preserved laboratory supplied jars/containers and packed in chilled containers for delivery to the laboratory under Chain of Custody documentation (Appendix C).

Item	Description
	Sample containers, preservation procedures, sample storage requirements and holding times were undertaken in accordance with those recommended by Standards Australia (AS/NZS 5667.1:1998 and AS 4482.1 as appropriate). Volatiles (such as BTEXN) were sampled in accordance with the NAGD and AS4482.2 1999 – noting that volatiles cannot be mixed. All samples were labelled with an indelible marker pen on water resistant labels attached to the sample jars/bags.
Decontamination Procedures	Vessel plant were washed down and inspected before work. Surfaces were covered by plastic sheeting for sample preparation. Polycarbonate core liners were rinsed with dilute acid, deionised water and a suitable solvent. Disposable, powder-free gloves were used when taking samples and changed after each sample. Sample mixing bowls and apparatus had to be decontaminated between each sample.
Laboratory Testing	Nineteen sediment quality samples were successfully submitted to a NATA accredited laboratory for the following analysis. - pH field/pHfox - Particle Size Analysis by Hydrometer - Sulfate Total - Metals¹ - Total Kjeldahl Nitrogen as N (TKN) By Discrete Analyser, Total Nitrogen as N (TKN + NOx) By Discrete Analyser and Total Phosphorus as P by Discrete Analyser - Total Organic Carbon (TOC) in Soil - TRH/BTEXN Fifteen physical properties sediment samples were submitted to a NATA accredited laboratory for the following analysis. - PSD - Absolute density - Bulk density Twelve hot spot sediment quality samples were successfully submitted to a NATA accredited laboratory for the following analysis. - Tributyltin as Sn - TOC
Laboratory testing – quality control	Quality control procedures were followed in accordance with guidelines for sampling presented in the Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds Australian Standard (AS4482.1-2005). Standard laboratory QA/QC procedures. One duplicate, split and triplicate sampling as required by NAGD.
Laboratory accreditation	All laboratory analysis was carried out by NATA accredited facilities.

Notes:

- Aluminium, Arsenic, Barium, Beryllium, Boron, Cadmium, Chromium (hexavalent), Cobalt, Copper, Lead, Manganese, Mercury, Molybdenum, Nickel, Selenium, Silver, Vanadium, Zinc

3.1.6 Quality Control

In addition to the aforementioned quality control/quality assurance procedures, the appropriate quality control sampling has been adhered to, based on NAGD guidelines detailed below in **Table 3-2**.

Table 3-2 QA/QC Indicators

Item	Frequency	Criteria
Field duplicate and triplicate samples	Intra-laboratory at 1 per 10 primary samples Inter-laboratory at 1 per 20 primary water samples	Samples collected analysed for the same analytes as the primary samples < 50% RPD
Trip Blanks	One per event	< LOR for blanks

Sample Volume, Preservation and Holding Times	All samples	Sample containers, preservation procedures, sample storage requirements and holding times are undertaken in accordance with those recommended by Standards Australia (AS/NZS 5667.1:1998 and AS 4482.1 as appropriate). All holding times comply with the requirements set out in "Australian Standard AS/NZS 5567.1:1998 and AS 4482.1".
Chain of Custody (CoC)	All samples	Samples are collected directly in into appropriately labelled and preserved laboratory supplied bottles and packed in chilled containers for delivery to the laboratory under Chain of Custody documentation.
Complete SAP objective met	All samples	Minimum 95% of all data on submitted samples validated as suitable for use
Analysis Methods	All samples	All samples to be subsampled, extracted/ digested & analysed at NATA-accredited laboratory (ALS, NATA accreditation No. 825). Methods adhere to adopted trigger levels and assessment criteria
Laboratory duplicates	1 per batch and per 20 samples	<5 x LOR = no limit on RPD >5 x LOR = 0-30% RPD
Matrix outliers	1 per batch and per 20 samples	Recovery of 70-130% for inorganics/metals, 60-140% for organics, or as per lab requirement RPDs for duplicates should be less than 30%
LOR	All samples	LORs are consistent between laboratories and batches and for all analytes.
Secondary data	All pre-existing data	All pre-existing data to be used in this assessment must meet the same QA/QC indicators.

3.1.7 Assessment Criteria

3.1.7.1 Offshore Disposal

For the proposed offshore disposal of potentially contaminated soft sediments (approximately 15,000 m³), sediment chemistry results (95% upper confidence limit [UCL] where appropriate) have been compared to the following assessment criteria:

- > National Assessment Guidelines for Dredging (2009) – Sediment Quality Screening Levels (ISQG-Low values);
- > ANZG - Guidelines for Fresh and Marine Water Quality (2018) – Interim Sediment Quality Guidelines – High (ISQG-High); and
- > DWER (2015a and b) Acid Sulfate Soils Guideline Series.

3.1.7.2 Onshore Disposal/Reuse

Granting the potentially contaminated soft sediments (approximately 15,000 m³) dredge material is intended for offshore disposal, there still exists the potential of contaminated soft sediments introduced to the water column by dredging to combine with clean caprock material intended for onshore reuse. Sediment chemistry results have therefore been compared to the following criteria:

- > National Environment Protection (Assessment of Site Contamination) Measure. Schedule B1 Guideline on Investigation Levels for Soils and Groundwater (NEPM 2013), specifically:
 - Ecological Screening Levels (ESLs) for areas of ecological significance;
 - Health Investigation Levels for developed public space (HIL-C); and
 - Health Screening Levels for Vapour Intrusion for high density residential (HSL-D);

> Health Screening Levels for Petroleum Hydrocarbons in Soils and Groundwater (CRC CARE 2011), specifically:

- Soil Health Screening Levels for Direct Contact for high density residential (HSL-B DC); and
- Soil Health Screening Levels for Direct Contact for intrusive maintenance workers (HSL-MW DC).

These assessment criteria have been adopted based on the proposed offshore disposal of all soft mud/sandy loam sediments (0.0-0.8 mbgl). Underlying 'natural geological material' is considered clean for reuse in the project as breakwater core material or for reuse in other projects.

3.2 Results

For the purpose of this report, results and assessment focus on sediment quality with respect to the assessment criteria detailed in **Section 3.1.7**. Detailed assessments of the physical properties of sediments sampled in the area are found in the *Geotechnical Report* (Cardno, 2022f) and the application of results to sediment transport investigations are documented in the *Sediment Transport Report* (Cardno, 2022b).

3.2.1 Sediment Properties

- > Field observations did not identify any visual signs of contamination (see field logs – **Appendix B**);
- > Field observations noted sediment largely as marine SAND, dark grey with various quantities of shell fragments and clay interspersed;
- > Field pH testing reported material between 8.7 to 9.1 (alkaline) (**Appendix A**); and
- > There is limited marine bed sediment in the area, the deepest refusal depth for push coring was 0.8 metres and for most sample locations the refusal depth was less than 0.5 metres (see field logs – **Appendix B**).

3.2.2 Sediment Quality

A data assessment table for initial sediment sampling and analysis is presented in **Appendix A** and full laboratory results are included in **Appendix D**. A summary of the outcomes associated with the results is presented below.

3.2.2.1 Metals and Metalloids

All concentrations of metals and metalloids for the site were below all assessment criteria for offshore and onshore disposal of sediments.

3.2.2.2 Organic Compounds

No organic compounds were detected, with all BTEX, TRH, PAH and organochlorine pesticide concentrations were below their respective LORs in all samples.

3.2.2.3 Organotin

BH2013 and BH2016 returned concentrations of TBT (BH2013: 3.8 µg/kg, BH2016: 9.5 µg/kg) above the limit of reporting (LOR).

The 95% UCL for TBT, corrected for 1% TOC as per the requirements of NAGD (9.5 µg/kg), marginally exceeded the NAGD screening level of 9 µg/kg.

No other samples recorded concentrations of organotin compounds above the LOR.

3.2.3 Additional TBT Sampling

As initial TBT results found the 95% UCL for TBT to be above the relevant NAGD low screening level, additional sampling was undertaken. Results from BH2013 led to a 'significant contamination' rating under the NAGD provision that one or more analyte in a given category fell between the screening level and SQG-High (**Appendix A**), step-out sampling and testing was conducted for an additional twelve sediment samples around the sample location where toxicity was found (**Figure 3-1**)

None of the twelve additional hot spot samples recorded concentrations of TBT above the LOR of 0.5 µg Sn/kg. Laboratory results for this sampling have been provided in **Appendix D**. Incorporation of the additional sampling with initial sampling leads to a calculated 95% UCL below the relevant NAGD low screening level. In accordance with NAGD, the dredge sediment is therefore considered acceptable for offshore disposal on the basis that the bulk composition of the dredge area, considering the initial testing plus step-out testing, indicates that it is non-toxic.

3.2.4 Acid Sulfate Soils

All sediment quality samples were tested for pH_{field} and pH_{fox} with results 'inconclusive' or indicating no PASS present as per DWER (2018). Three (3) samples were submitted for SPOCAS testing, with two (2) samples demonstrating Net Acidity values above the DWER ASS's management action criteria for of sands to loamy clays >1000 tonnes.

Table 3-3 provides a summary of soil analytical data applicable to DWER ASS management action criteria with exceedances highlighted in red (BH102, BH03). Laboratory analysis certificates are provided in **Appendix D**.

Table 3-3 SPOCAS testing data

Analyte	Unit	Criteria	BH102	BH03	BH09
Depth	m	N/A	0.0 - 0.75	0.0 - 0.25	0.0 - 0.75
pH _{KCl}	pH units	< 4	9.6	9.6	6.3
pH _{Fox}	pH units	< 4	5.4	6.7	5.3
Titrateable Actual Acidity	mol H+/tonne	> 18	< 2	< 2	< 2
Net Acidity	%S	> 0.03	< 0.05	< 0.04	< 0.02
Total Sulfide Acidity	%S	> 0.03	< 0.02	< 0.02	< 0.02
Acid Neutralising Capacity	% pyrite S	N/A	10.5	19.4	--

Note: -- Not tested

The results did not demonstrate the presence of ASS. Analysis shows that PASS is present at the site and likely to be present in surface-level seabed sediments rather than in those at depth, as net acidity levels measured for a sample taken from BH09 at 0.75m depth were within the assessment criteria. The results suggest that unconsolidated seabed sediments at the site should be considered PASS. When saturated, the opportunity for oxidation of PASS sediments is negligible as the available supply of oxygen necessary for a significant rate of acid formation is too low. The sediment is, therefore, considered suitable for offshore disposal with respect to PASS.

If any of the unconsolidated sediments were to be brought onshore, further testing would be need to be undertaken and treatment would potentially be required.

3.2.5 Quality Assurance / Quality Control

All quality control/quality assurance procedures outlined in **Section 3.1.6** and respective SOP's were followed during field sampling, and all analysis was completed within holding times.

Relative percent difference (RPD) was calculated for primary, duplicate and triplicate samples where 30% RPD values infer precise data. Where the RPD was above 30%, the primary result was only used in further assessment if RPD was within 5 times the LOR and therefore remained acceptable. A full QA/QC review is provided in **Appendix E**.

The QA/QC review concluded that there are no significant systematic errors in the data collection process and therefore, the dataset used for the assessment is considered valid and complete.

4 Sediment Quality Risk Assessment

This sediment quality risk assessment has been undertaken in line with the chosen assessment criteria (**Section 3.1.7**) which have been adopted based on the proposed offshore disposal of soft sediments and the sites proximity to sensitive environmental receptors. Clean geological material to be dredged and reused has been excluded from this risk assessment. If the proposed disposal of dredged material changes, then conclusions drawn from this sediment quality risk assessment should be revised.

4.1 Contaminants Identified

The following environmental contaminants were identified in the proposed excavated material during this investigation:

- > The 95% UCL for Tributyltin (9.5 µg/kg) marginally exceeded the NAGD screening level of 9 µg/kg. In line with NAGD guidance, BH2013 and may be pollution 'hot spots', given that no other surrounding samples recorded concentrations of organotin compounds above the LOR. Only BH2013 lies within the current proposed dredging and disturbance area and is further assessed;
- > The following metals recorded detectable concentrations in all samples and all were below the NAGD screening levels, ESLs and HILs (NEPM):
 - Aluminium;
 - Arsenic;
 - Chromium;
 - Cobalt;
 - Copper;
 - Iron;
 - Lead;
 - Manganese;
 - Nickel; and
 - Zinc.
- > Two (2) samples were classified as PASS within the top 0.75m of the seabed and no sediments were classified as ASS.
- > Based on the initial TBT results and in accordance NAGD guidelines, the top layer of sediment at BH2013 was considered to have a 'significant contamination'. Additional step-out sampling at 12 sites in the vicinity of BH2013 did not identify any further TBT concentrations above the LOR. This confirmed that a 'contamination hotspot' is not present and that the overall unconsolidated dredge volume (recalculated 95% UCL for TBT) is below the NAGD guideline values for all CoPC.

4.2 Human Health Risk

Based on the observed concentrations of identified contaminants and appropriate HILs (NEPM), as well as the fact that sediments will remain in the marine environment for dredging and construction, there is considered to be low risk to human health from the sediments and project actions.

Geological material that will be brought into the terrestrial environment will be in large fragments and is uncontaminated.

4.3 Environmental Risk

Laboratory results found concentrations for all CoPC to be below the relevant NAGD guideline values. Risk to the receiving environment is, therefore, considered to be low associated with changes to marine environmental quality (chemistry). Overall, unconsolidated sediments are considered suitable for offshore disposal, assuming the relevant controls of the disposal's physical effects (e.g. turbidity and sedimentation) are in place. Such controls are outlined in the *Draft DSDMP* (Cardno, 2022d).

Given a relatively low CSD dredge spill rate (see *Sediment Transport Report* [Cardno, 2022b]) the potential for contaminants in sediments resuspended during dredging, or in any dredge return water, to bio-accumulate in aquatic organisms should also be considered. However, as only low levels of contamination were recorded, the potential for the proposed works to increase the risk to aquatic biota over a long period should be considered low.

Given that dredged sediments within the pumping pipelines will remain saturated during transport to the disposal location, the risk of acid generation from dredged spoil would generally be dependent on the rate and duration of suspension during disposal. However, in open dynamic sea waters, if acid is generated, neutralising reactions occur instantaneously due to the buffering constituent's bicarbonate and carbonate contained in sea water. The potential to generate acid underwater following disturbance of PASS material during dredging is very low and any acid that is generated would be immediately neutralised. Therefore, from an ASS perspective, the dredging and disposal process is considered to pose a low risk to the surrounding environment.

Underlying natural geological material, described in detail in the *Geotechnical Report* (Cardno, 2022f), is considered to be 'clean' and pose low risk to environmental quality.

5 Conclusions and Project Implications

5.1 Summary of Findings

Assessment of potential contaminants in marine sediments adjacent to the existing jetty, boat ramp and carpark, and within the proposed project footprint, was carried out to inform the contamination status of the material for its proposed disposal, in accordance with the relevant industry standards and guidelines (primarily NAGD). Approximately 15,000 m³ of unconsolidated (primarily soft muds) material is proposed to be disposed offshore with the remaining 70,000 m³ of natural geological material (various strength caprock) to be reused.

As prescribed in NAGD (2009) and based on initial dredging plans and understanding of geology, a total of nineteen (19) sediment quality cores (in addition to geotechnical cores) were advanced to a maximum depth of 0.8 m below the seabed, to accurately classify the chemical and physical properties of the proposed dredge volume and area. Based on site history and relevant guidelines, several CoPC were tested for, which included metals & metalloids, organotin compounds, organic compounds, nutrients and ASS/PASS. Initial testing showed elevated concentration of TBT at one site within the dredge footprint, which led to 95% UCL for the substance being above the 'low' guideline value. Further sampling and analysis around this site demonstrated that it was an isolated event, rather than representative of a contamination hotspot.

The risk assessment concluded that the unconsolidated layer of soft sediments, overlaying natural geological material, is considered to be 'clean' and, therefore, suitable for open ocean disposal. The underlying geological material is considered 'clean natural material', suitable for the intended reuse as core material for the breakwaters.

5.2 Recommendations

This report should accompany necessary planning, approvals and management planning of the Project and be viewed with reference to all other investigations and studies as part of the overall Project design to date. The results of investigations detailed in this report indicate that the risk to the receiving (marine) environment associated with the quality (chemistry) of marine sediments to be disturbed by impact, dredging and disposal is low. The low risk is attributed to results showing low concentrations of CoPC in the disturbance area, well below relevant guideline values (NAGD, 2009). Furthermore, the risk of acid generation due to PASS is considered to be low and any acid generation would be neutralised by the receiving environment (seawater).

While the risk associated with sediment quality is considered to be low, the risk associated with the physical effects of dredging and disposal requires further consideration. It is recommended that the environmental risk associated with dredge plume dispersion (turbidity) and sedimentation is further investigated.

Should the proposed disposal method for unconsolidated sediments at the site change, the results of this investigation should be re-assessed with respect to proposed disposal (e.g. onshore). Similarly, should the extent and/or volume of dredging change, the new proposal should be assessed in light of the sampling and analysis detailed in this report.

5.3 Assumptions and Limitations

Assumptions have been made in this investigation, which may limit the accuracy of outcomes and associated advice that they inform. These include:

- > The outcomes of this assessment have been used, conservatively and based on expert opinion, to inform potential environmental risk;
- > Sediment sampling has been undertaken at a point in time, across reasonable spatial coverage at the site. This does not necessarily represent the chemistry of material throughout the site, nor over time; and
- > This report does not provide accurate geotechnical assessment of the proposed dredge material necessary to confirm the required physical properties suitable for structural design of the Project.

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APPENDIX

A

SEDIMENT QUALITY ASSESSMENT TABLE



	Inorganics										Organic	Organotin Compounds				pH/fox			BTEX							Metals										
	Moisture Content	Cobbles (>6cm)	Gravel (>2mm)	Sand (0.06-2.00 mm)	Silt (2-60 µm)	Clay (<µm)	Kjeldahl Nitrogen Total	Nitrogen (Total Oxidised)	Nitrogen (Total)	Sulphate	TOC	Tributyltin (Corrected for 1% TOC)	Tributyltin	Dibutyltin as Sn	Monobutyltin as Sn	pH (F)	pH (Fox)	Reaction Rate	Benzene	Ethylbenzene	Toluene	Total BTEX	Xylene (m & p)	Xylene (o)	Xylene Total	Aluminium	Arsenic	Cadmium	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	
	%	%	%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	µg Sn/kg	µg Sn/kg	pH Unit	pH Unit	Reaction Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	1	1	1	1	1	1	20	0.1	20	100	0.02	0.0005	0.0005	1	1	0.1	0.1	1	0.2	0.2	0.2	0.2	0.2	0.2	0.5	50	1	0.1	1	0.5	1	50	1	10	0.1	
CoA 2009, National Assessment Guidelines for Dredging Screening Levels												0.009															20	1.5	80		65		50		0.15	
DWER ASS Criteria for excavations of > 1000 tonnes																<4	<4																			
CRCCARE 2011 Soil HSL for Direct Contact, HSL-B Residential																																				
0-1m																			140	5900	21000				17000											
CRCCARE 2011 Soil HSL for Direct Contact, Intrusive Maintenance Worker																																				
0-3m																			1100	85000	120000				130000											
NEPM 2013 Table 1A(1) HILs Rec C Soil																											300	90		300	17000		600	19000	80	
NEPM 2013 Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand																																				
0-1m																			3	NL	NL				230											
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																																				
0-1m																			0.5	55	160				40											
NEPM 2013 Table 1B(6) ESLs for Areas of Ecological Significance, Fine Soil																			10	40	65				1.6											

Field ID	Sample Depth mbgl	Sampled Date	Matrix Description	Lab Report Number	22.8	<1	15	71	4	10	90	1.1	90	3900	0.06	<0.0005	<0.0005	<1	<1	8.9	6.7	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1620	2.5	<0.1	2.5	0.6	1.1	1560	1.8	138	<0.1
BH2001	0.00-0.50	28/09/2019	Sand/Soft Sediments	ES1931055	22.8	<1	15	71	4	10	90	1.1	90	3900	0.06	<0.0005	<0.0005	<1	<1	8.9	6.7	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1620	2.5	<0.1	2.5	0.6	1.1	1560	1.8	138	<0.1
BH2002	0.00-0.50	28/09/2019	Sand/Soft Sediments	ES1931055	26.9	<1	22	59	5	14	370	0.4	370	5130	0.1	<0.0005	<0.0005	<1	<1	8.7	6.8	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	2090	2.6	<0.1	4.6	0.9	1.6	2820	2.4	121	<0.1
BH2003	0.00-0.50	28/09/2019	Sand/Soft Sediments	ES1931055	26.9	<1	14	71	4	11	130	0.4	130	3400	0.09	<0.0005	<0.0005	<1	<1	9.1	6.8	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1860	3	<0.1	3.4	0.6	<1	1690	1.7	116	<0.1
BH2004	0.00-0.50	28/09/2019	Sand/Soft Sediments	ES1931055	44.4	<1	13	39	14	34	260	0.4	260	4910	0.22	<0.0005	<0.0005	<1	<1	9	7.1	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	3860	2.3	<0.1	7.8	2.4	1.9	4840	5	148	<0.1
BH2005	0.00-0.50	28/09/2019	Sand/Soft Sediments	ES1931055	23.4	<1	14	69	3	14	110	0.3	110	2880	0.08	<0.0005	<0.0005	<1	<1	9	7.1	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1970	2.2	<0.1	3.9	1.7	1	2890	2	224	<0.1
BH2006	0.00-0.50	28/09/2019	Sand/Soft Sediments	ES1931055	26.9	<1	6	84	3	7	40	0.3	40	4270	0.07	<0.0005	<0.0005	<1	<1	9	6.7	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1530	3.3	<0.1	1.8	0.6	<1	1540	1.5	149	<0.1
BH2007	0.00-0.50	27/09/2019	Sand/Soft Sediments	ES1931055	24.3	<1	4	87	3	6	120	0.2	120	3130	0.12	<0.0005	<0.0005	<1	<1	9.1	6.8	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1810	2.4	<0.1	3.5	0.8	<1	1940	2.2	129	<0.1
BH2008	0.00-0.50	26/09/2019	Sand/Soft Sediments	ES1931055	32.7	<1	14	60	7	19	150	0.4	150	4150	0.11	<0.0005	<0.0005	<1	<1	9.1	7	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	2820	1.8	<0.1	4.8	1.3	1.2	3110	3.2	119	<0.1
BH2009	0.00-0.50	27/09/2019	Sand/Soft Sediments	ES1931055	25.6	<1	6	83	1	10	120	0.3	120	2860	0.1	<0.0005	<0.0005	<1	<1	9	6.7	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1540	3	<0.1	3	0.8	<1	1860	2.2	147	<0.1
BH2010	0.00-0.50	26/09/2019	Sand/Soft Sediments	ES1931055	26	<1	1	80	6	13	60	0.5	60	2380	0.09	<0.0005	<0.0005	<1	<1	8.7	7.4	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1680	1.7	<0.1	3.5	1	2.1	2250	10	102	<0.1
BH2011	0.00-0.50	27/09/2019	Sand/Soft Sediments	ES1931055	30.5	<1	3	89	1	7	120	0.3	120	3420	0.08	<0.0005	<0.0005	<1	<1	8.8	6.8	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1830	3.2	<0.1	3.5	1.9	<1	2120	2.3	163	<0.1
BH2012	0.00-0.50	26/09/2019	Sand/Soft Sediments	ES1931055	21.8	<1	18	64	6	12	100	0.3	100	3170	0.12	<0.0005	<0.0005	<1	<1	9	6.8	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1810	2.1	<0.1	2.6	1.1	6.3	1730	4.7	76	<0.1
BH2013	0.00-0.30	27/09/2019	Sand/Soft Sediments	ES1931055	22.2	<1	9	80	2	9	140	0.3	140	3250	0.08	0.0475	0.0038	<1	<1	8.9	6.7	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1620	2.4	<0.1	2.8	0.8	1.4	1960	5.8	112	<0.1
BH2014	0.00-0.50	26/09/2019	Sand/Soft Sediments	ES1931055	18	<1	2	93	1	4	80	0.8	80	3020	0.06	<0.0005	<0.0005	<1	<1	8.8	6.6	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	410	3	<0.1	2.7	<0.5	1.3	1460	1.5	119	<0.1
BH2015	0.00-0.50	28/09/2019	Sand/Soft Sediments	ES1931055	25.8	<1	11	79	3	7	110	0.5	110	3370	0.08	<0.0005	<0.0005	<1	<1	8.8	6.7	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	450	3.5	<0.1	2.2	<0.5	<1	1490	1.5	139	<0.1
BH2016	0.00-0.50	27/09/2019	Sand/Soft Sediments	ES1931055	25.5	<1	4	78	7	11	150	0.4	150	2930	0.13	0.07308	0.0095	<1	<1	9	6.8	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1880	2	<0.1	3.4	0.7	1.1	1960	2.7	114	<0.1
BH2017	0.00-0.30	27/09/2019	Sand/Soft Sediments	ES1931055	23.4	<1	28	52	8	12	90	0.4	90	2760	0.13	<0.0005	<0.0005	<1	<1	9	7.3	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1990	2.4	<0.1	3.6	1.2	1.3	2590	4.4	96	<0.1
BH2018	0.00-0.50	27/09/2019	Sand/Soft Sediments	ES1931055	27.6	<1	6	82	1	11	150	0.3	150	3280	0.16	<0.0005	<0.0005	<1	<1	9	6.9	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1870	2.6	<0.1	2.8	0.8	1.2	1800	1.7	99	<0.1
BH2019	0.00-0.80	27/09/2019	Sand/Soft Sediments	ES1931055	18.8	<1	13	63	9	15	70	0.6	70	940	0.08	<0.0005	<0.0005	<1	<1	8.8	6.7	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	1790	<1	<0.1	1.7	1.6	1.6	890	5.3	40	<0.1

Statistical Summary																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
Number of Results	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	



				PAH/Phenols																TPH					CRC Care TPH Fractions								
	Nickel	Phosphorus	Zinc	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (sum of total)	Phenanthrene	Polycyclic aromatic hydrocarbons EPA/Vic	Pyrene	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	C10-C16	C16-C34	C34-C40	F2-NAPHTHALENE	C10 - C40 (Sum of total)	C6-C10	F1: C6-C10 less BTEX	
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
EQL	1	2	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.2	0.5	0.5	0.5	3	3	3	5	3	3	3	5	3	3	3	4	
CoA 2009, National Assessment Guidelines for Dredging Screening Levels	21		200														10																
DWER ASS Criteria for excavations of > 1000 tonnes																																	
CRCCARE 2011 Soil HSL for Direct Contact, HSL-B Residential																																	
0-1m																2200											4200	5800	8100			5600	5600
CRCCARE 2011 Soil HSL for Direct Contact, Intrusive Maintenance Worker																																	
0-3m																29000											62000	85000	120000			82000	82000
NEPM 2013 Table 1A(1) HILs Rec C Soil	1200		30000																														
NEPM 2013 Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand																																	
0-1m																NL														NL			
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																																	
0-1m																3														110			45
NEPM 2013 Table 1B(6) ESLs for Areas of Ecological Significance, Fine Soil								0.7																				-	-	25			

Field ID	Sample Depth mbgl	Sampled Date	Matrix Description	Lab Report Number																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				</
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Statistical Summary																																	
Number of Results	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	
Number of Detects	12	19	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	1	0	13	0	0	
Minimum Concentration	<1	181	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<0.2	<0.5	<0.5	<0.5	<3	<3	<3	<5	<3	<3	<3	<5	<3	<3	<3	<3	<3	
Minimum Detect	1	181	1.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	7	ND	4	ND	ND	ND
Maximum Concentration	2.7	331	14.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<0.2	<0.5	<0.5	<0.5	<3	<3	<3	<5	<3	<3	27	7	<3	34	<3	<3	
Maximum Detect	2.7	331	14.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	27	7	ND	34	ND	ND	ND
Average Concentration*	1.1	251	3.9	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.1	0.1	0.25	0.25	0.25	1.5	1.5	1.5	2.5	1.5	1.5	5.9	2.7	1.5	6.3	1.5	1.5	
Geometric Average*	0.97	248	3	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.1	0.1	0.25	0.25	0.25	1.5	1.5	1.5	2.5	1.5	1.5	4.2	2.6	1.5	4.2	1.5	1.5	
Median Concentration*	1.2	252	2.7	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.1	0.1	0.25	0.25	0.25	1.5	1.5	1.5	2.5	1.5	1.5	5	2.5	1.5	5	1.5	1.5	
Standard Deviation*	0.61	44	3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.9	1	0	7.3	0	0	
95% UCL (Student's t)*	1.494	273.2	4.283	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.1	0.1	0.25	0.25	0.25	1.5	1.5	1.5	2.5	1.5	1.5	7.83	2.998	1.5	8.53	1.5	1.5	
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

APPENDIX

B

SEDIMENT SAMPLING LOG SHEETS

Location	Date	Time	Sampler	Conditions	Sampling Method	Handling/storage	Description
BH2014	26/9	08:30	DS/PT	FINE, CALM 3.4m DEPTH	PUSH CORE THEN SPT	JAR/BAG w/ ICE	MARINE SAND, DARK GREY, SOME ORGANICS UNIFORM
BH2010	26/9	09:30	DS/PT	FINE, CALM	PUSH CORE THEN SPT		material from 3 separate cores to get enough sediment for testing.
BH2012	26/9	10:30	DS/PT	"	"		MARINE SAND, DARK GREY, SOME ROCK AND GRAVEL 2 SEPARATE CORES
BH2008	26/9	11:00	DS/PT	FINE, CALM 16m DEPTH	"		CORALSHELLS AT SURFACE, MAKING SEDIMENT GREY
" TRIP 1		11:30-13:00			"		MULTIPLE CORES REQ. (3) DARK MARINE SAND
" TRIP 2		13:00-13:30			"		" (2) → TO REFUSE RED/BROWN SHELL GERT
BH2019	27/9	07:30	PT	FINE, CALM	"		SAND, GREEN CLAY 2 SEPARATE CORES REFUSAL 0.9m SOME GREYS MARINE SAND, RED CLAY
BH2016	27/9	08:00	PT	"	"		MARINE SAND, SHELL FRAGMENT SOME RED CLAY
" SPLIT 1		08:15	PT	"	"		"
" SPLIT 2		08:30	PT	"	"		"
BH2018	27/9	09:00	PT	"	"		3 SEPARATED CORES
BH2011	27/9	09:45	PT	"	"		MARINE SAND RED CLAY 3 SEPARATED CORE
BH2009	27/9	10:20	"				MARINE SAND, SOME SHELL FRAGMENTS 4 CORES NEEDED. GREY SAND
BH2007	27/9	11:05					4 CORES NEEDED. GREY SAND
BH2017	27/9	12:00	"	"	"		SOME RED CLAY
BH2013	27/9	13:00	"	WINDY	"		MARINE SAND, GRAY REFUSAL 0.3m 4 CORES
BH2002	28/9	07:45	"	FINE, CALM	"		GREY MARINE SAND REFUSAL 0.3m
BH2003	28/9	08:00	"	"	"		GREY MARINE SAND RED CLAY REFUSAL 3 CORES NEEDED GREY MARINE SAND 4 CORE NEEDED

Location	Date	Time	Sampler	Conditions	Sampling Method	Handling/storage	Description
BH2001	28/9	08:25	PT	FINE & CALM	PUSH CORE THEN SPT	JAR / BAG ON ICE	GREY MARINE SAND SOME GRAVEL 3 CORE NEEDED
BH2006	"	08:45	PT	"	"	"	GREY MARINE SAND 2 CORE NEEDED
BH2004	28/9	09:10	PT	"	"	"	GREY MARINE SAND, GRAY CLAY 2 CORES NEEDED
BH2005	28/9	09:30	PT	"	"	"	GREY MARINE SAND, SOME CLAY AND GRAVEL 2 CORES NEEDED
BH2015	28/9	10:00	PT	"	"	"	GREY MARINE SAND, 2 CORES NEEDED

APPENDIX

C

SEDIMENT SAMPLING COC

Melbourne

6 Monterey Road
Dandenong South Vic 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney

Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane

1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth

2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521

e.mail : EnviroSales@eurofins.comweb : www.eurofins.com.au

Sample Receipt Advice

Company name: **Cardno (WA)**
Contact name: Daniel Strickland
Project name: MANDORAH MARINE FACILITIES
COC number: Not provided
Turn around time: 5 Day
Date/Time received: Oct 2, 2019 9:45 AM
Eurofins reference: **680294**

Sample information

- ☒ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☒ All samples have been received as described on the above COC.
- ☒ COC has been completed correctly.
- ☒ Attempt to chill was evident.
- ☒ Appropriately preserved sample containers have been used.
- ☒ All samples were received in good condition.
- ☒ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☒ Appropriate sample containers have been used.
- ☐ Split sample sent to requested external lab.
- ☐ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Robert Johnston on Phone : or by e.mail: RobertJohnston@eurofins.com

Results will be delivered electronically via e.mail to Daniel Strickland - daniel.strickland@cardno.com.au.



CHAIN OF CUSTODY

ALS Laboratory please tick →

CLIENT: Cardno (NT) Pty Ltd		TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)	
OFFICE: 93 Mitchell Street, Level 5, Darwin 0800		(Standard TAT may be longer for some tests e.g. Ultra Trace Chemicals)		Custody Seal intact? Yes ☒ No ☐ N/A ☐	
PROJECT: Mandorah Marine Facilities		ALS QUOTE NO.: SY/513/19 V4		Free ice / freeze box bricks present upon receipt? Yes ☒ No ☐ N/A ☐	
PURCHASE ORDER NUMBER: DZ1910		COUNTRY OF ORIGIN: AUSTRALIA		Random Sample Temperature on Receipt: 24.0 14.1	
PROJECT MANAGER: Daniel Strickland		CONTACT PH: 08 8481 0703		Other comment:	
SAMPLER: Daniel Strickland		SAMPLER MOBILE: 0431 245 399		RECEIVED BY: <i>Revised</i>	
COC Emailed to ALS? YES		EDD FORMAT (or default): Eadad		RECEIVED BY: <i>Revised</i>	
Email Reports to: daniel.strickland@cardno.com.au		RELINQUISHED BY: Daniel Strickland / Pablo Torres		DATE/TIME: 1.10.19	
Email Invoice to: daniel.strickland@cardno.com.au		DATE/TIME: Before 18:00 on respective date of sampling		DATE/TIME: 30/09/19 8:30u	

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Samples placed on ice after collection. 1 jar and green bags frozen upon delivery at laboratory. 3 jar and pulp bag refrigerated upon delivery at laboratory.

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NS. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (filtered bottle required)										Additional Information	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL Jars / Bags	As per test parameters on Quote SY/513/19											Comments on likely contaminant levels dilutions, or samples requiring specific QC analyses etc.
1	BH2001	28/09/2019 8:25	S	See containers listed on Quote SY/513/19	5	X											
2	BH2002	28/09/2019 7:45	S		5	X											
3	BH2003	28/09/2019 8:00	S		5	X											
4	BH2004	28/09/2019 8:10	S		5	X											
5	BH2005	28/09/2019 9:30	S		5	X											
6	BH2006	28/09/2019 8:45	S		5	X											
7	BH2007	27/09/2019 11:05	S		5	X											
8	BH2008	28/09/2019 11:00	S		5	X											
9	BH2009	27/09/2019 10:20	S		5	X											
10	BH2010	26/09/2019 9:30	S		5	X											
11	BH2011	27/09/2019 9:45	S		5	X											
12	BH2012	26/09/2019 10:30	S		5	X											
13	BH2013	27/09/2019 13:00	S		5	X											
14	BH2014	26/09/2019 8:30	S		5	X											
15	BH2015	28/09/2019 10:00	S		5	X											
16	BH2016	27/09/2019 8:00	S		5	X											
17	BH2017	27/09/2019 12:00	S		5	X											
18	BH2018	27/09/2019 9:00	S		5	X											
19	BH2019	27/09/2019 7:30	S		5	X											
20	TRIP1	26/09/2019	S		5	X											
21	TRIP2	26/09/2019	S		5	X											
22	SPLIT1	27/09/2019	S		5	X											Please send to Eurofins for equivalent analyses
23	SPLIT2	27/09/2019	S		5	X											
TOTAL					115	23	0	0									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AO = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic

V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass

Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugol's Iodine Preserved Bottle; STT = Sterile Sodium Thiosulfate Preserved Bottle

Environmental Division
Sydney
Work Order Reference
ES1931055

Telephone 61-2-8784 8944



CHAIN OF CUSTODY FORM - Client

ENVIROLAB GROUP

National phone number 1300 424 344

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
☎ 02 9910 6200 | ✉ sydney@envirolab.com.au

Perth Lab - MPL Laboratories
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25 Research Drive, Croydon South, VIC 3136
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Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
☎ 08 8967 1201 | ✉ darwin@envirolab.com.au

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Company:	EcOz Environmental		Client Project Name/Number/Site etc (ie report title):	EZ21285 - Mandorah sediment grabs Dec 2021	
Contact Person:	Emma Smith		PO No. (if applicable):	EZ21285	
Project Mgr:	Emma Smith		Envirolab Quote No. :	21NT059	
Sampler:	Jack Dymalla		Date results required:	☐ Standard ☐ Same Day ☐ 1 day ☒ 2 day ☐ 3 day	
Address:	70 Cavenagh St, Darwin City NT 0800		Note: Inform lab in advance if urgent turnaround is required - surcharges apply		
Phone:	08 8981 1100	Mob:	0430 835 540	Additional report format:	☒ Esdat ☐ Equis
Email Results to:	emma.smith@ecoz.com.au		Lab Comments:		
Email Invoice to:	emma.smith@ecoz.com.au & ecoz@ecoz.com.au				

Sample information					Tests Required														Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Tributyl Tin (TBT)	Total Organic Carbon (TOC) - Combustion													Provide as much information about the sample as you can
1	TBT01		15/12/2021	Sediment	X	X													
2	TBT02		15/12/2021	Sediment	X	X													
3	TBT03		15/12/2021	Sediment	X	X													
4	TBT04		15/12/2021	Sediment	X	X													
5	TBT05		15/12/2021	Sediment	X	X													
6	TBT06		15/12/2021	Sediment	X	X													
7	TBT07		15/12/2021	Sediment	X	X													
8	TBT08		15/12/2021	Sediment	X	X													
9	TBT09		15/12/2021	Sediment	X	X													
10	TBT10		15/12/2021	Sediment	X	X													
11	TBT11		15/12/2021	Sediment	X	X													
12	TBT12		15/12/2021	Sediment	X	X													
13	Duplicate 1		15/12/2021	Sediment	X	X													
14	Duplicate 2		15/12/2021	Sediment	X	X													

☐ Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis

Relinquished by (Company):	EcOz	Received by (Company):	Envirolab Darwin	Lab Use Only	
Print Name:	Jack Dymalla	Print Name:	SHARI PRASAD	Job number:	274223
Date & Time:	15.12.21 0940	Date & Time:	15.12.21 0940	Temperature:	20
Signature:	[Signature]	Signature:	[Signature]	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	
				Cooling: Ice / Ice pack / None	
				Security seal: Intact / Broken / None	

APPENDIX

D

SEDIMENT SAMPLING RESULTS

Cardno (NSW/ACT) Pty Ltd
Level 9, 203 Pacific Highway
St Leonards
NSW 2065



NATA Accredited
Accreditation Number 1261
Site Number 18217

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

Attention: Daniel Strickland

Report 680770-S
Project name MANDORAH MARINE FACILITIES
Received Date Oct 03, 2019

Client Sample ID			SPLIT 1
Sample Matrix			Soil
Eurofins Sample No.			S19-Oc07653
Date Sampled			Sep 27, 2019
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons - 1999 NEPM Fractions			
TRH C6-C9	20	mg/kg	< 20
TRH C10-C14	20	mg/kg	< 20
TRH C15-C28	50	mg/kg	< 50
TRH C29-C36	50	mg/kg	< 50
TRH C10-C36 (Total)	50	mg/kg	< 50
BTEX			
Benzene	0.1	mg/kg	< 0.1
Toluene	0.1	mg/kg	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2
o-Xylene	0.1	mg/kg	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3
4-Bromofluorobenzene (surr.)	1	%	103
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
Naphthalene ^{N02}	0.5	mg/kg	< 0.5
TRH C6-C10	20	mg/kg	< 20
TRH C6-C10 less BTEX (F1) ^{N04}	20	mg/kg	< 20
TRH >C10-C16	50	mg/kg	< 50
TRH >C10-C16 less Naphthalene (F2) ^{N01}	50	mg/kg	< 50
TRH >C16-C34	100	mg/kg	< 100
TRH >C34-C40	100	mg/kg	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100
Polycyclic Aromatic Hydrocarbons			
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2
Acenaphthene	0.5	mg/kg	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5
Anthracene	0.5	mg/kg	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5
Benzo(b&j)fluoranthene ^{N07}	0.5	mg/kg	< 0.5
Benzo(g,h,i)perylene	0.5	mg/kg	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5
Chrysene	0.5	mg/kg	< 0.5
Dibenz(a,h)anthracene	0.5	mg/kg	< 0.5

Client Sample ID			SPLIT 1
Sample Matrix			Soil
Eurofins Sample No.			S19-Oc07653
Date Sampled			Sep 27, 2019
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons			
Fluoranthene	0.5	mg/kg	< 0.5
Fluorene	0.5	mg/kg	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5
Naphthalene	0.5	mg/kg	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5
Pyrene	0.5	mg/kg	< 0.5
Total PAH*	0.5	mg/kg	< 0.5
2-Fluorobiphenyl (surr.)	1	%	80
p-Terphenyl-d14 (surr.)	1	%	60
Nitrate & Nitrite (as N)	5	mg/kg	< 5
Sulphate (as SO ₄)	30	mg/kg	1000
Total Kjeldahl Nitrogen (as N)	10	mg/kg	210
Total Nitrogen (as N)	10	mg/kg	210
Total Organic Carbon	0.1	%	0.9
Phosphorus	5	mg/kg	340
% Moisture	1	%	27
Heavy Metals (1M HCl Extract)			
Aluminium (1M HCl extract)	20	mg/kg	< 20
Arsenic (1M HCl extract)	2	mg/kg	2.3
Cadmium (1M HCl extract)	0.4	mg/kg	< 0.4
Chromium (1M HCl extract)	5	mg/kg	< 5
Cobalt (1M HCl extract)	5	mg/kg	600
Copper (1M HCl extract)	5	mg/kg	< 5
Iron (1M HCl extract)	20	mg/kg	99
Lead (1M HCl extract)	5	mg/kg	< 5
Manganese (1M HCl extract)	10	mg/kg	< 10
Mercury (1M HCl extract)	2	mg/kg	< 2
Nickel (1M HCl extract)	5	mg/kg	< 5
Zinc (1M HCl extract)	5	mg/kg	< 5
Acid Sulfate Soils Field pH Test			
pH-F (Field pH test)*	0.1	pH Units	9.5
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	8.7
Reaction Ratings* ^{S05}		comment	4.0

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Oct 08, 2019	14 Days
Total Recoverable Hydrocarbons - 2013 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Oct 08, 2019	14 Days
Total Recoverable Hydrocarbons - 2013 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Oct 08, 2019	
BTEX - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Oct 08, 2019	14 Days
Polycyclic Aromatic Hydrocarbons - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water	Melbourne	Oct 08, 2019	14 Days
Sulphate (as SO ₄) - Method: LTM-INO-4110 Sulfate by Discrete Analyser	Melbourne	Oct 08, 2019	28 Days
Total Organic Carbon - Method: LTM-INO-4060 Total Organic Carbon in water and soil	Melbourne	Oct 09, 2019	28 Days
Phosphorus - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Melbourne	Oct 08, 2019	180 Days
Heavy Metals (1M HCl Extract) - Method: USEPA 6010/6020 Heavy Metals - 1M HCl Extract	Melbourne	Oct 08, 2019	180 Days
Acid Sulfate Soils Field pH Test - Method: LTM-GEN-7060 Determination of field pH (pHF) and field pH peroxide (pHFOX) tests	Brisbane	Oct 08, 2019	7 Days
Total Nitrogen Set (as N) Nitrate & Nitrite (as N) - Method: LTM-INO-4120 Analysis of NO _x NO ₂ NH ₃ by FIA	Melbourne	Oct 11, 2019	28 Days
Total Kjeldahl Nitrogen (as N) - Method: LTM-INO-4310 TKN in Waters & Soils by FIA	Melbourne	Oct 08, 2019	28 Days
% Moisture - Method: LTM-GEN-7080 Moisture	Melbourne	Oct 04, 2019	14 Days

Company Name: Cardno (NSW/ACT) Pty Ltd
Address: Level 9, 203 Pacific Highway
St Leonards
NSW 2065

Order No.: DZ1910
Report #: 680770
Phone: 0294967700
Fax: 02 9499 3902

Received: Oct 3, 2019 2:20 PM
Due: Oct 11, 2019
Priority: 5 Day
Contact Name: Daniel Strickland

Project Name: MANDORAH MARINE FACILITIES

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Aluminium (1M HCl extract)	Arsenic (1M HCl extract)	Cadmium (1M HCl extract)	Chromium (1M HCl extract)	Cobalt (1M HCl extract)	Copper (1M HCl extract)	Iron (1M HCl extract)	Lead (1M HCl extract)	Manganese (1M HCl extract)	Mercury (1M HCl extract)	Nickel (1M HCl extract)	Phosphorus	Sulphate (as SO4)	Total Organic Carbon	Zinc (1M HCl extract)	Polycyclic Aromatic Hydrocarbons	Acid Sulfate Soils Field pH Test	BTEX	Total Nitrogen Set (as N)	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Sydney Laboratory - NATA Site # 18217																										
Brisbane Laboratory - NATA Site # 20794																						X				
Perth Laboratory - NATA Site # 23736																										
External Laboratory																										
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID																					
1	SPLIT 1	Sep 27, 2019		Soil	S19-Oc07653	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ug/L: micrograms per litre
ppm: Parts per million	ppb: Parts per billion	%: Percentage
org/100mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NC	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g,h,i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a,h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Nitrate & Nitrite (as N)	mg/kg	< 5			5	Pass	
Sulphate (as SO ₄)	mg/kg	< 30			30	Pass	
Total Kjeldahl Nitrogen (as N)	mg/kg	< 10			10	Pass	
Total Organic Carbon	%	< 0.1			0.1	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	99			70-130	Pass	
TRH C10-C14	%	92			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	99			70-130	Pass	
Toluene	%	103			70-130	Pass	

Test		Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Ethylbenzene		%	107			70-130	Pass	
m&p-Xylenes		%	101			70-130	Pass	
Xylenes - Total		%	103			70-130	Pass	
LCS - % Recovery								
Total Recoverable Hydrocarbons - 2013 NEPM Fractions								
Naphthalene		%	90			70-130	Pass	
TRH C6-C10		%	98			70-130	Pass	
TRH >C10-C16		%	89			70-130	Pass	
LCS - % Recovery								
Polycyclic Aromatic Hydrocarbons								
Acenaphthene		%	78			70-130	Pass	
Acenaphthylene		%	86			70-130	Pass	
Anthracene		%	79			70-130	Pass	
Benz(a)anthracene		%	73			70-130	Pass	
Benzo(a)pyrene		%	79			70-130	Pass	
Benzo(b&j)fluoranthene		%	87			70-130	Pass	
Benzo(g,h,i)perylene		%	74			70-130	Pass	
Benzo(k)fluoranthene		%	82			70-130	Pass	
Chrysene		%	78			70-130	Pass	
Dibenz(a,h)anthracene		%	75			70-130	Pass	
Fluoranthene		%	83			70-130	Pass	
Fluorene		%	82			70-130	Pass	
Indeno(1,2,3-cd)pyrene		%	81			70-130	Pass	
Naphthalene		%	74			70-130	Pass	
Phenanthrene		%	75			70-130	Pass	
Pyrene		%	77			70-130	Pass	
LCS - % Recovery								
Sulphate (as SO4)		%	87			70-130	Pass	
Total Kjeldahl Nitrogen (as N)		%	86			70-130	Pass	
Total Organic Carbon		%	88			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery								
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1				
TRH C6-C9	M19-Oc12707	NCP	%	73		70-130	Pass	
TRH C10-C14	M19-Oc12769	NCP	%	121		70-130	Pass	
Spike - % Recovery								
BTEX				Result 1				
Benzene	M19-Oc12707	NCP	%	70		70-130	Pass	
Toluene	M19-Oc12707	NCP	%	81		70-130	Pass	
Ethylbenzene	M19-Oc12707	NCP	%	91		70-130	Pass	
m&p-Xylenes	M19-Oc12707	NCP	%	88		70-130	Pass	
o-Xylene	M19-Oc12707	NCP	%	95		70-130	Pass	
Xylenes - Total	M19-Oc12707	NCP	%	91		70-130	Pass	
Spike - % Recovery								
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1				
Naphthalene	M19-Oc12707	NCP	%	102		70-130	Pass	
TRH C6-C10	M19-Oc12707	NCP	%	74		70-130	Pass	
TRH >C10-C16	M19-Oc12769	NCP	%	117		70-130	Pass	
Spike - % Recovery								
Polycyclic Aromatic Hydrocarbons				Result 1				
Acenaphthene	M19-Oc14722	NCP	%	84		70-130	Pass	
Acenaphthylene	M19-Oc14722	NCP	%	90		70-130	Pass	
Anthracene	M19-Oc14722	NCP	%	112		70-130	Pass	
Benz(a)anthracene	M19-Oc14722	NCP	%	90		70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzo(a)pyrene	M19-Oc14722	NCP	%	89			70-130	Pass	
Benzo(b&j)fluoranthene	M19-Oc14722	NCP	%	103			70-130	Pass	
Benzo(g,h,i)perylene	M19-Oc14722	NCP	%	101			70-130	Pass	
Benzo(k)fluoranthene	M19-Oc14722	NCP	%	87			70-130	Pass	
Chrysene	M19-Oc14722	NCP	%	98			70-130	Pass	
Dibenz(a,h)anthracene	M19-Oc14722	NCP	%	97			70-130	Pass	
Fluoranthene	M19-Oc14722	NCP	%	75			70-130	Pass	
Fluorene	M19-Oc14722	NCP	%	80			70-130	Pass	
Indeno(1,2,3-cd)pyrene	M19-Oc14722	NCP	%	112			70-130	Pass	
Naphthalene	M19-Oc14722	NCP	%	85			70-130	Pass	
Phenanthrene	M19-Oc14722	NCP	%	116			70-130	Pass	
Pyrene	M19-Oc14722	NCP	%	76			70-130	Pass	
Spike - % Recovery									
				Result 1					
Sulphate (as SO ₄)	M19-Oc09694	NCP	%	103			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M19-Oc12987	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	M19-Oc10378	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M19-Oc10378	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	M19-Oc10378	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M19-Oc12987	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	M19-Oc12987	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	M19-Oc12987	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	M19-Oc12987	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	M19-Oc12987	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	M19-Oc12987	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M19-Oc12987	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	M19-Oc12987	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	M19-Oc10378	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	M19-Oc10378	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	M19-Oc10378	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M19-Oc12021	NCP	mg/kg	7.9	8.4	7.0	30%	Pass	
Acenaphthylene	M19-Oc12021	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	M19-Oc12021	NCP	mg/kg	4.0	2.5	47	30%	Fail	Q15
Benz(a)anthracene	M19-Oc12021	NCP	mg/kg	< 0.5	0.6	54	30%	Fail	Q15
Benzo(a)pyrene	M19-Oc12021	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	M19-Oc12021	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g,h,i)perylene	M19-Oc12021	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	M19-Oc12021	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	M19-Oc12021	NCP	mg/kg	< 0.5	0.6	49	30%	Fail	Q15
Dibenz(a,h)anthracene	M19-Oc12021	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	M19-Oc12021	NCP	mg/kg	2.7	2.6	3.0	30%	Pass	
Fluorene	M19-Oc12021	NCP	mg/kg	5.7	6.1	6.0	30%	Pass	
Indeno(1,2,3-cd)pyrene	M19-Oc12021	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	M19-Oc12021	NCP	mg/kg	2.5	2.9	14	30%	Pass	
Phenanthrene	M19-Oc12021	NCP	mg/kg	16	10	46	30%	Fail	Q02
Pyrene	M19-Oc12021	NCP	mg/kg	2.1	2.0	6.0	30%	Pass	

Duplicate								
				Result 1	Result 2	RPD		
Nitrate & Nitrite (as N)	M19-Oc04650	NCP	mg/kg	< 5	< 5	<1	30%	Pass
Sulphate (as SO ₄)	M19-Oc05042	NCP	mg/kg	< 30	< 30	<1	30%	Pass
Total Organic Carbon	S19-Oc07653	CP	%	0.9	0.7	22	30%	Pass
% Moisture	B19-Oc07955	NCP	%	6.1	6.3	3.0	30%	Pass
Duplicate								
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD		
pH-F (Field pH test)*	S19-Oc07653	CP	pH Units	9.5	9.6	pass	30%	Pass
Reaction Ratings*	S19-Oc07653	CP	comment	4.0	4.0	pass	30%	Pass

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q02	The duplicate %RPD is outside the recommended acceptance criteria. Further analysis indicates sample heterogeneity as the cause
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.
S05	Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0; No reaction to slight. 2.0; Moderate reaction. 3.0; Strong reaction with persistent froth. 4.0; Extreme reaction.

Authorised By

Ursula Long	Analytical Services Manager
Emily Rosenberg	Senior Analyst-Metal (VIC)
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Julie Kay	Senior Analyst-Inorganic (VIC)
Myles Clark	Senior Analyst-SPOCAS (QLD)



Glenn Jackson General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

CERTIFICATE OF ANALYSIS

Work Order : **ES1931055**
Client : **CARDNO (WA) PTY LTD**
Contact : **MR DANIEL STRICKLAND**
Address : **222 Planet Street**
WELSHPOOL WA, AUSTRALIA 6106
Telephone : **+61 08 9273 3888**
Project : **Mandorah Marine Facilities**
Order number : **DZ1910**
C-O-C number : **1**
Sampler : **DANIEL STRICKLAND**
Site : **----**
Quote number : **SY/513/19 V2**
No. of samples received : **22**
No. of samples analysed : **22**

Page : 1 of 33
Laboratory : Environmental Division Sydney
Contact : Rhiannon Steere
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : 08 9406 1306
Date Samples Received : 01-Oct-2019 11:00
Date Analysis Commenced : 02-Oct-2019
Issue Date : 11-Oct-2019 17:34



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>
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW
Santusha Pandra	Senior Chemist	Brisbane Organics, Stafford, QLD
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- EP090: Sample 'TRIP2' shows poor matrix spike recovery due to matrix interference.
- EA150H: Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1 2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently NATA endorsement does not apply to hydrometer results.
- 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, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EG035: Poor matrix spike recovery was obtained for Mercury on sample ES1931055 # 1. Confirmed by re-analysis.
- EP080-SD: Surrogate recovery bias low due to sample matrix interferences, confirmed by re-analysis.
- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2001	BH2002	BH2003	BH2004	BH2005
Client sampling date / time					28-Sep-2019 08:25	28-Sep-2019 07:45	28-Sep-2019 08:00	28-Sep-2019 09:10	28-Sep-2019 09:30
Compound	CAS Number	LOR	Unit		ES1931055-001	ES1931055-002	ES1931055-003	ES1931055-004	ES1931055-005
					Result	Result	Result	Result	Result
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		8.9	8.7	9.1	9.0	9.0
pH (Fox)	----	0.1	pH Unit		6.7	6.8	6.8	7.1	7.1
Reaction Rate	----	1	Reaction Unit		4	4	4	4	4
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		22.8	26.9	26.9	44.4	23.4
EA150: Particle Sizing									
+75µm	----	1	%		85	79	85	46	82
+150µm	----	1	%		69	64	60	40	62
+300µm	----	1	%		35	37	26	29	37
+425µm	----	1	%		29	33	23	27	32
+600µm	----	1	%		24	30	21	24	28
+1180µm	----	1	%		17	25	16	18	19
+2.36mm	----	1	%		14	20	14	10	11
+4.75mm	----	1	%		11	14	12	6	5
+9.5mm	----	1	%		9	10	6	<1	2
+19.0mm	----	1	%		<1	<1	<1	<1	<1
+37.5mm	----	1	%		<1	<1	<1	<1	<1
+75.0mm	----	1	%		<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		10	14	11	34	14
Silt (2-60 µm)	----	1	%		4	5	4	14	3
Sand (0.06-2.00 mm)	----	1	%		71	59	71	39	69
Gravel (>2mm)	----	1	%		15	22	14	13	14
Cobbles (>6cm)	----	1	%		<1	<1	<1	<1	<1
ED040: Sulfur as SO4 2-									
Sulfate as SO4 2-	14808-79-8	100	mg/kg		3900	5130	3400	4910	2880
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES									
Aluminium	7429-90-5	50	mg/kg		1620	2090	1860	3860	1970
Arsenic	7440-38-2	1.0	mg/kg		2.5	2.6	3.0	2.3	2.2
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.5	mg/kg		0.6	0.9	0.6	2.4	1.7
Chromium	7440-47-3	1.0	mg/kg		2.5	4.6	3.4	7.8	3.9
Copper	7440-50-8	1.0	mg/kg		1.1	1.6	<1.0	1.9	1.0
Iron	7439-89-6	50	mg/kg		1560	2820	1690	4840	2890



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2001	BH2002	BH2003	BH2004	BH2005
Client sampling date / time					28-Sep-2019 08:25	28-Sep-2019 07:45	28-Sep-2019 08:00	28-Sep-2019 09:10	28-Sep-2019 09:30
Compound	CAS Number	LOR	Unit		ES1931055-001	ES1931055-002	ES1931055-003	ES1931055-004	ES1931055-005
					Result	Result	Result	Result	Result
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES - Continued									
Lead	7439-92-1	1.0	mg/kg		1.8	2.4	1.7	5.0	2.0
Manganese	7439-96-5	10	mg/kg		138	121	116	148	224
Nickel	7440-02-0	1.0	mg/kg		<1.0	1.4	<1.0	2.7	1.2
Zinc	7440-66-6	1.0	mg/kg		1.7	3.4	1.7	5.1	2.4
EG035-SDH: 1M HCl extractable Mercury by FIMS									
Mercury	7439-97-6	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		1.1	0.4	0.4	0.4	0.3
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		90	370	130	260	110
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		90	370	130	260	110
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		211	304	257	294	214
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.06	0.10	0.09	0.22	0.08
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2001	BH2002	BH2003	BH2004	BH2005
Client sampling date / time					28-Sep-2019 08:25	28-Sep-2019 07:45	28-Sep-2019 08:00	28-Sep-2019 09:10	28-Sep-2019 09:30
Compound	CAS Number	LOR	Unit		ES1931055-001	ES1931055-002	ES1931055-003	ES1931055-004	ES1931055-005
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	0.6	0.6	0.6	0.6
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	1.2	1.2	1.2	1.2
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	3	mg/kg		<3	4	5	6	3
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	5	mg/kg		<5	<5	<5	<5	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg		<3	4	5	6	3
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	<3	<3	<3	<3
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2001	BH2002	BH2003	BH2004	BH2005
Client sampling date / time					28-Sep-2019 08:25	28-Sep-2019 07:45	28-Sep-2019 08:00	28-Sep-2019 09:10	28-Sep-2019 09:30
Compound	CAS Number	LOR	Unit		ES1931055-001	ES1931055-002	ES1931055-003	ES1931055-004	ES1931055-005
					Result	Result	Result	Result	Result
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg		<3	<3	<3	3	<3
C29 - C36 Fraction	----	5	mg/kg		<5	<5	<5	<5	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg		<3	<3	<3	3	<3
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		<3.0	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg		<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	<5	9	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg		<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg		<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg		<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg		<4	36	<4	<4	13
Anthracene	120-12-7	4	µg/kg		<4	<4	<4	<4	<4
Fluoranthene	206-44-0	4	µg/kg		<4	37	<4	<4	8
Pyrene	129-00-0	4	µg/kg		<4	28	<4	<4	7
Benz(a)anthracene	56-55-3	4	µg/kg		<4	7	<4	<4	<4
Chrysene	218-01-9	4	µg/kg		<4	22	<4	<4	<4



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2001	BH2002	BH2003	BH2004	BH2005
Client sampling date / time					28-Sep-2019 08:25	28-Sep-2019 07:45	28-Sep-2019 08:00	28-Sep-2019 09:10	28-Sep-2019 09:30
Compound	CAS Number	LOR	Unit		ES1931055-001	ES1931055-002	ES1931055-003	ES1931055-004	ES1931055-005
					Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		<4	24	<4	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg		<4	11	<4	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg		<4	11	<4	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg		<4	15	<4	<4	<4
Perylene	198-55-0	4	µg/kg		<4	<4	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg		<4	14	<4	<4	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg		<4	<4	<4	<4	<4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg		<4	12	<4	<4	<4
Coronene	191-07-1	5	µg/kg		<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg		<4	217	9	<4	28
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg		<4	21	<4	<4	<4
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg		5	23	5	5	5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg		10	25	10	10	10
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		81.4	87.5	83.6	95.6	83.4
2-Chlorophenol-D4	93951-73-6	0.5	%		82.1	86.6	83.8	92.9	84.2
2,4,6-Tribromophenol	118-79-6	0.5	%		66.7	73.1	70.6	86.3	84.4
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		73.5	87.1	91.8	102	90.0
Anthracene-d10	1719-06-8	0.5	%		93.0	88.6	92.9	100	85.5
4-Terphenyl-d14	1718-51-0	0.5	%		86.4	82.1	87.6	101	87.8
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		88.4	88.5	85.0	77.2	78.6
Toluene-D8	2037-26-5	0.2	%		105	106	102	92.3	97.2
4-Bromofluorobenzene	460-00-4	0.2	%		99.0	101	106	88.0	101
EP080-SD: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		102	107	110	92.8	86.8
Toluene-D8	2037-26-5	0.2	%		97.9	89.3	107	91.2	83.7
4-Bromofluorobenzene	460-00-4	0.2	%		111	118	98.8	96.3	105
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		124	95.1	66.4	127	112
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		103	94.3	113	111	109
Anthracene-d10	1719-06-8	10	%		99.1	93.7	113	105	109



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2001	BH2002	BH2003	BH2004	BH2005
Client sampling date / time					28-Sep-2019 08:25	28-Sep-2019 07:45	28-Sep-2019 08:00	28-Sep-2019 09:10	28-Sep-2019 09:30
Compound	CAS Number	LOR	Unit		ES1931055-001	ES1931055-002	ES1931055-003	ES1931055-004	ES1931055-005
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	10	%		88.7	76.2	88.1	88.6	90.3



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2006	BH2007	BH2008	BH2009	BH2010
Client sampling date / time					28-Sep-2019 08:45	27-Sep-2019 11:05	26-Sep-2019 11:00	27-Sep-2019 10:20	26-Sep-2019 09:30
Compound	CAS Number	LOR	Unit		ES1931055-006	ES1931055-007	ES1931055-008	ES1931055-009	ES1931055-010
					Result	Result	Result	Result	Result
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		9.0	9.1	9.1	9.0	8.7
pH (Fox)	----	0.1	pH Unit		6.7	6.8	7.0	6.7	7.4
Reaction Rate	----	1	Reaction Unit		4	4	4	4	4
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		26.9	24.3	32.7	25.6	26.0
EA150: Particle Sizing									
+75µm	----	1	%		89	89	73	88	80
+150µm	----	1	%		83	61	69	62	51
+300µm	----	1	%		65	24	49	25	13
+425µm	----	1	%		40	19	38	21	8
+600µm	----	1	%		21	15	30	17	6
+1180µm	----	1	%		8	6	19	8	2
+2.36mm	----	1	%		5	2	12	5	1
+4.75mm	----	1	%		3	<1	7	2	<1
+9.5mm	----	1	%		2	<1	<1	2	<1
+19.0mm	----	1	%		<1	<1	<1	<1	<1
+37.5mm	----	1	%		<1	<1	<1	<1	<1
+75.0mm	----	1	%		<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		7	6	19	10	13
Silt (2-60 µm)	----	1	%		3	3	7	1	6
Sand (0.06-2.00 mm)	----	1	%		84	87	60	83	80
Gravel (>2mm)	----	1	%		6	4	14	6	1
Cobbles (>6cm)	----	1	%		<1	<1	<1	<1	<1
ED040: Sulfur as SO4 2-									
Sulfate as SO4 2-	14808-79-8	100	mg/kg		4270	3130	4150	2860	2380
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES									
Aluminium	7429-90-5	50	mg/kg		1530	1810	2820	1540	1680
Arsenic	7440-38-2	1.0	mg/kg		3.3	2.4	1.8	3.0	1.7
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.5	mg/kg		0.6	0.8	1.3	0.8	1.0
Chromium	7440-47-3	1.0	mg/kg		1.8	3.5	4.8	3.0	3.5
Copper	7440-50-8	1.0	mg/kg		<1.0	<1.0	1.2	<1.0	2.1
Iron	7439-89-6	50	mg/kg		1540	1940	3110	1860	2250



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2006	BH2007	BH2008	BH2009	BH2010
Client sampling date / time					28-Sep-2019 08:45	27-Sep-2019 11:05	26-Sep-2019 11:00	27-Sep-2019 10:20	26-Sep-2019 09:30
Compound	CAS Number	LOR	Unit		ES1931055-006	ES1931055-007	ES1931055-008	ES1931055-009	ES1931055-010
					Result	Result	Result	Result	Result
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES - Continued									
Lead	7439-92-1	1.0	mg/kg		1.5	2.2	3.2	2.2	10.0
Manganese	7439-96-5	10	mg/kg		149	129	119	147	102
Nickel	7440-02-0	1.0	mg/kg		<1.0	1.1	1.7	<1.0	<1.0
Zinc	7440-66-6	1.0	mg/kg		<1.0	5.9	3.1	2.7	2.2
EG035-SDH: 1M HCl extractable Mercury by FIMS									
Mercury	7439-97-6	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		0.3	0.2	0.4	0.3	0.5
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		40	120	150	120	60
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		40	120	150	120	60
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		258	245	264	271	183
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.07	0.12	0.11	0.10	0.09
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2006	BH2007	BH2008	BH2009	BH2010
Client sampling date / time					28-Sep-2019 08:45	27-Sep-2019 11:05	26-Sep-2019 11:00	27-Sep-2019 10:20	26-Sep-2019 09:30
Compound	CAS Number	LOR	Unit		ES1931055-006	ES1931055-007	ES1931055-008	ES1931055-009	ES1931055-010
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	0.6	0.6	0.6	0.6
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	1.2	1.2	1.2	1.2
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	3	mg/kg		<3	8	3	11	10
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	5	mg/kg		<5	<5	<5	<5	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg		<3	8	3	11	10
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	<3	<3	<3	<3
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2006	BH2007	BH2008	BH2009	BH2010
Client sampling date / time					28-Sep-2019 08:45	27-Sep-2019 11:05	26-Sep-2019 11:00	27-Sep-2019 10:20	26-Sep-2019 09:30
Compound	CAS Number	LOR	Unit		ES1931055-006	ES1931055-007	ES1931055-008	ES1931055-009	ES1931055-010
					Result	Result	Result	Result	Result
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg		<3	5	<3	7	6
C29 - C36 Fraction	----	5	mg/kg		<5	<5	<5	6	6
^ C10 - C36 Fraction (sum)	----	3	mg/kg		<3	5	<3	13	12
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		<3.0	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg		<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	57	<5	11	<5
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg		<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg		<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg		<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg		<4	<4	<4	<4	<4
Anthracene	120-12-7	4	µg/kg		<4	<4	<4	<4	<4
Fluoranthene	206-44-0	4	µg/kg		<4	<4	<4	<4	<4
Pyrene	129-00-0	4	µg/kg		<4	<4	<4	<4	<4
Benz(a)anthracene	56-55-3	4	µg/kg		<4	<4	<4	<4	<4
Chrysene	218-01-9	4	µg/kg		<4	<4	<4	<4	<4



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				BH2006	BH2007	BH2008	BH2009	BH2010
Client sampling date / time				28-Sep-2019 08:45	27-Sep-2019 11:05	26-Sep-2019 11:00	27-Sep-2019 10:20	26-Sep-2019 09:30
Compound	CAS Number	LOR	Unit	ES1931055-006	ES1931055-007	ES1931055-008	ES1931055-009	ES1931055-010
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	<4	<4	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	<4	<4	<4
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	<4	<4	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	<4
Indeno(1,2,3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	<4	<4
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	<4	57	<4	11	<4
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<4	<4	<4	<4	<4
^ 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
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	84.9	82.5	86.2	87.9	86.1
2-Chlorophenol-D4	93951-73-6	0.5	%	84.1	84.7	84.4	82.9	84.0
2,4,6-Tribromophenol	118-79-6	0.5	%	80.3	88.5	79.4	82.3	76.8
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	88.0	92.6	89.3	91.2	94.0
Anthracene-d10	1719-06-8	0.5	%	83.4	84.6	85.3	87.2	86.4
4-Terphenyl-d14	1718-51-0	0.5	%	82.4	87.0	87.4	88.9	87.4
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.2	%	91.0	93.5	92.7	91.0	90.2
Toluene-D8	2037-26-5	0.2	%	108	109	111	106	107
4-Bromofluorobenzene	460-00-4	0.2	%	104	105	106	99.8	102
EP080-SD: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.2	%	112	112	110	96.6	111
Toluene-D8	2037-26-5	0.2	%	108	108	101	91.2	102
4-Bromofluorobenzene	460-00-4	0.2	%	120	115	120	101	114
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	98.0	121	149	94.6	88.0
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	101	109	96.2	95.5	112
Anthracene-d10	1719-06-8	10	%	99.6	119	95.2	99.8	108

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Work Order : ES1931055
Client : CARDNO (WA) PTY LTD
Project : Mandorah Marine Facilities



Analytical Results

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

Client sample ID

				BH2006	BH2007	BH2008	BH2009	BH2010
Client sampling date / time				28-Sep-2019 08:45	27-Sep-2019 11:05	26-Sep-2019 11:00	27-Sep-2019 10:20	26-Sep-2019 09:30
Compound	CAS Number	LOR	Unit	ES1931055-006	ES1931055-007	ES1931055-008	ES1931055-009	ES1931055-010
				Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued								
4-Terphenyl-d14	1718-51-0	10	%	93.2	98.8	81.4	81.4	106



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				BH2011	BH2012	BH2013	BH2014	BH2015
Client sampling date / time				27-Sep-2019 09:45	26-Sep-2019 10:30	27-Sep-2019 13:00	26-Sep-2019 08:30	28-Sep-2019 10:00
Compound	CAS Number	LOR	Unit	ES1931055-011	ES1931055-012	ES1931055-013	ES1931055-014	ES1931055-015
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	8.8	9.0	8.9	8.8	8.8
pH (Fox)	----	0.1	pH Unit	6.8	6.8	6.7	6.6	6.7
Reaction Rate	----	1	Reaction Unit	4	4	4	4	4
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	30.5	21.8	22.2	18.0	25.8
EA150: Particle Sizing								
+75µm	----	1	%	91	81	89	95	89
+150µm	----	1	%	56	67	74	61	48
+300µm	----	1	%	24	35	32	12	17
+425µm	----	1	%	21	30	26	8	15
+600µm	----	1	%	17	27	22	6	14
+1180µm	----	1	%	6	21	13	3	12
+2.36mm	----	1	%	1	16	8	1	11
+4.75mm	----	1	%	<1	13	5	<1	10
+9.5mm	----	1	%	<1	7	<1	<1	7
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	7	12	9	4	7
Silt (2-60 µm)	----	1	%	1	6	2	1	3
Sand (0.06-2.00 mm)	----	1	%	89	64	80	93	79
Gravel (>2mm)	----	1	%	3	18	9	2	11
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
ED040: Sulfur as SO4 2-								
Sulfate as SO4 2-	14808-79-8	100	mg/kg	3420	3170	3250	3020	3370
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES								
Aluminium	7429-90-5	50	mg/kg	1830	1810	1620	410	450
Arsenic	7440-38-2	1.0	mg/kg	3.2	2.1	2.4	3.0	3.5
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.5	mg/kg	1.9	1.1	0.8	<0.5	<0.5
Chromium	7440-47-3	1.0	mg/kg	3.5	2.6	2.8	2.7	2.2
Copper	7440-50-8	1.0	mg/kg	<1.0	6.3	1.4	1.3	<1.0
Iron	7439-89-6	50	mg/kg	2120	1730	1960	1460	1490



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2011	BH2012	BH2013	BH2014	BH2015
Client sampling date / time					27-Sep-2019 09:45	26-Sep-2019 10:30	27-Sep-2019 13:00	26-Sep-2019 08:30	28-Sep-2019 10:00
Compound	CAS Number	LOR	Unit		ES1931055-011	ES1931055-012	ES1931055-013	ES1931055-014	ES1931055-015
					Result	Result	Result	Result	Result
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES - Continued									
Lead	7439-92-1	1.0	mg/kg		2.3	4.7	5.8	1.5	1.5
Manganese	7439-96-5	10	mg/kg		163	76	112	119	139
Nickel	7440-02-0	1.0	mg/kg		2.0	1.2	1.5	<1.0	<1.0
Zinc	7440-66-6	1.0	mg/kg		14.1	5.1	4.6	1.8	1.8
EG035-SDH: 1M HCl extractable Mercury by FIMS									
Mercury	7439-97-6	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		0.3	0.3	0.3	0.8	0.5
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		120	100	140	80	110
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		120	100	140	80	110
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		297	181	246	252	233
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.08	0.12	0.08	0.06	0.08
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2011	BH2012	BH2013	BH2014	BH2015
Client sampling date / time					27-Sep-2019 09:45	26-Sep-2019 10:30	27-Sep-2019 13:00	26-Sep-2019 08:30	28-Sep-2019 10:00
Compound	CAS Number	LOR	Unit		ES1931055-011	ES1931055-012	ES1931055-013	ES1931055-014	ES1931055-015
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	0.6	0.6	0.6	0.6
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	1.2	1.2	1.2	1.2
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	3	mg/kg		6	4	4	27	6
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	5	mg/kg		<5	<5	<5	7	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg		6	4	4	34	6
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	<3	<3	<3	<3
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2011	BH2012	BH2013	BH2014	BH2015
Client sampling date / time					27-Sep-2019 09:45	26-Sep-2019 10:30	27-Sep-2019 13:00	26-Sep-2019 08:30	28-Sep-2019 10:00
Compound	CAS Number	LOR	Unit		ES1931055-011	ES1931055-012	ES1931055-013	ES1931055-014	ES1931055-015
					Result	Result	Result	Result	Result
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg		4	<3	<3	16	4
C29 - C36 Fraction	----	5	mg/kg		<5	<5	<5	14	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg		4	<3	<3	30	4
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		<3.0	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg		<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	3.8	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	<5	14	<5	11
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg		<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg		<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg		<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg		<4	<4	<4	<4	<4
Anthracene	120-12-7	4	µg/kg		<4	<4	<4	<4	<4
Fluoranthene	206-44-0	4	µg/kg		<4	<4	<4	<4	<4
Pyrene	129-00-0	4	µg/kg		<4	<4	<4	<4	<4
Benz(a)anthracene	56-55-3	4	µg/kg		<4	<4	<4	<4	<4
Chrysene	218-01-9	4	µg/kg		<4	<4	<4	<4	<4



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2011	BH2012	BH2013	BH2014	BH2015
Client sampling date / time					27-Sep-2019 09:45	26-Sep-2019 10:30	27-Sep-2019 13:00	26-Sep-2019 08:30	28-Sep-2019 10:00
Compound	CAS Number	LOR	Unit		ES1931055-011	ES1931055-012	ES1931055-013	ES1931055-014	ES1931055-015
					Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		<4	<4	<4	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg		<4	<4	<4	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg		<4	<4	<4	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg		<4	<4	<4	<4	<4
Perylene	198-55-0	4	µg/kg		<4	<4	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg		<4	<4	<4	<4	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg		<4	<4	<4	<4	<4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg		<4	<4	<4	<4	<4
Coronene	191-07-1	5	µg/kg		<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg		<4	<4	14	<4	11
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg		<4	<4	<4	<4	<4
^ 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
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		87.6	88.4	85.7	84.4	84.8
2-Chlorophenol-D4	93951-73-6	0.5	%		82.9	86.6	81.6	86.4	84.9
2,4,6-Tribromophenol	118-79-6	0.5	%		83.1	68.3	74.4	71.0	68.6
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		91.9	95.3	89.7	88.4	91.5
Anthracene-d10	1719-06-8	0.5	%		87.8	90.1	87.2	85.0	86.7
4-Terphenyl-d14	1718-51-0	0.5	%		90.5	91.3	88.1	93.0	86.6
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		90.8	99.4	85.8	89.2	87.9
Toluene-D8	2037-26-5	0.2	%		107	117	102	108	100.0
4-Bromofluorobenzene	460-00-4	0.2	%		101	107	96.7	102	94.1
EP080-SD: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		110	81.2	104	109	106
Toluene-D8	2037-26-5	0.2	%		105	79.2	103	104	100.0
4-Bromofluorobenzene	460-00-4	0.2	%		119	95.5	112	114	109
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		103	70.9	108	97.4	97.4
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		95.2	104	92.4	100	119
Anthracene-d10	1719-06-8	10	%		97.7	103	97.7	97.6	118

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Work Order : ES1931055
Client : CARDNO (WA) PTY LTD
Project : Mandorah Marine Facilities



Analytical Results

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

Client sample ID

				BH2011	BH2012	BH2013	BH2014	BH2015
Client sampling date / time				27-Sep-2019 09:45	26-Sep-2019 10:30	27-Sep-2019 13:00	26-Sep-2019 08:30	28-Sep-2019 10:00
Compound	CAS Number	LOR	Unit	ES1931055-011	ES1931055-012	ES1931055-013	ES1931055-014	ES1931055-015
				Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued								
4-Terphenyl-d14	1718-51-0	10	%	76.3	86.4	80.1	82.9	110



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2016	BH2017	BH2018	BH2019	TRIP1
Client sampling date / time					27-Sep-2019 07:33	27-Sep-2019 12:00	27-Sep-2019 09:00	27-Sep-2019 07:30	26-Sep-2019 00:00
Compound	CAS Number	LOR	Unit		ES1931055-016	ES1931055-017	ES1931055-018	ES1931055-019	ES1931055-020
					Result	Result	Result	Result	Result
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		9.0	9.0	9.0	8.8	8.7
pH (Fox)	----	0.1	pH Unit		6.8	7.3	6.9	6.7	6.8
Reaction Rate	----	1	Reaction Unit		4	4	4	4	4
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		25.5	23.4	27.6	18.8	29.3
EA150: Particle Sizing									
+75µm	----	1	%		82	76	85	73	84
+150µm	----	1	%		60	65	69	62	73
+300µm	----	1	%		16	44	31	41	39
+425µm	----	1	%		11	40	24	36	32
+600µm	----	1	%		9	37	18	30	28
+1180µm	----	1	%		6	30	9	18	19
+2.36mm	----	1	%		4	26	5	10	12
+4.75mm	----	1	%		<1	24	2	6	7
+9.5mm	----	1	%		<1	20	<1	2	2
+19.0mm	----	1	%		<1	<1	<1	<1	<1
+37.5mm	----	1	%		<1	<1	<1	<1	<1
+75.0mm	----	1	%		<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		11	12	11	15	11
Silt (2-60 µm)	----	1	%		7	8	1	9	4
Sand (0.06-2.00 mm)	----	1	%		78	52	82	63	71
Gravel (>2mm)	----	1	%		4	28	6	13	14
Cobbles (>6cm)	----	1	%		<1	<1	<1	<1	<1
ED040: Sulfur as SO4 2-									
Sulfate as SO4 2-	14808-79-8	100	mg/kg		2930	2760	3280	940	2880
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES									
Aluminium	7429-90-5	50	mg/kg		1880	1990	1870	1790	2310
Arsenic	7440-38-2	1.0	mg/kg		2.0	2.4	2.6	<1.0	2.1
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.5	mg/kg		0.7	1.2	0.8	1.6	0.8
Chromium	7440-47-3	1.0	mg/kg		3.4	3.6	2.8	1.7	3.8
Copper	7440-50-8	1.0	mg/kg		1.1	1.3	1.2	1.6	1.6
Iron	7439-89-6	50	mg/kg		1960	2590	1800	890	2490



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2016	BH2017	BH2018	BH2019	TRIP1
Client sampling date / time					27-Sep-2019 07:33	27-Sep-2019 12:00	27-Sep-2019 09:00	27-Sep-2019 07:30	26-Sep-2019 00:00
Compound	CAS Number	LOR	Unit		ES1931055-016	ES1931055-017	ES1931055-018	ES1931055-019	ES1931055-020
					Result	Result	Result	Result	Result
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES - Continued									
Lead	7439-92-1	1.0	mg/kg		2.7	4.4	1.7	5.3	2.8
Manganese	7439-96-5	10	mg/kg		114	96	99	40	106
Nickel	7440-02-0	1.0	mg/kg		1.0	1.4	1.2	1.4	1.2
Zinc	7440-66-6	1.0	mg/kg		10.3	3.1	2.6	2.5	4.7
EG035-SDH: 1M HCl extractable Mercury by FIMS									
Mercury	7439-97-6	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		0.4	0.4	0.3	0.6	0.4
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		150	90	150	70	90
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		150	90	150	70	90
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		202	317	331	216	447
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.13	0.13	0.16	0.08	0.13
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2016	BH2017	BH2018	BH2019	TRIP1
Client sampling date / time					27-Sep-2019 07:33	27-Sep-2019 12:00	27-Sep-2019 09:00	27-Sep-2019 07:30	26-Sep-2019 00:00
Compound	CAS Number	LOR	Unit		ES1931055-016	ES1931055-017	ES1931055-018	ES1931055-019	ES1931055-020
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	0.6	0.6	0.6	0.6
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	1.2	1.2	1.2	1.2
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	3	mg/kg		3	5	7	<3	<3
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	5	mg/kg		<5	<5	<5	<5	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg		3	5	7	<3	<3
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	<3	<3	<3	<3
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2016	BH2017	BH2018	BH2019	TRIP1
Client sampling date / time					27-Sep-2019 07:33	27-Sep-2019 12:00	27-Sep-2019 09:00	27-Sep-2019 07:30	26-Sep-2019 00:00
Compound	CAS Number	LOR	Unit		ES1931055-016	ES1931055-017	ES1931055-018	ES1931055-019	ES1931055-020
					Result	Result	Result	Result	Result
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg		<3	<3	4	<3	<3
C29 - C36 Fraction	----	5	mg/kg		<5	<5	<5	<5	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg		<3	<3	4	<3	<3
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		<3.0	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg		1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg		2.9	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	50	55	30	19
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg		<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg		<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg		<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg		<4	<4	29	<4	<4
Anthracene	120-12-7	4	µg/kg		<4	<4	<4	<4	<4
Fluoranthene	206-44-0	4	µg/kg		13	<4	39	<4	<4
Pyrene	129-00-0	4	µg/kg		13	<4	29	<4	<4
Benz(a)anthracene	56-55-3	4	µg/kg		8	<4	7	<4	<4
Chrysene	218-01-9	4	µg/kg		8	<4	11	<4	<4



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2016	BH2017	BH2018	BH2019	TRIP1
Client sampling date / time					27-Sep-2019 07:33	27-Sep-2019 12:00	27-Sep-2019 09:00	27-Sep-2019 07:30	26-Sep-2019 00:00
Compound	CAS Number	LOR	Unit		ES1931055-016	ES1931055-017	ES1931055-018	ES1931055-019	ES1931055-020
					Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		13	<4	7	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg		6	<4	<4	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg		6	<4	<4	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg		9	<4	<4	<4	<4
Perylene	198-55-0	4	µg/kg		<4	<4	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg		11	<4	<4	<4	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg		<4	<4	<4	<4	<4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg		8	<4	<4	<4	<4
Coronene	191-07-1	5	µg/kg		<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg		95	50	177	30	19
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg		13	<4	<4	<4	<4
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg		15	5	6	5	5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg		17	10	10	10	10
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		86.6	89.1	87.4	82.0	82.4
2-Chlorophenol-D4	93951-73-6	0.5	%		84.2	89.0	84.2	81.7	84.9
2,4,6-Tribromophenol	118-79-6	0.5	%		68.1	73.6	66.3	61.8	63.1
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		92.2	94.6	90.6	85.2	88.4
Anthracene-d10	1719-06-8	0.5	%		88.9	90.1	86.9	82.8	83.8
4-Terphenyl-d14	1718-51-0	0.5	%		88.7	89.8	86.7	83.8	84.7
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		83.0	91.2	91.8	95.8	86.5
Toluene-D8	2037-26-5	0.2	%		99.8	103	102	110	98.4
4-Bromofluorobenzene	460-00-4	0.2	%		98.3	96.5	95.5	104	97.5
EP080-SD: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		91.9	93.3	112	90.8	84.7
Toluene-D8	2037-26-5	0.2	%		88.3	86.0	106	89.3	85.3
4-Bromofluorobenzene	460-00-4	0.2	%		98.0	110	118	94.7	88.0
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		83.8	102	108	107	115
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		101	114	110	103	98.2
Anthracene-d10	1719-06-8	10	%		107	106	104	106	104

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 Work Order : ES1931055
 Client : CARDNO (WA) PTY LTD
 Project : Mandorah Marine Facilities



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH2016	BH2017	BH2018	BH2019	TRIP1
Client sampling date / time					27-Sep-2019 07:33	27-Sep-2019 12:00	27-Sep-2019 09:00	27-Sep-2019 07:30	26-Sep-2019 00:00
Compound	CAS Number	LOR	Unit		ES1931055-016	ES1931055-017	ES1931055-018	ES1931055-019	ES1931055-020
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	10	%		95.5	98.7	104	99.2	97.7



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TRIP2	SPLIT2	----	----	----
Client sampling date / time					26-Sep-2019 00:00	27-Sep-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1931055-021	ES1931055-022	-----	-----	-----
					Result	Result	----	----	----
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		8.7	9.1	----	----	----
pH (Fox)	----	0.1	pH Unit		7.0	6.7	----	----	----
Reaction Rate	----	1	Reaction Unit		4	4	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		30.4	27.0	----	----	----
EA150: Particle Sizing									
+75µm	----	1	%		75	86	----	----	----
+150µm	----	1	%		63	65	----	----	----
+300µm	----	1	%		35	14	----	----	----
+425µm	----	1	%		30	10	----	----	----
+600µm	----	1	%		27	7	----	----	----
+1180µm	----	1	%		22	4	----	----	----
+2.36mm	----	1	%		16	2	----	----	----
+4.75mm	----	1	%		10	<1	----	----	----
+9.5mm	----	1	%		6	<1	----	----	----
+19.0mm	----	1	%		<1	<1	----	----	----
+37.5mm	----	1	%		<1	<1	----	----	----
+75.0mm	----	1	%		<1	<1	----	----	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		16	8	----	----	----
Silt (2-60 µm)	----	1	%		6	6	----	----	----
Sand (0.06-2.00 mm)	----	1	%		60	83	----	----	----
Gravel (>2mm)	----	1	%		18	3	----	----	----
Cobbles (>6cm)	----	1	%		<1	<1	----	----	----
ED040: Sulfur as SO4 2-									
Sulfate as SO4 2-	14808-79-8	100	mg/kg		3120	3820	----	----	----
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES									
Aluminium	7429-90-5	50	mg/kg		2710	1990	----	----	----
Arsenic	7440-38-2	1.0	mg/kg		2.6	2.5	----	----	----
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	----	----	----
Cobalt	7440-48-4	0.5	mg/kg		1.9	0.9	----	----	----
Chromium	7440-47-3	1.0	mg/kg		5.4	4.1	----	----	----
Copper	7440-50-8	1.0	mg/kg		1.3	<1.0	----	----	----
Iron	7439-89-6	50	mg/kg		5390	2100	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TRIP2	SPLIT2	----	----	----
Client sampling date / time					26-Sep-2019 00:00	27-Sep-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1931055-021	ES1931055-022	-----	-----	-----
					Result	Result	----	----	----
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES - Continued									
Lead	7439-92-1	1.0	mg/kg		5.5	3.1	----	----	----
Manganese	7439-96-5	10	mg/kg		129	131	----	----	----
Nickel	7440-02-0	1.0	mg/kg		2.2	1.0	----	----	----
Zinc	7440-66-6	1.0	mg/kg		3.4	9.8	----	----	----
EG035-SDH: 1M HCl extractable Mercury by FIMS									
Mercury	7439-97-6	0.10	mg/kg		<0.10	<0.10	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		0.4	0.4	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		200	360	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		200	360	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		408	622	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.11	0.16	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	----	----	----
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	----	----	----
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	----	----	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	----	----	----
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	----	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TRIP2	SPLIT2	----	----	----
Client sampling date / time					26-Sep-2019 00:00	27-Sep-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1931055-021	ES1931055-022	-----	-----	-----
					Result	Result	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	0.6	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	1.2	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	----	----	----
C10 - C14 Fraction	----	50	mg/kg		<50	<50	----	----	----
C15 - C28 Fraction	----	100	mg/kg		<100	<100	----	----	----
C29 - C36 Fraction	----	100	mg/kg		<100	<100	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	----	----	----
>C10 - C16 Fraction	----	3	mg/kg		<3	<3	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	----	----	----
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	----	----	----
>C16 - C34 Fraction	----	3	mg/kg		<3	<3	----	----	----
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	----	----	----
>C34 - C40 Fraction	----	5	mg/kg		<5	<5	----	----	----
>C10 - C40 Fraction (sum)	----	3	mg/kg		<3	<3	----	----	----
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	----	----	----
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	<3	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	----	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	----	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	----	----	----
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	----	----	----
Naphthalene	91-20-3	1	mg/kg		<1	<1	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TRIP2	SPLIT2	----	----	----
Client sampling date / time					26-Sep-2019 00:00	27-Sep-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1931055-021	ES1931055-022	-----	-----	-----
					Result	Result	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	<3	----	----	----
C10 - C14 Fraction	----	3	mg/kg		<3	<3	----	----	----
C15 - C28 Fraction	----	3	mg/kg		<3	<3	----	----	----
C29 - C36 Fraction	----	5	mg/kg		<5	<5	----	----	----
^ C10 - C36 Fraction (sum)	----	3	mg/kg		<3	<3	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	<3	----	----	----
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		<3.0	<3.0	----	----	----
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	----	----	----
Toluene	108-88-3	0.2	mg/kg		<0.2	<0.2	----	----	----
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	<0.2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.2	<0.2	----	----	----
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	<0.2	----	----	----
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	----	----	----
Naphthalene	91-20-3	0.2	mg/kg		<0.2	<0.2	----	----	----
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	----	----	----
Dibutyltin	1002-53-5	1	µgSn/kg		<1	2	----	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	9.5	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	<5	----	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	----	----	----
Acenaphthylene	208-96-8	4	µg/kg		<4	<4	----	----	----
Acenaphthene	83-32-9	4	µg/kg		<4	<4	----	----	----
Fluorene	86-73-7	4	µg/kg		<4	<4	----	----	----
Phenanthrene	85-01-8	4	µg/kg		<4	<4	----	----	----
Anthracene	120-12-7	4	µg/kg		<4	<4	----	----	----
Fluoranthene	206-44-0	4	µg/kg		<4	<4	----	----	----
Pyrene	129-00-0	4	µg/kg		<4	<4	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg		<4	<4	----	----	----
Chrysene	218-01-9	4	µg/kg		<4	<4	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TRIP2	SPLIT2	----	----	----
Client sampling date / time					26-Sep-2019 00:00	27-Sep-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1931055-021	ES1931055-022	-----	-----	-----
					Result	Result	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		<4	<4	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg		<4	<4	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg		<4	<4	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg		<4	<4	----	----	----
Perylene	198-55-0	4	µg/kg		<4	<4	----	----	----
Benzo(g,h,i)perylene	191-24-2	4	µg/kg		<4	<4	----	----	----
Dibenz(a,h)anthracene	53-70-3	4	µg/kg		<4	<4	----	----	----
Indeno(1,2,3.cd)pyrene	193-39-5	4	µg/kg		<4	<4	----	----	----
Coronene	191-07-1	5	µg/kg		<5	<5	----	----	----
^ Sum of PAHs	----	4	µg/kg		<4	<4	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg		<4	<4	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg		5	5	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg		10	10	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		86.0	83.5	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%		82.0	81.7	----	----	----
2,4,6-Tribromophenol	118-79-6	0.5	%		82.6	81.8	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		91.1	89.3	----	----	----
Anthracene-d10	1719-06-8	0.5	%		84.1	83.5	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		86.4	85.1	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		91.0	80.6	----	----	----
Toluene-D8	2037-26-5	0.2	%		99.4	86.4	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		105	92.2	----	----	----
EP080-SD: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		70.0	128	----	----	----
Toluene-D8	2037-26-5	0.2	%		74.6	142	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		89.4	148	----	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		104	75.3	----	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		103	99.7	----	----	----
Anthracene-d10	1719-06-8	10	%		93.8	105	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TRIP2	SPLIT2	----	----	----
Client sampling date / time					26-Sep-2019 00:00	27-Sep-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1931055-021	ES1931055-022	-----	-----	-----
					Result	Result	----	----	----
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	10	%		96.5	86.7	----	----	----



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2,4,6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130
EP080-SD: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	67	137
Toluene-D8	2037-26-5	74	134
4-Bromofluorobenzene	460-00-4	73	137
EP090S: Organotin Surrogate			
Tripopyltin	----	35	130
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	55	135
Anthracene-d10	1719-06-8	70	136
4-Terphenyl-d14	1718-51-0	57	127

CERTIFICATE OF ANALYSIS 274223**Client Details**

Client	Ecoz Environmental Services
Attention	Emma Smith
Address	Level 1, 70 Cavenagh Street, Darwin, NT, 0800

Sample Details

Your Reference	<u>EZ21285- Mandorah sediment grabs Dec2021</u>
Number of Samples	14 Sediment
Date samples received	17/12/2021
Date completed instructions received	17/12/2021

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	21/12/2021
Date of Issue	21/12/2021
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

Lien Tang, Assistant Operations Manager
Travis Carey, Organics - Team Leader

Authorised By

Michael Kubiak, Laboratory Manager

Organotin Compounds in Soil

Our Reference		274223-1	274223-2	274223-3	274223-4	274223-5
Your Reference	UNITS	TBT01	TBT02	TBT03	TBT04	TBT05
Date Sampled		15/12/2021	15/12/2021	15/12/2021	15/12/2021	15/12/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date extracted	-	20/12/2021	20/12/2021	20/12/2021	20/12/2021	20/12/2021
Date analysed	-	21/12/2021	21/12/2021	21/12/2021	21/12/2021	21/12/2021
Tributyltin as Sn	µg Sn/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate Triphenyltin	%	95	99	87	86	90

Organotin Compounds in Soil

Our Reference		274223-6	274223-7	274223-8	274223-9	274223-10
Your Reference	UNITS	TBT06	TBT07	TBT08	TBT09	TBT10
Date Sampled		15/12/2021	15/12/2021	15/12/2021	15/12/2021	15/12/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date extracted	-	20/12/2021	20/12/2021	20/12/2021	20/12/2021	20/12/2021
Date analysed	-	21/12/2021	21/12/2021	21/12/2021	21/12/2021	21/12/2021
Tributyltin as Sn	µg Sn/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate Triphenyltin	%	81	82	81	85	84

Organotin Compounds in Soil

Our Reference		274223-11	274223-12	274223-13	274223-14
Your Reference	UNITS	TBT11	TBT12	Duplicate 1	Duplicate 2
Date Sampled		15/12/2021	15/12/2021	15/12/2021	15/12/2021
Type of sample		Sediment	Sediment	Sediment	Sediment
Date extracted	-	20/12/2021	20/12/2021	20/12/2021	20/12/2021
Date analysed	-	21/12/2021	21/12/2021	21/12/2021	21/12/2021
Tributyltin as Sn	µg Sn/kg	<0.5	<0.5	<0.5	<0.5
Surrogate Triphenyltin	%	81	82	81	86

External Testing

Our Reference		274223-1	274223-2	274223-3	274223-4	274223-5
Your Reference	UNITS	TBT01	TBT02	TBT03	TBT04	TBT05
Date Sampled		15/12/2021	15/12/2021	15/12/2021	15/12/2021	15/12/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Total Organic Carbon by Combustion	mg/kg	1,600	1,200	1,400	1,200	1,300

External Testing

Our Reference		274223-6	274223-7	274223-8	274223-9	274223-10
Your Reference	UNITS	TBT06	TBT07	TBT08	TBT09	TBT10
Date Sampled		15/12/2021	15/12/2021	15/12/2021	15/12/2021	15/12/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Total Organic Carbon by Combustion	mg/kg	1,800	2,300	1,200	1,300	1,100

External Testing

Our Reference		274223-11	274223-12	274223-13	274223-14
Your Reference	UNITS	TBT11	TBT12	Duplicate 1	Duplicate 2
Date Sampled		15/12/2021	15/12/2021	15/12/2021	15/12/2021
Type of sample		Sediment	Sediment	Sediment	Sediment
Total Organic Carbon by Combustion	mg/kg	1,200	1,200	1,100	1,100

Moisture						
Our Reference	UNITS	274223-1	274223-2	274223-3	274223-4	274223-5
Your Reference		TBT01	TBT02	TBT03	TBT04	TBT05
Date Sampled		15/12/2021	15/12/2021	15/12/2021	15/12/2021	15/12/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	20/12/2021	20/12/2021	20/12/2021	20/12/2021	20/12/2021
Date analysed	-	20/12/2021	20/12/2021	20/12/2021	20/12/2021	20/12/2021
Moisture	%	24	23	25	23	23

Moisture						
Our Reference	UNITS	274223-6	274223-7	274223-8	274223-9	274223-10
Your Reference		TBT06	TBT07	TBT08	TBT09	TBT10
Date Sampled		15/12/2021	15/12/2021	15/12/2021	15/12/2021	15/12/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	20/12/2021	20/12/2021	20/12/2021	20/12/2021	20/12/2021
Date analysed	-	20/12/2021	20/12/2021	20/12/2021	20/12/2021	20/12/2021
Moisture	%	28	27	13	24	23

Moisture					
Our Reference	UNITS	274223-11	274223-12	274223-13	274223-14
Your Reference		TBT11	TBT12	Duplicate 1	Duplicate 2
Date Sampled		15/12/2021	15/12/2021	15/12/2021	15/12/2021
Type of sample		Sediment	Sediment	Sediment	Sediment
Date prepared	-	20/12/2021	20/12/2021	20/12/2021	20/12/2021
Date analysed	-	20/12/2021	20/12/2021	20/12/2021	20/12/2021
Moisture	%	22	21	21	22

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.
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. Note - air volume measurements are not covered by Envirolab's NATA accreditation.

QUALITY CONTROL: Organotin Compounds in Soil					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	274223-2
Date extracted	-			20/12/2021	1	20/12/2021	20/12/2021		20/12/2021	20/12/2021
Date analysed	-			21/12/2021	1	21/12/2021	21/12/2021		21/12/2021	21/12/2021
Tributyltin as Sn	µg Sn/kg	0.5	Org-025/026	<0.5	1	<0.5	<0.5	0	91	100
Surrogate Triphenyltin	%		Org-025/026	94	1	95	93	2	95	93

QUALITY CONTROL: Organotin Compounds in Soil					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	11	20/12/2021	20/12/2021		[NT]	[NT]
Date analysed	-			[NT]	11	21/12/2021	21/12/2021		[NT]	[NT]
Tributyltin as Sn	µg Sn/kg	0.5	Org-025/026	[NT]	11	<0.5	<0.5	0	[NT]	[NT]
Surrogate Triphenyltin	%		Org-025/026	[NT]	11	81	80	1	[NT]	[NT]

Client Reference: EZ21285- Mandorah sediment grabs Dec2021

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	1	1600	1500	6	91	[NT]

QUALITY CONTROL: External Testing						Duplicate		Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Total Organic Carbon by Combustion	mg/kg	100	Ext-054	[NT]	11	1200	1300	8	[NT]	[NT]

QUALITY CONTROL: Moisture						Duplicate		Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			20/12/2021	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Date analysed	-			20/12/2021	[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

Total Organic Carbon in soil conducted by Envirolab Services Pty Ltd, NSW, report reference 285714.

APPENDIX

E

SEDIMENT SAMPLING QA/QC REPORT

Sediment Data Quality Review

Mandorah Marine Facilities – Environmental Sediment Sampling and Analysis

This appendix Reviews the Quality Assurance (QA) and Quality Control (QC) documentation. Quality assurance encompasses the actions, procedures, checks and decisions undertaken to ensure the sample integrity and representativeness, and the reliability and accuracy of analysis results. The QA documentation should also include an indication of the Data Quality Objectives sought in relation to each significant action, test or process involved in the assessment.

QC activities measure the effectiveness of the QA procedures by undertaking testing, and then comparing results to previously established objectives. QC work will include the internal laboratory testing as well as results of QC samples submitted such as trip blanks and duplicates. The quality of the information and/or data is deemed satisfactory when the QC results demonstrate that agreed objectives have been met.

QA/QC Aspects	Evidence & Evaluation
QA Documentation	
Project Quality Plan/Work Plan and Data Quality Objectives	Cardno was engaged by the Department of Infrastructure, Planning and Logistics ("DPIIL") to conduct sediment sampling and analysis as part of the design and documentation services for new marine facilities to service the Mandorah and Cox Peninsula communities. The investigation was carried on the 26th, 27th and 28th of September 2019; and was in accordance with the proposed scope of work, as documented the Draft Sampling Analysis Plan (SAP) developed by the DIPL (Cardno Ref: 20190224_Mandorah Marine Facilities Sampling Plan') and in general compliance with the Australian standards AS 4482.1- 2005 "Guide to Sampling and Investigation of Potentially Contaminated Soil, Part 1: Non-volatile and Semi-volatile Compounds" and ANZECC & ARMCANZ 2000 "Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand".
Data Representativeness	
Holding Times	Chain of custody and laboratory reports provide evidence of holding times. Holding times were all compliant with required timeframes. Sample storage requirements and holding times were undertaken in accordance with those recommended by Standards Australia (AS/NZS 5667.1:1998 and AS 4482.1).
Verification of field procedures	The methodology conducted during this investigation is documented in the body of the Letter Report 'DZ1940Letter02.1_MandorahMarineFacilities EnvironmentalSampling.docx', and was in general conformance with the Sample and Analysis Plan.
Field Forms	Daily Records and data reporting sheets were used during field works to document and track observations and information collected during the site inspection and intrusive work investigations. Chain of Custody was used to ensure the integrity of the samples from collection to receipt by the analytical laboratory.
Data Precision & Accuracy	
QC Testing – Blind Replicates (Primary Lab)	For the field sampling event, blind replicates were taken from 2 samples for QC testing – 2 blind replicates were taken at one sample location and 1 blind replicate was taken at a second sample location. Calculated RPDs are presented in Table 1. - Acceptance Criteria: RPD < 30% - Soil Samples Analysed: 19 - Blind Replicate Samples Analysed: 3 - Blind Replicate Analyte Pairs: 306

QA/QC Aspects	Evidence & Evaluation
	- Number of Analyte Pairs Exceeding Criteria: 33 - Percentage of Analyte Pairs Exceeding Criteria: 10.7% Exceedances reported above the adopted quality objective of 30% were as follows: - Benzo(a)pyrene TEQ (LOR) - BH2016 – 0.017 mg/kg / SPLIT2 – 0.01 mg/kg RPD = 52% - Benzo(a)pyrene TEQ calc (Half) - BH2008 – 0.015 mg/kg / SPLIT2 – 0.005 mg/kg RPD = 100% - Benzo(a)pyrene TEQ calc (Zero) - BH2016 – 0.013 mg/kg / SPLIT2 – <0.004 mg/kg RPD = 106% - Kjeldahl Nitrogen Total - BH2008 – 150 mg/kg / TRIP1 – 90 mg/kg RPD = 50% - BH2016 – 150 mg/kg / SPLIT2 – 360 mg/kg RPS = 82% - Nitrogen Total - BH2008 – 150 mg/kg / TRIP1 – 90 mg/kg RPD = 50% - BH2016 – 150 mg/kg / SPLIT2 – 360 mg/kg RPD = 82% - Sulphate - BH2008 – 4150 mg/kg / TRIP1 – 2880 mg/kg RPD = 36% - Arsenic - BH2008 – 1.8 mg/kg / TRIP2 – 2.6 mg/kg RPD = 36% - Cobalt - BH2008 – 1.3 mg/kg / TRIP1 – 0.8 mg/kg RPD = 48% - BH2008 – 1.3 mg/kg / TRIP2 – 1.9 mg/kg RPD = 38% - Lead - BH2008 – 3.2 mg/kg / TRIP2 – 5.5 mg/kg RPD = 53% - Nickel - BH2008 – 1.7 mg/kg / TRIP1 – 1.2 mg/kg RPD = 34% - Iron - BH2008 – 3110 mg/kg / TRIP1 – 5390 mg/kg RPD = 54% - Phosphorous - BH2008 – 264 mg/kg / TRIP1 – 447 mg/kg RPD = 51% - BH2008 – 364 mg/kg / TRIP2 – 408 mg/kg RPD = 43% - BH2016 – 202 mg/kg / SPLIT2 – 622 mg/kg RPD = 102% - Zinc - BH2008 – 3.1 mg/kg / TRIP1 – 4.7 mg/kg RPD = 41% - Dibutyltin - BH2016 – 0.001 mg/kg / SPLIT2 – 0.002 mg/kg RPD = 67% - Napthalene - BH2008 – <0.005 mg/kg / TRIP1 – 0.019 mg/kg RPD = 117% - Benzo(b+j)fluoranthene - BH2016 – 0.013 mg/kg / SPLIT2 – <0.004 mg/kg RPD = 106% - Benz(a)anthracene - BH2016 – 0.008 mg/kg / SPLIT2 – <0.004 mg/kg RPD = 67% - Benz(a) pyrene - BH2016 – 0.009 mg/kg / SPLIT2 – <0.004 mg/kg RPD = 77% - Benz(g,h,i) perylene - BH2016 – 0.011 mg/kg / SPLIT2 – <0.004 mg/kg RPD = 93% - Benzo(k)fluoranthene - BH2016 – 0.006 mg/kg / SPLIT2 – <0.004 mg/kg RPD = 40%

QA/QC Aspects	Evidence & Evaluation
	- Chrysene - BH2016 – 0.008 mg/kg / SPLIT2 – <0.004 mg/kg RPD = 67% - Fluoranthene - BH2016 – 0.013 mg/kg / SPLIT2 – <0.004 mg/kg RPD = 106% - Indeno(1,2,3-c,d)pyrene - BH2016 – 0.008 mg/kg / SPLIT2 – <0.004 mg/kg RPD = 67% - Pyrene - BH2016 – 0.013 mg/kg / SPLIT2 – <0.004 mg/kg RPD = 106% - PAHs (Sum of total) - BH2008 – <0.004 mg/kg / TRIP1 – 0.019 mg/kg RPD = 130% - BH2016 – 0.095 mg/kg / SPLIT2 – <0.004 mg/kg RPD = 184% - Tributyltin as SN - BH2016 – 0.0029 mg/kg / SPLIT2 – 0.0095 mg/kg RPD = 106% - Benzo(e)pyrene - BH2016 – 0.006 mg/kg / SPLIT2 – <0.004 mg/kg RPD = 40% The differences between the primary and duplicate samples are taken into account by using the higher values when comparing against criteria (if applicable). The level of exceedances are generally minor and probably related to the low analyte concentrations of analyte pairs. Overall, these exceedances are not considered to affect the validity of the data set.
QC Testing – Field Splits (Secondary Lab)	For the field event one (1) blind triplicate sample was taken for QC testing. Calculated RPDs are presented in Table 1. - Acceptance Criteria: RPD < 30% - Soil Samples Analysed: 19 - Field Split Samples Analysed: 1 - Field Split Analyte Pairs: 99 - Number of Analyte Pairs Exceeding Criteria: 8 - Percentage of Analyte Pairs Exceeding Criteria: 8.1% Exceedances reported above the adopted quality objective of 30% were as follows: - Sulphate - BH2016 – 2930 mg/kg / SPLIT1 – 1000 mg/kg RPD = 98% - TOC - BH2016 – 0.13% / SPLIT1 – 0.9% RPD = 150% - Aluminium - BH2016 – 1880 mg/kg / SPLIT1 – <20 mg/kg RPD = 196% - Cobalt - BH2016 – 0.7 mg/kg / SPLIT1 – 600 mg/kg RPD = 200% - Iron - BH2016 – 1960 mg/kg / SPLIT1 – 99 mg/kg RPD = 181% - Manganese - BH2016 – 114 mg/kg / SPLIT1 – <10 mg/kg RPD = 168% - Phosphorous - BH2016 – 202 mg/kg / SPLIT1 – 340 mg/kg RPD = 51% - Zinc - BH2016 – 10.3 mg/kg / SPLIT1 – <5 mg/kg RPD = 69%

QA/QC Aspects	Evidence & Evaluation
Laboratory Internal QC	Both ALS (Primary) and Eurofins (Secondary) performed internal QC with adequate testing and satisfactory results for method blank laboratory control samples and laboratory duplicates.
	Primary Laboratory (ALS) The primary laboratory reported that there were no outliers for the following QC procedures: • Method blanks. • Duplicates. • Laboratory Control. • Analysis Holding Time. • Quality Control Sample Frequency Outliers. The following matrix spike exceedances were reported from the primary laboratory: • Mercury – BH2001: Recovery (60.1%) less than lower data quality objective (70 – 130%). • Total Phosphorus as P – SPLIT2: MS recovery not determined, background level greater than or equal to 4x spike level. • Monobutyltin – TRIP2: Recovery (18.7%) less than lower data quality objective (20 – 130%). The following Surrogate recovery outliers were reported from the primary laboratory: • Toluene-D8 – SPLIT2: Recovery (142%) greater than upper data quality objective (74 – 134%). • 4-Bromofluorobenzene – SPLIT2: Recovery (148%) greater than upper data quality objective (73 – 137%). • Tripropyltin – BH2008: Recovery (142%) greater than upper data quality objective (35 – 130%).
	Secondary Laboratory (Eurofins) The secondary laboratory reported that there were no outliers for the following QC procedures: • Method blanks. • Matrix Spikes. • Laboratory Control. • Analysis Holding Time. • Quality Control Sample Frequency Outliers. The following duplicate exceedances were reported from the secondary laboratory: • Anthracene– SPLIT1: RPD (47%) greater than acceptable limit (30%). • Benz(a)anthracene – SPLIT1: RPD (54%) greater than acceptable limit (30%). • Chrysene – SPLIT1: RPD (49%) greater than acceptable limit (30%). • Phenanthrene – SPLIT1: RPD (46%) greater than acceptable limit (30%).
Laboratory Method Detection Limit	Laboratory reports indicate the method detection limits were lower than the respective assessment criteria.

QA/QC Aspects	Evidence & Evaluation
NATA endorsement of laboratory reports	Laboratory reports were stamped with the NATA endorsement stamp and signature. ALS Sydney Accreditation No.: 825 Eurofins NSW Accreditation No.: 1261
Decontamination	Reusable equipment was decontaminated between sample locations using Decon 90 solution, followed by rinsing in tap water and deionised water.
Data Comparability	
Standard Procedures	Fieldwork procedures are detailed in the Letter Report - <i>Mandorah Marine Facilities - Environmental Sediment Sampling And Analysis</i> .
Qualified Personnel	Staff involved in managing and reviewing the project and those involved in fieldwork are qualified and suitably experienced in sediment sampling. Field work undertaken was undertaken by a Senior Coastal Engineer with experience working in contaminated sites. All fieldwork was undertaken by the same personnel. Project Management and Supervision undertaken by a Senior Coastal Engineer with 8+ years' experience working in coastal projects. Project Direction undertaken by a Principal Coastal Engineer with experience in marine sediment sampling.
Volatile Losses	Cardno made every effort to keep samples chilled during the site investigation and during transit to the laboratory by placing the samples in eskies with ice blocks, and ensuring that the eskies were kept closed and sealed as much as practicable.
Sample Integrity	Field Chain of Custody/Laboratory request forms are provided Letter Report - <i>Mandorah Marine Facilities - Environmental Sediment Sampling And Analysis</i>
Data Completeness	
Completeness of test program	The scope of work undertaken was generally consistent with the scope agreed upon by the Client and set out in the SAP.
Validity of Data Set	The data quality review indicates no significant systematic errors in the data collection process for soil and therefore, the data set used as the basis for the sediment sampling is considered valid and complete.

SDG		1		1		1		1	
Field ID		BH2008		TRIP1		RPD		BH2008	
Sampled Date/Time		26/09/2019 11:00		26/09/2019 11:00				26/09/2019 11:00	
								TRIP2	
								RPD	
Chem_Group	ChemName	Units	EQL						
	Benzo(a)pyrene TEQ (LOR)	mg/kg	0.5	1.2	1.2	0	1.2	1.2	0
	Benzo(a)pyrene TEQ (LOR)	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.01	0.01	0	0.01	0.01	0
	Benzo(a)pyrene TEQ calc (Half)	mg/kg	0.5	0.6	0.6	0	0.6	0.6	0
	Benzo(a)pyrene TEQ calc (Half)	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.005	0.005	0	0.005	0.005	0
	Benzo(a)pyrene TEQ calc (Zero)	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(a)pyrene TEQ calc (Zero)	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
pH field/fox	pH (F)	pH Unit	0.1	9.1	8.7	4	9.1	8.7	4
	pH (Fox)	pH Unit	0.1	7.0	6.8	3	7.0	7.0	0
	Reaction Rate	Reaction U	1	4.0	4.0	0	4.0	4.0	0
BTEX	Benzene	mg/kg	0.2 (Primary): 0.1 (Interlab)	<0.2	<0.2	0	<0.2	<0.2	0
	Benzene	mg/kg	0.2 (Primary): 0.1 (Interlab)	<0.2	<0.2	0	<0.2	<0.2	0
	Ethylbenzene	mg/kg	0.5 (Primary): 0.1 (Interlab)	<0.5	<0.5	0	<0.5	<0.5	0
	Ethylbenzene	mg/kg	0.2 (Primary): 0.1 (Interlab)	<0.2	<0.2	0	<0.2	<0.2	0
	Toluene	mg/kg	0.5 (Primary): 0.1 (Interlab)	<0.5	<0.5	0	<0.5	<0.5	0
	Toluene	mg/kg	0.2 (Primary): 0.1 (Interlab)	<0.2	<0.2	0	<0.2	<0.2	0
	Total BTEX	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
	Total BTEX	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
	Xylene (m & p)	mg/kg	0.5 (Primary): 0.2 (Interlab)	<0.5	<0.5	0	<0.5	<0.5	0
	Xylene (m & p)	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
	Xylene (o)	mg/kg	0.5 (Primary): 0.1 (Interlab)	<0.5	<0.5	0	<0.5	<0.5	0
	Xylene (o)	mg/kg	0.2 (Primary): 0.1 (Interlab)	<0.2	<0.2	0	<0.2	<0.2	0
	Xylene Total	mg/kg	0.5 (Primary): 0.3 (Interlab)	<0.5	<0.5	0	<0.5	<0.5	0
	Xylene Total	mg/kg	0.5 (Primary): 0.3 (Interlab)	<0.5	<0.5	0	<0.5	<0.5	0
	C6-C10 less BTEX (F1)	mg/kg	3 (Primary): 20 (Interlab)	<3.0	<3.0	0	<3.0	<3.0	0
	C6-C10 less BTEX (F1)	mg/kg	10 (Primary): 20 (Interlab)	<10.0	<10.0	0	<10.0	<10.0	0
Inorganics	Kjeldahl Nitrogen Total	mg/kg	20 (Primary): 10 (Interlab)	150.0	90.0	50	150.0	200.0	29
	Nitrogen (Total Oxidised)	mg/kg	0.1	0.4	0.4	0	0.4	0.4	0
	Nitrogen (Total)	mg/kg	20 (Primary): 10 (Interlab)	150.0	90.0	50	150.0	200.0	29
	Sulphate	mg/kg	100 (Primary): 30 (Interlab)	4150.0	2880.0	36	4150.0	3120.0	28
	TOC	%	0.02 (Primary): 0.1 (Interlab)	0.11	0.13	17	0.11	0.11	0
Lead	Lead	mg/kg	1 (Primary): 5 (Interlab)	3.2	2.8	13	3.2	5.5	53
Metals	Aluminium	mg/kg	50 (Primary): 20 (Interlab)	2820.0	2310.0	20	2820.0	2710.0	4
	Arsenic	mg/kg	1 (Primary): 2 (Interlab)	1.8	2.1	15	1.8	2.6	36
	Cadmium	mg/kg	0.1 (Primary): 0.4 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0
	Chromium (III+VI)	mg/kg	1 (Primary): 5 (Interlab)	4.8	3.8	23	4.8	5.4	12
	Cobalt	mg/kg	0.5 (Primary): 5 (Interlab)	1.3	0.8	48	1.3	1.9	38
	Copper	mg/kg	1 (Primary): 5 (Interlab)	1.2	1.6	29	1.2	1.3	8
	Iron	mg/kg	50 (Primary): 20 (Interlab)	3110.0	2490.0	22	3110.0	5390.0	54
	Manganese	mg/kg	10	119.0	106.0	12	119.0	129.0	8
	Mercury	mg/kg	0.1 (Primary): 2 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0
	Nickel	mg/kg	1 (Primary): 5 (Interlab)	1.7	1.2	34	1.7	2.2	26
	Phosphorus	mg/kg	2 (Primary): 5 (Interlab)	264.0	447.0	51	264.0	408.0	43
	Zinc	mg/kg	1 (Primary): 5 (Interlab)	3.1	4.7	41	3.1	3.4	9
Organotins	Dibutyltin	mg/kg	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Monobutyltin	mg/kg	0.001	<0.001	<0.001	0	<0.001	<0.001	0
PAH	Benzo(b+j)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(b+j)fluoranthene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
PAH/Phenols	2-methylnaphthalene	mg/kg	0.005	<0.005	<0.005	0	<0.005	<0.005	0
	Acenaphthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Acenaphthene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Acenaphthylene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Anthracene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Benz(a)anthracene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Benzo(a) pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(a) pyrene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Benzo(g,h,i)perylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(g,h,i)perylene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(k)fluoranthene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Chrysene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Chrysene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Dibenz(a,h)anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Dibenz(a,h)anthracene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Fluoranthene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Fluorene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Fluorene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Naphthalene	mg/kg	1 (Primary): 0.5 (Interlab)	<1.0	<1.0	0	<1.0	<1.0	0
	Naphthalene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Naphthalene	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0	<0.2	<0.2	0
	Naphthalene	mg/kg	0.005 (Primary): 0.5 (Interlab)	<0.005	0.019	117	<0.005	<0.005	0
	PAHs (Sum of total)	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	0.019	130	<0.004	<0.004	0
	Phenanthrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Phenanthrene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Pyrene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.004	0
	Tributyltin as SN	mg/kg	0.0005	<0.0005	<0.0005	0	<0.0005	<0.0005	0
SVOCs	Perylene	mg/kg	0.004	<0.004	<0.004	0	<0.004	<0.004	0
	Benzo(e)pyrene	mg/kg	0.004	<0.004	<0.004	0	<0.004	<0.004	0
	Coronene	mg/kg	0.005	<0.005	<0.005	0	<0.005	<0.005	0
TPH	C10-C16	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0
	C16-C34	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0	0
	C34-C40	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0	0
	F2-NAPHTHALENE	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0
	C6 - C9	mg/kg	3 (Primary): 20 (Interlab)	<3.0	<3.0	0	<3.0	<3.0	0
	C6 - C9	mg/kg	10 (Primary): 20 (Interlab)	<10.0	<10.0	0	<10.0	<10.0	0
	C10 - C14	mg/kg	50 (Primary): 20 (Interlab)	<50.0	<50.0	0	<50.0	<50.0	0
	C10 - C14	mg/kg	3 (Primary): 20 (Interlab)	<3.0	<3.0	0	<3.0	<3.0	0
	C15 - C28	mg/kg	3 (Primary): 50 (Interlab)	<3.0	<3.0	0	<3.0	<3.0	0
	C15 - C28	mg/kg	100 (Primary): 50 (Interlab)	<100.0	<100.0	0	<100.0	<100.0	0
	C29-C36	mg/kg	5 (Primary): 50 (Interlab)	<5.0	<5.0	0	<5.0	<5.0	0
	C29-C36	mg/kg	100 (Primary): 50 (Interlab)	<100.0	<100.0	0	<100.0	<100.0	0

				SDG			1		
				Field ID			1		
				Sampled Date/Time			RPD		
				BH2008			BH2008		
				26/09/2019 11:00			26/09/2019 11:00		
				TRIP1			TRIP2		
				26/09/2019 11:00			26/09/2019 11:00		
							RPD		

SDG		1		1	RPD	1	3-Oct-19	RPD
Field ID		BH2016	SPLIT2			BH2016	SPLIT 1	
Sampled Date/Time		27/09/2019 7:33	27/09/2019 7:33			27/09/2019 7:33	27/09/2019 7:33	
Chem_Group	ChemName	Units	EQL					
	Benzo(a)pyrene TEQ (LOR)	mg/kg	0.5	1.2	1.2	0	1.2	1.2
	Benzo(a)pyrene TEQ (LOR)	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.017	0.01	52		0
	Benzo(a)pyrene TEQ calc (Half)	mg/kg	0.5	0.6	0.6	0	0.6	0
	Benzo(a)pyrene TEQ calc (Half)	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.015	0.005	100		
	Benzo(a)pyrene TEQ calc (Zero)	mg/kg	0.5	<0.5	<0.5	0	<0.5	0
	Benzo(a)pyrene TEQ calc (Zero)	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.013	<0.004	106		
pH field/fox	pH (F)	pH Unit	0.1	9.0	9.1	1	9.0	
	pH (Fox)	pH Unit	0.1	6.8	6.7	1	6.8	8.7
	Reaction Rate	Reaction U	1	4.0	4.0	0	4.0	25
BTEX	Benzene	mg/kg	0.2 (Primary): 0.1 (Interlab)	<0.2	<0.2	0	<0.2	<0.1
	Benzene	mg/kg	0.2 (Primary): 0.1 (Interlab)	<0.2	<0.2	0	<0.2	<0.1
	Ethylbenzene	mg/kg	0.5 (Primary): 0.1 (Interlab)	<0.5	<0.5	0	<0.5	<0.1
	Ethylbenzene	mg/kg	0.2 (Primary): 0.1 (Interlab)	<0.2	<0.2	0	<0.2	<0.1
	Toluene	mg/kg	0.5 (Primary): 0.1 (Interlab)	<0.5	<0.5	0	<0.5	<0.1
	Toluene	mg/kg	0.2 (Primary): 0.1 (Interlab)	<0.2	<0.2	0	<0.2	<0.1
	Total BTEX	mg/kg	0.2	<0.2	<0.2	0	<0.2	
	Total BTEX	mg/kg	0.2	<0.2	<0.2	0	<0.2	
	Xylene (m & p)	mg/kg	0.5 (Primary): 0.2 (Interlab)	<0.5	<0.5	0	<0.5	<0.2
	Xylene (m & p)	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2
	Xylene (o)	mg/kg	0.5 (Primary): 0.1 (Interlab)	<0.5	<0.5	0	<0.5	<0.1
	Xylene (o)	mg/kg	0.2 (Primary): 0.1 (Interlab)	<0.2	<0.2	0	<0.2	<0.1
	Xylene Total	mg/kg	0.5 (Primary): 0.3 (Interlab)	<0.5	<0.5	0	<0.5	<0.3
	Xylene Total	mg/kg	0.5 (Primary): 0.3 (Interlab)	<0.5	<0.5	0	<0.5	<0.3
	C6-C10 less BTEX (F1)	mg/kg	3 (Primary): 20 (Interlab)	<3.0	<3.0	0	<3.0	<20.0
	C6-C10 less BTEX (F1)	mg/kg	10 (Primary): 20 (Interlab)	<10.0	<10.0	0	<10.0	<20.0
Inorganics	Kjeldahl Nitrogen Total	mg/kg	20 (Primary): 10 (Interlab)	150.0	360.0	82	150.0	210.0
	Nitrogen (Total Oxidised)	mg/kg	0.1	0.4	0.4	0	0.4	33
	Nitrogen (Total)	mg/kg	20 (Primary): 10 (Interlab)	150.0	360.0	82	150.0	210.0
	Sulphate	mg/kg	100 (Primary): 30 (Interlab)	2930.0	3820.0	26	2930.0	1000.0
	TOC	%	0.02 (Primary): 0.1 (Interlab)	0.13	0.16	21	0.13	0.9
Lead	Lead	mg/kg	1 (Primary): 5 (Interlab)	2.7	3.1	14	2.7	<5.0
Metals	Aluminium	mg/kg	50 (Primary): 20 (Interlab)	1880.0	1990.0	6	1880.0	<20.0
	Arsenic	mg/kg	1 (Primary): 2 (Interlab)	2.0	2.5	22	2.0	2.3
	Cadmium	mg/kg	0.1 (Primary): 0.4 (Interlab)	<0.1	<0.1	0	<0.1	<0.4
	Chromium (III+VI)	mg/kg	1 (Primary): 5 (Interlab)	3.4	4.1	19	3.4	<5.0
	Cobalt	mg/kg	0.5 (Primary): 5 (Interlab)	0.7	0.9	25	0.7	600.0
	Copper	mg/kg	1 (Primary): 5 (Interlab)	1.1	<1.0	10	1.1	<5.0
	Iron	mg/kg	50 (Primary): 20 (Interlab)	1960.0	2100.0	7	1960.0	99.0
	Manganese	mg/kg	10	114.0	131.0	14	114.0	<10.0
	Mercury	mg/kg	0.1 (Primary): 2 (Interlab)	<0.1	<0.1	0	<0.1	<2.0
	Nickel	mg/kg	1 (Primary): 5 (Interlab)	1.0	1.0	0	1.0	<5.0
	Phosphorus	mg/kg	2 (Primary): 5 (Interlab)	202.0	622.0	102	202.0	340.0
	Zinc	mg/kg	1 (Primary): 5 (Interlab)	10.3	9.8	5	10.3	<5.0
Organotins	Dibutyltin	mg/kg	0.001	0.001	0.002	67	0.001	
	Monobutyltin	mg/kg	0.001	<0.001	<0.001	0	<0.001	
PAH	Benzo(b+j)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Benzo(b+j)fluoranthene	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.013	<0.004	106	0.013	<0.5
PAH/Phenols	2-methylnaphthalene	mg/kg	0.005	<0.005	<0.005	0	<0.005	
	Acenaphthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Acenaphthene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.5
	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Acenaphthylene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.5
	Anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Anthracene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.5
	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Benz(a)anthracene	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.008	<0.004	67	0.008	<0.5
	Benzo(a) pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Benzo(a) pyrene	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.009	<0.004	77	0.009	<0.5
	Benzo(g,h,i)perylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Benzo(g,h,i)perylene	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.011	<0.004	93	0.011	<0.5
	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Benzo(k)fluoranthene	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.006	<0.004	40	0.006	<0.5
	Chrysene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Chrysene	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.008	<0.004	67	0.008	<0.5
	Dibenz(a,h)anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Dibenz(a,h)anthracene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.5
	Fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Fluoranthene	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.013	<0.004	106	0.013	<0.5
	Fluorene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Fluorene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.008	<0.004	67	0.008	<0.5
	Naphthalene	mg/kg	1 (Primary): 0.5 (Interlab)	<1.0	<1.0	0	<1.0	<0.5
	Naphthalene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Naphthalene	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0	<0.2	<0.5
	Naphthalene	mg/kg	0.005 (Primary): 0.5 (Interlab)	<0.005	<0.005	0	<0.005	<0.5
	PAHs (Sum of total)	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.095	<0.004	184	0.095	<0.5
	Phenanthrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Phenanthrene	mg/kg	0.004 (Primary): 0.5 (Interlab)	<0.004	<0.004	0	<0.004	<0.5
	Pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5
	Pyrene	mg/kg	0.004 (Primary): 0.5 (Interlab)	0.013	<0.004	106	0.013	<0.5
	Tributyltin as SN	mg/kg	0.0005	0.0029	0.0095	106	0.0029	
SVOCs	Perylene	mg/kg	0.004	<0.004	<0.004	0	<0.004	
	Benzo(e)pyrene	mg/kg	0.004	0.006	<0.004	40	0.006	
	Coronene	mg/kg	0.005	<0.005	<0.005	0	<0.005	
TPH	C10-C16	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0
	C16-C34	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0
	C34-C40	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0
	F2-NAPHTHALENE	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0
	C6 - C9	mg/kg	3 (Primary): 20 (Interlab)	<3.0	<3.0	0	<3.0	<20.0
	C6 - C9	mg/kg	10 (Primary): 20 (Interlab)	<10.0	<10.0	0	<10.0	<20.0
	C10 - C14	mg/kg	50 (Primary): 20 (Interlab)	<50.0	<50.0	0	<50.0	<20.0
	C10 - C14	mg/kg	3 (Primary): 20 (Interlab)	<3.0	<3.0	0	<3.0	<20.0
	C15 - C28	mg/kg	3 (Primary): 50 (Interlab)	<3.0	<3.0	0	<3.0	<50.0
	C15 - C28	mg/kg	100 (Primary): 50 (Interlab)	<100.0	<100.0	0	<100.0	<50.0
	C29-C36	mg/kg	5 (Primary): 50 (Interlab)	<5.0	<5.0	0	<5.0	<50.0
	C29-C36	mg/kg	100 (Primary): 50 (Interlab)	<100.0	<100.0	0	<100.0	<50.0

SDG	1	1		1	3-Oct-19	
Field ID	BH2016	SPLIT2	RPD	BH2016	SPLIT 1	RPD
Sampled Date/Time	27/09/2019 7:33	27/09/2019 7:33		27/09/2019 7:33	27/09/2019 7:33	

	+C10 - C36 (Sum of total)	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0
	+C10 - C36 (Sum of total)	mg/kg	3 (Primary): 50 (Interlab)	<3.0	<3.0	0	<3.0	<50.0	0
	C10 - C40 (Sum of total)	mg/kg	50 (Primary): 100 (Interlab)	<50.0	<50.0	0	<50.0	<100.0	0
	C6-C10	mg/kg	3 (Primary): 20 (Interlab)	<3.0	<3.0	0	<3.0	<20.0	0
	C6-C10	mg/kg	10 (Primary): 20 (Interlab)	<10.0	<10.0	0	<10.0	<20.0	0

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 80 (1-10 x EQL); 50 (10-30 x EQL); 30 (
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in t