BMT WBM

Port of Brisbane Maintenance Dredging - Sediment Quality Report 2014

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Synopsis: **A report describing the sampling and analysis of sediment quality in the Port of Brisbane during 2014 in accordance with the National Assessment Guidelines for Dredging (2009)**

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Executive Summary

Port of Brisbane Pty Ltd (PBPL) proposes to undertake its annual maintenance dredging within the navigational areas of the Brisbane River and Moreton Bay, primarily using the Trailer Suction Hopper Dredge (TSHD) 'Brisbane'. Maintenance dredging works extend from the Hamilton Reach of the Brisbane River to the North West Channel located in northern Moreton Bay. It is proposed that dredged material is disposed of at sea at the Mud Island Dredge Material Placement Area (MIDMPA).

A characterisation study of the physical and chemical properties of proposed dredged sediment was undertaken in accordance with the National Assessment Guidelines for Dredging (NAGD) to assess the suitability of dredged material for unconfined ocean disposal. The dredge area was divided into different dredging subareas based on existing contaminant data, comprising Zone 2 (Colmslie to Pinkenba), Zone 3 (within Port reaches) and Zone 4 (Entrance Channel). It is noted that Zone 1 (upstream of the dredge area) is not part of the annual dredging and samples from this zone have been used to collect reference samples upstream of the actual dredging areas.

Sediment sampling was undertaken in Zones 1 to 4 and from two sites in Moreton Bay, the MIDMPA and reference sites in Bramble Bay north of the Port of Brisbane. Sediments within the proposed dredging Zones 2 and 3 were characterised by a high proportion of fines, whereas Zone 4 was characterised by coarser sediments. The reference sites were characterised by a high proportion of fines including the MIDMPA and the Moreton Bay reference sites.

The sediments in the proposed dredging zones were characterised as suitable for ocean disposal in accordance with the NAGD on the basis of the following results:

- The upper 95% confidence limits (95% UCL) of the mean concentrations of all analysed metals and metalloids except nickel were well below their respective NAGD screening levels.
- Nickel concentrations exceeded the NAGD screening level of 21 mg/kg at most locations. Similar elevated nickel concentrations have been recorded previously, including reference areas unaffected by dredging and dredged material placement.
- Phase III elutriate and bioavailability testing was undertaken to investigate potential impacts of nickel on water quality and sediment biota. Elutriate test results were below the laboratory Limit of Reporting (LOR) and therefore below the ANZECC/ARMCANZ (2000) marine trigger limit for all samples. The dilute acid extraction results were below the NAGD screening level of 21 mg/kg for all samples. These results indicate that impacts to water quality can be considered minimal during dredging and dredged material disposal with regards to nickel. Furthermore, the bioavailable nickel fraction is unlikely to result in adverse impacts to sediment biota. As per NAGD, the sediments in the proposed dredge zones are characterised as suitable for ocean disposal with respect to nickel.
- Most organic contaminants including organotins, Total Petroleum Hydrocarbons (TPHs), Polyaromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs) had either concentrations below the LOR or the 95% UCLs were below the respective NAGD screening levels. Furthermore, radionuclide activity was below the laboratory LOR at all investigated locations.
- Whilst the 95% UCL for the organochlorine pesticides (OCPs) DDD, DDE and DDT were above the NAGD screening level for all dredge zones, concentrations of these parameters were similar to that

recorded at reference sites and the MIDMPA, suggesting broad-scale contamination for these parameters in western Moreton Bay.

- Phase III elutriate and porewater testing was undertaken to investigate the potential bioavailability of OCPs. Both elutriate and porewater testing resulted in concentrations below the laboratory LOR for all samples. It is noted that no marine trigger limits are given in ANZECC/ARMCANZ (2000) for DDD, DDT and DDE. Based on the above results the bioavailability of OCPs is considered very low and no adverse impacts on water quality and sediment biota are expected with respect to OCPs during dredging and dredged material disposal. On the basis of the Phase II and Phase III testing for OCPs, the sediments in dredge Zones 2, 3 and 4 are considered suitable for ocean disposal as per the NAGD guidelines with respect to OCPs.
- Nutrient levels were consistent with results of previous investigations. NAGD does not provide screening levels for nutrients. However, given that nutrient concentrations were in the typical range of coastal sediments, the risk of adverse impacts caused by nutrients during dredging and disposal is considered to be low.
- Acid Sulfate Soil testing indicated that no management would be required for the sediments at all investigated locations within the proposed dredge zones. Whilst the sediments were characterised as potential acid sulfate soils (PASS), sufficient acid neutralising capacity (ANC) of the sediments was recorded. This means that the sediments have sufficient capacity for neutralising acids upon oxidation.

The evaluation of laboratory and field QA/QC procedures and assessments indicated that all sampling, sample handling and storage and laboratory analysis was undertaken to a high standard providing scientific confidence that the presented results are valid to allow an assessment of sediment quality against the NAGD.

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1 Introduction

1.1 Background

Port of Brisbane Pty Ltd (PBPL) is required to maintain a minimum depth of clearance below the keel of vessels calling at the port to allow for effective shipping access to the port and ensure ship safety. Channel depths are declared by the Regional Harbour Master (Maritime Safety Queensland) and displayed on various shipping charts. PBPL undertakes an annual maintenance dredging program to ensure these minimum depths are maintained.

PBPL propose to undertake its annual maintenance dredging within the navigational areas of the Brisbane River and Moreton Bay, primarily using the Trailer Suction Hopper Dredge (TSHD) 'Brisbane'. Maintenance dredging works extend from the Hamilton Reach of the Brisbane River to the North West Channel located in northern Moreton Bay.

It is proposed that dredged material is disposed of at sea at the Mud Island Dredge Material Placement Area (MIDMPA). Therefore, characterisation of the physical and chemical properties of proposed dredged sediment was required to be undertaken in accordance with the National Assessment Guidelines for Dredging (Commonwealth of Australia 2009; henceforth NAGD).

This report documents the findings of a sampling campaign conducted in 2014. The overall aim of this study is to assess the physical and chemical properties of sediments to be dredged from the Port of Brisbane, and on the basis of the approach set out in NAGD, assess the suitability of dredged material for unconfined ocean disposal. The specific objectives of the study were to:

- Describe and quantify the physical properties of sediments to be dredged;
- Quantify concentrations of potential contaminants in sediments to be dredged;
- Compare contaminant concentrations to screening levels set out in NAGD to determine whether there is a need for further assessment; and
- Assess the bioavailability of contaminants and potential toxicity effects based on comparisons of contaminant concentrations to guideline values.

1.2 Proposed Dredging

PBPL's area of responsibility in relation to maintenance and capital dredging within port limits can be broadly divided into two zones on the basis of the water body type, navigable depths and nature of dredged material:

- Moreton Bay zone (enclosed/open coastal waters); and
- Brisbane River zone including the Port of Brisbane (middle/lower estuary).

This SAP only considers assessment of sediments for the Brisbane River zone. The Brisbane River zone extends from Hamilton Reach to the Outer Bar Cutting. Annual maintenance dredging is required to remove sediments accumulated by natural siltation processes within the catchment and sediment loads from residential and commercial developments.

To ensure that declared depths of navigational channels are maintained at all times, PBPL undertakes 'insurance' dredging of up to -0.5 metres below the declared depth.

On average, PBPL dredges about 400,000 m^3 to 450,000 m^3 of material each year. Additional dredging needs to be undertaken following major flood events, i.e. in 2011 and 2013.

The Brisbane River zone is divided into different dredging subareas based on existing contaminant data, comprising Zone 2, Zone 3 and Zone 4. It is noted that Zone 1 is not part of the annual dredging and samples from this zone have been used to collect reference samples upstream of the actual dredging areas.

The following average dredge volumes apply to the dredge subareas (Table 1-1).

Table 1-1 Approximate Maintenance Dredge Volumes

Dredging Subarea	Location	Average Dredge Volume (m^3)
Zone 2	Colmslie to Pinkenba	150,000
Zone 3	Within port reaches	250,000
Zone 4	Moreton Bay entrance channel	30,000

The maintenance dredging program is structured to maximise efficiencies and utilisation of PBPL's largest dredger, the *TSHD Brisbane*. The *TSHD Brisbane* typically carries out the majority of the port's maintenance dredging over a two month period between January and May (actual period varies depending on other commitments of the *TSHD Brisbane* and siltation patterns). The PBPL may also utilise smaller, more manoeuvrable dredging plant, such as grab dredgers and bed levellers, to maintain more confined areas within the Port Limits.

1.3 Offshore Disposal

The PBPL's policy with regard to dredged material is to maximise its beneficial reuse. In general, most of the material dredged by the PBPL from within Port Limits is used in reclamation works associated with development of the port. The reuse of this dredged material provides several benefits, including:

- Reduced pressure on sea disposal sites;
- The placement of any actual or potential acid sulphate material at depth beneath the water surface; and
- The containment of any contaminated material within a designated boundary, disconnected from the marine system and monitored to ensure the immobility of identified contaminants.

In 2009, the reclamation life of the Future Port Expansion (FPE) area was estimated to be approximately 30 years, based on the current level of port development at that time. Following extreme flood events in both 2011 and 2013 and the subsequent disposal of additional material in the FPE area, the estimated life of the FPE area was reduced by 20 years to 10 years. Given the importance of the FPE as an area to dispose of material unsuitable for ocean disposal, there has been a shift in thinking around the management of the FPE area.

The current proposed management of dredged material is to, where practical, dispose at sea all dredged material deemed suitable for ocean disposal. This proposed management initiative will ensure the long term viability of the FPE area for the disposal of material deemed unsuitable for ocean disposal.

In the past, significant quantities of dredged material from the Brisbane River have been placed offshore at the MIDMPA. In recent years only smaller volumes of dredged material from boat harbours in southern Moreton Bay were placed at the MIDMPA. However, it is proposed that the MIDMPA will be utilised for material found suitable for ocean disposal in future PBPL maintenance dredging campaigns.

1.4 Marine Communities and Environmental Values

The dredge site is located within the lower Brisbane River. The foreshore of the lower Brisbane River is in a highly modified condition, but still retains isolated patches of mangrove forest and tidal flats. The river channel is comprised of muds and sands, and supports a locally important trawl fishery (BMT WBM 2008c).

The Port of Brisbane port facilities are located at the Brisbane River mouth on land reclaimed over a shallow sub-tidal river delta containing a series of low lying mangrove islands, collectively called the Fisherman Islands. Brisbane River and adjacent waters of Moreton Bay experiences freshwater flows and ongoing inputs of sediments and contaminants derived from human activities in its catchment. Two major sewage treatment plants also have their sewage discharges within kilometres of the Port facilities (Luggage Point and Wynnum North wastewater treatment plant).

Construction of the present day port facilities over intertidal and subtidal areas has resulted in extensive changes to the environmental attributes of the Fisherman Islands area. However, significant areas of mangrove, saltmarsh and seagrass have also been retained, and form part of the Fisherman Islands wetland complex on the south eastern side of the Port of Brisbane (BMT WBM 2014). Moreton Bay Marine Park is situated to the south and east of the FPE seawall. This area contains one of the largest semi-contiguous seagrass beds in western Moreton Bay. A Ramsar listed wetland (Moreton Bay Ramsar site) is situated only kilometres to the south of the port facilities, comprising intertidal portions of the Fisherman Islands wetland complex. The seagrass and mudflats of the Ramsar site are recognised for their importance to dugong, marine turtles and migratory and resident shorebirds (BMT WBM 2008a).

MIDMPA is located between Mud Island and Fisherman Islands. Mud Island is an ancient coral reef that is no longer actively accreting coral skeletons, but still contains coral communities (Johnson and Neil 1998). MIDMPA is comprised of a fix of mud and sand substrate types, and provides habitat for a range of soft sediment benthic fauna (BMT WBM 2008b).

2 Methodology

2.1 Compliance with SAP and Guidelines

All sampling and analysis of sediments was undertaken in accordance with the NAGD (Commonwealth of Australia 2009). All sampling and analysis procedures followed the approach outlined in the sampling and analysis plan (SAP) prepared by BMT WBM on 17 October 2013. A copy of the SAP is provided in Appendix A.

2.2 Timing of Sampling

All sampling was undertaken in a single campaign during 21 to 23 October 2014, inclusive. Sampling was undertaken during daytime hours.

2.3 Sample Locations

2.3.1 Field Samples

Thirty five locations were sampled with a Van Veen grab sampler in accordance with the SAP and NAGD requirements. This included 26 sample locations within the proposed dredging area (Zones 2, 3 and 4) and nine reference locations (Zone 1, MIDMPA and Moreton Bay reference sites).

A map showing the actual sampling locations is provided in Figure 2-1.

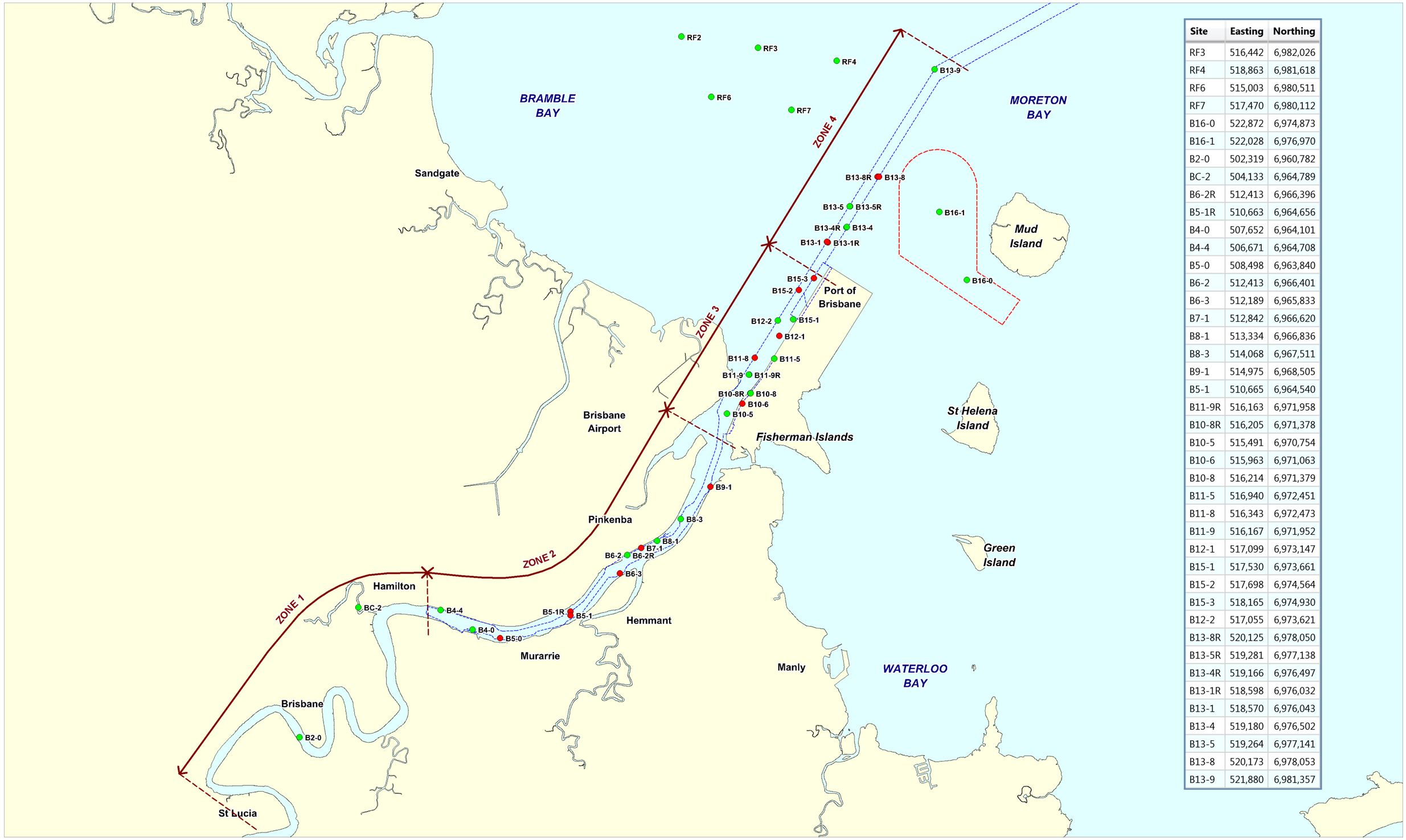
As per the SAP, all samples were analysed for a basic suite with a detailed suite analysed at selected study locations (refer to Figure 2-1 and Section 2.6).

2.3.2 QA/QC Samples

In accordance with NAGD requirements and based on the number of sample locations, the following field and laboratory quality control samples were taken:

- Three field triplicate samples at 10% of locations to determine the small scale (measured in metres) spatial variability of the sediment physical and chemical characteristics, i.e. two additional grab samples at locations 5-1 (Zone 2), 11-9 (Zone 3) and 13-4 (Zone 4);
- Two triplicate split samples (primary sample from 5% of locations thoroughly mixed and split into three sample container sets) to assess laboratory variation, with one of the three samples sent to a second (reference) laboratory for analysis. Split samples were obtained at location 6-2 (Zone 2) and 10-6 (Zone 3); and
- Three trip blank containers (one per sampling day) filled with inert material (e.g. chromatographic sand) to be analysed concurrent with the analysis of volatile organic substances such as BTEX and TPH C6-C9.

All samples were submitted to the primary and secondary laboratories in one batch so no inter-batch samples were required.



Site	Easting	Northing
RF3	516,442	6,982,026
RF4	518,863	6,981,618
RF6	515,003	6,980,511
RF7	517,470	6,980,112
B16-0	522,872	6,974,873
B16-1	522,028	6,976,970
B2-0	502,319	6,960,782
BC-2	504,133	6,964,789
B6-2R	512,413	6,966,396
B5-1R	510,663	6,964,656
B4-0	507,652	6,964,101
B4-4	506,671	6,964,708
B5-0	508,498	6,963,840
B6-2	512,413	6,966,401
B6-3	512,189	6,965,833
B7-1	512,842	6,966,620
B8-1	513,334	6,966,836
B8-3	514,068	6,967,511
B9-1	514,975	6,968,505
B5-1	510,665	6,964,540
B11-9R	516,163	6,971,958
B10-8R	516,205	6,971,378
B10-5	515,491	6,970,754
B10-6	515,963	6,971,063
B10-8	516,214	6,971,379
B11-5	516,940	6,972,451
B11-8	516,343	6,972,473
B11-9	516,167	6,971,952
B12-1	517,099	6,973,147
B15-1	517,530	6,973,661
B15-2	517,698	6,974,564
B15-3	518,165	6,974,930
B12-2	517,055	6,973,621
B13-8R	520,125	6,978,050
B13-5R	519,281	6,977,138
B13-4R	519,166	6,976,497
B13-1R	518,598	6,976,032
B13-1	518,570	6,976,043
B13-4	519,180	6,976,502
B13-5	519,264	6,977,141
B13-8	520,173	6,978,053
B13-9	521,880	6,981,357

LEGEND

- Basic Suite
- Basic Suite and Detailed Suite
- Dredge Area
- Dredge Material Placement Area

Title:

Actual Sediment Sampling Locations

Figure: **2-1**

Rev: **A**

N

0 2.5 5km

Approx. Scale

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Filepath : I:\B20259_I_BRH Port of Brisbane DLR\DRG\ECO_022_131212 Sediment Sampling Locations.wor

The Relative Standard Deviation (RSD) or Relative Percent Difference (RPD) was calculated for field triplicate and laboratory split samples. Assessment followed NAGD guidelines which recommend that the RSD or RPD of replicate samples agree within ±50 %. NAGD also notes that they may not always agree within this limit where sediments are very inhomogeneous or vary greatly in grain size.

2.4 Sample Collection

2.4.1 Grab Sampling

All sediment sampling was undertaken by experienced personnel. Sediment samples were collected using a stainless steel Van Veen grab sampler (0.14 m^2 gape).

Only samples obtained with properly closed grab jaws were processed to ensure that the fine sediment fractions were retained.

The grab sampler was thoroughly cleaned with De-con 90 solution prior to use and cleaned and rinsed with seawater between samples to prevent cross contamination between samples.

In order to overcome issues with potential high variability at sampling locations, a minimum of two grabs were collected at each sampling location and pooled as one sample. An adequate number of grabs was obtained and pooled for each sample location ensuring that sufficient sediment was collected for all analyses.

2.4.1.1 Sampling for Elutriate and Bioavailability Testing

Phase III testing was undertaken for parameters which have frequently exceeded the NAGD screening levels in the past. Based on the review of historical data in the SAP this included:

- Metals and metalloids;
- Organotins (TBT); and
- Organochlorine Pesticides (DDT, DDD, DDE, chlordane).

Phase III testing for metals/metalloids (and potential other metals/metalloids) was undertaken from the primary samples collected for the sediment quality assessment and based on the initial analysis results. Analysis was performed on the samples with the highest concentrations.

Bioavailability analysis for the organic contaminants (organotins and organochlorine pesticides) required porewater testing as per NAGD. Additional samples were collected for porewater testing at the locations which have historically shown the highest percentage of screening level exceedances. In order to meet required holding times, elutriate and bioavailability analysis for the organic contaminants was undertaken concurrent with the analysis of the primary samples.

As per the SAP, additional samples for porewater testing were obtained from five locations in Zone 2 and six locations in Zone 3.

2.4.2 Survey Vessel and Positioning

The BMT WBM vessel *Resolution II* was used for sampling the sediments. The vessel was thoroughly inspected and washed down prior to the beginning of sediment sampling each day.

Differential GPS was used on the survey vessel for position fixing and navigation to each sampling location.

The workspace on the vessel was washed down regularly with ambient seawater to clean all surfaces and minimize the potential for dust contamination of samples. All sample processing was undertaken away from any potential contamination sources such as engine exhausts, fuels, oils, greases, lead weights, zinc anodes, antifouling paint etc.

2.5 Sample Handling

Photographs of the grab samples were taken and grab samples were logged for its physical characteristics and variations in sediment type and texture (refer Appendix B). The grab samples from each location were carefully homogenized in a clean container prior to the filling of analytical laboratory-supplied clean sampling jars.

Nitrile gloves were worn by all field personnel handling the sediment, and gloves were disposed of after processing of each sample.

Sample bottles were labelled with a waterproof marker pen on the bottle label and lid. Sample bottles for organic analyses were filled with zero headspace to minimise volatilisation. A field trip blank sample container filled with clean chromatographic sand was placed with opened lid near the sample processing site while a sediment sample was completely processed.

All storage containers were chilled on ice immediately following sample collection. The samples were then transferred to BMT WBM office in sealed eskies at the end of each sampling day. Acid Sulfate Soil samples were frozen at the end of each sampling day to minimise potential oxidation of the sediment material.

At the end of the sampling campaign, all samples were submitted to the primary and secondary analytical laboratories.

All samples were submitted to the laboratories with Chain of Custody documentation (Appendices C and D).

2.6 Laboratory Analysis

2.6.1 Analytical Tests

Primary analysis of sediment samples was conducted by Advanced Analytical Australia (AAA). Certain analyses were subcontracted by AAA to other NATA accredited laboratories such as Particle Size Distribution (Golder Associates) and Total Organic Carbon (Sydney Analytical Laboratories). Australian Laboratory Services (ALS) was chosen as the secondary (reference) laboratory for inter-laboratory quality testing.

A total of 35 locations were analysed for a basic suite of parameters. Of these, 12 locations were also analysed for a detailed list of contaminants. Furthermore, elutriate and bioavailability (porewater and dilute acid extraction) testing was undertaken at selected locations as per the SAP.

Basic List of Parameters:

- Analysis included contaminants of (potential) concern and supplementary parameters:

- Metals/Metalloids (As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, Zn, Al, Fe);
- Organotins (MBT, DBT, TBT);
- Organochlorine pesticides (including DDT, DDD, DDE, chlordane);
- Particle Size Distribution (PSD);
- Moisture content; and
- Total Organic Carbon (TOC).

Detailed List of Parameters:

- Analysis included 'low risk' parameters that have been detected in the past but generally in concentrations below Limit of Reporting (LOR) or NAGD screening levels:
  - Polycyclic Aromatic Hydrocarbons (PAHs);
  - Total Petroleum Hydrocarbons (TPHs);
  - Polychlorinated Biphenyls (PCBs);
  - Acid Sulfate Soils;
  - Nutrients (TP, TN, NO_x, TKN); and
  - Radionuclides.

Elutriate and Bioavailability Testing:

- Metals/Metalloids;
- Organotins (TBT); and
- Organochlorine pesticides (DDT, DDD, DDE, chlordane).

2.6.2 Laboratory Quality Control

Both laboratories followed laboratory Quality Control (QC) procedures in accordance with requirements outlined in Appendix F of NAGD. This included analysis of laboratory blanks, duplicates, certified surrogate materials and spiked samples.

Validation of all laboratory QC analyses was conducted in accordance with Appendix A of NAGD to confirm suitable data quality for undertaking a rigorous characterisation of the proposed dredge material.

2.6.2.1 Laboratory Blanks

The purpose of this assessment is to monitor potential laboratory contamination of samples due to potential cross-contamination of samples during laboratory preparation, extraction or analysis. Blank sample concentrations should be at or near the detection limit of the method used.

2.6.2.2 Laboratory Duplicates

This assessment refers to a randomly selected intra-laboratory split sample, which provides information regarding the method precision and sample heterogeneity. Results are presented as Relative Percent Difference (RPD) values of two sample concentrations for a specific contaminant.

NAGD recommends that duplicates should agree within a typical RPD of the method of ±35 %. This recommended RPD is typically not adopted by analytical laboratories as it does not account for the greater uncertainty for contaminant concentrations close to the method's detection limit.

The primary laboratory AAA uses the following approach to assess duplicate RPD's:

- Result <10 times LOR – no limit to RPD; and
- Result >10 times LOR – RPD between 0% and 50%.

The secondary laboratory ALS follows this approach:

- Result <10 times LOR – no limit to RPD;
- Result between 10 and 20 times LOR – RPD between 0% and 50%; and
- Result >20 times LOR – RPD between 0% and 20%.

Refer to Appendices C and D for the acceptance criteria of subcontracted laboratories.

2.6.2.3 Surrogate and Matrix Spikes

Laboratory Control Samples are either certified reference materials or a blank sample spiked with known concentrations of the analytes of interest. The purpose of this measurement is to monitor method accuracy.

Matrix spikes refer to an intra-laboratory split sample spiked with a representative set of target analytes of known concentration. Matrix spikes are assessed to monitor potential sample matrix effects on analyte recoveries.

Surrogate spikes are used for organic analytes. Surrogates are known additions to samples which mimic the compounds of interested and are not normally expected to be present in the sample.

For both surrogate and matrix spikes, a calculation of the percent recovery of the spiked amount against the returned concentration is performed indicating analytical performance in terms of extraction efficiency.

NAGD states that recovery limits of 75% - 125% are generally acceptable. Analytical laboratories typically adopt specific surrogate and matrix spike recovery limits for the various contaminant compound groups. It is also noted that ideal recovery ranges may be waived in the event of sample matrix interference.

The primary laboratory AAA adopts the following acceptable surrogate and matrix spike recovery limits:

- Trace elements: 70-130%;
- Organic analyses: 50-150%;

- SVOC & speciated phenols: 10-140%; and
- Surrogates: 10-140%.

The secondary laboratory ALS adopts specific recovery limits for individual compounds.

2.7 Data Analysis

2.7.1 Sediment Contaminants

Concentrations of chemicals measured in sediment samples were compared to screening levels listed in Table 2 of NAGD to determine whether the material is suitable for unconfined placement at sea or if further analyses, such as elutriate, bioavailability or toxicity testing, are required.

Specifically, mean concentrations of chemical parameters at the upper 95% confidence level (95% UCL) were compared against NAGD guideline levels. This involved the following steps.

Data pre-treatment

Analytical values below detection limit were set to one-half of the laboratory Limit of Reporting (LOR) as per NAGD recommendation to facilitate 95% UCL calculation. Organic contaminant results were normalised to 1% TOC where the measured value is within the range of 0.2-10%. If TOC values were outside of this range, the highest (10%) or lowest (0.2%) value was adopted as appropriate. Organic parameters with concentrations below detection limits were not normalised to 1% TOC but were included at half their LOR.

One assumption in the calculation of the 95% UCL is that the samples are statistically independent. Therefore, field triplicate samples and laboratory split samples were not included in the 95% UCL calculation.

Selection of appropriate 95% UCL Calculation Method

The methodology for calculating the 95% UCL followed the approach recommended in Appendix A of NAGD. A Shapiro-Wilk test was used to determine whether data followed a normal distribution. The ProUCL (Version 4.1.00) software package was used for these calculations (Singh *et al.* 2010).

Calculation of 95% UCL and Comparison to Screening Levels

ProUCL Version 4.1.00 was used to calculate the 95% UCL. For normally distributed data, the arithmetic mean and standard deviation were calculated, and the 95% UCL was calculated using the one-tailed Student's *t* UCL test. For data that followed a log-normal (or other) distribution, the geomean was calculated, and the 95% UCL was analysed using non-parametric Jack-Knife analysis as per NAGD recommendation.

In some cases where only one value of a dataset was recorded above LOR, calculation of the Jack-Knife UCL was not possible. In these cases, the maximum recorded value of the dataset was conservatively used instead for comparison against NAGD trigger levels.

Should 95% UCL values for all analysed parameters fall below NAGD screening levels, the sediment would be considered clean and suitable for unconfined disposal at sea. Further testing was undertaken for samples where the NAGD screening level was exceeded, as described below.

2.7.2 Elutriate and Bioavailability Testing

As outlined on Section 2.4.1.1, elutriate and bioavailability testing was undertaken as per NAGD for a range of contaminants which have regularly exceeded screening levels in the past.

Elutriate Testing:

The elutriate test is designed to simulate release of contaminants from sediment during dredged material disposal. Testing was carried out using the USEPA's standard seawater elutriate test which involves shaking the sediment samples with four times the volume of seawater at room temperature for 30 minutes. The sample was allowed to settle for one hour and the supernatant was centrifuged or filtered (0.45 µm) within 60 minutes, and analysed using analytical methods appropriate for determining ultra-trace levels in seawater.

Results were compared to the respective ANZECC/ARMCANZ (2000) marine water quality trigger value (for 95% protection of species).

Bioavailability Testing:

The Dilute Acid Extraction (DAE) method was used to provide an estimate of the bioavailable fraction of metals/metalloids. The sediment samples were extracted using a weak acid and result compared against the respective NAGD screening levels.

For organic contaminants, analysis of pore water is the recommended bioavailability test as per NAGD. Porewater is assumed to represent the major route of exposure to sediment contaminants by benthic organisms. Porewater results were compared to the respective ANZECC/ARMCANZ (2000) marine water quality trigger value (for 95% protection of species).

Should both elutriate and bioavailability tests result in values less than the respective guideline limits, the material would be considered clean and suitable for ocean disposal.

2.7.3 Acid Sulfate Soils

The results of the chromium-suite acid sulfate analysis were assessed against the Australian framework for Acid Sulfate Soil management in coastal systems (Ahern *et al.* 1998). The risk of acidification was determined by the acid-base accounting approach (Ahern *et al.* 2004). Net acidity was calculated from the results as a measure of the acid producing capacity of the sampled sediment upon complete oxidation.

The calculated net acidity was then compared to the QASSIT action criteria of 0.03% S or 18 mol H^+/tonne to assess the need for acid sulfate soil management if the dredged sediments were to be placed on land. The liming rate indicates the amount of lime that needs to be added to the soil to manage its acid generating capacity.

3 Results

Sediment logs of the sampled sediments are shown in Appendix B. Detailed laboratory results are provided in Appendices C and D for the primary and secondary laboratory, respectively.

3.1 Physical Sediment Characteristics

Figure 3-1 presents the results of PSD in the proposed dredge area.

Consistent with results from 2013, sediments within Zones 2 and 3 were generally characterised by a high proportion of fines, with most samples having greater than 80% of fine material. The average proportion of silts was 40% and 36% for Zones 2 and 3, respectively, which was similar to results from 2013 (40% and 32%, respectively). In 2014 clay comprised an average of 45% and 69% at Zones 2 and 3 respectively, compared to 48% and 49% in 2013. Sands comprised 14% and 30% on average for Zones 2 and 3 in 2014, compared to 14% and 18% in 2013.

Zone 4 was characterised by coarser sediments with an average sand content of 59% and 3% coarse gravel, and 37% fines. Similar high proportions of coarse material were recorded in 2013.

The MIDMPA sediments were comparable to Zone 2 and Zone 3 sediments with respect to their PSD. The proportion of fine sediment recorded was higher in 2013 (90%) than 2014 (44%), most likely due to small scale sediment heterogeneity and low sampling effort at this location.

Similarly, the Moreton Bay reference sites were characterised by a high proportion of fines (89.9% on average in 2013 comparted to 85.8% in 2014) with silts and clays contributing on average 32-34% and 53-55%, respectively.

Sediments within Zone 1 had high proportions of sandy sediment comprising between 98% and 22% for the upstream reference location 2-0 and the Breakfast Creek site BC-2, respectively. This was higher than recorded in 2013, most likely reflecting small scale sediment heterogeneity and low sampling effort at this location.

Results

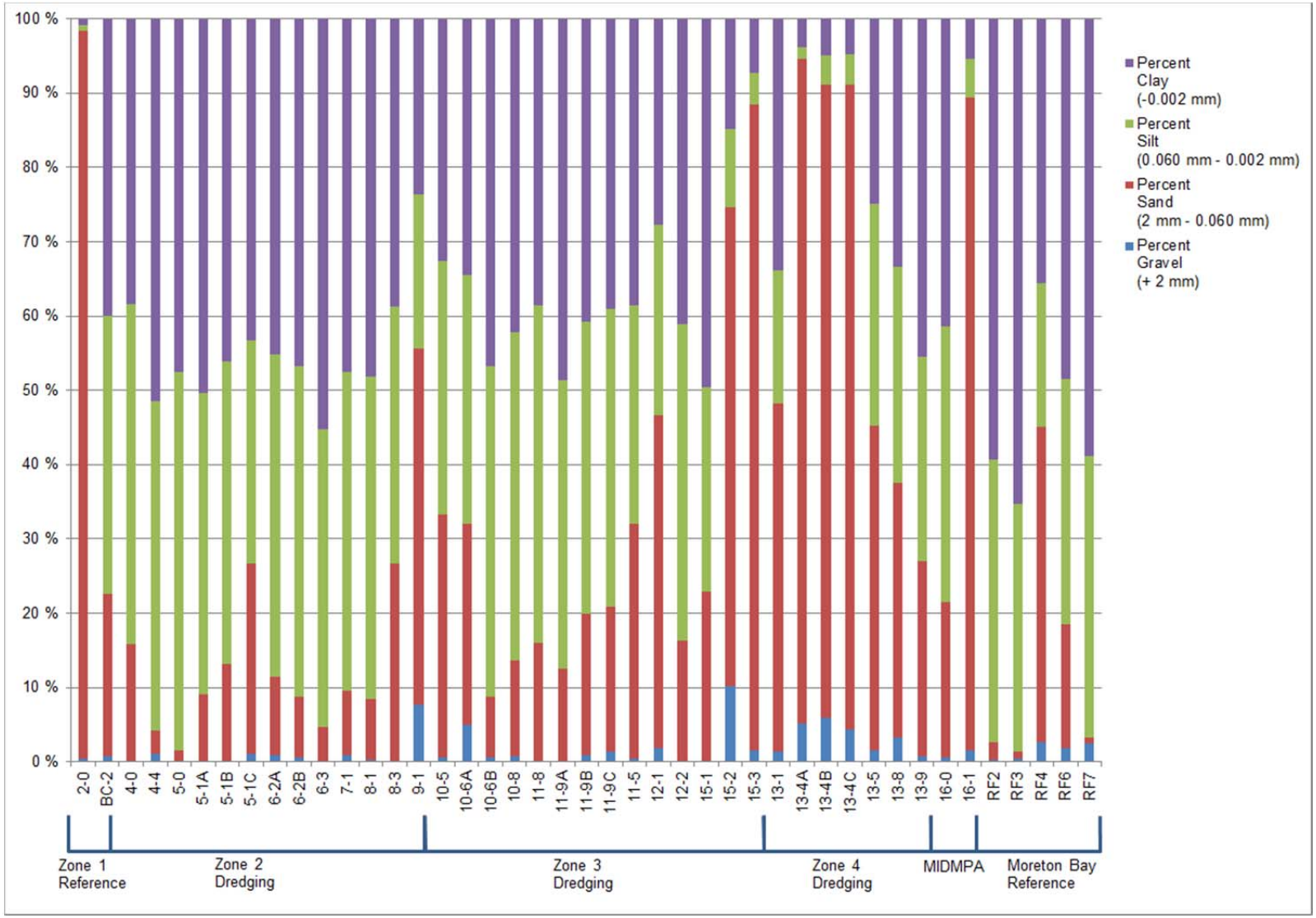

Figure 3-1 Particle Size Distribution Results

3.2 Chemical Sediment Characteristics

Table 3-1 presents the summary statistics and calculation of 95% UCLs for chemical parameters with concentrations above the laboratory LOR for the combined locations within the combined dredge Zones 2, 3 and 4.

Concentrations of chemical parameters for individual locations are presented in the following tables, including summary statistics and 95% UCL calculations for the individual dredge zones:

- Table 3-4: Zone 2 locations
- Table 3-5: Zone 3 locations
- Table 3-6: Zone 4 locations
- Table 3-7: Reference locations (Zone 1, MIDMPA and Moreton Bay reference sites)
- Table 3-8: Acid Sulfate Soil results (Chromium-Suite).

Table 3-1 Summary Statistics and 95% UCLs for Combined Locations in Zones 2, 3 and 4. Values Highlighted in Orange Indicate Exceedance of NAGD Screening Levels

Analytes	Units	NAGD Screening Level	Normal (N), Lognormal (L), Neither (X)	Mean / Geomean	Standard Deviation	95% UCL
Moisture Content	%		X	51.9	11.7	57.6
Trace Elements						
Aluminium	mg/kg	-	N	21112	6033	23133
Arsenic	mg/kg	20	N	6.6	0.8	6.8
Cadmium	mg/kg	1.5	-	-	-	-
Chromium	mg/kg	80	N	38.3	9.3	41.4
Copper	mg/kg	65	N	27.0	11.3	30.8
Iron	mg/kg	-	N	35885	8253	38649
Lead	mg/kg	50	X	11.5	6.2	14.7
Mercury	mg/kg	0.15	X	0.1	0.0	0.1
Nickel	mg/kg	21	X	24.3	7.6	28.3
Silver	mg/kg	1	-	-	-	-
Zinc	mg/kg	200	N	85.1	34.7	96.7
Total Petroleum Hydrocarbons						
TPH C6-C9	mg/kg	550	-	-	-	-
TPH C10-14	mg/kg	550	-	-	-	-
TPH C15-28	mg/kg	550	-	-	-	-
TPH C29-36	mg/kg	550	X	35.4	11.6	41.0
Poly Aromatic Hydrocarbons						
Naphthalene	µg/kg	-	X	4.4	12.4	10.6

Analytes	Units	NAGD Screening Level	Normal (N), Lognormal (L), Neither (X)	Mean / Geomean	Standard Deviation	95% UCL
1-Methylnaphthalene	µg/kg		-	-	-	-
2-Methylnaphthalene	µg/kg		-	-	-	-
Acenaphthylene	µg/kg		X	3.2	1.3	4.0
Acenaphthene	µg/kg		-	-	-	-
Fluorene	µg/kg		X	3.9	2.5	-
Phenanthrene	µg/kg		L	11.1	8.5	15.6
Anthracene	µg/kg		X	3.4	2.3	4.8
Fluoranthene	µg/kg		N	35.1	15.6	41.5
Pyrene	µg/kg		N	38.2	15.5	44.6
Benz(a)anthracene	µg/kg		N	18.2	11.2	24.0
Chrysene	µg/kg		N	18.5	9.5	23.4
Benzo(b)&(k)fluoranthene	µg/kg		N	42.8	21.0	53.7
Benzo(a)pyrene	µg/kg		N	23.4	12.0	29.7
Indeno(1,2,3-cd)pyrene	µg/kg		N	24.1	11.6	30.1
Dibenz(a,h)anthracene	µg/kg		X	3.3	1.7	4.3
Benzo(g,h,i)perylene	µg/kg		N	18.9	9.6	23.8
Coronene	µg/kg		-	-	-	-
Benzo(e)pyrene	µg/kg		N	16.4	9.1	21.1
Perylene	µg/kg		N	56.0	15.5	64.0
Total PAHs (as above)	µg/kg	10000	N	289	161	373
Organochlorine Pesticides						
Aldrin	µg/kg		-	-	-	-
alpha-BHC	µg/kg		-	-	-	-
beta-BHC	µg/kg		-	-	-	-
gamma-BHC (Lindane)	µg/kg	0.32	-	-	-	-
delta-BHC	µg/kg		-	-	-	-
cis-Chlordane	µg/kg	0.5	-	-	-	-
trans-Chlordane	µg/kg	0.5	-	-	-	-
p,p'-DDD	µg/kg	2	X	1.5	3.7	3.4
p,p'-DDE	µg/kg	2.2	X	2.9	1.4	3.8
p,p'-DDT	µg/kg	1.6	N	3.7	1.5	4.2
Dieldrin	µg/kg	280	-	-	-	-
alpha-Endosulfan	µg/kg		-	-	-	-
beta-Endosulfan	µg/kg		-	-	-	-
Endosulfan Sulphate	µg/kg		-	-	-	-
Endrin	µg/kg	10	-	-	-	-

Analytes	Units	NAGD Screening Level	Normal (N), Lognormal (L), Neither (X)	Mean / Geomean	Standard Deviation	95% UCL
Endrin ketone	µg/kg		-	-	-	-
Endrin aldehyde	µg/kg		-	-	-	-
Heptachlor	µg/kg		-	-	-	-
Heptachlor epoxide	µg/kg		-	-	-	-
Hexachlorobenzene	µg/kg		-	-	-	-
Methoxychlor	µg/kg	-	-	-	-	-
Oxychlordane	µg/kg	-	-	-	-	-
Organotins		-				
Monobutyl tin	µgSn/kg	-	-			-
Dibutyl tin	µgSn/kg	-	X	0.4	0.3	0.6
Tributyl tin	µgSn/kg	9	X	0.5	0.8	0.9
Polychlorinated Biphenyls						
Mono-PCB congeners	µg/kg	-	-	-	-	-
Di-PCB congeners	µg/kg	-	-	-	-	-
Tri-PCB congeners	µg/kg	-	-	-	-	-
Tetra-PCB congeners	µg/kg	-	-	-	-	-
Penta-PCB congeners	µg/kg	-	-	-	-	-
Hexa-PCB congeners	µg/kg	-	-	-	-	-
Hepta-PCB congeners	µg/kg	-	-	-	-	-
Octa-PCB congeners	µg/kg	-	-	-	-	-
Nona-PCB congeners	µg/kg	-	-	-	-	-
Deca-PCB congeners	µg/kg	-	-	-	-	-
Total PCB congeners	µg/kg	23	-	-	-	-
Nutrients, TOC, Cyanide						
Nitrate as N	mg/kg	-	-	-	-	-
Nitrite as N	mg/kg	-	-	-	-	-
Total Nitrogen	mg/kg	-	N	837	357	1058
Total Kjeldahl Nitrogen	mg/kg	-	N	837	357	1058
Total Phosphorus	mg/kg	-	N	747	229	823
Total Organic Carbon	%	-	N	1.3	0.5	1.5
Radionuclides						
Gross Alpha	mBq/g	-	-	-	-	-
Gross Beta	mBq/g	-	-	-	-	-

3.2.1 Trace Elements

3.2.1.1 Bulk Sediment Analysis

Concentrations of metals and metalloids were generally below NAGD screening levels across the study area (Table 3-1, Table 3-4 to Table 3-7). Cadmium and silver were not detected in any sample, consistent with the results of the 2013 sampling campaign. No individual samples exceeded the NAGD screening level for mercury, in contrast to 2013 when one sample (at location 13.5) exceeded the screening level (BMT WBM 2013).

Nickel concentrations exceeded the NAGD screening level of 21 mg/kg at most locations, in particular within the dredge Zones 2 and 3. The 95% UCL across all locations within the dredge Zones 2, 3 and 4 was 28.3 mg/kg, which was only slightly lower than recorded in 2013 (i.e. 35.5 mg/kg). The 95% UCL for nickel also exceeded the NAGD screening level for the individual dredge zones with concentrations of 33.2 mg/kg, 28.1 mg/kg and 21.0 mg/kg for Zones 2, 3 and 4, respectively.

Location 13.4 in Zone 4 contained elevated concentrations of copper, lead and zinc (Table 3-3). Elevated concentrations of all three parameters were recorded in one of two sub-samples analysed from this location, whereas the other sub-sample had low levels of these metals. To determine repeatability of results, all the sub-samples was re-analysed for copper, lead and zinc, with one of the two sub-samples split (i.e. three sub-samples). Similar spatial patterns were detected between the initial primary sub-samples and the repeat sub-samples. These results therefore indicate that there was a high degree of small-scale (measured in mm's to 10's of mm's) heterogeneity in copper, lead and zinc concentrations at this location, which is indicative of contamination caused by individual paint flecks. Despite containing this outlier, the 95% UCL for Zone 4 was less than respective NAGD screening levels for all three of these parameters.

Table 3-2 Concentrations of Copper, Lead and Zinc at Sample 13-4 in Primary and Repeat Sub-samples

Sample	Copper		Lead		Zinc	
	Primary	Repeat	Primary	Repeat	Primary	Repeat
13-4A	110	45	58	55	280	340
13-4B	25	15	35	17	180	100
13-4B (dupl)		17		25		130

The trace metal and metalloid concentrations recorded at reference locations followed similar trends to those at the dredge sites. In this regard, most metals and metalloids were below the NAGD screening level, except for nickel at one of the two locations in the MIDMPA, and four of the five Moreton Bay reference locations.

3.2.1.2 Elutriate and Bioavailability Testing

Phase III elutriate and bioavailability tests were undertaken to further investigate the elevated nickel concentrations and their potential impact on water quality and sediment biota (Table 3-3).

Samples with the highest recorded nickel concentrations were selected for all dredge zones. A total of 18 samples/sub-samples were analysed, which included four duplicate measurements as per NAGD. Elutriate test results were below the LOR and therefore below the ANZECC/ARMCANZ (2000) marine trigger limit of 7 µg/L (99% species protection) for all tested samples. The dilute acid extraction results were also below the NAGD screening level of 21 mg/kg for all samples, and similar to elutriate results, were consistent with levels recorded by BMT WBM (2013).

As high concentrations of copper, zinc and lead were recorded at Location 13.4 (see Section 3.2.1.1), elutriate and bioavailability testing was also undertaken for these parameters at this location. These results show that concentrations of all three parameters were below the detection limit in elutriate samples (which was well below the ANZECC/ARMCANZ (2000) marine trigger limit), and were well below NAGD screening levels in dilute acid extraction samples.

These results indicate that impacts to water quality can be considered minimal during dredging and dredged material disposal with regards to these metals. Furthermore, the bioavailable fraction of these metals is unlikely to result in adverse impacts to sediment biota.

On the basis of the Phase II and Phase III testing for metals and metalloids, the sediments in dredge Zones 2, 3 and 4 are considered suitable for ocean disposal as per the NAGD guidelines for all investigated metals and metalloids.

Table 3-3 Nickel Elutriate and Bioavailability Testing Results

Zone	Sample	Elutriate (µg/L)				Dilute Acid Extraction (mg/kg)			
		Nickel	Copper	Lead	Zinc	Nickel	Copper	Lead	Zinc
Zone 2	4-0	<3	-	-	-	9.7	-	-	-
	4-0 (dupl)	<3	-	-	-	10	-	-	-
	4-4	<3	-	-	-	9	-	-	-
	5-0	<3	-	-	-	8.7	-	-	-
	6-2A	<3	-	-	-	8.9	-	-	-
	8-1	<3	-	-	-	8.1	-	-	-
Zone 3	10-5	<3	-	-	-	8.1	-	-	-
	10-8	<3	-	-	-	7.3	-	-	-
	11-9A	<3	-	-	-	8.8	-	-	-
	11-8	<3	-	-	-	7.8	-	-	-
	12-2	<3	-	-	-	7.2	-	-	-
	12-2 (dupl)	<3	-	-	-	7.6	-	-	-
	15-1	<3	-	-	-	9.3	-	-	-
	15-1 (dupl)	<3	-	-	-	10	-	-	-
Zone 4	13-1	<3	-	-	-	5.9	-	-	-
	13-4A	-	<1	<1	<5		5.8	9.7	44
	13-9	<3	-	-	-	5.4	-	-	-
	13-9 (dupl)	<3	-	-	-	5	-	-	-
N/A	Elutriate Blank	<3	<1	<1	<5	5	-	-	-

Zone	Sample	Elutriate (µg/L)					Dilute Acid Extraction (mg/kg)		
PQL		3	1	1	5	0.1	0.1	0.5	0.5
Guideline value (and protection level)		7 (99% protection level)	1.3 (95% protection level)	4.4 (95% protection level)	15 (95% protection level)	21	65	50	200

3.2.2 Total Petroleum Hydrocarbons (TPHs)

Concentrations of TPHs were below the LOR for the C6-C9, C10-C14 and C15-C28 fractions at all locations. A few low level detections of TPHs C29-C36 were noted at individual locations in all dredge zones with a maximum normalised concentration of 48.5 mg/kg which is well below the NAGD screening level of 550 mg/kg. This is consistent with the results of BMT WBM (2013).

Therefore, the sediments in dredge Zones 2, 3 and 4 are suitable for ocean disposal as per the NAGD guidelines with respect to TPHs.

TPHs were not assessed at the reference locations.

3.2.3 Polyaromatic Hydrocarbons (PAHs)

Relatively low level detections of PAHs were noted at all investigated study locations within all dredge zones. The 95% UCL for total PAHs was well below the NAGD screening level of 10,000 µg/kg for all dredge zones with 329 µg/kg, 408 µg/kg for Zone 2 and Zone 3 and a maximum normalised concentration of 630 µg/kg for Zone 4. The 95% UCL for total PAHs across all dredge zones was 373 µg/kg. These results are consistent with previous sampling in 2013 (BMT WBM 2013).

One the basis of these results the sediments in dredge Zones 2, 3 and 4 are suitable for ocean disposal as per the NAGD guidelines with respect to PAHs.

PAHs were not assessed at the reference locations.

3.2.4 Organochlorine Pesticides (OCPs)

3.2.4.1 Bulk Sediment

The concentrations for most OCPs were below the laboratory LOR at all study locations. The only exceptions within the dredge zones were DDT, DDD and DDE. In summary:

- DDD was recorded in two samples in Zone 2 (3.5 and 12.9 µg/kg in samples 7-1 and 8-3, respectively), but was below the detection limit in all other samples in this zone. The 95% UCL for DDD exceeded the NAGD guideline value in Zone 2 (4.6 µg/kg, compared to 2 µg/kg).
- DDD was not detected in the other zones, and therefore was below the NAGD screening level of 2 µg/kg.
- DDE and DDT were recorded in all samples in Zone 2 and nine of the 11 samples in Zone 3. At Zone 4, DDE was recorded in two of five samples, and DDT was recorded in four of five samples. The 95% UCL for DDE and DDT exceeded the NAGD guideline values (2.2 and 1.6,

respectively) in Zones 2 (4.2 and 4.7 µg/kg, respectively), 3 (4.4 and 4.7 µg/kg, respectively) and 4 (2.9 and 4.3 µg/kg, respectively).

The concentrations of DDE and DDD were consistent with that reported by BMT WBM (2013). BMT WBM (2013) did not however record DDT in the study area, despite considering the same locations and levels of reporting. Notwithstanding this, concentrations of DDE and DDT were similar to that recorded at reference sites and the MIDMPA (DDE <2 to 5.6 µg/kg; DDT <2 to 4.6 µg/kg), suggesting broad-scale contamination for these parameters in western Moreton Bay.

3.2.4.2 Elutriate and Bioavailability Testing

Phase III elutriate and bioavailability (porewater) testing was undertaken to investigate the potential bioavailability of OCPs. As outlined in Section 2.4.1.1, five additional samples (plus one duplicate) were analysed from Zone 2 and six samples (plus two duplicates) were analysed from Zone 3 based on historical data.

Both elutriate and porewater testing resulted in concentrations below the laboratory LOR for all samples. It is noted that no marine trigger limits are given in ANZECC/ARMCANZ (2000) for DDD, DDT and DDE.

Based on the above results the bioavailability of OCPs is considered very low and no adverse impacts on water quality and sediment biota are expected with respect to OCPs during dredging and dredged material placement.

On the basis of the Phase II and Phase III testing for OCPs, the sediments in dredge Zones 2, 3 and 4 are considered suitable for ocean disposal as per the NAGD guidelines with respect to OCPs.

3.2.5 Organotins

Concentrations of organotins were either below the LOR or detected at low concentrations well below the NAGD screening level of 9 µgSn/kg across all dredge zones. The 95% UCL for TBT was 1.1 µgSn/kg and 1.3 µgSn/kg and 0.4 µgSn/kg for Zone 2 and 3, respectively. TBT was below the detection limit in all samples at Zone 4. Across the combined dredge zones, the 95% UCL for TBT was 0.9 µgSn/kg (compared to 0.7 µgSn/kg in 2013).

Based on these results the sediments in all dredge zones are considered suitable for ocean disposal as per the NAGD guidelines with respect to organotins.

At the reference locations, organotin concentrations were mostly below the LOR with only a few low level detections noted well below the NAGD screening level.

3.2.6 Polychlorinated Biphenyls (PCBs)

Concentrations of PCBs were below the laboratory LOR at all investigated locations. Therefore, the sediments in the dredge zones are considered suitable for ocean disposal as per the NAGD guidelines with respect to PCBs.

No assessment of PCBs was undertaken at the reference locations.

3.2.7 Radionuclides

Measurements of gross alpha and gross beta activity were below the laboratory LOR at all investigated locations. Therefore, the sediments in the dredge zones are considered suitable for ocean disposal as per the NAGD guidelines with respect to radionuclides.

No assessment of radionuclides was undertaken at the reference locations.

3.2.8 Nutrients and Carbon Content

Total Nitrogen and Total Kjeldahl Nitrogen concentrations ranged between 220 mg/kg and 1320 mg/kg across the dredge zones. Total Phosphorus concentrations ranged between 260 mg/kg and 1300 mg/kg. Nitrate and Nitrite concentrations were below the LOR in all samples. TOC content ranged between 0.15% and 2% across the dredge zones.

Similar levels of nutrients and TOC were noted across the reference locations. No screening levels exist in NAGD for nutrients and carbon content in sediments. However, nutrient and carbon levels were considered to be consistent with other harbour areas in Moreton Bay (e.g. WBM 2005a, b).

3.2.9 Acid Sulfate Soils

Acid Sulfate Soil testing indicated that no management would be required for the sediments at all investigated locations within dredge Zones 2, 3 and 4 (Table 3-8).

Actual acidity (TAA) was below the LOR at all locations indicating that the sediments are not actual acid sulfate soils.

Chromium reducible sulfur was above the LOR at all locations indicating that the sediments are potential acid sulfate soils (PASS). However, the acid neutralising capacity (ANC) was in excess of the chromium reducible sulfur at all locations. This means that the sediments have sufficient capacity for neutralising acids upon oxidation.

In case of ocean disposal of the dredged material, oxidation of the dredge material is considered unlikely as the sediments will stay saturated with seawater. Under normal operating conditions of the dredging vessel (PASS exposure timeframe of less than 24 hours) it is considered that the risk of oxidation is low. Therefore, sea disposal is unlikely to require any treatment of the dredged material.

Results

Table 3-4 Summary Statistics and 95% UCLs for Zone 2. Values Highlighted in Orange Indicate Exceedance of NAGD Screening Levels

Analytes		NAGD Screening Level	4-0	4-4	5-0	5-1A	6-2A	6-3	7-1	8-1	8-3	9-1	Normal (N), Lognormal (L), Neither (X)	Mean / Geomean	Standard Deviation	95% UCL
Moisture Content	%	-	61.5	64.2	63.2	58	60	64.2	60.5	64.3	57.8	47.2	N	60.1	5.2	63.1
Trace Elements																
Aluminium	mg/kg	-	24000	27000	27000	27000	27000	26000	26000	26000	22000	19000	X	24956	2685	26657
Arsenic	mg/kg	20	5.8	7.5	7	6.6	7.1	7.7	7.3	7.8	6.2	5.6	N	6.9	0.8	7.3
Cadmium	mg/kg	1.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
Chromium	mg/kg	80	46	49	49	47	47	47	46	46	40	42	N	45.9	2.8	47.6
Copper	mg/kg	65	47	41	37	31	45	37	34	37	27	24	N	36.0	7.3	40.3
Iron	mg/kg	-	41000	46000	44000	41000	45000	43000	45000	43000	36000	33000	N	41700	4191	44130
Lead	mg/kg	50	13	17	14	19	14	14	14	14	11	8.4	N	13.8	2.9	15.5
Mercury	mg/kg	0.15	0.07	0.1	0.09	0.1	0.09	0.09	0.1	0.11	0.09	0.05	N	0.1	0.0	0.1
Nickel	mg/kg	21	35	34	33	30	33	32	32	32	27	31	N	31.9	2.2	33.2
Silver	mg/kg	1	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	-	-	-	-
Zinc	mg/kg	200	99	120	110	100	100	110	97	110	82	69	N	99.7	14.9	108.3
Total Petroleum Hydrocarbons																
TPH C6-C9	mg/kg	550	-	-	<20	<10	-	<20	<20	-	-	<10	-	-	-	-
TPH C10-14	mg/kg	550	-	-	<20	<10	-	<20	<20	-	-	<10	-	-	-	-
TPH C15-28	mg/kg	550	-	-	<100	<50	-	<100	<100	-	-	<50	-	-	-	-
TPH C29-36	mg/kg	550	-	-	<100	37.3	-	<100	<100	-	-	<50	N	42.5	-	53.1
Poly Aromatic Hydrocarbons																
Naphthalene	µg/kg	-	-	-	3.1	3.3	-	3.2	<5	-	-	<5	N	3.0	0.4	3.3
1-Methylnaphthalene	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
2-Methylnaphthalene	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-

Results

Analytes		NAGD Screening Level	4-0	4-4	5-0	5-1A	6-2A	6-3	7-1	8-1	8-3	9-1	Normal (N), Lognormal (L), Neither (X)	Mean / Geomean	Standard Deviation	95% UCL
Acenaphthylene	µg/kg	-	-	-	3.8	<5	-	3.7	<5	-	-	<5	N	3.1	0.7	3.6
Acenaphthene	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
Fluorene	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
Phenanthrene	µg/kg	-	-	-	12.5	11.3	-	10.0	6.5	-	-	6.3	N	9.3	2.8	12.0
Anthracene	µg/kg	-	-	-	4.4	3.3	-	3.7	<5	-	-	<5	N	3.5	0.8	4.0
Fluoranthene	µg/kg	-	-	-	38.8	32.7	-	29.5	25.3	-	-	19.8	N	29.2	7.2	36.1
Pyrene	µg/kg	-	-	-	41.9	40.7	-	30.5	28.2	-	-	21.9	N	32.6	8.5	40.8
Benz(a)anthracene	µg/kg	-	-	-	21.3	20.0	-	16.3	14.1	-	-	12.5	N	16.8	3.7	20.4
Chrysene	µg/kg	-	-	-	21.9	18.0	-	16.8	14.7	-	-	12.5	N	16.8	3.5	20.2
Benzo(b)&(k)fluoranthene	µg/kg	-	-	-	46.9	43.3	-	37.9	35.3	-	-	27.1	N	38.1	7.6	45.4
Benzo(a)pyrene	µg/kg	-	-	-	26.3	22.7	-	20.0	17.6	-	-	14.6	N	20.2	4.5	24.5
Indeno(1,2,3-cd)pyrene	µg/kg	-	-	-	25.0	21.3	-	20.0	20.0	-	-	14.6	N	20.2	3.7	23.8
Dibenz(a,h)anthracene	µg/kg	-	-	-	3.8	<5	-	2.6	2.9	-	-	<5	N	3.0	0.6	3.4
Benzo(g,h,i)perylene	µg/kg	-	-	-	20.6	17.3	-	18.4	13.5	-	-	12.5	N	16.5	3.4	19.7
Coronene	µg/kg	-	-	-	<10	<10	-	<10	<10	-	-	<10	-	-	-	-
Benzo(e)pyrene	µg/kg	-	-	-	19.4	18.0	-	15.3	14.1	-	-	11.5	N	15.6	3.1	18.6
Perylene	µg/kg	-	-	-	68.8	29.3	-	57.9	54.7	-	-	45.8	N	51.3	14.8	65.4
Total PAHs (as above)	µg/kg	10000	-	-	356	280	-	289	247	-	-	198	N	274	58	330
Organochlorine Pesticides																
Aldrin	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
alpha-BHC	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
beta-BHC	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
gamma-BHC (Lindane)	µg/kg	0.32	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
delta-BHC	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
cis-Chlordane	µg/kg	0.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
trans-Chlordane	µg/kg	0.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-

Results

Analytes		NAGD Screening Level	4-0	4-4	5-0	5-1A	6-2A	6-3	7-1	8-1	8-3	9-1	Normal (N), Lognormal (L), Neither (X)	Mean / Geomean	Standard Deviation	95% UCL
p,p'-DDD	µg/kg	2	<2	<2	<2	<2	<2	<2	3.5	<2	12.9	<2	X	1.5	3.7	4.6
p,p'-DDE	µg/kg	2.2	3.8	3.0	3.8	3.3	4.1	3.7	3.5	3.7	4.3	5.2	N	3.8	0.6	4.2
p,p'-DDT	µg/kg	1.6	5.0	4.5	5.0	2.7	3.5	4.7	3.5	4.2	4.3	5.2	N	4.3	0.8	4.7
Dieldrin	µg/kg	280	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
alpha-Endosulfan	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
beta-Endosulfan	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Endosulfan Sulphate	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Endrin	µg/kg	10	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Endrin ketone	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Endrin aldehyde	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Heptachlor	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Heptachlor epoxide	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Hexachlorobenzene	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Methoxychlor	µg/kg	-	<2	<2	<2	<2	<2	3.2	<2	<2	<2	<2	-	-	-	-
Oxychlordane	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Organotins																
Monobutyl tin	µgSn/kg	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	-			-
Dibutyl tin	µgSn/kg	-	0.5	0.6	0.8	1.5	<1.0	<1.0	<1.0	<1.0	0.4	<0.5	X	0.5	0.3	0.8
Tributyl tin	µgSn/kg	9	1.8	1.0	1.6	0.3	0.6	0.6	0.8	0.6	0.6	<0.5	N	0.8	0.5	1.1
Polychlorinated Biphenyls																
Mono-PCB congeners	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
Di-PCB congeners	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
Tri-PCB congeners	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
Tetra-PCB congeners	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
Penta-PCB congeners	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-

Results

Analytes		NAGD Screening Level	4-0	4-4	5-0	5-1A	6-2A	6-3	7-1	8-1	8-3	9-1	Normal (N), Lognormal (L), Neither (X)	Mean / Geomean	Standard Deviation	95% UCL
Hexa-PCB congeners	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
Hepta-PCB congeners	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
Octa-PCB congeners	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
Nona-PCB congeners	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
Deca-PCB congeners	µg/kg	-	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
Total PCB congeners	µg/kg	23	-	-	<5	<5	-	<5	<5	-	-	<5	-	-	-	-
Nutrients, TOC, Cyanide																
Nitrate as N	mg/kg	-	-	-	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-
Nitrite as N	mg/kg	-	-	-	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-
Total Nitrogen	mg/kg	-	-	-	1320	1150	-	-	-	-	-	-	X	1232	120	-
Total Kjeldahl Nitrogen	mg/kg	-	-	-	1320	1150	-	-	-	-	-	-	X	1232	120	-
Total Phosphorus	mg/kg	-	940	1000	1000	870	1100	1000	980	980	820	740	N	943.0	104.8	1004
Total Organic Carbon	%		1.6	2	1.6	1.5	1.7	1.9	1.7	1.9	1.4	0.96	N	1.6	0.3	1.8
Radionuclides																
Gross Alpha	mBq/g	-	-	-	<60	<60	-	-	-	-	-	<60	-	-	-	-
Gross Beta	mBq/g	-	-	-	<135	<135	-	-	-	-	-	<135	-	-	-	-

Results

Table 3-5 Summary Statistics and 95% UCLs for Zone 3. Values Highlighted in Orange Indicate Exceedance of NAGD Screening Levels

Analytes		NAGD Level	10-5	10-6A	10-8	11-8	11-9A	11-5	12-1	12-2	15-1	15-2	15-3	Normal (N), Lognorm (L), Neither (X)	Mean / Geomean	SD	95% UCL
Moisture Content	%	-	54.3	54.9	61.5	54.3	55.6	56.1	48.4	58	63.5	37.2	23.3	X	49.9	11.7	57.9
Trace Elements																	
Aluminium	mg/kg	-	21000	20000	23000	23000	25000	21000	18000	23000	27000	11000	7400	N	19840	6196	23163
Arsenic	mg/kg	20	5.8	6.5	7.2	6.6	7.2	6.5	5.1	6.5	6.1	5.9	7	N	6.5	0.6	6.8
Cadmium	mg/kg	1.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
Chromium	mg/kg	80	38	37	41	41	43	36	30	40	42	22	18	N	35.0	8.8	39.9
Copper	mg/kg	65	24	24	28	26	27	24	17	25	25	8.2	4.7	X	18.9	7.8	25.5
Iron	mg/kg	-	36000	34000	39000	40000	42000	35000	29000	39000	42000	21000	18000	N	33900	8595	38560
Lead	mg/kg	50	10	11	12	12	13	11	8.8	12	11	4.7	3.3	X	9.2	3.1	11.6
Mercury	mg/kg	0.15	0.07	0.07	0.08	0.09	0.08	0.07	0.05	0.07	0.08	0.02	0.01	X	0.1	0.0	0.1
Nickel	mg/kg	21	28	23	27	28	31	24	21	28	33	13	10	N	23.8	7.4	28.1
Silver	mg/kg	1	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	-	-	-	-
Zinc	mg/kg	200	76	86	84	84	85	76	57	78	79	34	28	X	65.8	20.8	81.1
Total Petroleum Hydrocarbons																	
TPH C6-C9	mg/kg	550		<10		<10			<10			<10	<10	-	-	-	-
TPH C10-14	mg/kg	550		<10		<10			<10			<10	<10	-	-	-	-
TPH C15-28	mg/kg	550		<50		<50			<50			<50	<50	-	-	-	-
TPH C29-36	mg/kg	550		48.5		34.7			<50			<50	<50	N	31.6	10.3	41.5
Poly Aromatic Hydrocarbons																	
Naphthalene	µg/kg	-		<5		4.0			<5			<5	<5	-	-	-	-
1-Methylnaphthalene	µg/kg	-		<5		<5			<5			<5	<5	-	-	-	-
2-Methylnaphthalene	µg/kg	-		<5		<5			<5			<5	<5	-	-	-	-
Acenaphthylene	µg/kg	-		3.8		5.3			<5			<5	<5	N	3.3	1.3	4.5

Results

Analytes		NAGD Level	10-5	10-6A	10-8	11-8	11-9A	11-5	12-1	12-2	15-1	15-2	15-3	Normal (N), Lognorm (L), Neither (X)	Mean / Geomean	SD	95% UCL
Acenaphthene	µg/kg	-		<5		<5			<5			<5	<5	-	-	-	-
Fluorene	µg/kg	-		<5		<5			<5			<5	<5	-	-	-	-
Phenanthrene	µg/kg	-		9.2		18.0			7.3			<5	<5	N	11.5	5.7	14.0
Anthracene	µg/kg	-		<5		5.3			<5			<5	<5	X	2.9	1.3	-
Fluoranthene	µg/kg	-		33.1		55.3			23.6			20.5	<5	N	33.1	15.7	45.4
Pyrene	µg/kg	-		36.9		58.0			27.3			23.1	<5	N	36.3	15.6	48.9
Benz(a)anthracene	µg/kg	-		18.5		32.7			12.7			<5	<5	N	13.8	12.6	25.8
Chrysene	µg/kg	-		16.9		32.0			12.7			12.8	<5	N	15.4	10.7	25.6
Benzo(b)&(k)fluoranthene	µg/kg	-		45.4		73.3			31.8			30.8	<10	N	37.3	24.9	61.0
Benzo(a)pyrene	µg/kg	-		27.7		42.0			17.3			15.4	<5	N	21.0	14.8	35.1
Indeno(1,2,3-cd)pyrene	µg/kg	-		27.7		38.0			22.7			17.9	<5	N	21.8	13.1	34.3
Dibenz(a,h)anthracene	µg/kg	-		3.8		5.3			<5			<5	<5	N	3.3	1.3	4.5
Benzo(g,h,i)perylene	µg/kg	-		23.8		31.3			12.7			12.8	<5	N	16.6	11.2	27.3
Coronene	µg/kg	-		<10		<10			<10			<10	<10	-	-	-	-
Benzo(e)pyrene	µg/kg	-		18.5		28.0			12.7			<5	<5	N	12.8	10.9	23.2
Perylene	µg/kg	-		64.6		54.7			69.1			74.4	75.0	N	67.5	8.3	75.5
Total PAHs	µg/kg	10000		331		480			245			<100	<100	N	231	186	408
Organochlorine Pesticides																	
Aldrin	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
alpha-BHC	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
beta-BHC	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
gamma-BHC (Lindane)	µg/kg	0.32	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
delta-BHC	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
cis-Chlordane	µg/kg	0.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
trans-Chlordane	µg/kg	0.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
p,p'-DDD	µg/kg	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-

Results

Analytes		NAGD Level	10-5	10-6A	10-8	11-8	11-9A	11-5	12-1	12-2	15-1	15-2	15-3	Normal (N), Lognorm (L), Neither (X)	Mean / Geomean	SD	95% UCL
p,p'-DDE	µg/kg	2.2	5.4	3.1	3.8	3.3	3.3	3.6	3.6	4.3	6.7	<2	<2	N	3.4	1.6	4.4
p,p'-DDT	µg/kg	1.6	4.6	3.8	4.4	3.3	2.8	3.6	3.6	5.0	7.5	<2	<2	N	3.6	1.9	4.7
Dieldrin	µg/kg	280	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
alpha-Endosulfan	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
beta-Endosulfan	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Endosulfan Sulphate	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Endrin	µg/kg	10	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Endrin ketone	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Endrin aldehyde	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Heptachlor	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Heptachlor epoxide	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Hexachlorobenzene	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Methoxychlor	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Oxychlordane	µg/kg	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Organotins																	
Monobutyl tin	µgSn/kg	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	-	-	-	-
Dibutyl tin	µgSn/kg	-	0.4	<0.5	<1.0	0.4	0.6	0.6	<0.5	0.5	<1.0	<0.5	<0.5	N	0.4	0.1	0.5
Tributyl tin	µgSn/kg	9	<0.5	<0.5	<1.0	<0.5	4.0	0.4	<0.5	0.4	<1.0	<0.5	<0.5	X	0.4	1.2	1.3
Polychlorinated Biphenyls																	
Mono-PCB congeners	µg/kg	-	-	<5	-	<5	-	-	<5	-	-	<5	<5	-	-	-	-
Di-PCB congeners	µg/kg	-	-	<5	-	<5	-	-	<5	-	-	<5	<5	-	-	-	-
Tri-PCB congeners	µg/kg	-	-	<5	-	<5	-	-	<5	-	-	<5	<5	-	-	-	-
Tetra-PCB congeners	µg/kg	-	-	<5	-	<5	-	-	<5	-	-	<5	<5	-	-	-	-
Penta-PCB congeners	µg/kg	-	-	<5	-	<5	-	-	<5	-	-	<5	<5	-	-	-	-
Hexa-PCB congeners	µg/kg	-	-	<5	-	<5	-	-	<5	-	-	<5	<5	-	-	-	-

Results

Analytes		NAGD Level	10-5	10-6A	10-8	11-8	11-9A	11-5	12-1	12-2	15-1	15-2	15-3	Normal (N), Lognorm (L), Neither (X)	Mean / Geomean	SD	95% UCL
Hepta-PCB congeners	µg/kg	-	-	<5	-	<5	-	-	<5	-	-	<5	<5	-	-	-	-
Octa-PCB congeners	µg/kg	-	-	<5	-	<5	-	-	<5	-	-	<5	<5	-	-	-	-
Nona-PCB congeners	µg/kg	-	-	<5	-	<5	-	-	<5	-	-	<5	<5	-	-	-	-
Deca-PCB congeners	µg/kg	-	-	<5	-	<5	-	-	<5	-	-	<5	<5	-	-	-	-
Total PCB congeners	µg/kg	23	-	<5	-	<5	-	-	<5	-	-	<5	<5	-	-	-	-
Nutrients, TOC, Cyanide																	
Nitrate as N	mg/kg	-	-	<0.1	-	<0.1	-	-	<0.1	-	-	<0.1	<0.1	-	-	-	-
Nitrite as N	mg/kg	-	-	<0.1	-	<0.1	-	-	<0.1	-	-	<0.1	<0.1	-	-	-	-
Total Nitrogen	mg/kg	-	-	950	-	1090	-	-	900	-	-	380	220	N	708	383	1073
Total Kjeldahl Nitrogen	mg/kg	-	-	950	-	1090	-	-	900	-	-	380	220	N	708	383	1073
Total Phosphorus	mg/kg	-	800	720	810	840	850	690	600	810	820	370	290	N	680	201	797
Total Organic Carbon	%		1.3	1.3	1.6	1.5	1.8	1.4	1.1	1.4	1.2	0.39	0.18	N	1.2	0.5	1.5
Radionuclides																	
Gross Alpha	mBq/g	-	-	<60	-	<60	-	-	<60	-	-	<60	<60	-	-	-	-
Gross Beta	mBq/g	-	-	<135	-	<135	-	-	<135	-	-	<135	<135	-	-	-	-

Results

Table 3-6 Summary Statistics and 95% UCLs for Zone 4. Values Highlighted in Orange Indicate Exceedance of NAGD Screening Levels

Analytes		NAGD Level	13-1	13-4A	13-5	13-8	13-9	Normal (N), Lognormal (L), Neither (X)	Mean / Geomean	Standard Deviation	95% UCL
Moisture Content	%	-	45.2	19.6	46.9	52.3	62.6	N	45.3	15.9	60.5
Trace Elements											
Aluminium	mg/kg	-	16000	4500	17000	19000	22000	N	15700	6667	22056
Arsenic	mg/kg	20	6.6	4.7	6.1	6.7	7.9	N	6.4	1.2	7.5
Cadmium	mg/kg	1.5	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
Chromium	mg/kg	80	32	14	32	33	37	X	28.1	9.0	38.1
Copper	mg/kg	65	15	**46.8**	18	15	15	L			35.2
Iron	mg/kg	-	29000	16000	30000	31000	35000	N	28200	7190	35055
Lead	mg/kg	50	11	**38.8**	12	9.6	10	L			28.3
Mercury	mg/kg	0.15	0.08	0.03	0.08	0.07	0.05	N	0.1	0.0	0.1
Nickel	mg/kg	21	18	9	19	18	20	X	16.2	4.4	21.0
Silver	mg/kg	1	<0.25	<0.25	<0.25	<0.25	<0.25	-	-	-	-
Zinc	mg/kg	200	62	**212.5**	65	54	56	X	76.3	68.7	155.4
Total Petroleum Hydrocarbons											
TPH C6-C9	mg/kg	550	<10	-	-	<10	-	-	-	-	-
TPH C10-14	mg/kg	550	<10	-	-	<10	-	-	-	-	-
TPH C15-28	mg/kg	550	<50	-	-	<50	-	-	-	-	-
TPH C29-36	mg/kg	550	<50	-	-	<50	-	-	-	-	-
Poly Aromatic Hydrocarbons											
Naphthalene	µg/kg	-	36.0	-	-	<5	-	X	9.5	23.7	-
1-Methylnaphthalene	µg/kg	-	<5	-	-	<5	-	-	-	-	-

Results

Analytes		NAGD Level	13-1	13-4A	13-5	13-8	13-9	Normal (N), Lognormal (L), Neither (X)	Mean / Geomean	Standard Deviation	95% UCL
2-Methylnaphthalene	µg/kg	-	9.0	-	-	<5	-	X	4.7	4.6	-
Acenaphthylene	µg/kg	-	6.0	-	-	<5	-	X	3.9	2.5	-
Acenaphthene	µg/kg	-	<5	-	-	<5	-	_	-	-	-
Fluorene	µg/kg	-	6.0	-	-	<5	-	X	3.9	2.5	-
Phenanthrene	µg/kg	-	35.0	-	-	12.0	-	X	20.5	16.3	-
Anthracene	µg/kg	-	10.0	-	-	<5	-	X	5.0	5.3	-
Fluoranthene	µg/kg	-	71.0	-	-	37.0	-	X	51.2	24.1	-
Pyrene	µg/kg	-	73.0	-	-	39.1	-	X	53.4	23.9	-
Benz(a)anthracene	µg/kg	-	42.0	-	-	22.8	-	X	31.0	13.6	-
Chrysene	µg/kg	-	39.0	-	-	21.7	-	X	29.1	12.2	-
Benzo(b)&(k)fluoranthene	µg/kg	-	85.0	-	-	52.2	-	X	66.6	23.2	-
Benzo(a)pyrene	µg/kg	-	46.0	-	-	29.3	-	X	36.7	11.8	-
Indeno(1,2,3-cd)pyrene	µg/kg	-	48.0	-	-	31.5	-	X	38.9	11.7	-
Dibenz(a,h)anthracene	µg/kg	-	8.0	-	-	<5	-	X	4.5	3.9	-
Benzo(g,h,i)perylene	µg/kg	-	39.0	-	-	21.7	-	X	29.1	12.2	-
Coronene	µg/kg	-	<10	-	-	<10	-	_	-	-	-
Benzo(e)pyrene	µg/kg	-	34.0	-	-	20.7	-	X	26.5	9.4	-
Perylene	µg/kg	-	46.0	-	-	31.5	-	X	38.1	10.2	-
Total PAHs	µg/kg	10000	630	-	-	315	-	X	445.6	222.6	-
Organochlorine Pesticides											
Aldrin	µg/kg	-	<2	<2	<2	<2	<2	_	-	-	-
alpha-BHC	µg/kg	-	<2	<2	<2	<2	<2	_	-	-	-
beta-BHC	µg/kg	-	<2	<2	<2	<2	<2	_	-	-	-
gamma-BHC (Lindane)	µg/kg	0.32	<2	<2	<2	<2	<2	_	-	-	-
delta-BHC	µg/kg	-	<2	<2	<2	<2	<2	_	-	-	-
cis-Chlordane	µg/kg	0.5	<2	<2	<2	<2	<2	_	-	-	-

Results

Analytes		NAGD Level	13-1	13-4A	13-5	13-8	13-9	Normal (N), Lognormal (L), Neither (X)	Mean / Geomean	Standard Deviation	95% UCL
trans-Chlordane	µg/kg	0.5	<2	<2	<2	<2	<2	-	-	-	-
p,p'-DDD	µg/kg	2	<2	<2	<2	<2	<2	-	-	-	-
p,p'-DDE	µg/kg	2.2	3.0	<2	3.1	<2	<2	N	1.8	1.1	2.9
p,p'-DDT	µg/kg	1.6	2.0	<2	5.1	3.3	2.7	N	2.8	1.5	4.3
Dieldrin	µg/kg	280	<2	<2	<2	<2	<2	-	-	-	-
alpha-Endosulfan	µg/kg	-	<2	<2	<2	<2	<2	-	-	-	-
beta-Endosulfan	µg/kg	-	<2	<2	<2	<2	<2	-	-	-	-
Endosulfan Sulphate	µg/kg	-	<2	<2	<2	<2	<2	-	-	-	-
Endrin	µg/kg	10	<2	<2	<2	<2	<2	-	-	-	-
Endrin ketone	µg/kg	-	<2	<2	<2	<2	<2	-	-	-	-
Endrin aldehyde	µg/kg	-	<2	<2	<2	<2	<2	-	-	-	-
Heptachlor	µg/kg	-	<2	<2	<2	<2	<2	-	-	-	-
Heptachlor epoxide	µg/kg	-	<2	<2	<2	<2	<2	-	-	-	-
Hexachlorobenzene	µg/kg	-	<2	<2	<2	<2	<2	-	-	-	-
Methoxychlor	µg/kg	-	<2	<2	<2	<2	<2	-	-	-	-
Oxychlordane	µg/kg	-	<2	<2	<2	<2	<2	-	-	-	-
Organotins											
Monobutyl tin	µgSn/kg	-	<10	<10	<10	<10	<10	-	-	-	-
Dibutyl tin	µgSn/kg	-	<0.5	<0.5	0.7	<0.5	<1.0	-	-	-	-
Tributyl tin	µgSn/kg	9	<0.5	<0.5	<0.5	<0.5	<1.0	-	-	-	-
Polychlorinated Biphenyls											
Mono-PCB congeners	µg/kg	-	<5			<5		-	-	-	-
Di-PCB congeners	µg/kg	-	<5			<5		-	-	-	-
Tri-PCB congeners	µg/kg	-	<5			<5		-	-	-	-

Results

Analytes		NAGD Level	13-1	13-4A	13-5	13-8	13-9	Normal (N), Lognormal (L), Neither (X)	Mean / Geomean	Standard Deviation	95% UCL
Tetra-PCB congeners	µg/kg	-	<5			<5		-	-	-	-
Penta-PCB congeners	µg/kg	-	<5			<5		-	-	-	-
Hexa-PCB congeners	µg/kg	-	<5			<5		-	-	-	-
Hepta-PCB congeners	µg/kg	-	<5			<5		-	-	-	-
Octa-PCB congeners	µg/kg	-	<5			<5		-	-	-	-
Nona-PCB congeners	µg/kg	-	<5			<5		-	-	-	-
Deca-PCB congeners	µg/kg	-	<5			<5		-	-	-	-
Total PCB congeners	µg/kg	23	<5			<5		-	-	-	-
Nutrients, TOC, Cyanide											
Nitrate as N	mg/kg	-	<0.1			<0.1		-	-	-	-
Nitrite as N	mg/kg	-	<0.1			<0.1		-	-	-	-
Total Nitrogen	mg/kg	-	700			820		X	758	85	-
Total Kjeldahl Nitrogen	mg/kg	-	700			820		X	758	85	-
Total Phosphorus	mg/kg	-	490	280	560	490	560	N	476	115	586
Total Organic Carbon	%		1	0.18	0.98	0.92	1.1	N	0.8	0.4	1.2
Radionuclides											
Gross Alpha	mBq/g	-	<60			<60		-	-	-	-
Gross Beta	mBq/g	-	<135			<135		-	-	-	-

Results

Table 3-7 Analytical Results for Reference Locations. Values Highlighted in Orange Indicate Exceedance of NAGD Screening Levels

Analytes	Units	NAGD Level	DMPA		Reference				
			16-0	16-1	RF2	RF3	RF4	RF6	RF7
Moisture Content	%	-	57.4	25.4	67.4	66.3	56	61.7	64.3
Trace Elements									
Aluminium	mg/kg	-	21000	5900	42000	28000	21000	24000	30000
Arsenic	mg/kg	20	6.7	3.7	9	6.7	5.8	6.5	6
Cadmium	mg/kg	1.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/kg	80	39	15	68	47	37	40	48
Copper	mg/kg	65	27	6.7	34	23	15	19	32
Iron	mg/kg	-	37000	16000	68000	42000	34000	38000	48000
Lead	mg/kg	50	15	3.4	22	15	11	13	18
Mercury	mg/kg	0.15	0.09	0.09	0.11	0.08	0.06	0.08	0.1
Nickel	mg/kg	21	24	12	37	26	20	23	33
Silver	mg/kg	1	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Zinc	mg/kg	200	86	26	120	80	60	68	94
Total Petroleum Hydrocarbons									
TPH C6-C9	mg/kg	550	-	-	-	-	-	-	-
TPH C10-14	mg/kg	550	-	-	-	-	-	-	-
TPH C15-28	mg/kg	550	-	-	-	-	-	-	-
TPH C29-36	mg/kg	550	-	-	-	-	-	-	-
Poly Aromatic Hydrocarbons									
Naphthalene	µg/kg	-	-	-	-	-	-	-	-
1-Methylnaphthalene	µg/kg	-	-	-	-	-	-	-	-
2-Methylnaphthalene	µg/kg	-	-	-	-	-	-	-	-
Acenaphthylene	µg/kg	-	-	-	-	-	-	-	-
Acenaphthene	µg/kg	-	-	-	-	-	-	-	-

Results

Analytes	Units	NAGD Level	DMPA		Reference				
Fluorene	µg/kg	-	-	-	-	-	-	-	-
Phenanthrene	µg/kg	-	-	-	-	-	-	-	-
Anthracene	µg/kg	-	-	-	-	-	-	-	-
Fluoranthene	µg/kg	-	-	-	-	-	-	-	-
Pyrene	µg/kg	-	-	-	-	-	-	-	-
Benz(a)anthracene	µg/kg	-	-	-	-	-	-	-	-
Chrysene	µg/kg	-	-	-	-	-	-	-	-
Benzo(b)&(k)fluoranthene	µg/kg	-	-	-	-	-	-	-	-
Benzo(a)pyrene	µg/kg	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/kg	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	µg/kg	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	µg/kg	-	-	-	-	-	-	-	-
Coronene	µg/kg	-	-	-	-	-	-	-	-
Benzo(e)pyrene	µg/kg	-	-	-	-	-	-	-	-
Perylene	µg/kg	-	-	-	-	-	-	-	-
Total PAHs	µg/kg	10000	-	-	-	-	-	-	-
Organochlorine Pesticides									
Aldrin	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
alpha-BHC	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
beta-BHC	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
gamma-BHC (Lindane)	µg/kg	0.32	<2	<2	<2	<2	<2	<2	<2
delta-BHC	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
cis-Chlordane	µg/kg	0.5	<2	<2	<2	<2	<2	<2	<2
trans-Chlordane	µg/kg	0.5	<2	<2	<2	<2	<2	<2	<2
p,p'-DDD	µg/kg	2	<2	<2	<2	<2	<2	<2	<2
p,p'-DDE	µg/kg	2.2	3.1	<2	2.3	2.9	<2	2.7	5.6
p,p'-DDT	µg/kg	1.6	3.8	<2	4.6	2.9	<2	3.6	3.8

Results

Analytes	Units	NAGD Level	DMPA		Reference				
Dieldrin	µg/kg	280	<2	<2	<2	<2	<2	<2	<2
alpha-Endosulfan	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
beta-Endosulfan	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
Endosulfan Sulphate	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
Endrin	µg/kg	10	<2	<2	<2	<2	<2	<2	<2
Endrin ketone	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
Endrin aldehyde	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
Heptachlor	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
Heptachlor epoxide	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
Hexachlorobenzene	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
Methoxychlor	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
Oxychlordane	µg/kg	-	<2	<2	<2	<2	<2	<2	<2
Organotins									
Monobutyl tin	µgSn/kg	-	<10	<10	<10	<10	<10	<10	<10
Dibutyl tin	µgSn/kg	-	0.8	4.0	<1.0	<1.0	<0.5	<1.0	0.7
Tributyl tin	µgSn/kg	9	0.6	9.6	<1.0	<1.0	<0.5	<1.0	<1.0
Polychlorinated Biphenyls									
Mono-PCB congeners	µg/kg	-	-	-	-	-	-	-	-
Di-PCB congeners	µg/kg	-	-	-	-	-	-	-	-
Tri-PCB congeners	µg/kg	-	-	-	-	-	-	-	-
Tetra-PCB congeners	µg/kg	-	-	-	-	-	-	-	-
Penta-PCB congeners	µg/kg	-	-	-	-	-	-	-	-
Hexa-PCB congeners	µg/kg	-	-	-	-	-	-	-	-
Hepta-PCB congeners	µg/kg	-	-	-	-	-	-	-	-
Octa-PCB congeners	µg/kg	-	-	-	-	-	-	-	-
Nona-PCB congeners	µg/kg	-	-	-	-	-	-	-	-
Deca-PCB congeners	µg/kg	-	-	-	-	-	-	-	-

Results

Analytes	Units	NAGD Level	DMPA		Reference				
Total PCB congeners	µg/kg	23	-	-	-	-	-	-	-
Nutrients, TOC, Cyanide									
Nitrate as N	mg/kg	-	-	-	-	-	-	-	-
Nitrite as N	mg/kg	-	-	-	-	-	-	-	-
Total Nitrogen	mg/kg	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/kg	-	-	-	-	-	-	-	-
Total Phosphorus	mg/kg	-	740	280	970	670	530	600	770
Total Organic Carbon	%		1.3	0.25	1.3	1.4	0.97	1.1	1.6
Radionuclides									
Gross Alpha	mBq/g	-	-	-	-	-	-	-	-
Gross Beta	mBq/g	-	-	-	-	-	-	-	-

Results

Table 3-8 Acid Sulfate Soil Results (Chromium Suite)

Parameter	Unit	Zone 2							Zone 3						Zone 4	
		5-0	5-1A	5-1B	5-1C	6-3	7-1	9-1	10-6A	10-6B	11-8	12-1	15-2	15-3	13-1	13-8
pH_{kcl}	pH units	8.4	8.3	8.4	8.7	8.5	8.6	8.8	8.8	8.8	8.7	8.9	9.3	9.4	9.1	9.1
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chromium Reducible Sulfur	%w/w	0.11	0.17	0.3	0.37	0.13	0.16	0.05	0.17	0.26	0.19	0.12	0.05	0.04	0.14	0.17
a-Chromium Reducible Sulfur	moles H^+/t	72	110	190	230	82	98	33	110	160	120	77	30	27	90	100
S_{KCl}	%w/w S	0.12	0.17	0.15	0.14	0.17	0.16	0.062	0.1	0.093	0.1	0.073	0.053	0.043	0.11	0.15
ANC_{BT}	% $CaCO_3$	2.4	1.9	2.2	2.7	2.5	3.6	2.5	4.3	4.3	3.5	2.8	3.4	1.5	3.8	7.5
s-ANC_{BT}	%w/w S	0.78	0.62	0.72	0.85	0.82	1.2	0.82	1.4	1.4	1.1	0.9	1.1	0.48	1.2	2.4
s-Net Acidity	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
a-Net Acidity	moles H^+/t	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Liming rate	kg $CaCO_3$/t	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+/t	72	110	190	230	82	98	33	110	160	120	77	30	27	90	100
Liming rate without ANCE	kg $CaCO_3$/t	5.4	8	14	18	6.1	7.3	2.5	8	12	8.7	5.8	2.3	2	6.8	7.9

4 Data Validation

This Section provides an assessment of data validation including evaluation of QA/QC assessment of laboratory and field replicates and laboratory QA/QC procedures in order to provide scientific confidence that the presented results are valid.

4.1 Laboratory QA/QC

Details of the laboratory QA/QC for the primary and secondary laboratories are provided in Appendix C and D. A summary of this assessment is provided in the following sections. Refer to Section 2.6.2 for a description of laboratory QA/QC procedures.

4.1.1 Limits of Reporting (LORs)

Selected organic LORs were raised due to the high moisture content in selected samples. Furthermore, selected organochlorine pesticide, MBT and silver LORs were raised due to matrix interferences.

The raised LORs resulted from inherent sediment properties in the study area. The raised LORs for selected organics are not considered problematic for the assessment against NAGD.

4.1.2 Sample Holding Times and Storage Conditions

All samples were received by the laboratories in appropriately pre-treated and preserved containers. Samples were chilled with ice whilst in the field and during delivery (ice packs). All analyses were undertaken by the laboratories within recommended holding times.

4.1.3 Laboratory Blanks

The laboratory blank assessment was satisfactory.

Measurements of laboratory blanks for the chemical analyses were always below the LOR of the specific analysis method in the primary and secondary laboratories. This indicates that samples were not contaminated by procedures followed during laboratory analysis.

4.1.4 Laboratory Duplicates

The assessment of laboratory duplicates was acceptable.

For chemical analyses conducted by the primary laboratory, RPDs for all measured components were within the laboratories acceptance criteria.

4.1.5 Surrogate and Matrix Spikes

The assessment of surrogate and matrix spike recoveries was satisfactory.

The primary laboratory AAA recorded surrogate and matrix spike recoveries outside the laboratory limits for Monobutyl-tin (MBT). The spike recovery was biased low due to matrix interference. This is not considered problematic given that all organotins species (MBT, DBT and TBT) were detected at low concentrations or below LOR.

The primary laboratory AAA also noted that the spike recovery for aluminium and iron could not be accurately determined due to significant levels of analyte present in samples. This is not considered an issue as neither metals are toxic or had unusually high concentrations.

4.2 Field QA/QC

4.2.1 Field Trip Blank

No BTEX compounds or volatile Total Petroleum Hydrocarbons (TPH C6-C9) were detected in any trip blank samples, indicating that samples were not contaminated with volatile organic carbons during field sampling and processing of samples.

4.2.2 Field Triplicates

The assessment of field triplicate samples taken at Locations 5-1, 11-9 and 13-4 indicated relatively homogenous sediment contaminant concentrations over smaller scales with the RSD or RPD generally below the 50% NAGD criterion (Table 4-1). The exceptions to this were:

- The PAH Naphthalene at Location 5-1
- TBT at Location 5-1 and 11-9.

The exceedance of the NAGD criterion for these contaminants is not considered problematic given that it was either due to generally low concentrations (TBT) or the exceedance was only marginal (Naphthalene).

For measurements at low concentrations close to LOR, small differences in concentration typically result in large changes in the RPD or RSD value.

4.2.3 Field Triplicate Splits

Analyses of field triplicate splits were within the ±50 % NAGD criterion for RSDs or RPDs for most samples (Table 4-2). The exception was TBT at Location 6-2, which had a RPD/RSD value of 54.6%. This indicates a high degree of heterogeneity in TBT at this location, which most reflects the presence of small paint flecks in the sediment. The exceedance of the NAGD criterion for TBT was not considered problematic given that it had low concentrations that were well below the screening level.

4.3 Summary of Data Validation

The evaluation of laboratory and field QA/QC procedures and assessments indicates that all sampling, sample handling and storage and laboratory analysis was undertaken to a high standard providing scientific confidence that the presented results are valid to allow an assessment of sediment quality against the NAGD guidelines.

Table 4-1 Summary of Triplicate Field Core Analysis for Sediment Contaminants. Orange Shading Indicates Exceedance of 50% Criterion for Relative Standard Deviation (RSD) or Relative Percent Difference (RPD)

Analytes	Units	NAGD Screening Level	Sample 5-1				Sample 13-4				Sample 11-9			
			5-1A	5-1B	5-1C	RSD/RPD (%)	13-4A	13-4B	13-4C	RSD/RPD (%)	11-9A	11-9B	11-9C	RSD/RPD (%)
Moisture Content	%	-	58	57.3	55.8	2.0	19.6	21.9	22.1	6.6	55.6	52.1	52.6	3.5
Trace Elements														
Aluminium	mg/kg	-	27000	25000	23000	8.0	4500	4900	5900	14.1	25000	22000	23000	6.5
Arsenic	mg/kg	20	6.6	7	6	7.7	4.7	4.6	4.6	1.2	7.2	6.9	7.3	2.9
Cadmium	mg/kg	1.5	<0.1	0.21	0.17	21.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-
Chromium	mg/kg	80	47	48	42	7.0	14	15	18	13.3	43	39	42	5.0
Copper	mg/kg	65	31	36	30	9.9	110	25	19	99.1	27	25	28	5.7
Iron	mg/kg		41000	39000	37000	5.1	16000	15000	17000	6.3	42000	38000	41000	5.2
Lead	mg/kg	50	19	25	24	14.2	58	35	20	50.8	13	12	13	4.6
Mercury	mg/kg	0.15	0.1	0.17	0.15	25.8	0.03	0.02	0.02	24.7	0.08	0.09	0.1	11.1
Nickel	mg/kg	21	30	28	22	15.6	9	8.6	9.3	3.9	31	26	29	8.8
Silver	mg/kg	1	<0.25	0.53	0.51	3.8	<0.25	<0.25	<0.25	-	<0.25	<0.25	<0.25	-
Zinc	mg/kg	200	100	110	100	5.6	280	180	140	36.1	85	77	84	5.3
Total Petroleum Hydrocarbons														
TPH C6-C9	mg/kg	550	<10	<10	<10	-	-	-	-	-	-	-	-	-
TPH C10-14	mg/kg	550	<10	<10	<10	-	-	-	-	-	-	-	-	-
TPH C15-28	mg/kg	550	<50	<50	43.3	-	-	-	-	-	-	-	-	-
TPH C29-36	mg/kg	550	37.3	50.7	65.8	27.8	-	-	-	-	-	-	-	-
Poly Aromatic Hydrocarbons														
Naphthalene	µg/kg	-	3.3	5.7	<5	52.6	-	-	-	-	-	-	-	-
1-Methylnaphthalene	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	µg/kg	-	<5	5.0	<5	-	-	-	-	-	-	-	-	-
Acenaphthylene	µg/kg	-	<5	4.3	<5	-	-	-	-	-	-	-	-	-

Data Validation

Analytes	Units	NAGD Screening Level	Sample 5-1				Sample 13-4				Sample 11-9			
Acenaphthene	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-
Fluorene	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-
Phenanthrene	µg/kg	-	11.3	13.6	10.0	15.5	-	-	-	-	-	-	-	-
Anthracene	µg/kg	-	3.3	5.0	<5	40.0	-	-	-	-	-	-	-	-
Fluoranthene	µg/kg	-	32.7	43.6	35.8	15.0	-	-	-	-	-	-	-	-
Pyrene	µg/kg	-	40.7	47.9	45.0	8.1	-	-	-	-	-	-	-	-
Benz(a)anthracene	µg/kg	-	20.0	30.7	22.5	23.0	-	-	-	-	-	-	-	-
Chrysene	µg/kg	-	18.0	27.1	20.0	22.1	-	-	-	-	-	-	-	-
Benzo(b)&(k)fluoranthene	µg/kg	-	43.3	65.0	56.7	19.9	-	-	-	-	-	-	-	-
Benzo(a)pyrene	µg/kg	-	22.7	35.7	27.5	23.0	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/kg	-	21.3	29.3	32.5	20.7	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	µg/kg	-	<5	5.0	5.0	0.0	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	µg/kg	-	17.3	27.1	25.8	22.7	-	-	-	-	-	-	-	-
Coronene	µg/kg	-	<10	<10	<10	-	-	-	-	-	-	-	-	-
Benzo(e)pyrene	µg/kg	-	18.0	25.0	21.7	16.2	-	-	-	-	-	-	-	-
Perylene	µg/kg	-	29.3	39.3	50.0	26.1	-	-	-	-	-	-	-	-
Total PAHs (as above)	µg/kg	10000	280	407	350	18.4	-	-	-	-	-	-	-	-
Organochlorine Pesticides														
Aldrin	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
alpha-BHC	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
beta-BHC	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
gamma-BHC (Lindane)	µg/kg	0.32	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
delta-BHC	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
cis-Chlordane	µg/kg	0.5	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
trans-Chlordane	µg/kg	0.5	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
p,p'-DDD	µg/kg	2	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
p,p'-DDE	µg/kg	2.2	3.3	3.6	3.3	4.0	<2	<2	<2	-	3.3	3.1	3.8	9.4

Data Validation

Analytes	Units	NAGD Screening Level	Sample 5-1				Sample 13-4				Sample 11-9			
p,p'-DDT	µg/kg	1.6	2.7	1.4	2.5	30.6	<2	<2	<2	-	2.8	3.8	3.1	15.3
Dieldrin	µg/kg	280	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
alpha-Endosulfan	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
beta-Endosulfan	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
Endosulfan Sulphate	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
Endrin	µg/kg	10	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
Endrin ketone	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
Endrin aldehyde	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
Heptachlor	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
Heptachlor epoxide	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
Hexachlorobenzene	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
Methoxychlor	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
Oxychlordane	µg/kg	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
Organotins														
Monobutyl tin	µgSn/kg	-	<10	<10	<10	-	<10	<10	<10	-	<10	<10	<10	-
Dibutyl tin	µgSn/kg	-	1.5	2.5	3.0	33.7	<0.5	<0.5	<0.5	-	0.6	0.4	0.5	19.4
Tributyl tin	µgSn/kg	9	0.3	0.4	3.1	121.8	<0.5	<0.5	<0.5	-	4.0	<0.5	0.4	165.7
Polychlorinated Biphenyls														
Mono-PCB congeners	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-
Di-PCB congeners	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-
Tri-PCB congeners	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-
Tetra-PCB congeners	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-
Penta-PCB congeners	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-
Hexa-PCB congeners	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-
Hepta-PCB congeners	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-
Octa-PCB congeners	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-
Nona-PCB congeners	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-

Data Validation

Analytes	Units	NAGD Screening Level	Sample 5-1				Sample 13-4				Sample 11-9			
Deca-PCB congeners	µg/kg	-	<5	<5	<5	-	-	-	-	-	-	-	-	-
Total PCB congeners	µg/kg	23	<5	<5	<5	-	-	-	-	-	-	-	-	-
Nutrients, TOC, Cyanide														
Nitrate as N	mg/kg	-	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
Nitrite as N	mg/kg	-	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
Total Nitrogen	mg/kg	-	1150	1010	910	11.8	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/kg	-	1150	1010	910	11.8	-	-	-	-	-	-	-	-
Total Phosphorus	mg/kg	-	870	830	680	12.6	280	300	340	10.0	-	-	-	-
Total Organic Carbon	%	-	1.5	1.4	1.2	11.2	0.18	0.5	0.15	70.1	1.8	1.6	1.6	6.9
Radionuclides														
Gross Alpha	mBq/g	35000	<60	<60	<60	-	-	-	-	-	-	-	-	-
Gross Beta	mBq/g	35000	<135	<135	<135	-	-	-	-	-	-	-	-	-
Acid Sulfate Soils														
pH_{kcl}	pH units		8.3	8.4	8.7	-	-	-	-	-	-	-	-	-
s-TAA pH 6.5	%w/w S		<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-
TAA pH 6.5	moles H^+/t		<5	<5	<5	-	-	-	-	-	-	-	-	-
Chromium Reducible Sulfur	%w/w		0.17	0.3	0.37	-	-	-	-	-	-	-	-	-
a-Chromium Reducible Sulfur	moles H^+/t		110	190	230	-	-	-	-	-	-	-	-	-
S_{KCl}	%w/w S		0.17	0.15	0.14	-	-	-	-	-	-	-	-	-
ANC_{BT}	% $CaCO_3$		1.9	2.2	2.7	-	-	-	-	-	-	-	-	-
s-ANC_{BT}	%w/w S		0.62	0.72	0.85	-	-	-	-	-	-	-	-	-
s-Net Acidity	%w/w S		<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-
a-Net Acidity	moles H^+/t		<10	<10	<10	-	-	-	-	-	-	-	-	-
Liming rate	kg $CaCO_3$/t		<0.75	<0.75	<0.75	-	-	-	-	-	-	-	-	-

Table 4-2 Summary of Triplicate Laboratory Split Analysis. Orange Shading Indicates Exceedance of 50% Criterion for Relative Standard Deviation (RSD) or Relative Percent Difference (RPD)

Analytes	Units	NAGD Level	Sample 6-2				Sample 10-6			
			6-2A	6-2B	6-2C	RSD/RPD (%)	10-6A	10-6B	10-6C	RSD/RPD (%)
Moisture Content	%	-	60	61.1	62.1	1.7	54.9	54.7	52.6	2.4
Trace Elements										
Aluminium	mg/kg	-	27000	27000	28100	2.3	20000	20000	20600	1.7
Arsenic	mg/kg	20	7.1	7.4	7.98	6.0	6.5	5.9	7.41	11.5
Cadmium	mg/kg	1.5	<0.1	<0.1	0.1	-	<0.1	<0.1	0.1	-
Chromium	mg/kg	80	47	48	46.9	1.3	37	35	37.4	3.5
Copper	mg/kg	65	45	42	38	8.4	24	23	24.4	3.0
Iron	mg/kg	-	45000	43000	52200	10.4	34000	34000	40500	10.4
Lead	mg/kg	50	14	14	19	18.4	11	11	15.8	22.0
Mercury	mg/kg	0.15	0.09	0.09	0.09	0.0	0.07	0.07	0.09	15.1
Nickel	mg/kg	21	33	34	42.6	14.4	23	22	29.4	16.2
Silver	mg/kg	1	<0.25	<0.25	0.2	-	<0.25	<0.25	0.2	-
Zinc	mg/kg	200	100	100	136	18.6	86	76	99.2	13.4
Total Petroleum Hydrocarbons										
TPH C6-C9	mg/kg	550	-	-	-	-	<10	<10	<10	-
TPH C10-14	mg/kg	550	-	-	-	-	<10	<10	<50	-
TPH C15-28	mg/kg	550	-	-	-	-	<50	61.8	<100	-
TPH C29-36	mg/kg	550	-	-	-	-	48.5	74.5	<100	42.4
Poly Aromatic Hydrocarbons										
Naphthalene	µg/kg	-	-	-	-	-	<5	<5	<5	-
1-Methylnaphthalene	µg/kg	-	-	-	-	-	<5	<5	-	-
2-Methylnaphthalene	µg/kg	-	-	-	-	-	<5	<5	<5	-
Acenaphthylene	µg/kg	-	-	-	-	-	3.8	7.3	9	39.1
Acenaphthene	µg/kg	-	-	-	-	-	<5	<5	<5	-
Fluorene	µg/kg	-	-	-	-	-	<5	<5	<5	-

Data Validation

Analytes	Units	NAGD Level	Sample 6-2				Sample 10-6			
Phenanthrene	µg/kg	-	-	-	-	-	9.2	12.7	11	15.9
Anthracene	µg/kg	-	-	-	-	-	<5	<5	6	-
Fluoranthene	µg/kg	-	-	-	-	-	33.1	43.6	34	15.8
Pyrene	µg/kg	-	-	-	-	-	36.9	48.2	35	17.8
Benz(a)anthracene	µg/kg	-	-	-	-	-	18.5	24.5	21	14.3
Chrysene	µg/kg	-	-	-	-	-	16.9	24.5	25	20.5
Benzo(b)&(k)fluoranthene	µg/kg	-	-	-	-	-	45.4	69.1	39	31.0
Benzo(a)pyrene	µg/kg	-	-	-	-	-	27.7	40.0	33	18.4
Indeno(1,2,3-cd)pyrene	µg/kg	-	-	-	-	-	27.7	51.8	31	35.5
Dibenz(a,h)anthracene	µg/kg	-	-	-	-	-	3.8	8.2	11	46.9
Benzo(g,h,i)perylene	µg/kg	-	-	-	-	-	23.8	34.5	30	18.2
Coronene	µg/kg	-	-	-	-	-	<10	<10	10	-
Benzo(e)pyrene	µg/kg	-	-	-	-	-	18.5	27.3	23	19.2
Perylene	µg/kg	-	-	-	-	-	64.6	79.1	31	42.4
Total PAHs (as above)	µg/kg	10000	-	-	-	-	331	473	349	20.1
Organochlorine Pesticides										
Aldrin	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
alpha-BHC	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
beta-BHC	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
gamma-BHC (Lindane)	µg/kg	0.32	<2	<2	<0.50	-	<2	<2	<0.50	-
delta-BHC	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
cis-Chlordane	µg/kg	0.5	<2	<2	<0.50	-	<2	<2	<0.50	-
trans-Chlordane	µg/kg	0.5	<2	<2	<0.50	-	<2	<2	<0.50	-
p,p'-DDD	µg/kg	2	<2	1.2	<0.50	-	<2	<2	<0.50	-
p,p'-DDE	µg/kg	2.2	4.1	4.1	<0.50	0.0	3.1	4.5	<0.50	38.5
p,p'-DDT	µg/kg	1.6	3.5	4.1	<0.50	15.4	3.8	5.5	<0.50	34.6
Dieldrin	µg/kg	280	<2	<2	<0.50	-	<2	<2	<0.50	-
alpha-Endosulfan	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-

Data Validation

Analytes	Units	NAGD Level	Sample 6-2				Sample 10-6			
beta-Endosulfan	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
Endosulfan Sulphate	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
Endrin	µg/kg	10	<2	<2	<0.50	-	<2	<2	<0.50	-
Endrin ketone	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
Endrin aldehyde	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
Heptachlor	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
Heptachlor epoxide	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
Hexachlorobenzene	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
Methoxychlor	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
Oxychlordane	µg/kg	-	<2	<2	<0.50	-	<2	<2	<0.50	-
Organotins		-								
Monobutyl tin	µgSn/kg	-	<10	<10	<1	-	<10	<10	<1	-
Dibutyl tin	µgSn/kg	-	<1.0	0.6	<1	-	<0.5	0.5	<1	-
Tributyl tin	µgSn/kg	9	0.6	2.1	1.4	54.6	<0.5	<0.5	0.5	-
Polychlorinated Biphenyls										
Mono-PCB congeners	µg/kg	-	-	-	-	-	<5	<5	<5	-
Di-PCB congeners	µg/kg	-	-	-	-	-	<5	<5	<5	-
Tri-PCB congeners	µg/kg	-	-	-	-	-	<5	<5	<5	-
Tetra-PCB congeners	µg/kg	-	-	-	-	-	<5	<5	<5	-
Penta-PCB congeners	µg/kg	-	-	-	-	-	<5	<5	<5	-
Hexa-PCB congeners	µg/kg	-	-	-	-	-	<5	<5	<5	-
Hepta-PCB congeners	µg/kg	-	-	-	-	-	<5	<5	<5	-
Octa-PCB congeners	µg/kg	-	-	-	-	-	<5	<5	<5	-
Nona-PCB congeners	µg/kg	-	-	-	-	-	<5	<5	<5	-
Deca-PCB congeners	µg/kg	-	-	-	-	-	<5	<5	<5	-
Total PCB congeners	µg/kg	23	-	-	-	-	<5	<5	<5	-
Nutrients, TOC, Cyanide										
Nitrate as N	mg/kg	-	-	-	-	-	<0.1	<0.1	<0.1	-

Data Validation

Analytes	Units	NAGD Level	Sample 6-2				Sample 10-6			
Nitrite as N	mg/kg	-	-	-	-	-	<0.1	<0.1	<0.1	-
Total Nitrogen	mg/kg	-	-	-	-	-	950	1000	720	16.8
Total Kjeldahl Nitrogen	mg/kg	-	-	-	-	-	950	1000	720	16.8
Total Phosphorus	mg/kg	-	1100	1300	-	16.7	720	680	487	19.8
Total Organic Carbon	%	-	1.7	1.7	1.3	14.7	1.3	1.1	0.93	16.7
Radionuclides										
Gross Alpha	mBq/g	35000	-	-	-	-	<60	<60	-	-
Gross Beta	mBq/g	35000	-	-	-	-	<135	<135	-	-
Acid Sulfate Soils										
pH $_{kcl}$	pH units	-	-	-	-	-	8.8	8.8	8.7	0.7
s-TAA pH 6.5	%w/w S	-	-	-	-	-	<0.01	<0.01	<0.02	-
TAA pH 6.5	moles H^+/t	-	-	-	-	-	<5	<5	<2	-
Chromium Reducible Sulfur	%w/w	-	-	-	-	-	0.17	0.26	0.276	24.3
a-Chromium Reducible Sulfur	moles H^+/t	-	-	-	-	-	110	160	172	22.3
S_{KCl}	%w/w S	-	-	-	-	-	0.1	0.093	-	7.3
ANC_{BT}	% $CaCO_3$	-	-	-	-	-	4.3	4.3	6.06	20.8
s-ANC_{BT}	%w/w S	-	-	-	-	-	1.4	1.4	1.94	19.7
s-Net Acidity	%w/w S	-	-	-	-	-	<0.01	<0.01	<0.02	-
a-Net Acidity	moles H^+/t	-	-	-	-	-	<10	<10	<10	-
Liming rate	kg $CaCO_3$/t	-	-	-	-	-	<0.75	<0.75	<1	-

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Appendix A Sampling and Analysis Plan

BMT WBM

Port of Brisbane Maintenance Dredging - Sediment Sampling and Analysis Plan 2013

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Date: October 2013
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Port of Brisbane Maintenance Dredging - Sediment Sampling and Analysis Plan 2013

Prepared for:	Port of Brisbane Pty Ltd
Prepared by:	BMT WBM Pty Ltd (Member of the BMT group of companies)

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Synopsis: **A sediment sampling and analysis plan for the assessment of physical and chemical sediment properties associated with Port of Brisbane maintenance dredging**

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
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1 Introduction

Port of Brisbane Pty Ltd (PBPL) is required to maintain a minimum depth of clearance below the keel of vessels calling at the port to allow for effective shipping access to the port and ensure ship safety. Channel depths are declared by the Harbour Master (Maritime Safety Queensland) and displayed on various shipping charts. PBPL undertakes an annual maintenance dredging program to ensure these minimum depths are maintained.

PBPL propose to undertake its annual maintenance dredging within the navigational areas of the Brisbane River and Moreton Bay, primarily using the Trailer Suction Hopper Dredge (TSHD) 'Brisbane'. Maintenance dredging works extend from the Hamilton Reach of the Brisbane River to the North West Channel located in northern Moreton Bay.

PBPL aims to ensure that all dredging activities, including extraction and placement of material, are undertaken in accordance with existing legislation and with minimal environmental harm. A key component of achieving this aim is to undertake a contaminant assessment of the material proposed for dredging prior to the commencement of the dredging program.

1.1 Sediment Sampling and Analysis Plan (SAP) Objectives

The aim of this SAP is to provide a set of procedures that will allow a statistically valid evaluation of the physical and chemical sediment properties of the sediments to be dredged. The results of this assessment will assist in determining the likely impacts of unconfined offshore disposal of the dredged sediment.

The assessment of physico-chemical sediment properties will be undertaken on the basis of the approach set out in the National Assessment Guidelines for Dredging (Commonwealth of Australia 2009; henceforth NAGD).

The specific SAP objectives are to:

- Provide a summary of proposed dredging and disposal operations for the project;
- Identify a list of contaminants based on a review of existing data and potential contaminant sources;
- Determine the number of samples required to provide an adequate characterisation of the physical and chemical sediment properties;
- Develop procedures for adequate field collection and handling of sediment samples;
- Outline adequate quality assurance and quality control (QA/QC) procedures for field sampling and laboratory analysis;
- Provide a description of statistical procedures used to determine the contaminant status of the dredged material;
- Describe procedures for validating the analytical data to assess whether the sample collection, handling and laboratory analysis was undertaken to a standard allowing assessment of sediment quality against the NAGD guidelines; and

- Outline the proposed reporting framework for the sediment quality results that will address the requirements of the Determining Authority.

1.2 Proposed Dredging

PBPL's area of responsibility in relation to maintenance and capital dredging within port limits can be broadly divided into two zones on the basis of the water body type, navigable depths and nature of dredged material:

- Moreton Bay zone (enclosed/open coastal waters); and
- Brisbane River zone including the Port of Brisbane (middle/lower estuary).

This SAP only considers assessment of sediments for the Brisbane River zone. The Brisbane River zone extends from Hamilton Reach to the Outer Bar Cutting. Annual maintenance dredging is required to remove sediments accumulated by natural siltation processes within the catchment and sediment loads from residential and commercial developments.

To ensure that declared depths of navigational channels are maintained at all times, PBPL undertakes 'insurance' dredging of up to -0.5 metres below the declared depth.

On average, PBPL dredges about 400,000 m^3 to 450,000 m^3 of material each year. Additional dredging needs to be undertaken following major flood events, i.e. in 2011 and 2013.

The Brisbane River zone is divided into different dredging subareas based on existing contaminant data (Figure 2-1), comprising Zone 2, Zone 3 and Zone 4. It is noted that Zone 1 is not part of the annual dredging and samples from this zone have been used to collect control samples upstream of the actual dredging areas.

The following average dredge volumes apply to the dredge subareas (Table 1-1):

Table 1-1 Approximate Maintenance Dredge Volumes

Dredging Subarea	Extents	Average Dredge Volume (m^3)
Zone 2	Colmslie to Pinkenba	150,000
Zone 3	Within port reaches	250,000
Zone 4	Moreton Bay entrance channel	30,000

The maintenance dredging program is structured to maximise efficiencies and utilisation of PBPL's largest dredger, the trailing suction hopper dredge *TSHD Brisbane*. The *TSHD Brisbane* typically carries out the majority of the ports maintenance dredging over a two month period between January and May (actual period varies depending on other commitments of the *TSHD Brisbane* and siltation patterns). The PBPL may also utilise smaller, more manoeuvrable dredging plant, such as grab dredgers and bed levellers, to maintain more confined areas within the Port Limits.

1.3 Offshore Disposal

The PBPL's policy with regard to dredged material is to maximise its beneficial reuse. In general, most of the material dredged by the PBPL from within Port Limits is used in reclamation works

associated with development of the port. The reuse of this dredged material provides several benefits, including:

- Reduced pressure on sea disposal sites;
- The placement of any actual or potential acid sulphate material at depth beneath the water surface; and
- The containment of any contaminated material within a designated boundary, disconnected from the marine system and monitored to ensure the immobility of identified contaminants.

In 2009, the reclamation life of the Future Port Expansion (FPE) area was estimated to be approximately 30 years, based on the current level of port development at that time. Following extreme flood events in both 2011 and 2013 and the subsequent disposal of additional material in the FPE area, the estimated life of the FPE area was reduced by 20 years to 10 years. Given the importance of the FPE as an area to dispose of material unsuitable for ocean disposal, there has been a shift in thinking around the management of the FPE area.

The current proposed management of dredged material is to, where practical, dispose at sea all dredged material deemed suitable for ocean disposal. This proposed management initiative will ensure the long term viability of the FPE area for the disposal of material deemed unsuitable for ocean disposal.

In the past, significant quantities of dredged material from the Brisbane River have been placed offshore at the Mud Island Dredge Material Placement Area (DMPA) (Figure 2-1). In recent years only smaller volumes of dredged material from boat harbours in southern Moreton Bay were placed at the Mud Island DMPA. However, it is proposed that the Mud Island DMPA will be utilised for material found suitable for ocean disposal in future PBPL maintenance dredging campaigns.

2 Review of Existing Information

Prior to each annual maintenance dredging campaign, PBPL undertook assessments of sediment quality at 45 sampling locations within the dredging zones 2 to 4 (Figure 2-1).

Additional samples were obtained from three locations in Zone 1 and Breakfast Creek upstream of the dredging area in order to assess potential sediment quality impacts from the upstream catchment. The sediment quality results for the annual sampling program between 2000 and 2013 are summarised in Section 2.1.

Due to major flooding in the Brisbane River catchment in early January 2011 and late January 2013, emergency dredging was required to maintain declared depths. Twelve to twenty locations were sampled within the port and three to four locations within the Mud Island DMPA for the 2011 and 2013 flood sampling campaigns, respectively. The sediment quality assessments included elutriate and bioavailability analyses for selected trace metals and organic contaminants.

Additionally, a comparison of sediment quality (organochlorine pesticides and dioxins) at 14 sampling locations at the Mud Island DMPA and seven reference sites in Moreton Bay (Sites RF1 to RF7 in Figure 2-1) was undertaken in 2013 to assess if the emergency dredging and disposal activities impacted on sediment and water quality in Moreton Bay. The sediment quality results for the 2011 and 2013 flood sampling are summarised in Section 2.2.

Conclusions based on the review of the annual and flood sampling data are provided in Section 2.3.

2.1 Annual Sediment Quality Data 2000 – 2013

Detailed sediment quality studies have been undertaken within the Port of Brisbane since 1998. This review considers sediment quality data collected between 2000 and 2012. This comprises the studies detailed in Table 2-1.

In addition to the routine monitoring documented in Table 2-1, further sampling was carried in 2011 and 2013 (Worley Parsons 2011b, 2013b, 2013c, 2013d) to assess the effects of floods on sediment quality. Refer to Section 2.2 for a description of these studies.

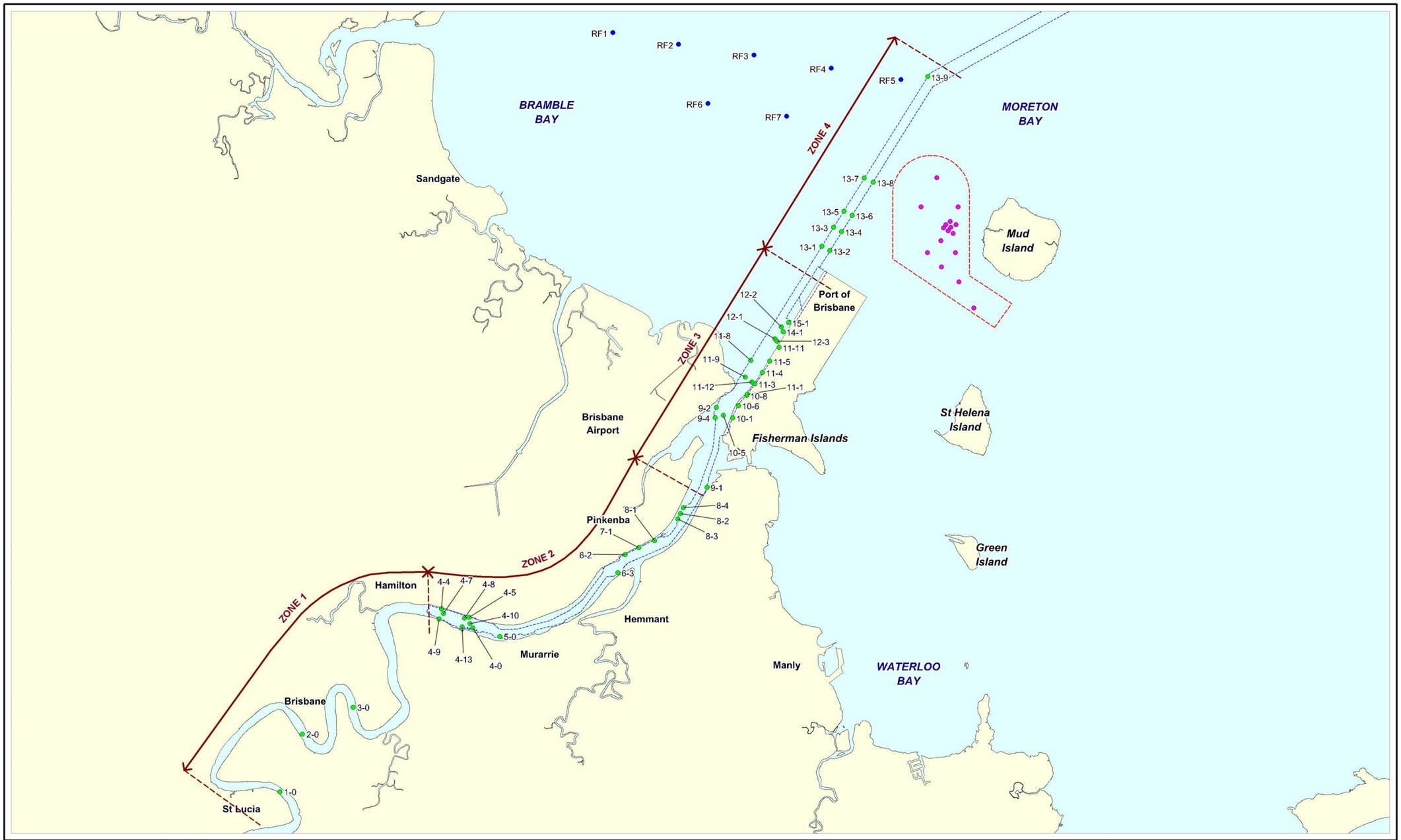
Table 2-1 Previous Routine Annual Sediment Quality Studies

Reference	Sampling Date
Maunsell McIntyre (2001)	November 2000
Butler Partners (2002)	November 2001
Hydrobiology (2003)	November 2002
Hydrobiology (2004)	November 2003
SKM (2005)	November 2004
SKM (2006)	January 2006
SKM (2007)	February 2007
Worley Parsons (2008)	January 2008
Worley Parsons (2009)	February 2009
GHD (2010)	January 2010
Worley Parsons (2011a)	December 2010
Worley Parsons (2012)	December 2011
Worley Parsons (2013a)	December 2012

A wide range of analytical parameters have been measured between 2000 and 2012 as summarised in Table 2-2. Analysis was undertaken at a total of 45 locations within the dredge areas. Additional samples were collected from three control locations upstream of the dredging areas as well as from Breakfast Creek (these locations are not within the dredge areas).

Table 2-2 Summary of Sediment Quality Data 2000 - 2012

Analytical Parameter	Measurement Events
Inorganics	
Metals & Metalloids	2000-2012
Organics	
Organotins	2000-2012
Total Petroleum Hydrocarbons (TPHs)	2000-2012
Benzene, Toluene, Ethylbenzene, Xylene (BTEX)	2000-2012
Polycyclic Aromatic Hydrocarbons (PAHs)	2000-2012 (30% of locations)
Organophosphate and Organochlorine Pesticides (OPPs and OCPs)	2000-2012 (40% of locations between 2000 and 2006)
Polychlorinated Biphenyls (PCBs)	2000-2012 (30% of locations)
Radionuclides	2010-2012
Acid Sulfate Soils	2000-2012



LEGEND

- Existing Sample Site
- Reference Sample Site
- DMPA Emergency Dredging Monitoring Sites
- Dredge Area
- Dredge Material Placement Area

Title:
Historic Sediment Sampling Locations

Figure: **2-1**

Rev: **A**

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

N

0 2.5 5km

Approx. Scale

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2.1.1 Metals and Metalloids

Testing for metals and metalloids has included analysis of arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc between 2000 and 2012. Antimony and silver were also tested between 2001 and 2004.

The main contaminants of potential concern in terms of metals and metalloids were mercury and nickel. Mercury and nickel concentrations frequently exceeded the NAGD screening level at the 95% Upper Confidence Limit of the mean (95% UCL). Silver exceeded the NAGD screening level at the 95% UCL between 2002 and 2004. All other metals and metalloid 95% UCL concentrations were generally below the 95% UCL between 2000 and 2013.

The temporal and spatial trends observed for trace metals between 2000 and 2012 are detailed in the following sections.

2.1.1.1 Mercury

The NAGD screening level for mercury (0.15 mg/kg) was exceeded on numerous occasions in the Brisbane River dredge zones, particularly in Zone 2. Figure 2-2 shows the number of occasions when the screening level was exceeded between 2000 and 2012 and the number of sites for dredge zones 2 to 4 where exceedances were noted.

For Zone 2, mercury concentrations exceeded the screening level on 61 - 70% of occasions at 25% of locations. At a similar number of sites in Zone 2 exceedances were noted on 20 – 40% of occasions between 2000 and 2012.

Some exceedances of the mercury screening level were noted also for Zone 3 and Zone 4. However, those exceedances occurred only at a limited number of sites whilst no screening level exceedances were noted at 70 – 80% of locations in Zone 3 and Zone 4 between 2000 and 2012.

In Zone 3 most exceedances of the mercury screening level occurred at three sites (9-2, 10-6 and 11-8) occurring on 31 – 69% of occasions. In Zone 4, exceedances were only noted at two sites (13-5 and 13-6) on 8 – 23% of occasions.

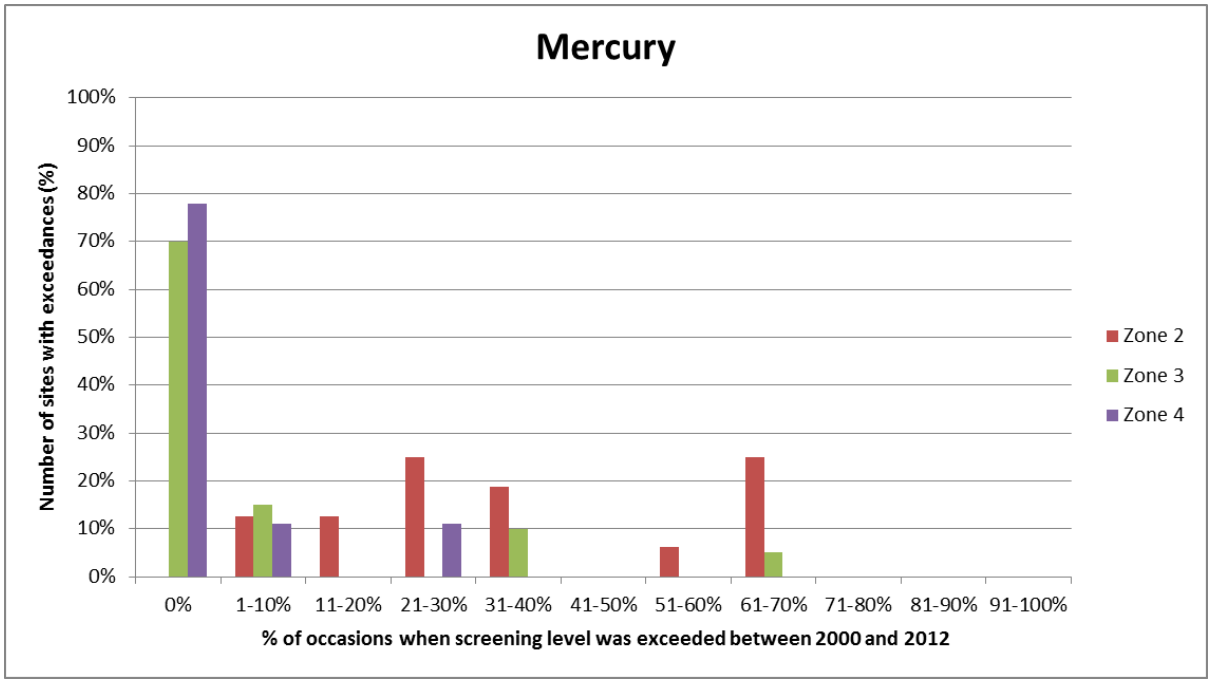


Figure 2-2 Exceedances of the NAGD Screening Level for Mercury between 2000 and 2012 in Dredge Zones 2, 3 and 4

2.1.1.2 Nickel

Exceedances of the nickel screening level (21 mg/kg) were noted for most locations across all dredge zones (Figure 2-3). Exceedances of the screening level on more than 80% of occasions were noted at a cumulative 56% of sites in Zone 2, 20% of sites in Zone 3 and 11% of sites in Zone 4. Average Nickel concentrations were 24.2 mg/kg for Zone 2, 20.1 mg/kg for Zone 3 and 21.4 mg/kg for Zone 4, i.e. close to the nickel screening level of 21 mg/kg.

Given the widespread exceedances of the nickel screening level across all dredge zones and that exceedances were also commonly noted for the upstream control sites, it appears likely that the elevated nickel concentrations are of natural origin. It is recognised that sediments in Australia including South-East Queensland commonly have high natural levels of nickel (NAGD 2009 and Preda & Cox 2002).

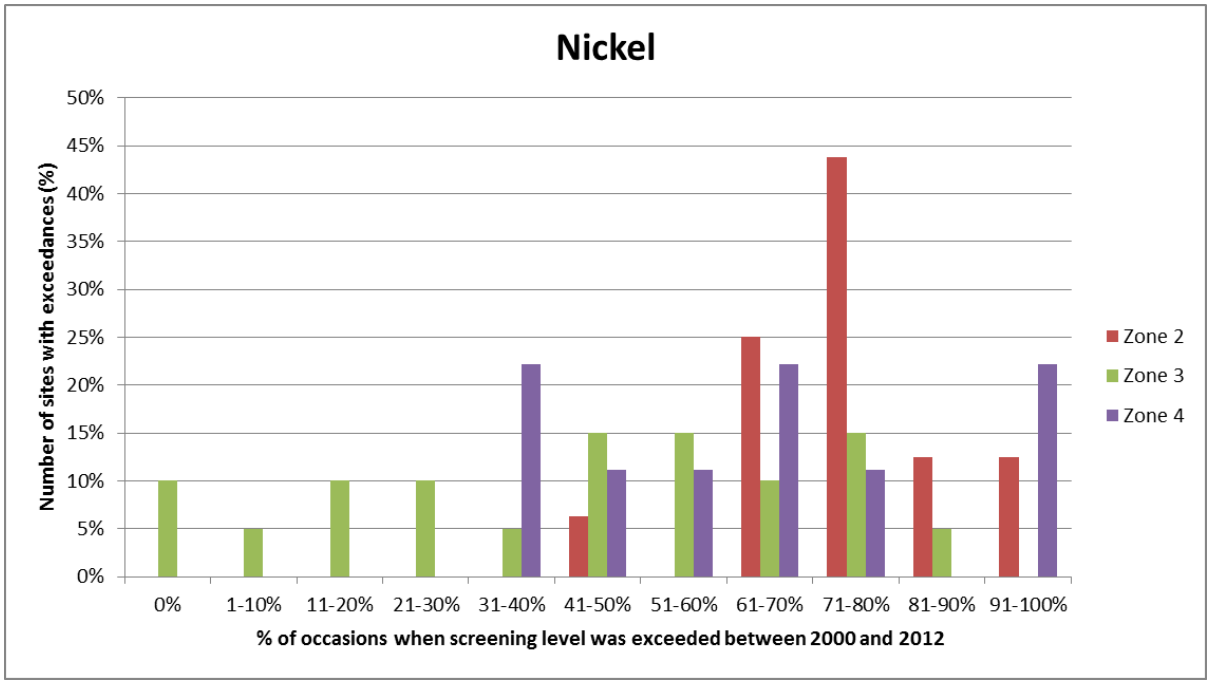


Figure 2-3 Exceedances of the NAGD Screening Level for Nickel between 2000 and 2012 in Dredge Zones 2, 3 and 4

2.1.1.3 Arsenic

Concentrations for arsenic were below the NAGD screening level of 20 mg/kg at all locations and dredge zones between 2000 and 2012.

2.1.1.4 Cadmium

Cadmium concentrations were below the NAGD screening level of 1.5 mg/kg with the exception of one site in Zone 2 (Site 6-2) where the screening level was met or exceeded between 2007 and 2009 with concentrations ranging between 1.5 – 6.3 mg/kg.

However, cadmium concentrations were below screening level at all locations between 2010 and 2012. The 95% UCL for cadmium was below the screening level between 2000 and 2013 for all dredge zones.

Average cadmium concentrations between 2000 and 2012 were 0.30 mg/kg for Zone 2, 0.20 mg/kg for Zone 3 and 0.17 mg/kg for Zone 4, i.e. well below the screening level across all dredge zones.

2.1.1.5 Chromium

Chromium concentrations were mostly below the screening level of 80 mg/kg. The only exceptions were noted at site 9-1 in Zone 3 where the screening level was exceeded in 2002 and 2012 with concentrations ranging between 94 – 100 mg/kg. However, the 95% UCL remained below the screening level. Furthermore, exceedances of the chromium screening level were noted at four sites in Zone 2 in 2000 with concentrations ranging between 88.6 – 101 mg/kg.

2.1.1.6 Copper

Copper concentrations exceeded the NAGD screening level of 65 mg/kg on a few occasions in Zone 2 and Zone 3. No exceedances of the copper screening level were noted for Zone 4 (Figure 2-4).

In Zone 2 exceedances were noted at five out of sixteen locations, with only one to two detections noted at four of these locations between 2000 and 2012. At site 6-2 in Zone 2 exceedances of the screening level occurred on 46% of occasions. However, in 2011 and 2012 copper concentrations were below the screening level at this site.

The only exceedances of the copper screening level in Zone 3 were noted for site 9-1 in 2000 and 2008.

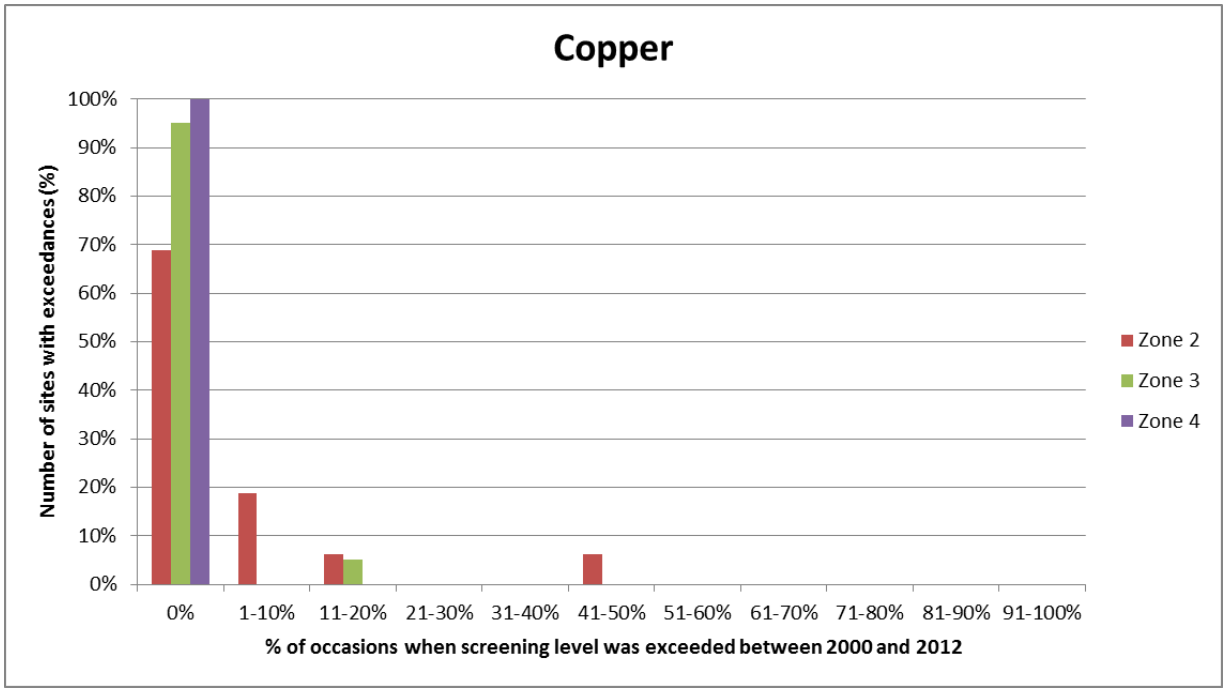


Figure 2-4 Exceedances of the NAGD Screening Level for Copper between 2000 and 2012 in Dredge Zones 2, 3 and 4

2.1.1.7 Lead

Some individual exceedances of the lead screening level (50 mg/kg) were noted, in particular in Zone 2 where exceedances were noted at seven locations (Figure 2-5). Since 2001 there were only single detections of lead above the screening level noted per annual sampling event. The 95% UCL for lead was below the NAGD screening level since 2001.

Exceedances on individual sites were noted on less than 20% of occasions, i.e. only once or twice between 2000 and 2012 in Zone 2. In Zone 3 and Zone 4, the only exceedances of the lead screening level were noted at single sites (9-1 in Zone 3 and 13-4 in Zone 4) and only on one or two occasions between 2000 and 2012.

The last screening level exceedance was noted in 2009 for Zone 2, in 2000 for Zone 3 and in 2010 for Zone 4. The average concentrations of lead between 2000 and 2012 were 26.9 mg/kg for Zone

2, 13.7 mg/kg for Zone 3 and 12.3 mg/kg for Zone 4, i.e. well below the screening level across all dredge zones.

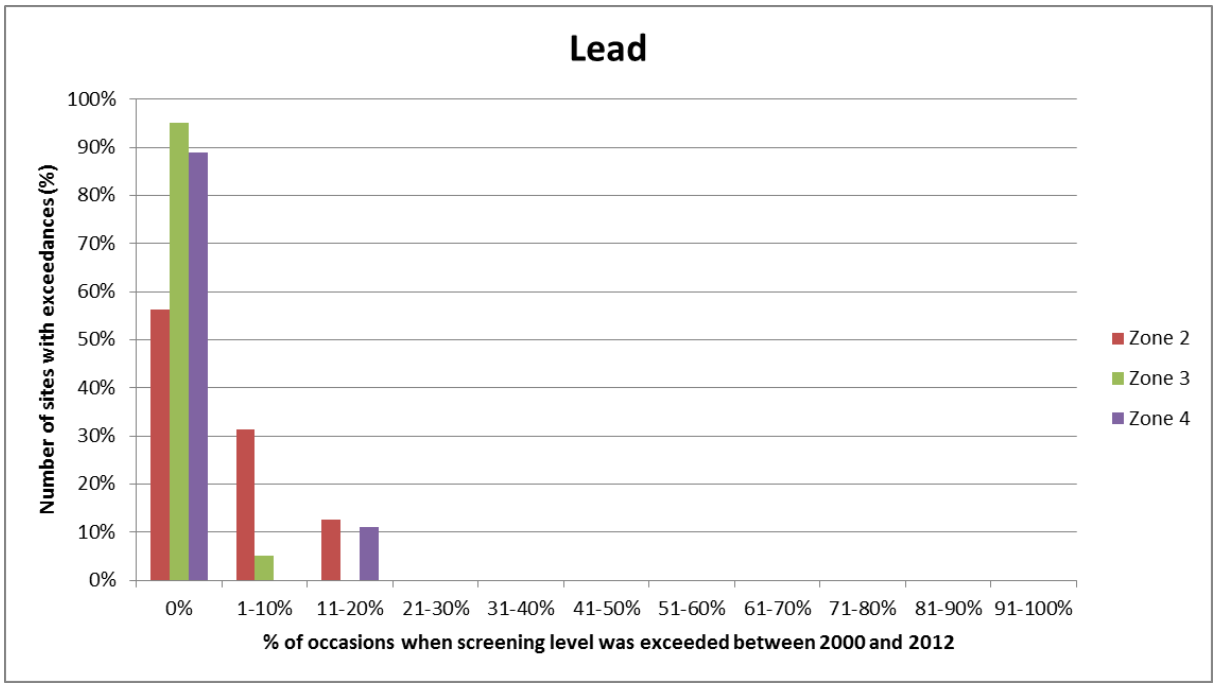


Figure 2-5 Exceedances of the NAGD Screening Level for Lead between 2000 and 2012 in Dredge Zones 2, 3 and 4

2.1.1.8 Zinc

Individual exceedances of the zinc screening level (200 mg/kg) were noted at eight locations in Zone 2. However, most of these exceedances occurred only once or twice (<15% occurrence) between 2000 and 2012 (Figure 2-6). Only at location 6-2 exceedances occurred on more than 30% of occasions (four times between 2000 and 2012). It is noted that the last exceedance of the zinc screening level in Zone 2 occurred in 2010.

In Zone 3 only a single exceedances was noted at location 9-1 in 2000. No exceedances of the zinc screening level were noted in Zone 4.

The average zinc concentration between 2000 and 2012 was 130.3 mg/kg for Zone 2, 74.0 mg/kg for Zone 3 and 57.1 mg/kg for Zone 4, i.e. well below the NAGD screening level across all dredge zones.

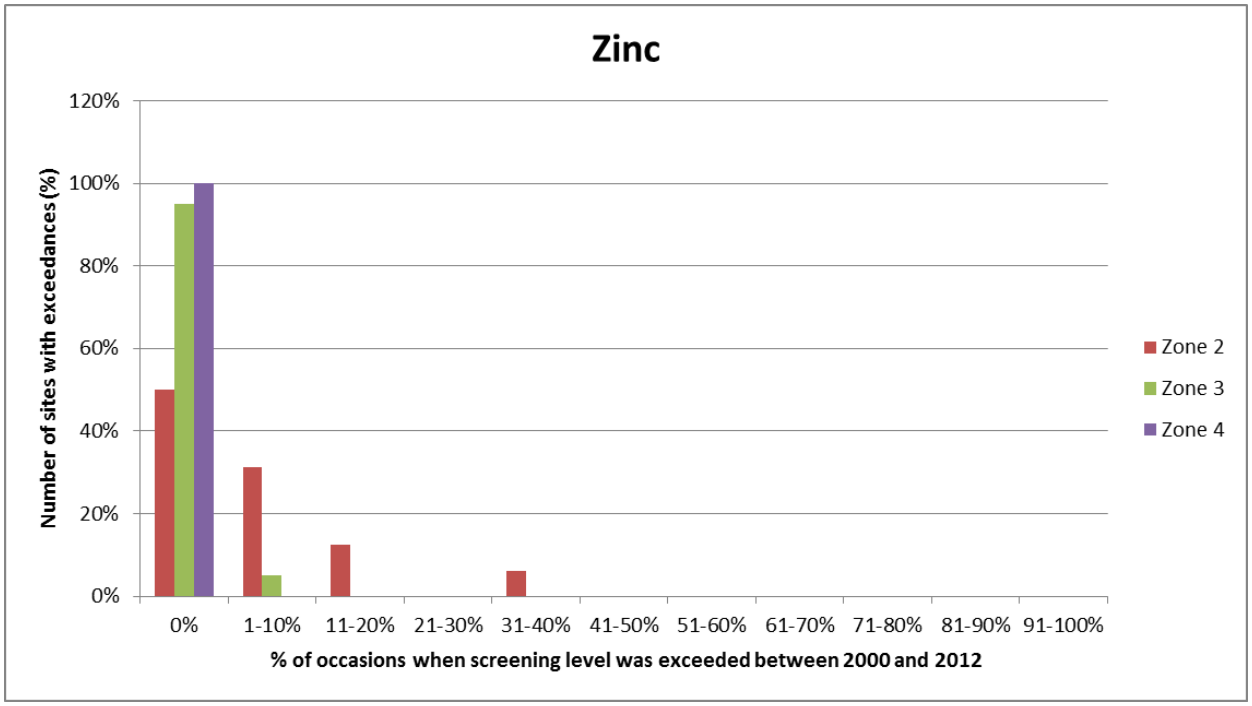


Figure 2-6 Exceedances of the NAGD Screening Level for Zinc between 2000 and 2012 in Dredge Zones 2, 3 and 4

2.1.1.9 Antimony and Silver

In addition to the metals and metalloids outlined above, antimony and silver were tested between 2001 and 2004. While antimony concentrations remained below the Limit of Reporting (LOR) for all sampling events, silver was detected at several locations and concentrations exceeded the screening level at one site in Zone 3 (11-8) between 2002 and 2004.

2.1.2 Organotins

Concentrations of TBT at the 95% UCL frequently exceeded the NAGD screening level (9 µg Sn/kg) between 2000 and 2012, particularly in dredge zones 2 and 3.

Exceedances of the TBT screening level were noted predominantly in Zone 2, including several exceedances of the NAGD high level of 70 µg Sn/kg (Figure 2-7). At sampling site 4-4 in Zone 2, the screening level was exceeded during all sampling events except in 2001, including six exceedances of the NAGD high level. At several other locations in Zone 2, screening level exceedances were noted between 20 to 70% of occasions.

In Zone 3, exceedances of the TBT screening level were typically only noted once or twice between 2000 and 2013, corresponding to 8% and 15% of occasions in Figure 2-7. The only exception was site 9-1, where exceedances of the screening level were noted on 69% of occasions. This included five sampling events where the NAGD high level was exceeded. This corresponds to a generally higher occurrence of metal/metalloid exceedances at this site as outlined in Section 1.1.1. It is noted that site 9-1 is the site located closest to Zone 2.

Only a single exceedance of the TBT screening level was noted at site 13-1 in Zone 4 in 2006.

The average normalised TBT concentration between 2000 and 2012 was 28.8 µg Sn/kg for Zone 2, 21.8 µg Sn/kg for Zone 3 and 0.7 µg Sn/kg for Zone 4. If site 9-1 is excluded from Zone 3, the average concentration is 4.4 µg Sn/kg, i.e. less than the NAGD screening level.

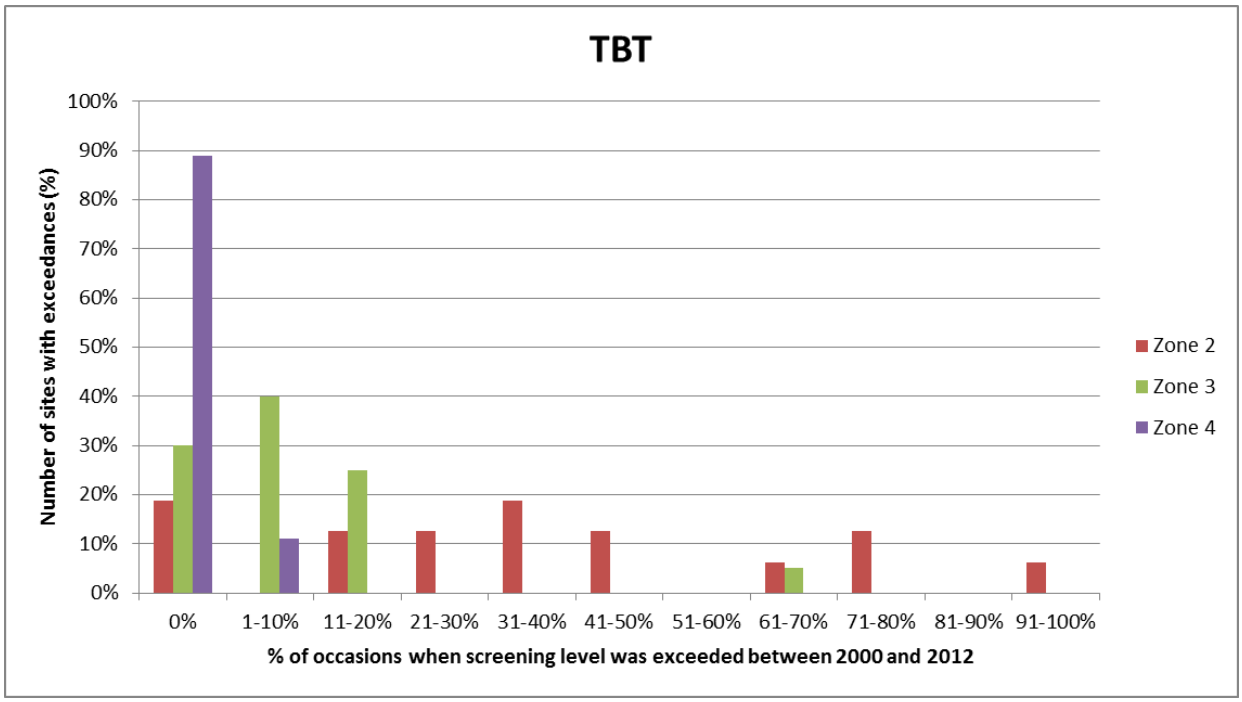


Figure 2-7 Exceedances of the NAGD Screening Level for TBT between 2000 and 2012 in Dredge Zones 2, 3 and 4

2.1.3 Benzene, Toluene, Ethylbenzene and Xylene (BTEX)

BTEX concentrations were below LOR in all samples and all zones between 2000 and 2012.

2.1.4 Total Petroleum Hydrocarbons (TPHs)

While TPHs were detected on several occasions across all dredge zones, the total TPH concentration was below the NAGD screening level of 550 mg/kg at all sampling locations between 2000 and 2012. Most detections of TPHs were noted in Zone 2, with less detections noted for Zone 3 and only some isolated detections recorded in Zone 4.

2.1.5 Polycyclic Aromatic Hydrocarbons (PAHs)

Total PAHs concentrations were mostly below the NAGD screening level of 10,000 µg/kg except for two individual detections above screening level in Zone 2 and Zone 3 in 2001. The 95% UCL for PAHs exceeded the screening level in 2011. However, since 2001, the total PAHs concentrations remained well below the screening level for all dredge zones.

2.1.6 Polychlorinated Biphenyls (PCBs)

Total PCBs concentrations were mostly well below the NAGD screening level of 23 µg/kg or below LOR. The only exceptions were site 10-6 in Zone 3 where detections above the screening level were noted in 2001 and 2012 and site 13-1 in Zone 4, where a detection above screening level was noted in 2011.

2.1.7 Organochlorine Pesticides (OCPs)

The 95% UCL concentrations of the OCPs dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethane (DDD) and Dichlordiphenyldichloroethylene (DDE) frequently exceeded the NAGD screening level between 2000 and 2013. In some cases the 95% UCL concentrations of chlordane also exceeded the NAGD screening level.

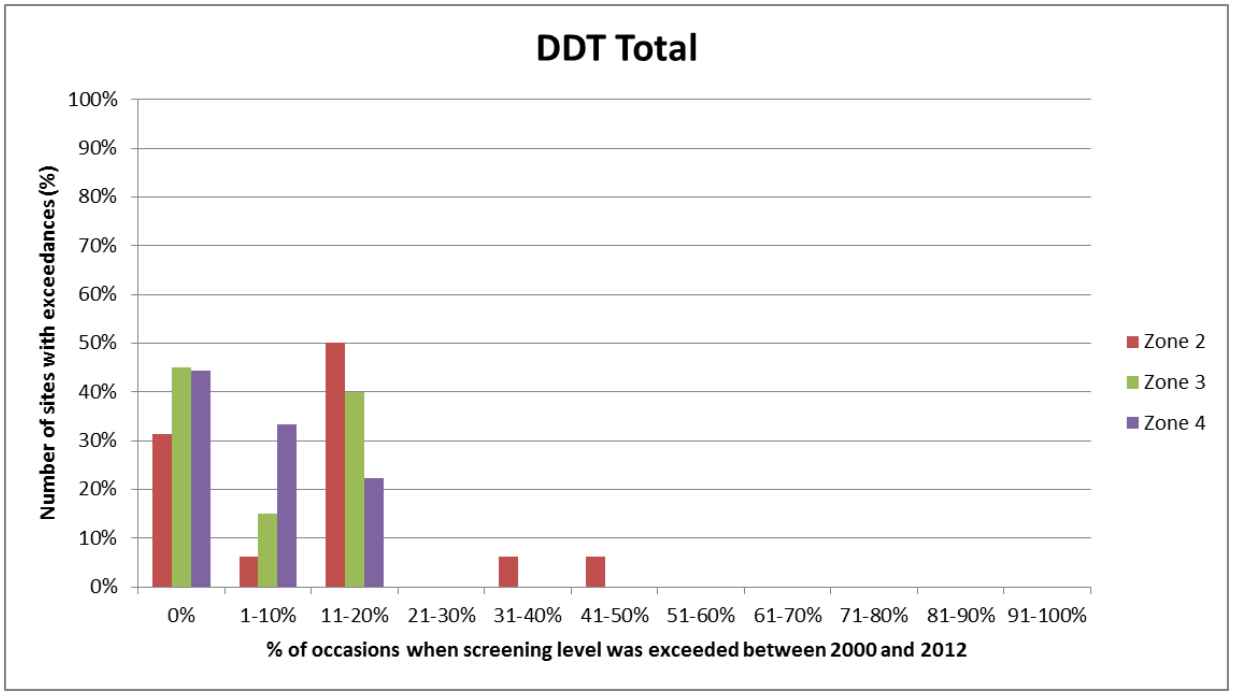
Total DDT concentrations and its metabolites DDD and DDE exceeded their respective screening levels (1.6, 2 and 2.2 µg/kg for DDT, DDD and DDE, respectively) on numerous occasions across all dredge zones (). This includes some exceedances of the NAGD high levels for DDT (46 µg/kg) and DDD (20 µg/kg), but DDE concentrations did not exceed the NADG high level of 27 µg/kg.

Most of these screening level exceedances for DDT, DDD and DDE were recorded at Zone 2, occasional exceedances of all three parameters were also recorded in Zone 3 and 4 between 2000 and 2012. The DDT breakdown product DDE was generally detected more frequently than DDT and DDD (Figure 2-8).

The presence of DDT and its metabolites across all dredge zones and consistent detections over the last decade demonstrates the long term environmental persistence of DDT and its metabolites.

Furthermore, several exceedances of the chlordane NAGD screening level of 0.5 µg/kg and the NAGD high level of 6 µg/kg were noted between 2000 and 2012.

In 2002, chlordane concentrations exceeded the screening level at all tested sampling locations in Zone 2, 3 and 4. Whilst no screening level exceedances were noted between 2003 and 2007, one to three locations in Zone 2 had concentrations higher than the screening level in 2008, 2009 and 2011 (sites 4-0, 4-4, 4-5, 4-7 and 4-8). One exceedance of the chlordane screening level was also noted in 2011 in Zone 3 (site 11-8).



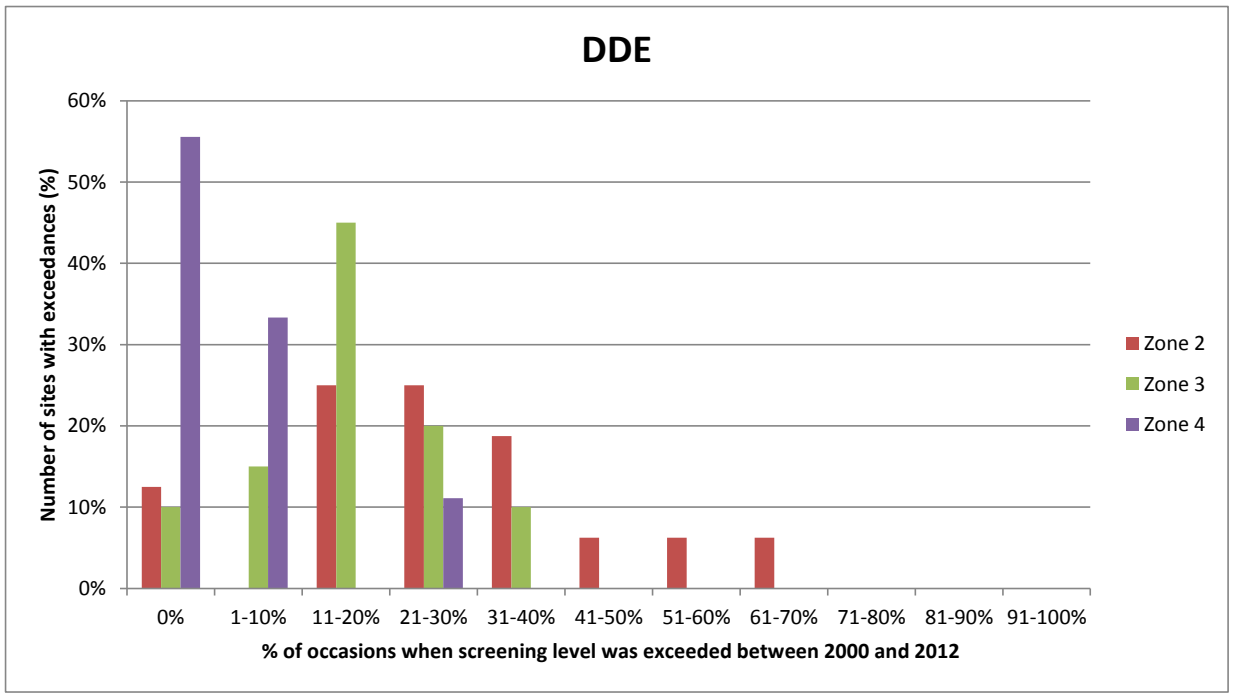


Figure 2-8 Exceedances of the NAGD Screening Level for total DDT (upper plot) and DDE (lower plot) between 2000 and 2012 in Dredge Zones 2, 3 and 4. Similar Trends for DDD.

2.1.9 Organophosphorus Pesticides (OPPs)

Concentrations of OPPs were below LOR for all sampled locations between 2000 and 2012.

2.1.10 Radionuclides

Radionuclides (gross alpha and beta) were analysed at eight sites across all dredge zones between 2010 and 2012.

Concentrations of radionuclides were detected in the January 2010 sampling but in concentrations well below the NAGD screening level of 35 Bq/g (maximum concentration 0.97 Bq/g). Radionuclide concentrations were below the LOR at all sites in all following sampling campaigns.

2.1.11 Acid Sulfate Potential

Acid sulfate soil testing indicates that the sediments in the dredge zone have no actual acidity but are generally considered to be Potential Acid Sulfate Soils (PASS). Assessments of the buffer capacity indicate that the sediments in all dredge zones have sufficient acid neutralizing capacity to buffer any acid potentially generated through onshore disposal.

Acid Sulfate Soil test results were generally consistent between 2000 and 2012.

2.2 Flood Sampling 2011 and 2013

The review of flood sampling sediment quality results included Worley Parsons (2011b, 2013b, 2013c, 2013d).

The 2011 and 2013 sampling campaigns (Worley Parsons 2011b and 2013b) included all parameters as per Table 1 of the NAGD. Additionally, porewater ammonium concentrations were measured and acid sulfate soils assessed in 2011. For both studies elutriate and bioavailability testing for nickel and mercury was undertaken.

Further testing for DDT, DDD, DDE and dioxins/furans was undertaken in 2013 including a comparison of 14 sampling locations at the Mud Island DMPA against seven Moreton Bay reference locations to assess whether the emergency dredging and disposal has affected sediment quality in Moreton Bay (Worley Parsons 2013c and 2013d).

2.2.1 Metals and Metalloids

In 2011, nickel (9 of 15 locations), mercury (3 of 15 locations) and lead (1 location) were the only metals to exceed their respective NAGD screening levels. In 2013, nickel was the only metal to exceed screening levels at 18 of the 24 locations sampled. All other metals/metalloids were below their respective screening levels.

Elutriate and bioavailability testing was undertaken for nickel and mercury in 2011 and 2013. For both sampling events, the elutriate concentrations for mercury were below LOR and nickel elutriate concentrations were well below the ANZECC/AMRCANZ (2000) 95% species protection level of 70 µg/L or below LOR. Furthermore, dilute acid extraction results for mercury and nickel indicated low bioavailability of these metals with concentrations below their respective NAGD screening level in all samples in 2011 and 2013.

These results indicated low likelihood for adverse water quality and sediment quality impacts during dredging and disposal for mercury and nickel.

2.2.1.1 Comparison to Annual Sampling

Consistent with the annual sampling undertaken between 2000 and 2012, nickel and mercury concentrations were the main contaminants of concern within the dredge areas with concentrations similar to the annual sampling events. Lead was detected above the screening level on some occasions during the annual sampling. Similar to the flood sampling, detections were noted only at single locations per annual event and 95% UCL concentrations were below the NAGD screening level.

2.2.2 Organochlorine Pesticides (OCPs)

DDT and its metabolites were detected in 2011 with DDE detected in nine of 15 locations. Whilst normalised DDD and DDE concentrations remained below their respective screening levels, normalised DDT concentrations exceeded the NAGD screening level at two locations. All other OCPs were below LOR at all locations in 2011.

In 2013, DDD was detected in one sample with a concentration exceeding the NAGD screening level. DDE exceeded the NAGD screening level of 2.2 µg/kg in all samples with a 95% UCL of 5.25 µg/kg.

2.2.2.1 Comparison to Annual Sampling

Similar to the annual sampling events, DDT and its metabolites were detected above the NAGD screening level in the flood sampling. Concentrations were similar to those detected in the annual sampling.

2.2.2.2 Comparison to Background Concentrations (2013)

Total DDT concentrations were below the LOR at all locations, including those at Mud Island DMPA and reference locations.

Sampling carried out prior to the 2013 emergency dredged material disposal event detected DDE at all 20 sampling locations within the dredged area, and one of the four locations within the DMPA. DDD was above the LOR in one sample within the dredged area (10µg/kg normalised to % TOC), and was also above the NAGD Screening level of 2 µg/kg.

Further more detailed sampling was carried out to compare contaminant concentrations at 14 locations in the DMPA and seven reference locations, following the 2013 emergency dredged material disposal event. The results of this sampling indicated that:

- DDT was again below the LOR at all locations, including those at Mud Island DMPA and reference locations.
- DDE was detected at all sampling locations with 95% UCL concentrations exceeding the NAGD screening level at both the DMPA and reference locations. This indicates that DDE was widespread throughout the study area.
- A comparison of the 80th percentile DDE of the reference locations was higher than historical levels of DDE in the Brisbane River. This indicates that the Brisbane River flood plume in

January 2013 impacted on the Brisbane River, Bramble Bay and the wider Moreton Bay region and the maintenance dredging operations undertaken by PBPL were not likely to have caused or spread this contamination.

- Additional elutriate and pore water analyses for OCPs indicated that DDD and DDE are likely adsorbed to the clay fraction of the sediment and thus not bioavailable.

2.2.3 Dioxins

Dioxins and furans were detected in the 2011 and 2013 flood sampling events. A toxic effect factor is allocated to each compounds which allows the total toxicity of combined dioxins and furans to be determined using the toxic equivalence (TEQ).

In 2011, the WHO-TEQ$_{(0.5\ LOR)}$ value (concentrations below LOR are assigned a concentration equal to half the LOR) was elevated at one location in Zone 3 with a concentration of 25.36 pg/g. All other sampling locations, including at the DMPA had concentrations between 6.02 and 10.89 pg/g WHO-TEQ.

In 2013, the WHO-TEQ concentrations were generally lower ranging between 0.5 pg/g to 5.3 pg/g.

There are no sediment quality guideline values for comparison that would apply to Australian sediments.

2.2.3.1 Comparison to Background Concentrations (2013)

The WHO-TEQ concentrations at the Mud Island DMPA sites ranged between 4.24 to 4.94 pg/g. The WHO-TEQ concentrations were higher at the reference site in comparison ranging between 7.87 to 7.97 pg/g. Approximately 99% of the sediment concentrations at all sampling locations comprised of 99% dioxins and 1% furans.

Pore water WHO-TEQs ranged between 0.5 and 7.3 pg/g at the DMPA and between 3.1 and 8.0 pg/g at the reference sites. Mean values and 95% UCL concentrations were lower than the 80th percentile of dioxins/furans at the reference area.

A comparison with historical data (Hermanussen et al. 2004; Mueller et al. 2004) shows that dioxins/furans have been historically present within Moreton Bay in elevated concentrations and that their concentrations are not directly related to dredging activities.

2.2.4 Organotins

Organotin concentrations were below the NAGD screening level or below LOR in 2011 and 2013.

2.2.4.1 Comparison to Annual Sampling

The relatively low concentrations of organotins in the flood sampling of 2011 and 2013 appear to be different to the pattern observed in the annual sampling campaigns. However, it should be noted that TBT was only detected at three locations above the NAGD screening for the annual 2010 and 2012 sampling events.

The overall low organotin concentrations across the dredge area after the 2011 and 2013 floods may be due to burial and mixing with sediments from the catchment.

2.2.5 Polychlorinated Biphenyls (PCBs)

PCB concentrations were below LOR at all sampling locations in 2011. In 2013, one location in Zone 3 had a normalised total PCB concentration (38.9 µg/kg) exceeding the NAGD screening level of 23 µg/kg. PCB concentrations were below LOR at all other locations in 2013.

2.2.5.1 Comparison to Annual Sampling

Similar to the annual sampling events, PCBs exceeded the NAGD screening level at only one location or were not detected.

2.2.6 Other Organic Contaminants

Concentrations of BTEX, TPHs, PAHs, OPPs, Phenols, Chlorobenzenes, halogenated compounds and non-organochlorine pesticides were either below LOR or below their respective screening levels in 2011 and 2013.

2.2.6.1 Comparison to Annual Sampling

The pattern observed for BTEX, TPHs, PAHs, OPPs were similar to the those observed in the annual sampling events, i.e. BTEX and OPPs were below their laboratory LORs whereas TPHs and PAHs were typically detected but at concentrations well below the respective NAGD screening levels.

2.2.7 Porewater Ammonia

Sediments at all locations had porewater concentrations below the literature derived guideline level of 11 mg/L (Batley and Simpson 2009). The only exception was one site in Zone 2 where the guideline level was marginally exceeded (16.6 mg/L).

2.2.8 Acid Sulfate Soil

Acid sulfate soils were tested in the 2011 flood sampling. Actual acidity was below the laboratory LOR for all samples, but potential acidity exceeded the QASSIT guideline limit identifying the samples as potential acid sulfate soils (PASS).

The acid neutralising capacity was sufficient in all samples resulting in a net acidity less than the LOR indicating that no liming would be required if the material would be placed on land.

2.2.8.1 Comparison to Annual Sampling

Results for the flood sampling were consistent with the annual maintenance dredge sampling.

2.3 Summary of Annual and Flood Sampling Data

Consistent across the annual and flood sampling events, the main contaminants of concern in the Brisbane River dredge area were the metals nickel and mercury, and DDT metabolites. TBT was also found above screening levels during routine annual monitoring, but was below screening levels in the 2011 and 2013 post-flood sampling episodes. This could suggest that the flood events had dispersed, diluted or buried TBT contaminated material.

Exceedances of the NAGD screening level for mercury, organochlorine pesticides and organotins were most frequently detected upstream of the Port area, i.e. in Zone 2 with a lower occurrence of screening level exceedances in the Port area (Zone 3) and the Entrance Channel area (Zone 4).

The similar spatial patterns of contaminant distribution observed between the regular annual sampling and the flood sampling indicates that catchment runoff from the urbanised and industrialised area upstream of the Port and not the Port of Brisbane is likely the main contributor of contaminants in the dredge area.

Organochlorine pesticides may be present due to broad non-point catchment sources or as legacy material. TBT is mainly originating from local marine industry sources and ships. Mercury may be introduced to the system via sewage treatment plant discharges (including trade waste) or other industrial point sources along the river.

The wide distribution of high nickel concentrations across the entire dredge area and upstream reference locations indicates that nickel is of natural origin (due to local mineralogy) across the broader catchment.

3 Sampling and Analysis

3.1 Sampling Rationale

3.1.1 Number of Sampling Locations

As per NAGD, the number of sample locations for medium sized projects (up to 500,000 m^3) should be divided into distinct sites based on their chemical characteristics. Based on the review of historical data (Section 2) and consistent with previous sampling campaigns, the dredge area was divided into three zones (Table 3-1).

Table 6 of NAGD was used to determine the number of sampling locations for each dredging subarea. Given that current, good quality data were available to support the classification, the number of sampling locations was halved and rounded up as per NAGD. Table 3-1 also shows the required number of sampling locations for Phase III testing (elutriate and bioavailability).

In addition to the required samples to be obtained from the dredge areas, samples will be collected also from upstream and downstream 'reference' areas. This includes two locations from Zone 1 which were sampled in previous sampling campaigns and five locations from Moreton Bay which were sampled as part of additional sediment sampling following the 2011 and 2013 flooding. Furthermore, two samples will be collected from the Mud Island DMPA.

Table 3-1 Number of Sampling Locations as per NAGD

Dredging Subarea	Classification	Dredge Volume (m^3)	# Locations – Phase II	# Locations – Phase III
Zone 2	Probably contaminated	150,000	10	5 + 1 replicate
Zone 3	Probably clean	250,000	11	6 + 2 replicates
Zone 4	Probably clean	30,000	5	3 + 1 replicate
Additional Samples				
Zone 1	Upstream Reference	N/A	2	N/A
Moreton Bay	Downstream Reference	N/A	5	N/A
Mud Island	DMPA	N/A	2	N/A

3.1.2 QA/QC Samples

In accordance with NAGD requirements, the following field and laboratory quality control samples will be obtained:

- Field triplicate samples (two additional grab samples at 10% of sample locations) to determine the small scale variability of the sediment physical and chemical characteristics. Based on a total of 26 primary locations in dredged areas (Zones 2, 3 and 4), field triplicate samples would be required at three locations. Two additional samples would therefore be collected at location 5-1 (Zone 2), 11-9 (Zone 3) and 13-4 (Zone 4).
- Triplicate split samples (primary sample from 5% of locations thoroughly mixed and split into three sample container sets) to assess laboratory variation, with one of the three samples sent to a second (reference) laboratory for analysis. Based on a total of 26 primary locations in dredged areas (Zones 2, 3 and 4), field split samples would be required at two locations. Split samples would be undertaken at location 6-2 (Zone 2) and 10-6 (Zone 3).

- One trip blank container per sampling day filled with inert material (e.g. chromatographic sand) to be analysed concurrent with the analysis of volatile organic substances such as; and
- One inter-batch sample from a previous batch of samples if more than one batch is submitted to the laboratory, to determine the analytical variation between batches. However, it is anticipated that all samples will be submitted in one batch.

Table 3-2 provides a summary of QA/QC samples to be obtained for the three dredging subareas.

Table 3-2 Number of Primary and QA/QC Samples

Dredging Subarea	Primary Samples	Field Triplicate Samples	Triplicate Split Samples	Trip blanks
Zone 2	10	2	2	1 per sampling day
Zone 3	11	2	2	
Zone 4	5	2		

3.1.3 Sampling for Elutriate and Bioavailability Testing

The sediment sampling will include additional sediment samples for Phase III testing (elutriate and bioavailability). Phase III testing will be undertaken for parameters which have frequently exceeded the NAGD screening levels in the past. Based on the review of historical data (Section 2) this will include:

- Metals and metalloids (nickel and mercury);
- Organotins (TBT); and
- Organochlorine Pesticides (DDT, DDD, DDE, chlordane).

Exceedances of NAGD screening levels were predominantly detected in Zone 2 and Zone 3. In accordance with Table 7 of NAGD, five locations would need to be sampled for Zone 2 and six locations for Zone 3 (Table 3-1).

In order to allow elutriate analysis, 20 L of seawater will be collected from the Mud Island DMPA.

Phase III testing for nickel and mercury (and potential other metals/metalloids) can be undertaken from the primary samples collected for the sediment quality assessment. The bioavailability analysis for nickel and mercury will involve dilute acid extraction as per NAGD. Analysis will be performed on the samples with the highest concentrations.

Bioavailability analysis for the organic contaminants (organotins and organochlorine pesticides) will require porewater testing as per NAGD. Additional samples will be collected for porewater testing at the locations which have historically shown the highest percentage of screening level exceedances. The proposed sampling locations for this testing are provided in Section 3.2.1. In order to meet required holding times, elutriate and bioavailability analysis for the organic contaminants will be undertaken concurrent with the analysis of the primary samples.

3.2 Sampling Locations

A map with the proposed sampling locations is provided in Figure 3-1. In order to provide consistency with previous sampling and to facilitate comparisons with historical data, most of the proposed sampling locations were selected from the set of historical sampling locations, and to

also focus on areas that are most frequently dredged. Additionally, sampling locations were added to close spatial gaps in sediment quality data. These include sampling locations 5-1 in Zone 2 as well as locations 9-5 and 9-6 in Zone 3 (Figure 3-1).

As outlined in more detail in Section 3.5, samples from all locations will be analysed for a basic suite of parameters. A selection of these sites will also be analysed for a detailed suite in addition to the basic suite including 'low risk' parameters that have been detected in the past but were typically below their respective NAGD screening levels.

3.2.1 Sampling Locations for Porewater Testing

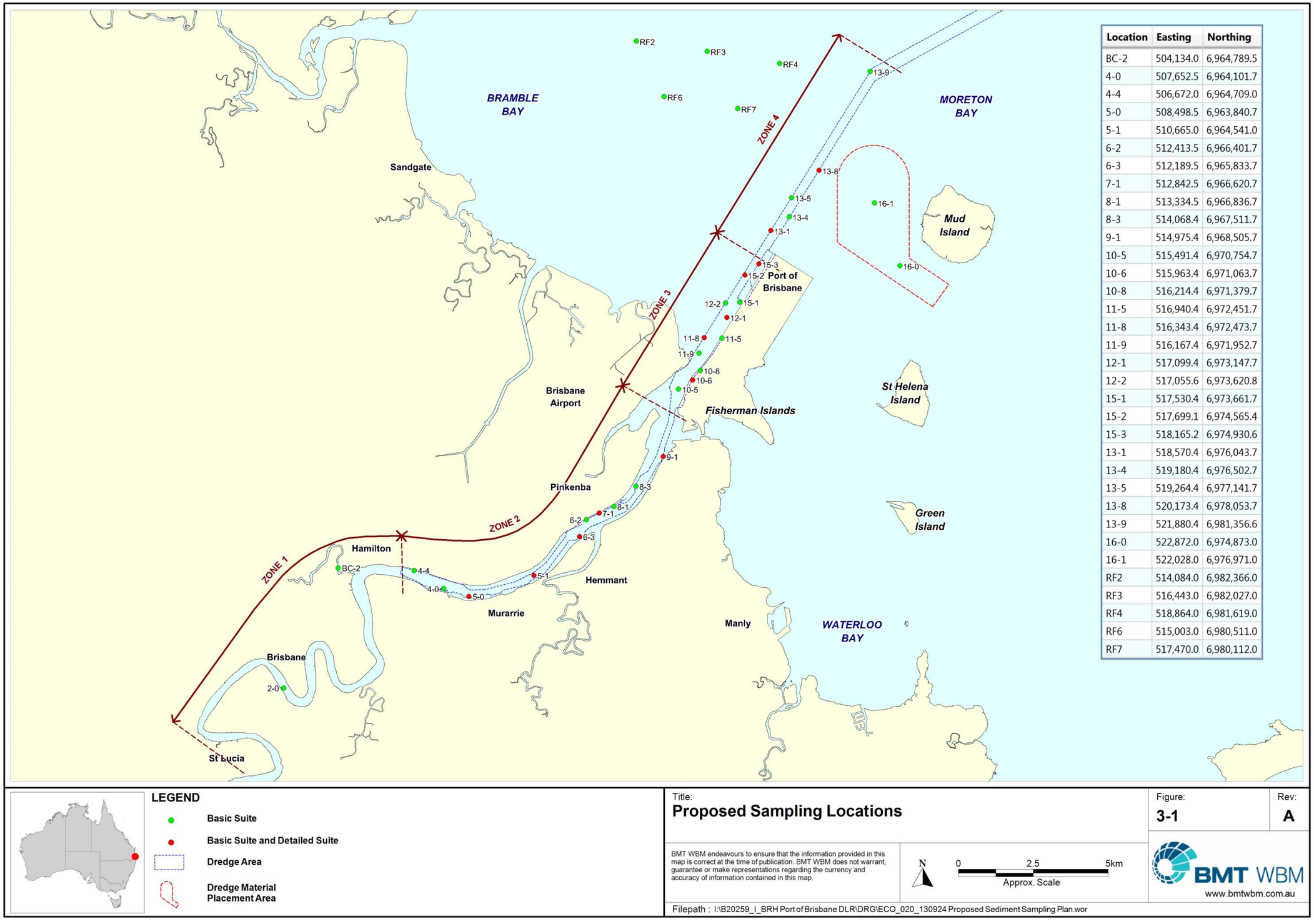
Additional sediment samples will be collected at selected locations for pore water testing of organic contaminants as part of the Phase III elutriate and bioavailability assessments (refer to Section 3.1.3).

Exceedances of NAGD screening levels were predominantly detected in Zone 2 and Zone 3. Five additional pore water samples (plus one replicate) and six samples (plus two replicates) will be collected from zones 2 and 3, respectively (see also Table 3-1). Four samples will be collected from Zone 4 however based on the historical data samples will only be analysed if contaminants exceed screening levels during Phase II sampling.

Based on the review of historical data, sample locations with the highest percentage of screening level exceedances between 2000 and 2012 were chosen for the additional pore water testing:

Zone 2: Locations 4-0, 5-0, 6-2, 7-1 and 8-3.

Zone 3: Locations 10-5, 10-6, 10-8, 11-8, 11-9 and 12-1.



Location	Easting	Northing
BC-2	504,134.0	6,964,789.5
4-0	507,652.5	6,964,101.7
4-4	506,672.0	6,964,709.0
5-0	508,498.5	6,963,840.7
5-1	510,665.0	6,964,541.0
6-2	512,413.5	6,966,401.7
6-3	512,189.5	6,965,833.7
7-1	512,842.5	6,966,620.7
8-1	513,334.5	6,966,836.7
8-3	514,068.4	6,967,511.7
9-1	514,975.4	6,968,505.7
10-5	515,491.4	6,970,754.7
10-6	515,963.4	6,971,063.7
10-8	516,214.4	6,971,379.7
11-5	516,940.4	6,972,451.7
11-8	516,343.4	6,972,473.7
11-9	516,167.4	6,971,952.7
12-1	517,099.4	6,973,147.7
12-2	517,055.6	6,973,620.8
15-1	517,530.4	6,973,661.7
15-2	517,699.1	6,974,565.4
15-3	518,165.2	6,974,930.6
13-1	518,570.4	6,976,043.7
13-4	519,180.4	6,976,502.7
13-5	519,264.4	6,977,141.7
13-8	520,173.4	6,978,053.7
13-9	521,880.4	6,981,356.6
16-0	522,872.0	6,974,873.0
16-1	522,028.0	6,976,971.0
RF2	514,084.0	6,982,366.0
RF3	516,443.0	6,982,027.0
RF4	518,864.0	6,981,619.0
RF6	515,003.0	6,980,511.0
RF7	517,470.0	6,980,112.0

LEGEND

- Basic Suite
- Basic Suite and Detailed Suite
- Dredge Area
- Dredge Material Placement Area

Title:
Proposed Sampling Locations

Figure: **3-1**
Rev: **A**

N
0 2.5 5km
Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : I:\B20259_I_BRH Port of Brisbane DLR\DRG\ECO_020_130924 Proposed Sediment Sampling Plan.wor

3.3 Sample Collection Methodology

3.3.1 Survey Vessel and Positioning

A suitable sampling vessel will be used to undertake sediment sampling. Navigation to the sampling locations will be undertaken using a differentially corrected global positioning system (GPS) with an accuracy of approximately ±1 m.

3.3.2 Sediment Grab Sampling

NAGD Appendix D states that:

'*grab samplers may be used, i.e., for maintenance dredging surveys in frequently dredged areas with substantial shipping traffic. Here, because the sediments are mixed continually, samples taken with a grab sampler can be representative as long as the grab is designed to retain the entire sample.*'

It is also noted that the one metre long sediment cores obtained in all previous sampling campaigns were always composited to single samples. Furthermore, highest contamination levels are typically expected in the top sediment layer, which would be sampled using a grab sampler. It is therefore proposed that a grab sampler will be used to obtain representative sediment samples.

All sediment sampling will be undertaken by experienced personnel. A Van Veen grab sampler (0.14 m^2 gape) will be used to collect surface sediments from all sample locations. Only samples obtained with properly closed grab jaws will be processed to ensure that the fine sediment fractions are retained.

The grab sampler will be thoroughly cleaned with De-con 90 solution prior to use and cleaned and rinsed with seawater to prevent cross contamination between samples.

In order to overcome issues with potential high variability at sampling locations, a minimum of two grabs will be collected at each sampling location and pooled as one sample. An adequate number of grabs will be obtained and pooled for each sample location to ensure that sufficient sediment is collected for all analyses.

3.3.3 Sample Handling

3.3.3.1 Sample Processing

Sample management procedures on the sampling vessel will include the careful processing of sediment samples following the recovery of the sediment grab sample from the seabed.

Photographs of the grab samples will be taken and field personnel will log each sample for its physical characteristics and variations in sediment type and texture. The grab samples from each location will be carefully homogenized in a clean container prior to the filling of analytical laboratory-supplied clean sampling jars.

Sample bottles will be labelled with a waterproof marker pen on the bottle label and lid. Sample bottles for organic analyses will be filled with zero headspace to prevent volatilisation. QA/QC samples will be blind-labelled to ensure that the laboratories cannot relate the QA sample back to the primary sample.

3.3.3.2 Sample Log

All sediment samples will be geotechnically logged upon collection on a standardised pro-forma. The following information will be recorded:

- Project name and number;
- The name of the sample collector;
- Date and Time of sampling;
- Type of grab sampler used;
- Field sample number;
- Northing and Easting of sample location (from onboard DGPS);
- Sediment colour;
- Sediment odour;
- Field texture (fine sand, silt, clay, sand, clayey sand);
- Tidal predictions and water depth at sample location (derived from onboard depth sounder);
- Weather and sea state conditions at the time of sampling; and
- General comments pertaining to the sample (e.g. presence of organic matter or benthic organisms, etc.

3.3.3.3 Sample Processing QA/QC

All sample handling and processing will be performed to minimise contamination and sample mix-ups. All sample equipment will be cleaned prior to sample collection using a scrub with decontamination solution followed by a rinse with seawater.

The workspace on the vessel will be washed down regularly with ambient seawater to clean all surfaces and minimize the potential for dust contamination of samples. All sample processing will be undertaken away from any potential contamination sources such as engine exhausts, fuels, oils, greases, lead weights, zinc anodes, antifouling paint etc.

Nitrile gloves will be worn by all field personnel handling the sediment, and gloves will be disposed of after processing of each sample.

Utmost care will be maintained in ensuring that cross-contamination between samples is not possible. Samples collected from each location will be placed into appropriately cleaned and preserved containers (labelled prior to filling) provided by the analytical laboratories.

Following sample processing and filling of sample containers, all samples will be immediately chilled on ice following sample collection. All acid sulfate soil samples will be transferred to a freezer at the end of each sampling day to minimise potential oxidation of the samples.

3.3.3.4 Sample Submission and Chain of Custody

All samples will be traced using Chain of Custody (COC) documentation submitted to the laboratory. This will ensure that sample possession and processing can be traced from sample collection to reporting of results.

The COC record may include, but is not limited to, the following information:

- Project name and number;
- Name(s) of sampler(s);
- Sample type, identification number and location;
- Date of collection;
- Number and types of containers;
- Required analyses;
- Preservatives (if any) and storage conditions; and
- Signatures documenting change of sample custody.

At the conclusion of the sampling program the sediment samples will be submitted to the analytical laboratories for processing and analysis in a single batch within prescribed holding times.

3.4 Health & Safety and Contingency Plan

3.4.1 Health and Safety

The vessel skipper will keep in close contact with Brisbane VTS/Harbour Control during sampling. Grab sampling can be completed at each location in around 20 minutes with logging and processing undertaken in locations out of the path of large vessels (as necessary and dependent upon shipping movements).

A single anchor may be used to anchor the vessel. The anchor would be placed upstream and upwind of the vessel. A marker buoy may be placed on the anchor if required.

The sampling vessel will display appropriate flags (R over Y) for the work being carried out at all times. Interactions with other vessel traffic will be minimised by being mindful of approaching vessels.

3.4.2 Adverse Weather

The planning of field sampling will involve regular checking of available weather forecast services for the study area. There are no unusual hazards in operating the grab sampler in wet weather.

In case of adverse weather conditions that would make sampling unacceptable due to strong winds and high waves, the sampling team and vessel operator would remain on stand-by until weather conditions improve to allow rigorous and safe collection of sediment samples.

3.4.3 Equipment Failure

The grab sampler and lifting arrangement is sufficiently robust and no failure of the equipment is expected to occur during the sampling. Prior to sampling, all equipment will be thoroughly checked and repaired if necessary.

In the unlikely event of equipment failure during sampling, repairs to any equipment would be undertaken as soon as possible to minimise delays as far as practical.

3.5 Contaminants List

3.5.1 Rationale for Selection of Sampling Parameters

In accordance with NAGD, the contaminants to be investigated should include:

- Toxic substances known, from previous investigations, to occur in dredge area sediments at levels greater than one-tenth of the screening levels; or
- Based on the historical review, substances potentially present at such levels in the sediments to be dredged.

Based on the review of existing sediment quality data (Section 2), samples will be analysed as follows:

Basic List of Parameters:

- Analysis undertaken at all sampling locations;
- Analysis includes contaminants of (potential) concern and supplementary parameters:
  - Metals/Metalloids (As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, Zn, Al, Fe);
  - Organotins (MBT, DBT, TBT);
  - Organochlorine Pesticides (including DDT, DDD, DDE, chlordane);
  - Particle size distribution;
  - Moisture content; and
  - Total Organic Carbon.

Detailed List of Parameters:

- Analysis undertaken at 30% of sampling locations and new sampling locations (i.e. 5-1, 9-5 and 9-6).
- Analysis includes ‘low risk’ parameters that have been detected in the past but generally in concentrations below LOR or NAGD screening levels:
  - Polycyclic Aromatic Hydrocarbons (PAHs);
  - Total Petroleum Hydrocarbons (TPHs);
  - Polychlorinated Biphenyls (PCBs);
  - Acid Sulfate Soils;
  - Nutrients (TP, TN, NOx, TKN); and

- Radionuclides.

Elutriate and Bioavailability Testing:

- Metals/Metalloids (Hg and Ni);
- Organotins (TBT); and
- Organochlorine Pesticides (DDT, DDD, DDE, chlordane).

3.6 Laboratory Analysis

3.6.1 Analytical Laboratories

Primary analysis of the sediment samples will be conducted by Advanced Analytical Australia Pty Ltd (AAA). Australian Laboratory Services (ALS) will be used as the secondary (reference) laboratory for inter-laboratory quality testing.

Both analytical laboratories are fully accredited by the National Association of Testing Authorities (NATA). AAA will subcontract some of the analyses to specialised NATA accredited laboratories, i.e. Sydney Analytical Laboratories (ammonia, Total Organic Carbon) and Microanalysis (Particle Size Distribution).

3.6.2 Analytical Tests

The primary laboratory Advanced Analytical Australia will perform all analyses in accordance with NAGD and will meet or provide better practical quantitation limits (PQL) than the target PQL's (Table 3-3).

Table 3-3 Analytical Parameters and Practical Quantitation Limits

Parameter	Target Practical Quantitation Limit (required)	Practical Quantitation Limit (Advanced Analytical Australia)
Moisture Content	0.1%	0.1%
Particle Size (sieve and sedigraph)	Size distribution (sieve + hydrometer or equivalent) and rates of settlement after 50% and 90% of settlement in seawater if possible.	10 to 0.001mm Settling velocities in m/s for all particle size fractions
Total Organic Carbon	0.1%	0.01%
Total Petroleum Hydrocarbons	100 mg/kg	10-50 mg/kg
Polychlorinated Biphenyls	5 µg/kg	5 µg/kg
PAHs (naphthalene, acenaphthalene, acenapthene, fluorene, phenanthene, anthracene, total fluoranthene, benzo [a]anthracene, benzo [a] pyrene, chrysene, dibenz[a,h] anthracene, pyrene, 2-methylnapthalene)	Individual - 5 µg/kg; Sum of PAHs - 100 µg/kg	Individual - 5 µg/kg; Sum of PAHs - 100 µg/kg

Parameter	Target Practical Quantitation Limit (required)	Practical Quantitation Limit (Advanced Analytical Australia)
Trace Metals and Metalloids (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc)	0.1 – 100 mg/kg, Hg- 0.01 mg/kg	0.1 – 5 mg/kg, Hg – 0.01 mg/kg
Organotins (MBT, DBT, TBT)	1 µg Sn/kg	0.5 µg Sn/kg
OCP Pesticides	1 µg/kg	OCP-1 µg/kg
Total Nitrogen Total Kjeldahl Nitrogen Nitrate & Nitrite as N Total Phosphorus	N/A N/A 0.1 mg/kg N/A	20 mg/kg 20 mg/kg 0.1 mg/kg 1 mg/kg
Acid Sulfate Soils	N/A	2 mole H^+/tonne
Radionuclides	N/A	35 Bq/g

3.6.3 Sample Containers

Based on the proposed analyses, the following sample containers would be required per sample:

- 2 x 250 mL glass jar – organic/inorganic chemical analysis;
- 1 x 125 mL glass jar – nutrient analyses;
- 1 x medium plastic clipseal bag (50-100 g) – particle size distribution; and
- 1 x small clipseal bag (200 g) – acid sulfate soil.

3.6.4 Quality Control – Laboratory Analysis

Both laboratories will follow laboratory QC procedures in accordance with requirements outlined in Appendix F of NAGD. This includes analysis of laboratory blanks, duplicates, certified reference materials and spiked samples.

3.6.4.1 Laboratory Blanks

The purpose of this assessment is to monitor a potential laboratory contamination of samples due to potential cross-contamination of samples during laboratory preparation, extraction or analysis. Blank sample concentrations should be at or near the detection limit of the method used.

3.6.4.2 Laboratory Duplicates

This assessment refers to a randomly selected intra-laboratory split sample, which provides information regarding the method precision and sample heterogeneity. Results are presented as Relative Percent Difference (RPD) values of two sample concentrations for a specific contaminant.

NAGD recommends that duplicates should agree within a typical RPD of the method of ±35 %. This recommended RPD is typically not adopted by analytical laboratories as it does not account for the greater uncertainty for contaminant concentrations close to the method's detection limit.

The primary laboratory AAA uses the following approach to assess duplicate RPD's:

- Result <10 times LOR – no limit to RPD; and
- Result >10 times LOR – RPD between 0% and 50%.

The secondary laboratory ALS adopts specific RPDs for individual compounds.

3.6.4.3 Surrogate and Matrix Spikes

Laboratory Control Samples are either certified reference materials or a blank sample spiked with known concentrations of the analytes of interest. The purpose of this measurement is to monitor method accuracy.

Matrix spikes refer to an intra-laboratory split sample spiked with a representative set of target analytes of known concentration. Matrix spikes are assessed to monitor potential sample matrix effects on analyte recoveries.

Surrogate spikes are used for organic analytes. Surrogates are known additions to samples which mimic the compounds of interest and are not normally expected to be present in the sample.

For both surrogate and matrix spikes, a calculation of the percent recovery of the spiked amount against the returned concentration is performed indicating analytical performance in terms of extraction efficiency.

NAGD states that recovery limits of 75% - 125% are generally acceptable. Analytical laboratories typically adopt specific surrogate and matrix spike recovery limits for the various contaminant compound groups. It is also noted that ideal recovery ranges may be waived in the event of sample matrix interference.

The primary laboratory AAA adopts the following acceptable surrogate and matrix spike recovery limits:

- Trace elements: 70-130%;
- Organic analyses: 50-150%;
- SVOC & speciated phenols: 10-140%; and
- Surrogates: 10-140%.

The secondary laboratory ALS adopts specific recovery limits for individual compounds.

3.7 Data Analysis

3.7.1 Sediment Contaminants

Concentrations of chemicals measured in sediment samples at each dredging sub-area (or reference area) will be compared to screening levels listed in Table 2 of NAGD. This will provide a basis for determining whether dredged material is suitable for unconfined placement at sea or if further analyses, such as elutriate, bioavailability or toxicity testing, are required.

For each dredging sub-area, the mean concentrations of chemical parameters at the upper 95% confidence level (95% UCL) will be calculated and compared against NAGD guideline levels. This involves the following steps.

Data pre-treatment

Analytical values below detection limit will be set to one-half of the laboratory Limit of Reporting (LOR) as per NAGD recommendation to facilitate 95% UCL calculation. Organic contaminant results will be normalised to 1% Total Organic Carbon (TOC) where the measured value is within the range of 0.2-10%. If TOC values are outside of this range, the highest (10%) or lowest (0.2%) value will be adopted as appropriate. Organic parameters with concentrations below detection limits will not be normalised to 1% TOC but included at half their LOR.

One assumption in the calculation of the 95% UCL is that the samples are statistically independent. Therefore, field triplicate samples and laboratory split samples will not be included in the 95% UCL calculation.

Outliers

Outliers will be treated in accordance with the procedure in NAGD. In summary this will involve:

(a) Outliers (for all parameters) will be identified as any data points greater than two standard deviations.

(b) For TBT, where outliers are detected, the stored portion of the sample will be analysed in triplicate.

(c) If the original result is not confirmed through the re-analysis, it will be discarded in favour of the mean of the three triplicate samples.

NAGD does not provided guidance on treatment of outliers for other parameters. Outliers for other parameters will be noted in the report but included in calculation of the 95% UCL.

Selection of appropriate 95% UCL Calculation Method

The methodology for calculating the 95% UCL follows the approach recommended in Appendix A of NAGD. A Shapiro-Wilk test will be used to determine whether data followed a normal distribution. The ProUCL (Version 4.1.00) software package will be used for these calculations (Singh et al. 2010).

Calculation of 95% UCL and Comparison to Screening Levels

ProUCL Version 4.1.00 will be used to calculate the 95% UCL. For normally distributed data, the arithmetic mean and standard deviation will be calculated, and the 95% UCL calculated using the one-tailed Student's *t* UCL test. For data that follows a log-normal (or other) distribution, the geomean will be calculated, and the 95% UCL analysed using non-parametric Jack-Knife analysis as per NAGD recommendation.

In cases where an insufficient number of discrete values in the dataset would not allow calculation of the 95% UCL (e.g. most values below LOR), the maximum recorded value of the dataset will be conservatively used instead for comparison against NAGD trigger levels.

Should 95% UCL values for all analysed parameters fall below NAGD screening levels, the sediment would be considered clean and suitable for unconfined disposal at sea.

3.7.2 Baseline Concentrations

NAGD states that ambient baseline concentrations can be determined by sampling of sediment at reference areas in the vicinity of an existing disposal site. Similar to the approach followed in Worley Parsons (2013c, d), the data collected from the five reference locations in Moreton Bay would be used to derive ambient baseline concentrations if required (RF2, 3, 4, 6 and 7 in Figure 3-1).

3.8 Elutriate and Bioavailability Testing

As outlined on Section 3.1.3, elutriate and bioavailability testing will be undertaken as per NAGD for a range of contaminants which have regularly exceeded screening levels in the past.

Elutriate Testing:

The elutriate test is designed to simulate release of contaminants from sediment during dredged material disposal. Testing will be carried out using the USEPA's standard seawater elutriate test which involves shaking the sediment samples with four times the volume of seawater at room temperature for 30 minutes. The sample will be allowed to settle for one hour and the supernatant centrifuged or filtered (0.45 µm) within sixty minutes, and analysed using analytical methods appropriate for determining ultra-trace levels in seawater.

Results will be compared to the respective ANZECC/ARMCANZ (2000) marine water quality trigger value (for 95% or 99% protection of species, as appropriate).

Bioavailability Testing:

The Dilute Acid Extraction (DAE) method will be used to provide an estimate of the bioavailable fraction of the contaminant of concern in case of metal/metalloid analysis. The sediment samples will be extracted using a weak acid and the results compared against the respective NAGD screening levels.

Porewater analysis would be undertaken for organic contaminants such as TBT. Porewater is assumed to represent the major route of exposure to sediment contaminants by benthic organisms and is the recommended bioavailability test for organic contaminants as per NAGD. Porewater results would be compared to the respective ANZECC/ARMCANZ (2000) marine water quality trigger value (for 95% protection of species).

Should both elutriate and bioavailability tests result in values less than the respective guideline limits, the material would be considered clean and suitable for ocean disposal.

3.8.1 Acid Sulfate Soils

The results of the chromium-suite acid sulfate analysis will be assessed against the Australian framework for Acid Sulfate Soil management in coastal systems (Ahern et al. 1998). The risk of acidification will be determined by the acid-base accounting approach (Ahern et al. 2004). Net acidity will be calculated from the results as a measure of the acid producing capacity of the sampled sediment upon complete oxidation.

The calculated net acidity will then be compared to the QASSIT action criteria of 0.03% S or 18 mol H+/tonne to assess the need for acid sulfate soil management if the dredged sediments were to be placed on land.

The liming rate will indicate the amount of lime that needs to be added to the soil to manage its acid generating capacity.

3.9 Data Validation

All laboratory analyses will be validated in accordance with Appendix A of NAGD to confirm suitable data quality for undertaking a rigorous characterisation of the proposed dredge material.

Data Validation will involve assessment of the following:

- Sample holding times and storage conditions;
- Laboratory blanks, duplicates and surrogate/matrix spikes; and
- Field triplicates samples, triplicate sample splits and trip blank.

The proposed data quality objectives for data validation are outlined in Table 3-4.

Table 3-4 Data Quality Objectives for Data Validation

Parameter	Data Quality Objective
Holding Time	Samples received within specified holding time (NAGD Appendix H)
Field Triplicate Samples	Relative Standard Deviation <50%
Triplicate Split Samples, including inter-laboratory samples	Relative Standard Deviation <50%
Laboratory Blanks	At or near the Limit of Reporting (LOR)
Laboratory Duplicate Samples	Relative Percent Difference (RPD) <35% or as per laboratory requirements
Laboratory Matrix Spikes	Recovery as per laboratory requirements
Surrogate Spikes	Recovery as per laboratory requirements

3.10 Reporting

The reporting of sediment quality results will be undertaken in a SAP Implementation Report in accordance with NAGD including the following components:

- Summary of the SAP, or SAP appended to the report;
- Outline of potential problems encountered and deviations from the SAP, including justification;
- Description of the sampling carried out, along with the actual sampling locations, sample numbers (including replicates and QA samples), completed COC forms, field logs and description of sediments;
- Comparison of the 95% UCL of mean chemical concentrations of sediments in the dredge subareas;
- Assessment of QA/QC procedures for both field and laboratory data;

- Data validation including comparison to data quality objectives;
- Appendices including all laboratory and field data; and
- Conclusions as to the acceptability or otherwise of the dredge material for unconfined ocean disposal and recommendations as to further work required.

4 References

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Worley Parsons (2013c) Emergency Dredging Sediment Sampling – Round 2 Organochlorine Pesticides Results. Report prepared for Port of Brisbane Pty Ltd.

Worley Parsons (2013d) Emergency Dredging Sediment Sampling – Round 2 Dioxin Results. Report prepared for Port of Brisbane Pty Ltd.

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Appendix B Sediment Sample Logs

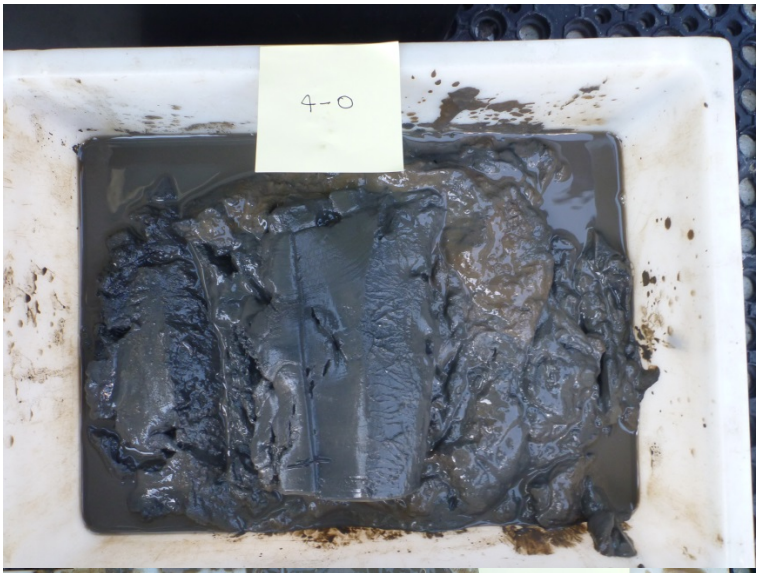
Sediment Sample Logs

Project number: B20259

Project Name: PoB Sediment Sampling

Samplers: Brad Hiles, Conor Jones and Brandon John

Site No.	Date	Time	General Location	Easting	Northing	Depth	Weather conditions	Type of Sampler	Colour	Field Texture (Fine/course sand, silt, clay clayey sand)	Palasticity	Odour	Shell grit	biota	General Comment
RF6	21/10/2013	9:41	Moreton Bay	515003	6980511	7.7	Fine	Grab	grey/brown	silt/fine sand	no	no	0	0	
RF2	21/10/2013	9:33	Moreton Bay	514083	6982366	8.7	Fine	Grab	greybrown	silt/fine sand	no	no	0	0	small % of fine shell grit
RF3	21/10/2013	10:06	Moreton Bay	516442	6982026	9.5	Fine	Grab	grey	mud/silt	no	no	0	0	fine layer of brown silt above grey mud
RF7	21/10/2013	10:20	Moreton Bay	517470	6980112	8.5	Fine	Grab	grey	mud/silt	no	no	0	0	fine layer of brown silt above grey mud
RF4	21/10/2013	10:33	Moreton Bay	518863	6981618	10.2	Fine	Grab	grey	mud/silt	no	no	5	0	fine layer of brown silt above grey mud
13_9	21/10/2013	11:02	Zone 4	521880	6981357	13.7	Fine	Grab	grey	fine sand/mud	no	no	5	0	fine layer of brown silt above grey mud
16_0	21/10/2013	11:25	Mud Island	522872	6974873	10.1	Fine	Grab	brown/grey	silt/mud	no	no	0	0	fine layer of brown silt above grey mud
16_1	21/10/2013	11:45	Mud Island	522028	6976970	9.4	Fine	Grab	brown/grey	fine sand/mud	no	no	0	1	fine layer of brown silt above grey mud
13_8	21/10/2013	12:21	Zone 4	520125	6978050	12	N 5kts / fine	Grab	grey	silt/mud	no	no	2	0	fine layer of brown silt above grey mud
13_5	21/10/2013	12:41	Zone 4	519281	6977138	7.9	N 8kts / fine	Grab	grey	silt/mud	yes	no	0	0	
13_4A	21/10/2013	13:12	Zone 4	519166	6976497	7.3	N 10kts /fine	Grab	grey	mud	no	no	15	0	course shell grit
13_4B	21/10/2013	13:10	Zone 4	519166	6976497	7.3	N 10kts /fine	Grab	grey	mud	no	no	15	0	course shell grit
13_4C	21/10/2013	13:10	Zone 4	519166	6976497	7.3	N 10kts /fine	Grab	grey	mud	no	no	15	0	course shell grit
13_1	21/10/2013	13:10	Zone 4	518570	6976043	7	N 15kts /fine	Grab	grey	silt/mud	no	no	1	0	fine layer of brown silt above grey mud
11_8	21/10/2013	14:09	Zone 3	516343	6972473	2.9	NE 12kts /fine	Grab	grey	silt/mud	no	no	1	0	fine layer of brown silt above grey mud
11_9A	21/10/2013	14:32	Zone 3	516163	6971958	14.2	NE 12kts /fine	Grab	grey	fine sand/silt/mud	no	no	0	0	
11_9B	21/10/2013	14:36	Zone 3	516163	6971958	14.2	NE 12kts /fine	Grab	grey	silt/mud	no	no	0	0	sediments very soft
11_9C	21/10/2013	14:41	Zone 3	516163	6971958	14.3	NE 12kts /fine	Grab	grey	silt/mud	no	yes	0	0	
15_3	22/10/2013	9:17	Zone 3	518165	6974930	12.4	N 2-5kts /fine	Grab	grey	silt/mud	no	no	0	0	
15_2	22/10/2013	9:35	Zone 3	517698	6974564	13.1	N 2-5kts /fine	Grab	grey/brown	Silt/sand	no	no	40	0	
15_1	22/10/2013	9:53	Zone 3	517530	6973661	15.4	N 2-5kts /fine	Grab	Brown	mud	no	no	0	0	soft
12_2	22/10/2013	10:07	Zone 3	517055	6973621	8.4	N 2-5kts /fine	Grab	grey	silt/mud	no	no	0	0	fine layer of brown silt above grey mud, trawler 'Mega Rose' trawled over the site prior to undertaking sampling
12_1	22/10/2013	10:26	Zone 3	517099	6973147	16.4	N 2-5kts /fine	Grab	grey	silt/mud	no	no	0	0	fine layer of brown silt above grey mud
11_5	22/10/2013	10:42	Zone 3	515491	6970754	15.3	10kts NE	Grab	brown	silt/mud	no	no	0	0	very fine layer of sand above muddy substrate
10_8	22/10/2013	11:01	Zone 3	516205	6971378	15.3	10kts NE	Grab	brown	silt/mud	no	no	0	0	very fine layer of sand above muddy substrate
10_6	22/10/2013	11:34	Zone 3	515963	6971063	6.9	8kts NE	Grab	brown	fine sand/clay/mud	no	no	0	0	muddy substrate with soft clay pieces and fine sand/organic matter layer
10_5	22/10/2013	12:00	Zone 3	515491	6970754	16	12kts NE	Grab	brown	silt/mud	no	no	1	0	
9_1	22/10/2013	13:20	Zone 2	514975	6968505	11.4	12kts NE	Grab	grey	silt/mud	no	no	2	0	muddy substrate with sand/shell grit upper layer
8_3	22/10/2013	13:40	Zone 2	514068	6967511	10.1	15kts NE	Grab	grey	silt/mud	no	no	0	0	fine layer of brown silt above grey mud
8_1	22/10/2013	14:00	Zone 2	513334	6966836	12	15kts NE	Grab	grey	silt/mud	no	no	0	0	fine layer of brown silt above grey mud
7_1	22/10/2013	14:21	Zone 2	512842	6966620	11.9	Fine / ESE 18kts	Grab	grey	silt/mud	no	no	5	0	grey muddy substrate with brown fine silt overlayer
6_2	22/10/2013	14:45	Zone 2	512413	6966401	11	Fine / E 12kts	Grab	grey	fine sand/silt/mud	no	no	0	0	
6_3	22/10/2013	15:05	Zone 2	512189	6965833	11.9	Fine / E 12kts	Grab	grey	fine sand/silt/mud	no	no	0	0	
5_1A	22/10/2013	15:35	Zone 2	510663	6964656	6.9	Fine / E 12kts	Grab	dark brown	silt/mud	no	no	0	0	Original site was located in the middle of the channel, however due to high currents and inability to obtain a full grab sample the site was re-positioned closer to the edge of the channel. Original grab location consisted of muddy/sand loam with course shell grit (~60% of grab)
5_1B	22/10/2013	15:39	Zone 2	510663	6964656	6.4	Fine / E 12kts	Grab	dark brown	silt/mud	no	no	0	0	
5_1C	22/10/2013	15:42	Zone 2	510663	6964656	6.7	Fine / E 12kts	Grab	dark brown	silt/mud	no	no	0	0	
2_0	23/10/2013	8:35	Zone 1	502319	6960782	10.3	Fine / W 10kts	Grab	light olive grey	fine-medium sands	no	no	0	0	
BC-2	23/10/2013	9:20	Zone 1	504133	6964789	3.5	Fine / W 10kts	Grab	grey	mud/fine sand	no	no	0	1	
4_4	23/10/2013	9:37	Zone 2	506671	6964708	9.8	Fine / SW 5kts	Grab	grey	silt/mud	no	no	0	0	fine layer of brown silt above grey mud
4_0	23/10/2013	9:55	Zone 2	507652	6964101	10.2	Fine / SW 5kts	Grab	grey	silt/mud	no	no	0	0	fine layer of brown silt above grey mud
5_0	23/10/2013	10:06	Zone 2	508498	6963840	9.8	Fine / NW 10kts	Grab	grey	silt/mud	no	no	0	0	fine layer of brown silt above grey mud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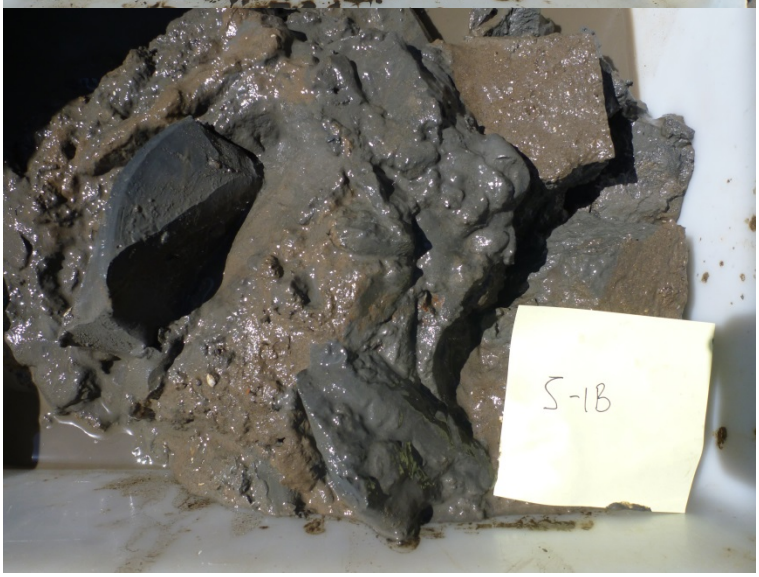
4-4


5-0


5-1A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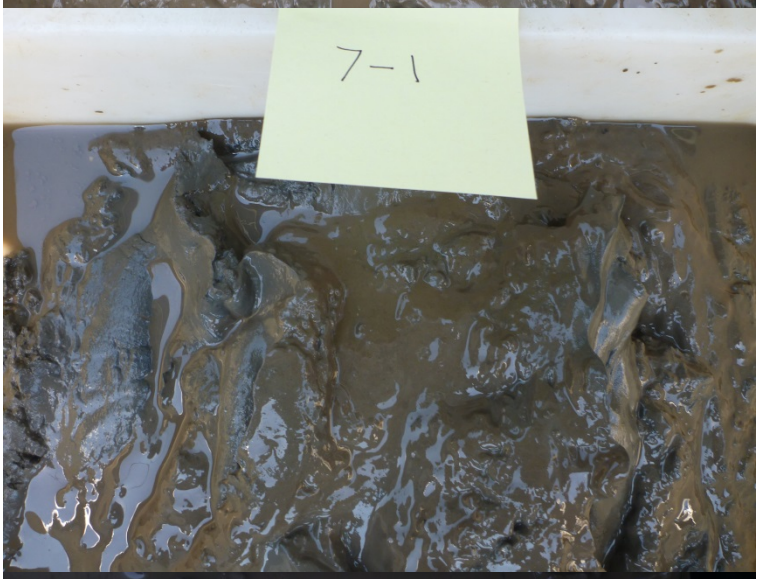
5-1C


6-2


6-3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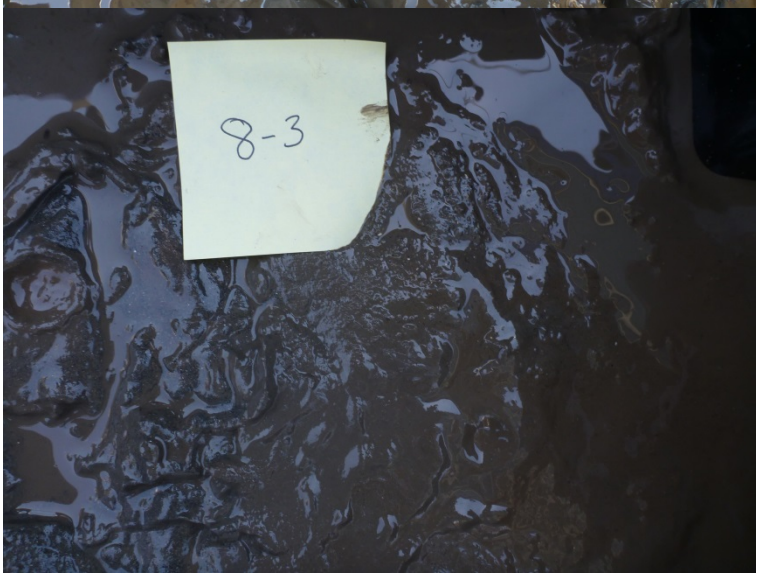
8-1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9-1


10-5


10-6


10-8


11-5


11-8


11-9


11-9B

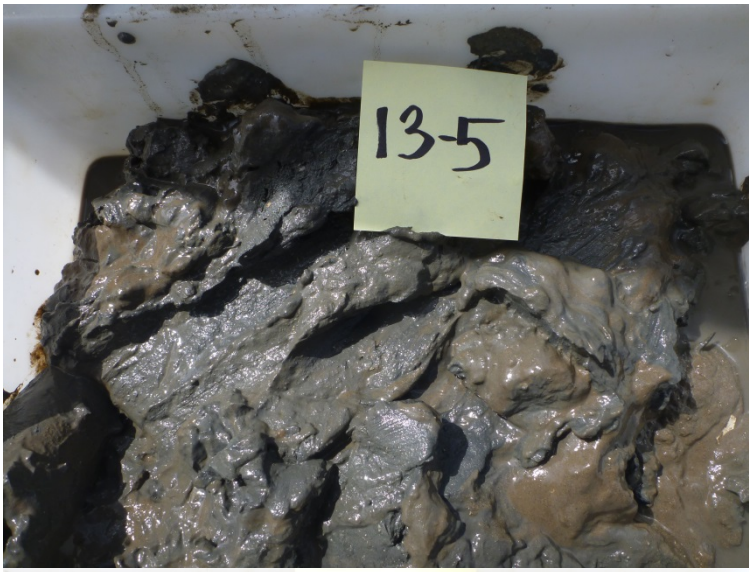

11-9C


12-1


12-2


13-1


13-4RB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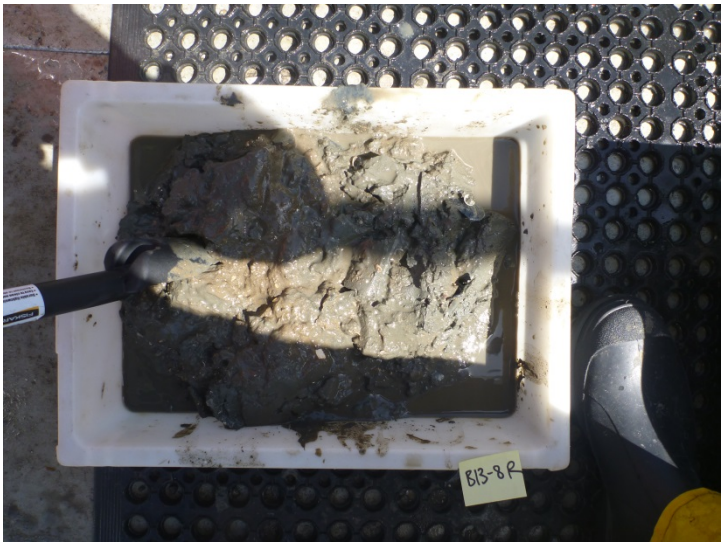
15-1


15-3


16-0


B2-0


B13-4R
A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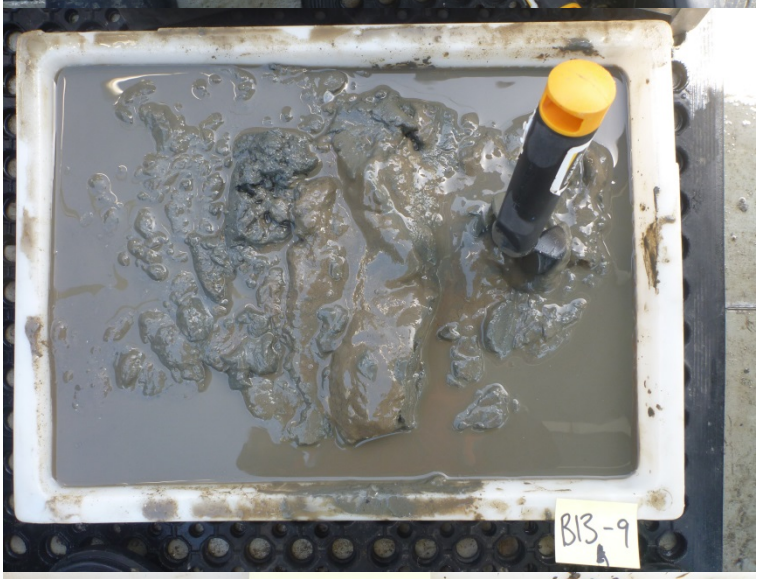
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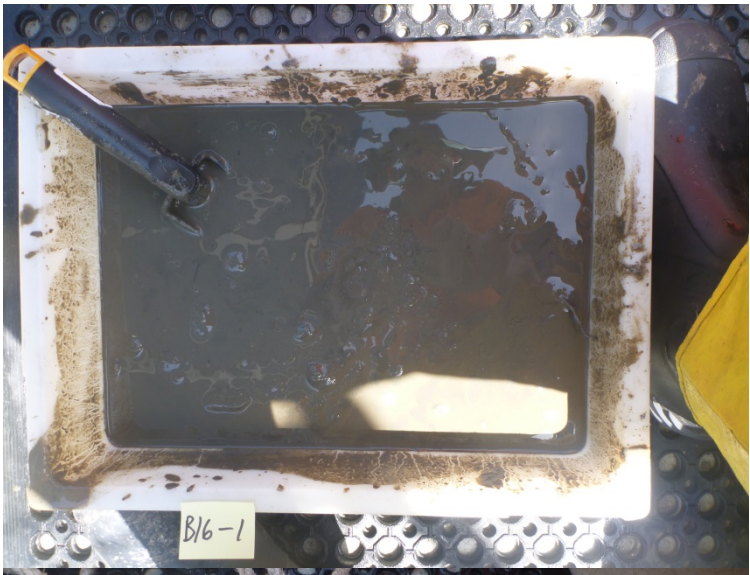
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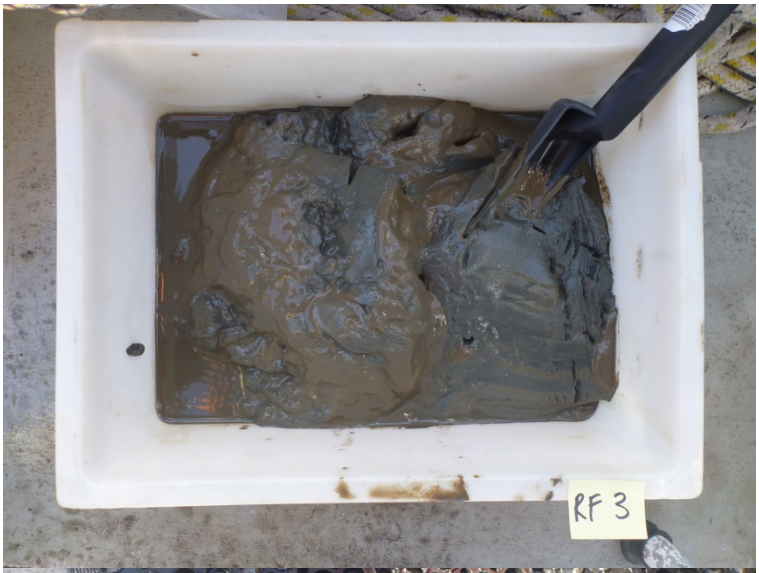
BC 2


RF 2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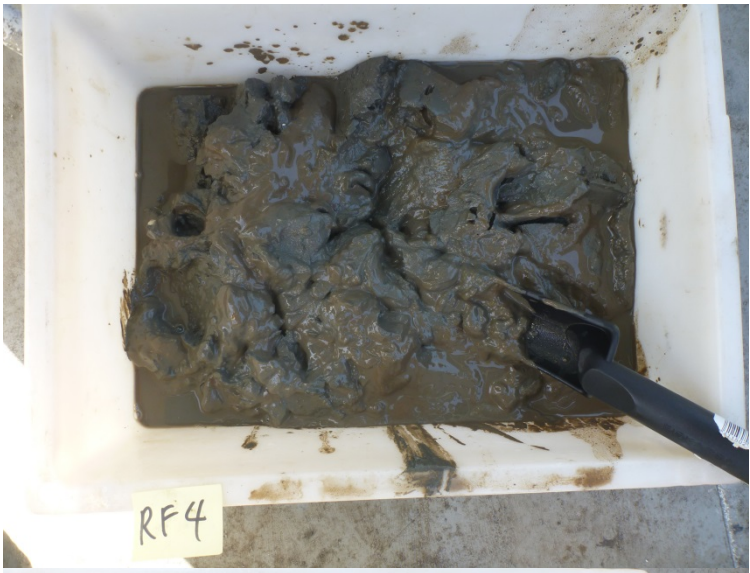
RF 4


RF6


RF 7

Appendix C Laboratory Results – Primary Laboratory

CHAIN OF CUSTODY **QUOTE NO:** EN13_111A Page 1 of 4 21/10

FROM	*Client:*	*BMT WBM*	**TO**	*ADVANCED ANALYTICAL AUSTRALIA*	
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	Project Manager:	*Markus Billerbeck*		*Contact: Andrew Bradbury* AA14/5575	
	E-mail Address:	markus.bilerbeck@bmtwbm.com.au		*Email: andrew.bradbury@advancedanalytical.com.au*	
	Project Ref:	*Port of Brisbane*		www.advancedanalytical.com.au	
	Turn-Around-Time : Standard / FAST	*Standard*			
	Report results by e-mail: (excel) / (pdf)				

ANALYSES

Laboratory ID	*Client ID*	*Sample Date*	*Preservation*	*Matrix*	PSD (seive and Sedigraph)	moisture content	total organic carbon	TPH (C6-C36)	trace metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, Ag, Al, Fe)	Nutrients (TN, NO3, NO2, TKN and TP)	Organotins (TBT, DBT, MBT)	Organochlorine pesticides	PAHs (plus total PHS)	Total PCBs	Acid sulfate soils (CRS/TAA)	Radionulides (sum of gross alpha/beta)	Elutriate testing - Organotins (TBT) and Organochlorine pesticides (DDT, DDD, DDE, chlordane)	Porewater (organotins and organochlorine pesticicides)	Trip blanks - volatiles (BTEX/TPH C6-C9)
1	BC-2	1-10-14		Soil	X	X	X	-	X		X	X							
2	2-0	↓		↓	X	X	X	-	X		X	X							
3	4-0				X	X	X	-	X		X	X					X	X	
4	4-4				X	X	X	-	X		X	X							
5	5-0				X	X	X	X	X	X	X	X	X	X	X	X	X	X	
6	5-1A				X	X	X	X	X	X	X	X	X	X	X	X			
7	5-1B				X	X	X	X	X	X	X	X	X	X	X	X			
8	6-2A	2/10/14			X	X	X		X		X	X					X	X	
9	6-2B	2/10/14			X	X	X		X		X	X							
10	6-3	1/10/14			X	X	X	X	X		X	X	X		X				
11	7-1				X	X	X	X	X		X	X	X		X			X	
12	8-1				X	X	X		X		X	X							
13	8-3				X	X	X		X		X	X					X	X	
14	9-1	↓		↓	X	X	X	X	X		X	X	X	X	X	X			

07 OCT 2014

Metals to Analyse :

RELINQUISHED BY: **Date:** **RECEIVED BY:** **Date:**

CHAIN OF CUSTODY **QUOTE NO:** EN13_111A Page 2 of 4

FROM	*Client:*	*BMT WBM*	**TO**	***ADVANCED ANALYTICAL AUSTRALIA***
	Address:	*Level 8 200 Creek St Spring Hill, Qld 4001*		*Unit 1, 482 Kingsford Smith Drive, Hamilton Q 4007*
	Tel:	(07) 38316744 *Fax:* (07) 38323627		*Tel: 07 3268 1228 Fax: 07 3268 1238*
	Project Manager:	*Markus Billerbeck*		*Contact: Andrew Bradbury*
	E-mail Address:	markus.bilerbeck@bmtwbm.com.au		*Email: andrew.bradbury@advancedanalytical.com.au*
	Project Ref:	*Port of Brisbane*		www.advancedanalytical.com.au
	Turn-Around-Time : Standard / FAST	*Standard*		
	Report results by e-mail: (excel) / (pdf)			

ANALYSES

Laboratory ID	*Client ID*	*Sample Date*	*Preservation*	*Matrix*	PSD (seive and Sedigraph)	moisture content	total organic carbon	TPH (C6-C36)	trace metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, Ag, Al, Fe)	Nutrients (TN, NO3, NO2, TKN and TP)	Organotins (TBT, DBT, MBT)	Organochlorine pesticides	PAHs (plus total PHS)	Total PCBs	Acid sulfate soils (CRS/TAA)	Radionulides (sum of gross alpha/beta)	Elutriate testing - Organotins (TBT) and Organochlorine pesticides (DDT, DDD, DDE, chlordane)	Porewater (organotins and organochlorine pesticides)	Trip blanks - volatiles (BTEX/TPH C6-C9)
				Soil															
15	10-5	2/10/14		Soil	X	X	X		X		X	X					X	X	
16	10-6A	↓		↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
17	10-8				X	X	X		X		X	X					X	X	
18	11-9A				X	X	X		X		X	X					X	X	
19	11-8				X	X	X	X	X	X	X	X	X	X	X	X	X	X	
20	11-5				X	X	X		X		X	X							
21	12-1				X	X	X	X	X	X	X	X	X	X	X	X	X	X	
22	12-2				X	X	X		X		X	X							
23	15-1				X	X	X		X		X	X							
24	15-3	↓			X	X	X	X	X	X	X	X	X	X	X	X			
46	Trip Blank	1/10/14			X														X
47	Trip Blank	2/10/14			X														X
	-	-			X														
25	15-2	2/10/14		↓	X	X	X	X	X	X	X	X	X	X	X	X			

Metals to Analyse :

RELINQUISHED BY: **Date:** **RECEIVED BY:** **Date:**

CHAIN OF CUSTODY **QUOTE NO:** EN13_111A Page 3 of 4

FROM	*Client:*	*BMT WBM*	**TO**	***ADVANCED ANALYTICAL AUSTRALIA***
	Address:	*Level 8 200 Creek St Spring Hill, Qld 4001*		*Unit 1, 482 Kingsford Smith Drive, Hamilton Q 4007*
	Tel:	(07) 38316744 *Fax:* (07) 38323627		*Tel: 07 3268 1228 Fax: 07 3268 1238*
	Project Manager:	*Markus Billerbeck*		*Contact: Andrew Bradbury*
	E-mail Address:	markus.bilerbeck@bmtwbm.com.au		*Email: andrew.bradbury@advancedanalytical.com.au*
	Project Ref:	*Port of Brisbane*		www.advancedanalytical.com.au
	Turn-Around-Time : Standard / FAST	*Standard*		
	Report results by e-mail: excel / pdf			

ANALYSES

Laboratory ID	*Client ID*	*Sample Date*	*Preservation*	*Matrix*	PSD (seive and Sedigraph)	moisture content	total organic carbon	TPH (C6-C36)	trace metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, Ag, Al, Fe)	Nutrients (TN, NO3, NO2, TKN and TP)	Organotins (TBT, DBT, MBT)	Organochlorine pesticides	PAHs (plus total PHS)	Total PCBs	Acid sulfate soils (CRS/TAA)	Radionulides (sum of gross alpha/beta)	Elutriate testing - Organotins (TBT) and Organochlorine pesticides (DDT, DDD, DDE, chlordane)	Porewater (organotins and organochlorine pesticides)	Trip blanks - volatiles (BTEX/TPH C6-C9)
				Soil															
26	13-1	2-10-14		Soil	X	X	X	X	X	X	X	X	X	X	X	X			
27	13-4A	↓		↓	X	X	X		X		X	X							
28	13-4B				X	X	X		X		X	X							
29	13-5				X	X	X		X		X	X							
30	13-8				X	X	X	X	X	X	X	X	X	X	X	X			
31	13-9				X	X	X		X		X	X							
32	RF2	3-10-14			X	X	X		X		X	X							
33	RF3	↓			X	X	X		X		X	X							
34	RF4				X	X	X		X		X	X							
35	RF6				X	X	X		X		X	X							
36	RF7				X	X	X		X		X	X							
37	16-1				X	X	X		X		X	X							
38	16-0	↓			X	X	X		X		X	X							
39	16-9B	2-10-14		↓	X	X	X		X		X	X					X	X	

Metals to Analyse :

RELINQUISHED BY: **Date:** **RECEIVED BY:** **Date:**

CHAIN OF CUSTODY **QUOTE NO:** EN13_111A Page 4 of 4

FROM	*Client:*	*BMT WBM*	**TO**	***ADVANCED ANALYTICAL AUSTRALIA***	
	Address:	*Level 8 200 Creek St Spring Hill, Qld 4001*		*Unit 1, 482 Kingsford Smith Drive, Hamilton Q 4007*	
	Tel:	(07) 38316744 *Fax:* (07) 38323627		*Tel: 07 3268 1228 Fax: 07 3268 1238*	
	Project Manager:	*Markus Billerbeck*		*Contact: Andrew Bradbury*	
	E-mail Address:	markus.bilerbeck@bmtwbm.com.au		*Email: andrew.bradbury@advancedanalytical.com.au*	
	Project Ref:	*Port of Brisbane*		www.advancedanalytical.com.au	
	Turn-Around-Time : Standard / FAST	*Standard*			
	Report results by e-mail: excel / pdf				

ANALYSES

Laboratory ID	*Client ID*	*Sample Date*	*Preservation*	*Matrix*	PSD (seive and Sedigraph)	moisture content	total organic carbon	TPH (C6-C36)	trace metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, Ag, Al, Fe)	Nutrients (TN, NO3, NO2, TKN and TP)	Organotins (TBT, DBT, MBT)	Organochlorine pesticides	PAHs (plus total PHS)	Total PCBs	Acid sulfate soils (CRS/TAA)	Radionulides (sum of gross alpha/beta)	Elutriate testing - Organotins (TBT) and Organochlorine pesticides (DDT, DDD, DDE, chlordane)	Porewater (organotins and organochlorine pesticides)	Trip blanks - volatiles (BTEX/TPH C6-C9)
				Soil															
40	8-3B	1-10-14		Soil													X	X	
41	10-6B	2-10-14			X	X	X	X	X	X	X	X	X	X	X	X	[redacted]	[redacted]	
TB 7/10 ~~42~~	[redacted]	[redacted]																	
42	11-8B	"															X	X	
43	5-1C	1-10-14			X	X	X	X	X	X	X	X	X	X	X	2			
44	11-9C	2-10-14			X	X	X		X		X	X							
45	13-4C	3-10-14		↓	X	X	X		X		X	X							

Metals to Analyse :

RELINQUISHED BY: **Date:** **RECEIVED BY:** **Date:**

REPORT OF ANALYSIS

Laboratory Reference: A14/5575-A [R00]

Client: BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane QLD 4000

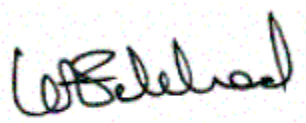
Contact: Markus Billerbeck

Order No:
Project: Port of Brisbane - Sediments
Sample Type: Sediment
No. of Samples: 47
Date Received: 07/10/2014
Date Completed: 22/10/2014

Laboratory Contact Details:

Client Services Manager: Trent Biggin
Technical Enquiries: Andrew Bradbury
Telephone: +61 7 3268 1228
Fax: +61 7 3268 1238
Email: brisbane@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:



Ian Eckhard
Technical Director

Comments:
All samples tested as submitted by client. All attached results have been checked and approved for release.
This is the Final Report and supersedes any reports previously issued with this reference number.
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Accreditation No.15109

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Batch Number: A14/5575-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/1** **BC-2** **01/10/2014**	**/2** **2-0** **01/10/2014**	**/3** **4-0** **01/10/2014**	**/4** **4-4** **01/10/2014**
Moisture Content						
Moisture Content	04-004	%	59.1	19.6	61.5	64.2
Trace Elements						
Aluminium	04-001	mg/kg	21,000	3,500	24,000	27,000
Arsenic	04-001	mg/kg	7.2	2.4	5.8	7.5
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	38	9.6	46	49
Copper	04-001	mg/kg	39	3.6	47	41
Iron	04-001	mg/kg	35,000	12,000	41,000	46,000
Lead	04-001	mg/kg	27	5.2	13	17
Mercury	04-002	mg/kg	0.1	0.01	0.07	0.1
Nickel	04-001	mg/kg	26	7.0	35	34
Phosphorus*	04-001	mg/kg	870	260	940	1,000
Silver	04-001	mg/kg	<0.25	<0.25	<0.25	<0.25
Zinc	04-001	mg/kg	140	24	99	120
BTEX						
Total Petroleum Hydrocarbons						
Poly Aromatic Hydrocarbons						
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-BHC	04-024	µg/kg	<2	<2	<2	<2
beta-BHC	04-024	µg/kg	<2	<2	<2	<2
gamma-BHC (Lindane)	04-024	µg/kg	<2	<2	<2	<2
delta-BHC	04-024	µg/kg	<2	<2	<2	<2
cis-Chlordane	04-024	µg/kg	<2	<2	<2	<2
trans-Chlordane	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDD	04-024	µg/kg	2.0	<2	<2	<2
p,p'-DDE	04-024	µg/kg	6.0	<2	6.0	6.0
p,p'-DDT	04-024	µg/kg	7.0	<2	8.0	9.0
Dieldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
beta-Endosulfan	04-024	µg/kg	<2	<2	<2	<2

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Batch Number: A14/5575-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference:	**-**	**-**	**/1**	**/2**	**/3**	**/4**
Client Reference:	**-**	**-**	**BC-2**	**2-0**	**4-0**	**4-4**
Date Sampled:	**-**	**-**	**01/10/2014**	**01/10/2014**	**01/10/2014**	**01/10/2014**
Analysis Description	**Method**	**Units**				
Endosulfan Sulphate	04-024	µg/kg	<2	<2	<2	<2
Endrin	04-024	µg/kg	<2	<2	<2	<2
Endrin ketone	04-024	µg/kg	<2	<2	<2	<2
Endrin aldehyde	04-024	µg/kg	<2	<2	<2	<2
Heptachlor	04-024	µg/kg	<2	<2	<2	<2
Heptachlor epoxide	04-024	µg/kg	<2	<2	<2	<2
Hexachlorobenzene	04-024	µg/kg	<2	<2	<2	<2
Methoxychlor	04-024	µg/kg	<2	<2	<2	<2
Oxychlordane*	04-024	µg/kg	<2	<2	<2	<2
Surrogate Recovery	04-024	%	107	96	93	100
Date Extracted	04-024	-	8/10/2014	8/10/2014	8/10/2014	8/10/2014
Date Analysed	04-024	-	10/10/2014	10/10/2014	10/10/2014	10/10/2014
Polychlorinated Biphenyls						
Organotins						
Monobutyl tin	04-026	µgSn/kg	<10	<10	<10	<10
Dibutyl tin	04-026	µgSn/kg	1.3	<0.50	0.80	1.2
Tributyl tin	04-026	µgSn/kg	2.1	<0.50	2.9	2.0
Surrogate 1 Recovery	04-026	%	74	86	79	78
Date Extracted	04-026	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014
Date Analysed	04-026	-	18/10/2014	18/10/2014	18/10/2014	18/10/2014
Subcontract Analysis						
Total Organic Carbon	SUB	%	2.0	1.0	1.6	2.0
Particle Size Distribution	SUB		To follow	To follow	To follow	To follow

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Batch Number: A14/5575-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/5** **5-0** **01/10/2014**	**/6** **5-1A** **01/10/2014**	**/7** **5-1B** **01/10/2014**	**/8** **6-2A** **02/10/2014**
Moisture Content						
Moisture Content	04-004	%	63.2	58.0	57.3	60.0
Trace Elements						
Aluminium	04-001	mg/kg	27,000	27,000	25,000	27,000
Arsenic	04-001	mg/kg	7.0	6.6	7.0	7.1
Cadmium	04-001	mg/kg	<0.1	<0.1	0.21	<0.1
Chromium	04-001	mg/kg	49	47	48	47
Copper	04-001	mg/kg	37	31	36	45
Iron	04-001	mg/kg	44,000	41,000	39,000	45,000
Lead	04-001	mg/kg	14	19	25	14
Mercury	04-002	mg/kg	0.09	0.10	0.17	0.09
Nickel	04-001	mg/kg	33	30	28	33
Phosphorus*	04-001	mg/kg	1,000	870	830	1,100
Silver	04-001	mg/kg	<0.25	<0.25	0.53	<0.25
Zinc	04-001	mg/kg	110	100	110	100
BTEX						
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<20	<10	<10	[NA]
TPH C10-14	04-020	mg/kg	<20	<10	<10	[NA]
TPH C15-28	04-020	mg/kg	<100	<50	<50	[NA]
TPH C29-36	04-020	mg/kg	<100	56	71	[NA]
Surrogate Recovery	04-020	%	108	99	90	[NA]
Date Extracted	04-020	-	8/10/2014	8/10/2014	8/10/2014	[NA]
Date Analysed	04-020	-	9/10/2014	9/10/2014	9/10/2014	[NA]
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	5.0	5.0	8.0	[NA]
1-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0	<5.0	[NA]
2-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0	7.0	[NA]
Acenaphthylene	04-022	µg/kg	6.0	<5.0	6.0	[NA]
Acenaphthene	04-022	µg/kg	<5.0	<5.0	<5.0	[NA]
Fluorene	04-022	µg/kg	<5.0	<5.0	<5.0	[NA]
Phenanthrene	04-022	µg/kg	20	17	19	[NA]
Anthracene	04-022	µg/kg	7.0	5.0	7.0	[NA]

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Batch Number: A14/5575-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/5** **5-0** **01/10/2014**	**/6** **5-1A** **01/10/2014**	**/7** **5-1B** **01/10/2014**	**/8** **6-2A** **02/10/2014**
Fluoranthene	04-022	µg/kg	62	49	61	[NA]
Pyrene	04-022	µg/kg	67	61	67	[NA]
Benz(a)anthracene	04-022	µg/kg	34	30	43	[NA]
Chrysene	04-022	µg/kg	35	27	38	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	75	65	91	[NA]
Benzo(a)pyrene	04-022	µg/kg	42	34	50	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	40	32	41	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	6.0	<5.0	7.0	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	33	26	38	[NA]
Coronene	04-022	µg/kg	<10	<10	<10	[NA]
Benzo(e)pyrene	04-022	µg/kg	31	27	35	[NA]
Perylene	04-022	µg/kg	110	44	55	[NA]
Total PAHs (as above)	04-022	µg/kg	570	420	570	[NA]
Surrogate 1 Recovery	04-022	%	96	81	86	[NA]
Surrogate 2 Recovery	04-022	%	94	78	89	[NA]
Surrogate 3 Recovery	04-022	%	97	92	90	[NA]
Date Extracted	04-022	-	8/10/2014	8/10/2014	8/10/2014	[NA]
Date Analysed	04-022	-	10/10/2014	10/10/2014	10/10/2014	[NA]
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-BHC	04-024	µg/kg	<2	<2	<2	<2
beta-BHC	04-024	µg/kg	<2	<2	<2	<2
gamma-BHC (Lindane)	04-024	µg/kg	<2	<2	<2	<2
delta-BHC	04-024	µg/kg	<2	<2	<2	<2
cis-Chlordane	04-024	µg/kg	<2	<2	<2	<2
trans-Chlordane	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDD	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDE	04-024	µg/kg	6.0	5.0	5.0	7.0
p,p'-DDT	04-024	µg/kg	8.0	4.0	2.0	6.0
Dieldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
beta-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
Endosulfan Sulphate	04-024	µg/kg	<2	<2	<2	<2

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Batch Number: A14/5575-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/5** **5-0** **01/10/2014**	**/6** **5-1A** **01/10/2014**	**/7** **5-1B** **01/10/2014**	**/8** **6-2A** **02/10/2014**
Endrin	04-024	µg/kg	<2	<2	<2	<2
Endrin ketone	04-024	µg/kg	<2	<2	<2	<2
Endrin aldehyde	04-024	µg/kg	<2	<2	<2	<2
Heptachlor	04-024	µg/kg	<2	<2	<2	<2
Heptachlor epoxide	04-024	µg/kg	<2	<2	<2	<2
Hexachlorobenzene	04-024	µg/kg	<2	<2	<2	<2
Methoxychlor	04-024	µg/kg	<2	<2	<2	<2
Oxychlordane*	04-024	µg/kg	<2	<2	<2	<2
Surrogate Recovery	04-024	%	101	97	91	103
Date Extracted	04-024	-	8/10/2014	8/10/2014	8/10/2014	8/10/2014
Date Analysed	04-024	-	10/10/2014	10/10/2014	10/10/2014	10/10/2014
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	<5.0	<5.0	<5.0	[NA]
Di-PCB congeners	04-029	µg/kg	<5.0	<5.0	<5.0	[NA]
Tri-PCB congeners	04-029	µg/kg	<5.0	<5.0	<5.0	[NA]
Tetra-PCB congeners	04-029	µg/kg	<5.0	<5.0	<5.0	[NA]
Penta-PCB congeners	04-029	µg/kg	<5.0	<5.0	<5.0	[NA]
Hexa-PCB congeners	04-029	µg/kg	<5.0	<5.0	<5.0	[NA]
Hepta-PCB congeners	04-029	µg/kg	<5.0	<5.0	<5.0	[NA]
Octa-PCB congeners	04-029	µg/kg	<5.0	<5.0	<5.0	[NA]
Nona-PCB congeners	04-029	µg/kg	<5.0	<5.0	<5.0	[NA]
Deca-PCB congeners	04-029	µg/kg	<5.0	<5.0	<5.0	[NA]
Total PCB congeners	04-029	µg/kg	<5.0	<5.0	<5.0	[NA]
Surrogate 1 Recovery	04-029	%	100	88	92	[NA]
Surrogate 2 Recovery	04-029	%	104	94	100	[NA]
Date Extracted	04-029	-	8/10/2014	8/10/2014	8/10/2014	[NA]
Date Analysed	04-029	-	10/10/2014	10/10/2014	10/10/2014	[NA]
Organotins						
Monobutyl tin	04-026	µgSn/kg	<10	<10	<10	<10
Dibutyl tin	04-026	µgSn/kg	1.2	2.2	3.5	<1.0
Tributyl tin	04-026	µgSn/kg	2.5	0.50	0.60	1.0
Surrogate 1 Recovery	04-026	%	78	73	78	76
Date Extracted	04-026	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014

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Laboratory Reference:	-	-	/5	/6	/7	/8
Client Reference:	-	-	5-0	5-1A	5-1B	6-2A
Date Sampled:	-	-	01/10/2014	01/10/2014	01/10/2014	02/10/2014
Analysis Description	**Method**	**Units**				
Date Analysed	04-026	-	18/10/2014	18/10/2014	18/10/2014	18/10/2014
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.6	1.5	1.4	1.7
Nitrate as N	SUB	mg/kg	<0.1	<0.1	<0.1	[NA]
Nitrite as N	SUB	mg/kg	<0.1	<0.1	<0.1	[NA]
Total Kjeldahl Nitrogen	SUB	mg/kg	1,320	1,150	1,010	[NA]
Total Nitrogen	SUB	mg/kg	1,320	1,150	1,010	[NA]
Particle Size Distribution	SUB		To follow	To follow	To follow	To follow
Gross Alpha	SUB	mBq/g	<60	<60	<60	[NA]
Gross Beta	SUB	mBq/g	<135	<135	<135	[NA]
Chromium Reducible Suite	SUB		See Comments	See Comments	See Comments	[NA]

Laboratory Reference:	-	-	/9	/10	/11	/12
Client Reference:	-	-	6-2B	6-3	7-1	8-1
Date Sampled:	-	-	02/10/2014	01/10/2014	01/10/2014	01/10/2014
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	61.1	64.2	60.5	64.3
Trace Elements						
Aluminium	04-001	mg/kg	27,000	26,000	26,000	26,000
Arsenic	04-001	mg/kg	7.4	7.7	7.3	7.8
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	48	47	46	46
Copper	04-001	mg/kg	42	37	34	37
Iron	04-001	mg/kg	43,000	43,000	45,000	43,000
Lead	04-001	mg/kg	14	14	14	14
Mercury	04-002	mg/kg	0.09	0.09	0.10	0.11
Nickel	04-001	mg/kg	34	32	32	32
Phosphorus*	04-001	mg/kg	1,300	1000	980	980
Silver	04-001	mg/kg	<0.25	<0.25	<0.25	<0.25
Zinc	04-001	mg/kg	100	110	97	110
BTEX						

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/9** **6-2B** **02/10/2014**	**/10** **6-3** **01/10/2014**	**/11** **7-1** **01/10/2014**	**/12** **8-1** **01/10/2014**
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	[NA]	<20	<20	[NA]
TPH C10-14	04-020	mg/kg	[NA]	<20	<20	[NA]
TPH C15-28	04-020	mg/kg	[NA]	<100	<100	[NA]
TPH C29-36	04-020	mg/kg	[NA]	<100	<100	[NA]
Surrogate Recovery	04-020	%	[NA]	110	100	[NA]
Date Extracted	04-020	-	[NA]	8/10/2014	8/10/2014	[NA]
Date Analysed	04-020	-	[NA]	9/10/2014	9/10/2014	[NA]
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	[NA]	6.0	<5.0	[NA]
1-Methylnaphthalene	04-022	µg/kg	[NA]	<5.0	<5.0	[NA]
2-Methylnaphthalene	04-022	µg/kg	[NA]	<5.0	<5.0	[NA]
Acenaphthylene	04-022	µg/kg	[NA]	7.0	<5.0	[NA]
Acenaphthene	04-022	µg/kg	[NA]	<5.0	<5.0	[NA]
Fluorene	04-022	µg/kg	[NA]	<5.0	<5.0	[NA]
Phenanthrene	04-022	µg/kg	[NA]	19	11	[NA]
Anthracene	04-022	µg/kg	[NA]	7.0	<5.0	[NA]
Fluoranthene	04-022	µg/kg	[NA]	56	43	[NA]
Pyrene	04-022	µg/kg	[NA]	58	48	[NA]
Benz(a)anthracene	04-022	µg/kg	[NA]	31	24	[NA]
Chrysene	04-022	µg/kg	[NA]	32	25	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	[NA]	72	60	[NA]
Benzo(a)pyrene	04-022	µg/kg	[NA]	38	30	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	[NA]	38	34	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	[NA]	5.0	5.0	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	[NA]	35	23	[NA]
Coronene	04-022	µg/kg	[NA]	<10	<10	[NA]
Benzo(e)pyrene	04-022	µg/kg	[NA]	29	24	[NA]
Perylene	04-022	µg/kg	[NA]	110	93	[NA]
Total PAHs (as above)	04-022	µg/kg	[NA]	550	420	[NA]
Surrogate 1 Recovery	04-022	%	[NA]	96	105	[NA]
Surrogate 2 Recovery	04-022	%	[NA]	99	94	[NA]
Surrogate 3 Recovery	04-022	%	[NA]	100	106	[NA]

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/9** **6-2B** **02/10/2014**	**/10** **6-3** **01/10/2014**	**/11** **7-1** **01/10/2014**	**/12** **8-1** **01/10/2014**
Date Extracted	04-022	-	[NA]	8/10/2014	17/10/2014	[NA]
Date Analysed	04-022	-	[NA]	10/10/2014	17/10/2014	[NA]
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-BHC	04-024	µg/kg	<2	<2	<2	<2
beta-BHC	04-024	µg/kg	<2	<2	<2	<2
gamma-BHC (Lindane)	04-024	µg/kg	<2	<2	<2	<2
delta-BHC	04-024	µg/kg	<2	<2	<2	<2
cis-Chlordane	04-024	µg/kg	<2	<2	<2	<2
trans-Chlordane	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDD	04-024	µg/kg	2.0	<2	6.0	<2
p,p'-DDE	04-024	µg/kg	7.0	7.0	6.0	7.0
p,p'-DDT	04-024	µg/kg	7.0	9.0	6.0	8.0
Dieldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
beta-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
Endosulfan Sulphate	04-024	µg/kg	<2	<2	<2	<2
Endrin	04-024	µg/kg	<2	<2	<2	<2
Endrin ketone	04-024	µg/kg	<2	<2	<2	<2
Endrin aldehyde	04-024	µg/kg	<2	<2	<2	<2
Heptachlor	04-024	µg/kg	<2	<2	<2	<2
Heptachlor epoxide	04-024	µg/kg	<2	<2	<2	<2
Hexachlorobenzene	04-024	µg/kg	<2	<2	<2	<2
Methoxychlor	04-024	µg/kg	<2	6.0	<2	<2
Oxychlordane*	04-024	µg/kg	<2	<2	<2	<2
Surrogate Recovery	04-024	%	107	104	98	96
Date Extracted	04-024	-	8/10/2014	8/10/2014	8/10/2014	8/10/2014
Date Analysed	04-024	-	10/10/2014	10/10/2014	11/10/2014	11/10/2014
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	[NA]	<5.0	<5.0	[NA]
Di-PCB congeners	04-029	µg/kg	[NA]	<5.0	<5.0	[NA]
Tri-PCB congeners	04-029	µg/kg	[NA]	<5.0	<5.0	[NA]
Tetra-PCB congeners	04-029	µg/kg	[NA]	<5.0	<5.0	[NA]

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Laboratory Reference:	-	-	**/9**	**/10**	**/11**	**/12**
Client Reference:	-	-	**6-2B**	**6-3**	**7-1**	**8-1**
Date Sampled:	-	-	**02/10/2014**	**01/10/2014**	**01/10/2014**	**01/10/2014**
Analysis Description	**Method**	**Units**				
Penta-PCB congeners	04-029	µg/kg	[NA]	<5.0	<5.0	[NA]
Hexa-PCB congeners	04-029	µg/kg	[NA]	<5.0	<5.0	[NA]
Hepta-PCB congeners	04-029	µg/kg	[NA]	<5.0	<5.0	[NA]
Octa-PCB congeners	04-029	µg/kg	[NA]	<5.0	<5.0	[NA]
Nona-PCB congeners	04-029	µg/kg	[NA]	<5.0	<5.0	[NA]
Deca-PCB congeners	04-029	µg/kg	[NA]	<5.0	<5.0	[NA]
Total PCB congeners	04-029	µg/kg	[NA]	<5.0	<5.0	[NA]
Surrogate 1 Recovery	04-029	%	[NA]	103	96	[NA]
Surrogate 2 Recovery	04-029	%	[NA]	107	100	[NA]
Date Extracted	04-029	-	[NA]	8/10/2014	8/10/2014	[NA]
Date Analysed	04-029	-	[NA]	10/10/2014	11/10/2014	[NA]
Organotins						
Monobutyl tin	04-026	µgSn/kg	<10	<10	<10	<10
Dibutyl tin	04-026	µgSn/kg	1.0	<1.0	<1.0	<1.0
Tributyl tin	04-026	µgSn/kg	3.5	1.2	1.3	1.1
Surrogate 1 Recovery	04-026	%	79	76	80	77
Date Extracted	04-026	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014
Date Analysed	04-026	-	18/10/2014	18/10/2014	18/10/2014	18/10/2014
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.7	1.9	1.7	1.9
Particle Size Distribution	SUB		To follow	To follow	To follow	To follow

Laboratory Reference:	-	-	**/13**	**/14**	**/15**	**/16**
Client Reference:	-	-	**8-3**	**9-1**	**10-5**	**10-6A**
Date Sampled:	-	-	**01/10/2014**	**01/10/2014**	**02/10/2014**	**02/10/2014**
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	57.8	47.2	54.3	54.9
Trace Elements						
Aluminium	04-001	mg/kg	22,000	19,000	21,000	20,000
Arsenic	04-001	mg/kg	6.2	5.6	5.8	6.5
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/13** **8-3** **01/10/2014**	**/14** **9-1** **01/10/2014**	**/15** **10-5** **02/10/2014**	**/16** **10-6A** **02/10/2014**
Chromium	04-001	mg/kg	40	42	38	37
Copper	04-001	mg/kg	27	24	24	24
Iron	04-001	mg/kg	36,000	33,000	36,000	34,000
Lead	04-001	mg/kg	11	8.4	10	11
Mercury	04-002	mg/kg	0.09	0.05	0.07	0.07
Nickel	04-001	mg/kg	27	31	28	23
Phosphorus*	04-001	mg/kg	820	740	800	720
Silver	04-001	mg/kg	<0.25	<0.25	<0.25	<0.25
Zinc	04-001	mg/kg	82	69	76	86
BTEX						
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	[NA]	<10	[NA]	<10
TPH C10-14	04-020	mg/kg	[NA]	<10	[NA]	<10
TPH C15-28	04-020	mg/kg	[NA]	<50	[NA]	<50
TPH C29-36	04-020	mg/kg	[NA]	<50	[NA]	63
Surrogate Recovery	04-020	%	[NA]	94	[NA]	99
Date Extracted	04-020	-	[NA]	8/10/2014	[NA]	8/10/2014
Date Analysed	04-020	-	[NA]	10/10/2014	[NA]	10/10/2014
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	[NA]	<5.0	[NA]	<5.0
1-Methylnaphthalene	04-022	µg/kg	[NA]	<5.0	[NA]	<5.0
2-Methylnaphthalene	04-022	µg/kg	[NA]	<5.0	[NA]	<5.0
Acenaphthylene	04-022	µg/kg	[NA]	<5.0	[NA]	5.0
Acenaphthene	04-022	µg/kg	[NA]	<5.0	[NA]	<5.0
Fluorene	04-022	µg/kg	[NA]	<5.0	[NA]	<5.0
Phenanthrene	04-022	µg/kg	[NA]	6.0	[NA]	12
Anthracene	04-022	µg/kg	[NA]	<5.0	[NA]	<5.0
Fluoranthene	04-022	µg/kg	[NA]	19	[NA]	43
Pyrene	04-022	µg/kg	[NA]	21	[NA]	48
Benz(a)anthracene	04-022	µg/kg	[NA]	12	[NA]	24
Chrysene	04-022	µg/kg	[NA]	12	[NA]	22
Benzo(b)&(k)fluoranthene	04-022	µg/kg	[NA]	26	[NA]	59
Benzo(a)pyrene	04-022	µg/kg	[NA]	14	[NA]	36

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Indeno(1,2,3-cd)pyrene	04-022	µg/kg	[NA]	14	[NA]	36
Dibenz(a,h)anthracene	04-022	µg/kg	[NA]	<5.0	[NA]	5.0
Benzo(g,h,i)perylene	04-022	µg/kg	[NA]	12	[NA]	31
Coronene	04-022	µg/kg	[NA]	<10	[NA]	<10
Benzo(e)pyrene	04-022	µg/kg	[NA]	11	[NA]	24
Perylene	04-022	µg/kg	[NA]	44	[NA]	84
Total PAHs (as above)	04-022	µg/kg	[NA]	190	[NA]	430
Surrogate 1 Recovery	04-022	%	[NA]	81	[NA]	96
Surrogate 2 Recovery	04-022	%	[NA]	86	[NA]	97
Surrogate 3 Recovery	04-022	%	[NA]	86	[NA]	96
Date Extracted	04-022	-	[NA]	8/10/2014	[NA]	8/10/2014
Date Analysed	04-022	-	[NA]	11/10/2014	[NA]	11/10/2014
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-BHC	04-024	µg/kg	<2	<2	<2	<2
beta-BHC	04-024	µg/kg	<2	<2	<2	<2
gamma-BHC (Lindane)	04-024	µg/kg	<2	<2	<2	<2
delta-BHC	04-024	µg/kg	<2	<2	<2	<2
cis-Chlordane	04-024	µg/kg	<2	<2	<2	<2
trans-Chlordane	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDD	04-024	µg/kg	18	<2	<2	<2
p,p'-DDE	04-024	µg/kg	6.0	5.0	7.0	4.0
p,p'-DDT	04-024	µg/kg	6.0	5.0	6.0	5.0
Dieldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
beta-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
Endosulfan Sulphate	04-024	µg/kg	<2	<2	<2	<2
Endrin	04-024	µg/kg	<2	<2	<2	<2
Endrin ketone	04-024	µg/kg	<2	<2	<2	<2
Endrin aldehyde	04-024	µg/kg	<2	<2	<2	<2
Heptachlor	04-024	µg/kg	<2	<2	<2	<2
Heptachlor epoxide	04-024	µg/kg	<2	<2	<2	<2
Hexachlorobenzene	04-024	µg/kg	<2	<2	<2	<2

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Laboratory Reference:	-	-	**/13**	**/14**	**/15**	**/16**
Client Reference:	-	-	**8-3**	**9-1**	**10-5**	**10-6A**
Date Sampled:	-	-	**01/10/2014**	**01/10/2014**	**02/10/2014**	**02/10/2014**
Analysis Description	**Method**	**Units**				
Methoxychlor	04-024	µg/kg	<2	<2	<2	<2
Oxychlordane*	04-024	µg/kg	<2	<2	<2	<2
Surrogate Recovery	04-024	%	101	89	104	101
Date Extracted	04-024	-	8/10/2014	8/10/2014	8/10/2014	8/10/2014
Date Analysed	04-024	-	11/10/2014	11/10/2014	11/10/2014	11/10/2014
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Di-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Tri-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Tetra-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Penta-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Hexa-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Hepta-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Octa-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Nona-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Deca-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Total PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Surrogate 1 Recovery	04-029	%	[NA]	86	[NA]	99
Surrogate 2 Recovery	04-029	%	[NA]	92	[NA]	104
Date Extracted	04-029	-	[NA]	8/10/2014	[NA]	8/10/2014
Date Analysed	04-029	-	[NA]	11/10/2014	[NA]	11/10/2014
Organotins						
Monobutyl tin	04-026	µgSn/kg	<10	<10	<10	<10
Dibutyl tin	04-026	µgSn/kg	0.60	<0.50	0.50	<0.50
Tributyl tin	04-026	µgSn/kg	0.80	<0.50	<0.50	<0.50
Surrogate 1 Recovery	04-026	%	79	79	76	78
Date Extracted	04-026	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014
Date Analysed	04-026	-	18/10/2014	18/10/2014	18/10/2014	18/10/2014
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.4	0.96	1.3	1.3
Nitrate as N	SUB	mg/kg	[NA]	[NA]	[NA]	<0.1
Nitrite as N	SUB	mg/kg	[NA]	[NA]	[NA]	<0.1
Total Kjeldahl Nitrogen	SUB	mg/kg	[NA]	[NA]	[NA]	950

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Laboratory Reference:	-	-	/13	/14	/15	/16
Client Reference:	-	-	8-3	9-1	10-5	10-6A
Date Sampled:	-	-	01/10/2014	01/10/2014	02/10/2014	02/10/2014
Analysis Description	**Method**	**Units**				
Total Nitrogen	SUB	mg/kg	[NA]	[NA]	[NA]	950
Particle Size Distribution	SUB		To follow	To follow	To follow	To follow
Gross Alpha	SUB	mBq/g	[NA]	<60	[NA]	<60
Gross Beta	SUB	mBq/g	[NA]	<135	[NA]	<135
Chromium Reducible Suite	SUB		[NA]	See Comments	[NA]	See Comments

Laboratory Reference:	-	-	/17	/18	/19	/20
Client Reference:	-	-	10-8	11-9A	11-8	11-5
Date Sampled:	-	-	02/10/2014	02/10/2014	02/10/2014	02/10/2014
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	61.5	55.6	54.3	56.1
Trace Elements						
Aluminium	04-001	mg/kg	23,000	25,000	23,000	21,000
Arsenic	04-001	mg/kg	7.2	7.2	6.6	6.5
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	41	43	41	36
Copper	04-001	mg/kg	28	27	26	24
Iron	04-001	mg/kg	39,000	42,000	40,000	35,000
Lead	04-001	mg/kg	12	13	12	11
Mercury	04-002	mg/kg	0.08	0.08	0.09	0.07
Nickel	04-001	mg/kg	27	31	28	24
Phosphorus*	04-001	mg/kg	810	850	840	690
Silver	04-001	mg/kg	<0.25	<0.25	<0.25	<0.25
Zinc	04-001	mg/kg	84	85	84	76
BTEX						
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	[NA]	[NA]	<10	[NA]
TPH C10-14	04-020	mg/kg	[NA]	[NA]	<10	[NA]
TPH C15-28	04-020	mg/kg	[NA]	[NA]	<50	[NA]
TPH C29-36	04-020	mg/kg	[NA]	[NA]	52	[NA]
Surrogate Recovery	04-020	%	[NA]	[NA]	100	[NA]

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/17** **10-8** **02/10/2014**	**/18** **11-9A** **02/10/2014**	**/19** **11-8** **02/10/2014**	**/20** **11-5** **02/10/2014**
Date Extracted	04-020	-	[NA]	[NA]	8/10/2014	[NA]
Date Analysed	04-020	-	[NA]	[NA]	10/10/2014	[NA]
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	[NA]	[NA]	6.0	[NA]
1-Methylnaphthalene	04-022	µg/kg	[NA]	[NA]	<5.0	[NA]
2-Methylnaphthalene	04-022	µg/kg	[NA]	[NA]	<5.0	[NA]
Acenaphthylene	04-022	µg/kg	[NA]	[NA]	8.0	[NA]
Acenaphthene	04-022	µg/kg	[NA]	[NA]	<5.0	[NA]
Fluorene	04-022	µg/kg	[NA]	[NA]	<5.0	[NA]
Phenanthrene	04-022	µg/kg	[NA]	[NA]	27	[NA]
Anthracene	04-022	µg/kg	[NA]	[NA]	8.0	[NA]
Fluoranthene	04-022	µg/kg	[NA]	[NA]	83	[NA]
Pyrene	04-022	µg/kg	[NA]	[NA]	87	[NA]
Benz(a)anthracene	04-022	µg/kg	[NA]	[NA]	49	[NA]
Chrysene	04-022	µg/kg	[NA]	[NA]	48	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	[NA]	[NA]	110	[NA]
Benzo(a)pyrene	04-022	µg/kg	[NA]	[NA]	63	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	[NA]	[NA]	57	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	[NA]	[NA]	8.0	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	[NA]	[NA]	47	[NA]
Coronene	04-022	µg/kg	[NA]	[NA]	<10	[NA]
Benzo(e)pyrene	04-022	µg/kg	[NA]	[NA]	42	[NA]
Perylene	04-022	µg/kg	[NA]	[NA]	82	[NA]
Total PAHs (as above)	04-022	µg/kg	[NA]	[NA]	720	[NA]
Surrogate 1 Recovery	04-022	%	[NA]	[NA]	91	[NA]
Surrogate 2 Recovery	04-022	%	[NA]	[NA]	95	[NA]
Surrogate 3 Recovery	04-022	%	[NA]	[NA]	97	[NA]
Date Extracted	04-022	-	[NA]	[NA]	8/10/2014	[NA]
Date Analysed	04-022	-	[NA]	[NA]	11/10/2014	[NA]
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-BHC	04-024	µg/kg	<2	<2	<2	<2
beta-BHC	04-024	µg/kg	<2	<2	<2	<2

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/17** **10-8** **02/10/2014**	**/18** **11-9A** **02/10/2014**	**/19** **11-8** **02/10/2014**	**/20** **11-5** **02/10/2014**
gamma-BHC (Lindane)	04-024	µg/kg	<2	<2	<2	<2
delta-BHC	04-024	µg/kg	<2	<2	<2	<2
cis-Chlordane	04-024	µg/kg	<2	<2	<2	<2
trans-Chlordane	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDD	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDE	04-024	µg/kg	6.0	6.0	5.0	5.0
p,p'-DDT	04-024	µg/kg	7.0	5.0	5.0	5.0
Dieldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
beta-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
Endosulfan Sulphate	04-024	µg/kg	<2	<2	<2	<2
Endrin	04-024	µg/kg	<2	<2	<2	<2
Endrin ketone	04-024	µg/kg	<2	<2	<2	<2
Endrin aldehyde	04-024	µg/kg	<2	<2	<2	<2
Heptachlor	04-024	µg/kg	<2	<2	<2	<2
Heptachlor epoxide	04-024	µg/kg	<2	<2	<2	<2
Hexachlorobenzene	04-024	µg/kg	<2	<2	<2	<2
Methoxychlor	04-024	µg/kg	<2	<2	<2	<2
Oxychlordane*	04-024	µg/kg	<2	<2	<2	<2
Surrogate Recovery	04-024	%	112	104	102	103
Date Extracted	04-024	-	8/10/2014	8/10/2014	8/10/2014	8/10/2014
Date Analysed	04-024	-	11/10/2014	11/10/2014	11/10/2014	11/10/2014
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	[NA]	[NA]	<5.0	[NA]
Di-PCB congeners	04-029	µg/kg	[NA]	[NA]	<5.0	[NA]
Tri-PCB congeners	04-029	µg/kg	[NA]	[NA]	<5.0	[NA]
Tetra-PCB congeners	04-029	µg/kg	[NA]	[NA]	<5.0	[NA]
Penta-PCB congeners	04-029	µg/kg	[NA]	[NA]	<5.0	[NA]
Hexa-PCB congeners	04-029	µg/kg	[NA]	[NA]	<5.0	[NA]
Hepta-PCB congeners	04-029	µg/kg	[NA]	[NA]	<5.0	[NA]
Octa-PCB congeners	04-029	µg/kg	[NA]	[NA]	<5.0	[NA]
Nona-PCB congeners	04-029	µg/kg	[NA]	[NA]	<5.0	[NA]
Deca-PCB congeners	04-029	µg/kg	[NA]	[NA]	<5.0	[NA]

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Total PCB congeners	04-029	µg/kg	[NA]	[NA]	<5.0	[NA]
Surrogate 1 Recovery	04-029	%	[NA]	[NA]	98	[NA]
Surrogate 2 Recovery	04-029	%	[NA]	[NA]	103	[NA]
Date Extracted	04-029	-	[NA]	[NA]	8/10/2014	[NA]
Date Analysed	04-029	-	[NA]	[NA]	11/10/2014	[NA]
Organotins						
Monobutyl tin	04-026	µgSn/kg	<10	<10	<10	<10
Dibutyl tin	04-026	µgSn/kg	<1.0	1.0	0.60	0.80
Tributyl tin	04-026	µgSn/kg	<1.0	7.2	<0.50	0.60
Surrogate 1 Recovery	04-026	%	77	73	78	78
Date Extracted	04-026	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014
Date Analysed	04-026	-	18/10/2014	18/10/2014	18/10/2014	18/10/2014
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.6	1.8	1.5	1.4
Nitrate as N	SUB	mg/kg	[NA]	[NA]	<0.1	[NA]
Nitrite as N	SUB	mg/kg	[NA]	[NA]	<0.1	[NA]
Total Kjeldahl Nitrogen	SUB	mg/kg	[NA]	[NA]	1,090	[NA]
Total Nitrogen	SUB	mg/kg	[NA]	[NA]	1,090	[NA]
Particle Size Distribution	SUB		To follow	To follow	To follow	To follow
Gross Alpha	SUB	mBq/g	[NA]	[NA]	<60	[NA]
Gross Beta	SUB	mBq/g	[NA]	[NA]	<135	[NA]
Chromium Reducible Suite	SUB		[NA]	[NA]	See Comments	[NA]

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Moisture Content						
Moisture Content	04-004	%	48.4	58.0	63.5	23.3
Trace Elements						
Aluminium	04-001	mg/kg	18,000	23,000	27,000	7,400
Arsenic	04-001	mg/kg	5.1	6.5	6.1	7.0
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	30	40	42	18
Copper	04-001	mg/kg	17	25	25	4.7
Iron	04-001	mg/kg	29,000	39,000	42,000	18,000
Lead	04-001	mg/kg	8.8	12	11	3.3
Mercury	04-002	mg/kg	0.05	0.07	0.08	0.01
Nickel	04-001	mg/kg	21	28	33	10
Phosphorus*	04-001	mg/kg	600	810	820	290
Silver	04-001	mg/kg	<0.25	<0.25	<0.25	<0.25
Zinc	04-001	mg/kg	57	78	79	28
BTEX						
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	[NA]	[NA]	<10
TPH C10-14	04-020	mg/kg	<10	[NA]	[NA]	<10
TPH C15-28	04-020	mg/kg	<50	[NA]	[NA]	<50
TPH C29-36	04-020	mg/kg	<50	[NA]	[NA]	<50
Surrogate Recovery	04-020	%	111	[NA]	[NA]	123
Date Extracted	04-020	-	8/10/2014	[NA]	[NA]	8/10/2014
Date Analysed	04-020	-	10/10/2014	[NA]	[NA]	10/10/2014
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
1-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
2-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
Acenaphthylene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
Acenaphthene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
Fluorene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
Phenanthrene	04-022	µg/kg	8.0	[NA]	[NA]	<5.0
Anthracene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/21** **12-1** **02/10/2014**	**/22** **12-2** **02/10/2014**	**/23** **15-1** **02/10/2014**	**/24** **15-3** **02/10/2014**
Fluoranthene	04-022	µg/kg	26	[NA]	[NA]	<5.0
Pyrene	04-022	µg/kg	30	[NA]	[NA]	<5.0
Benz(a)anthracene	04-022	µg/kg	14	[NA]	[NA]	<5.0
Chrysene	04-022	µg/kg	14	[NA]	[NA]	<5.0
Benzo(b)&(k)fluoranthene	04-022	µg/kg	35	[NA]	[NA]	<10
Benzo(a)pyrene	04-022	µg/kg	19	[NA]	[NA]	<5.0
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	25	[NA]	[NA]	<5.0
Dibenz(a,h)anthracene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
Benzo(g,h,i)perylene	04-022	µg/kg	14	[NA]	[NA]	<5.0
Coronene	04-022	µg/kg	<10	[NA]	[NA]	<10
Benzo(e)pyrene	04-022	µg/kg	14	[NA]	[NA]	<5.0
Perylene	04-022	µg/kg	76	[NA]	[NA]	15
Total PAHs (as above)	04-022	µg/kg	270	[NA]	[NA]	<100
Surrogate 1 Recovery	04-022	%	100	[NA]	[NA]	91
Surrogate 2 Recovery	04-022	%	96	[NA]	[NA]	91
Surrogate 3 Recovery	04-022	%	107	[NA]	[NA]	105
Date Extracted	04-022	-	8/10/2014	[NA]	[NA]	8/10/2014
Date Analysed	04-022	-	14/10/2014	[NA]	[NA]	14/10/2014
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-BHC	04-024	µg/kg	<2	<2	<2	<2
beta-BHC	04-024	µg/kg	<2	<2	<2	<2
gamma-BHC (Lindane)	04-024	µg/kg	<2	<2	<2	<2
delta-BHC	04-024	µg/kg	<2	<2	<2	<2
cis-Chlordane	04-024	µg/kg	<2	<2	<2	<2
trans-Chlordane	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDD	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDE	04-024	µg/kg	4.0	6.0	8.0	<2
p,p'-DDT	04-024	µg/kg	4.0	7.0	9.0	<2
Dieldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
beta-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
Endosulfan Sulphate	04-024	µg/kg	<2	<2	<2	<2

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/21** **12-1** **02/10/2014**	**/22** **12-2** **02/10/2014**	**/23** **15-1** **02/10/2014**	**/24** **15-3** **02/10/2014**
Endrin	04-024	µg/kg	<2	<2	<2	<2
Endrin ketone	04-024	µg/kg	<2	<2	<2	<2
Endrin aldehyde	04-024	µg/kg	<2	<2	<2	<2
Heptachlor	04-024	µg/kg	<2	<2	<2	<2
Heptachlor epoxide	04-024	µg/kg	<2	<2	<2	<2
Hexachlorobenzene	04-024	µg/kg	<2	<2	<2	<2
Methoxychlor	04-024	µg/kg	<2	<2	<2	<2
Oxychlordane*	04-024	µg/kg	<2	<2	<2	<2
Surrogate Recovery	04-024	%	108	109	100	104
Date Extracted	04-024	-	8/10/2014	8/10/2014	8/10/2014	8/10/2014
Date Analysed	04-024	-	14/10/2014	14/10/2014	14/10/2014	14/10/2014
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Di-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Tri-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Tetra-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Penta-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Hexa-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Hepta-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Octa-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Nona-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Deca-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Total PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Surrogate 1 Recovery	04-029	%	100	[NA]	[NA]	96
Surrogate 2 Recovery	04-029	%	102	[NA]	[NA]	97
Date Extracted	04-029	-	8/10/2014	[NA]	[NA]	8/10/2014
Date Analysed	04-029	-	14/10/2014	[NA]	[NA]	14/10/2014
Organotins						
Monobutyl tin	04-026	µgSn/kg	<10	<10	<10	<10
Dibutyl tin	04-026	µgSn/kg	<0.50	0.70	<1.0	<0.50
Tributyl tin	04-026	µgSn/kg	<0.50	0.60	<1.0	<0.50
Surrogate 1 Recovery	04-026	%	80	79	79	82
Date Extracted	04-026	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014

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Laboratory Reference:	-	-	/21	/22	/23	/24
Client Reference:	-	-	12-1	12-2	15-1	15-3
Date Sampled:	-	-	02/10/2014	02/10/2014	02/10/2014	02/10/2014
Analysis Description	**Method**	**Units**				
Date Analysed	04-026	-	18/10/2014	18/10/2014	18/10/2014	18/10/2014
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.1	1.4	1.2	0.18
Nitrate as N	SUB	mg/kg	<0.1	[NA]	[NA]	<0.1
Nitrite as N	SUB	mg/kg	<0.1	[NA]	[NA]	<0.1
Total Kjeldahl Nitrogen	SUB	mg/kg	900	[NA]	[NA]	220
Total Nitrogen	SUB	mg/kg	900	[NA]	[NA]	220
Particle Size Distribution	SUB		To follow	To follow	To follow	To follow
Gross Alpha	SUB	mBq/g	<60	[NA]	[NA]	<60
Gross Beta	SUB	mBq/g	<135	[NA]	[NA]	<135
Chromium Reducible Suite	SUB		See Comments	[NA]	[NA]	See Comments

Laboratory Reference:	-	-	/25	/26	/27	/28
Client Reference:	-	-	15-2	13-1	13-4A	13-4B
Date Sampled:	-	-	02/10/2014	02/10/2014	02/10/2014	02/10/2014
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	37.2	45.2	19.6	21.9
Trace Elements						
Aluminium	04-001	mg/kg	11,000	16,000	4,500	4,900
Arsenic	04-001	mg/kg	5.9	6.6	4.7	4.6
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	22	32	14	15
Copper	04-001	mg/kg	8.2	15	110	25
Iron	04-001	mg/kg	21,000	29,000	16,000	15,000
Lead	04-001	mg/kg	4.7	11	58	35
Mercury	04-002	mg/kg	0.02	0.08	0.03	0.02
Nickel	04-001	mg/kg	13	18	9.0	8.6
Phosphorus*	04-001	mg/kg	370	490	280	300
Silver	04-001	mg/kg	<0.25	<0.25	<0.25	<0.25
Zinc	04-001	mg/kg	34	62	280	180
BTEX						

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/25** **15-2** **02/10/2014**	**/26** **13-1** **02/10/2014**	**/27** **13-4A** **02/10/2014**	**/28** **13-4B** **02/10/2014**
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	<10	[NA]	[NA]
TPH C10-14	04-020	mg/kg	<10	<10	[NA]	[NA]
TPH C15-28	04-020	mg/kg	<50	<50	[NA]	[NA]
TPH C29-36	04-020	mg/kg	<50	<50	[NA]	[NA]
Surrogate Recovery	04-020	%	112	117	[NA]	[NA]
Date Extracted	04-020	-	8/10/2014	8/10/2014	[NA]	[NA]
Date Analysed	04-020	-	10/10/2014	10/10/2014	[NA]	[NA]
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<5.0	36	[NA]	[NA]
1-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
2-Methylnaphthalene	04-022	µg/kg	<5.0	9.0	[NA]	[NA]
Acenaphthylene	04-022	µg/kg	<5.0	6.0	[NA]	[NA]
Acenaphthene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Fluorene	04-022	µg/kg	<5.0	6.0	[NA]	[NA]
Phenanthrene	04-022	µg/kg	<5.0	35	[NA]	[NA]
Anthracene	04-022	µg/kg	<5.0	10	[NA]	[NA]
Fluoranthene	04-022	µg/kg	8.0	71	[NA]	[NA]
Pyrene	04-022	µg/kg	9.0	73	[NA]	[NA]
Benz(a)anthracene	04-022	µg/kg	<5.0	42	[NA]	[NA]
Chrysene	04-022	µg/kg	5.0	39	[NA]	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	12	85	[NA]	[NA]
Benzo(a)pyrene	04-022	µg/kg	6.0	46	[NA]	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	7.0	48	[NA]	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	<5.0	8.0	[NA]	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	5.0	39	[NA]	[NA]
Coronene	04-022	µg/kg	<10	<10	[NA]	[NA]
Benzo(e)pyrene	04-022	µg/kg	<5.0	34	[NA]	[NA]
Perylene	04-022	µg/kg	29	46	[NA]	[NA]
Total PAHs (as above)	04-022	µg/kg	<100	630	[NA]	[NA]
Surrogate 1 Recovery	04-022	%	99	99	[NA]	[NA]
Surrogate 2 Recovery	04-022	%	96	95	[NA]	[NA]
Surrogate 3 Recovery	04-022	%	105	102	[NA]	[NA]

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/25** **15-2** **02/10/2014**	**/26** **13-1** **02/10/2014**	**/27** **13-4A** **02/10/2014**	**/28** **13-4B** **02/10/2014**
Date Extracted	04-022	-	8/10/2014	8/10/2014	[NA]	[NA]
Date Analysed	04-022	-	14/10/2014	14/10/2014	[NA]	[NA]
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-BHC	04-024	µg/kg	<2	<2	<2	<2
beta-BHC	04-024	µg/kg	<2	<2	<2	<2
gamma-BHC (Lindane)	04-024	µg/kg	<2	<2	<2	<2
delta-BHC	04-024	µg/kg	<2	<2	<2	<2
cis-Chlordane	04-024	µg/kg	<2	<2	<2	<2
trans-Chlordane	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDD	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDE	04-024	µg/kg	<2	3.0	<2	<2
p,p'-DDT	04-024	µg/kg	<2	2.0	<2	<2
Dieldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
beta-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
Endosulfan Sulphate	04-024	µg/kg	<2	<2	<2	<2
Endrin	04-024	µg/kg	<2	<2	<2	<2
Endrin ketone	04-024	µg/kg	<2	<2	<2	<2
Endrin aldehyde	04-024	µg/kg	<2	<2	<2	<2
Heptachlor	04-024	µg/kg	<2	<2	<2	<2
Heptachlor epoxide	04-024	µg/kg	<2	<2	<2	<2
Hexachlorobenzene	04-024	µg/kg	<2	<2	<2	<2
Methoxychlor	04-024	µg/kg	<2	<2	<2	<2
Oxychlordane*	04-024	µg/kg	<2	<2	<2	<2
Surrogate Recovery	04-024	%	106	104	101	108
Date Extracted	04-024	-	8/10/2014	8/10/2014	8/10/2014	8/10/2014
Date Analysed	04-024	-	14/10/2014	14/10/2014	14/10/2014	14/10/2014
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Di-PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Tri-PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Tetra-PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/25** **15-2** **02/10/2014**	**/26** **13-1** **02/10/2014**	**/27** **13-4A** **02/10/2014**	**/28** **13-4B** **02/10/2014**
Penta-PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Hexa-PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Hepta-PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Octa-PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Nona-PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Deca-PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Total PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Surrogate 1 Recovery	04-029	%	100	98	[NA]	[NA]
Surrogate 2 Recovery	04-029	%	100	101	[NA]	[NA]
Date Extracted	04-029	-	8/10/2014	8/10/2014	[NA]	[NA]
Date Analysed	04-029	-	14/10/2014	14/10/2014	[NA]	[NA]
Organotins						
Monobutyl tin	04-026	µgSn/kg	<10	<10	<10	<10
Dibutyl tin	04-026	µgSn/kg	<0.50	<0.50	<0.50	<0.50
Tributyl tin	04-026	µgSn/kg	<0.50	<0.50	<0.50	<0.50
Surrogate 1 Recovery	04-026	%	77	69	88	89
Date Extracted	04-026	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014
Date Analysed	04-026	-	18/10/2014	18/10/2014	18/10/2014	18/10/2014
Subcontract Analysis						
Total Organic Carbon	SUB	%	0.39	1.0	0.18	0.50
Nitrate as N	SUB	mg/kg	<0.1	<0.1	[NA]	[NA]
Nitrite as N	SUB	mg/kg	<0.1	<0.1	[NA]	[NA]
Total Kjeldahl Nitrogen	SUB	mg/kg	380	700	[NA]	[NA]
Total Nitrogen	SUB	mg/kg	380	700	[NA]	[NA]
Particle Size Distribution	SUB		To follow	To follow	To follow	To follow
Gross Alpha	SUB	mBq/g	<60	<60	[NA]	[NA]
Gross Beta	SUB	mBq/g	<135	<135	[NA]	[NA]
Chromium Reducible Suite	SUB		See Comments	See Comments	[NA]	[NA]

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Laboratory Reference:	-	-	/29	/30	/31	/32
Client Reference:	-	-	13-5	13-8	13-9	RF2
Date Sampled:	-	-	02/10/2014	02/10/2014	02/10/2014	03/10/2014
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	46.9	52.3	62.6	67.4
Trace Elements						
Aluminium	04-001	mg/kg	17,000	19,000	22,000	42,000
Arsenic	04-001	mg/kg	6.1	6.7	7.9	9.0
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	32	33	37	68
Copper	04-001	mg/kg	18	15	15	34
Iron	04-001	mg/kg	30,000	31,000	35,000	68,000
Lead	04-001	mg/kg	12	9.6	10	22
Mercury	04-002	mg/kg	0.08	0.07	0.05	0.11
Nickel	04-001	mg/kg	19	18	20	37
Phosphorus*	04-001	mg/kg	560	490	560	970
Silver	04-001	mg/kg	<0.25	<0.25	<0.25	<0.25
Zinc	04-001	mg/kg	65	54	56	120
BTEX						
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	[NA]	<10	[NA]	[NA]
TPH C10-14	04-020	mg/kg	[NA]	<10	[NA]	[NA]
TPH C15-28	04-020	mg/kg	[NA]	<50	[NA]	[NA]
TPH C29-36	04-020	mg/kg	[NA]	<50	[NA]	[NA]
Surrogate Recovery	04-020	%	[NA]	119	[NA]	[NA]
Date Extracted	04-020	-	[NA]	8/10/2014	[NA]	[NA]
Date Analysed	04-020	-	[NA]	10/10/2014	[NA]	[NA]
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	[NA]	<5.0	[NA]	[NA]
1-Methylnaphthalene	04-022	µg/kg	[NA]	<5.0	[NA]	[NA]
2-Methylnaphthalene	04-022	µg/kg	[NA]	<5.0	[NA]	[NA]
Acenaphthylene	04-022	µg/kg	[NA]	<5.0	[NA]	[NA]
Acenaphthene	04-022	µg/kg	[NA]	<5.0	[NA]	[NA]
Fluorene	04-022	µg/kg	[NA]	<5.0	[NA]	[NA]
Phenanthrene	04-022	µg/kg	[NA]	11	[NA]	[NA]
Anthracene	04-022	µg/kg	[NA]	<5.0	[NA]	[NA]

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/29** **13-5** **02/10/2014**	**/30** **13-8** **02/10/2014**	**/31** **13-9** **02/10/2014**	**/32** **RF2** **03/10/2014**
Fluoranthene	04-022	µg/kg	[NA]	34	[NA]	[NA]
Pyrene	04-022	µg/kg	[NA]	36	[NA]	[NA]
Benz(a)anthracene	04-022	µg/kg	[NA]	21	[NA]	[NA]
Chrysene	04-022	µg/kg	[NA]	20	[NA]	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	[NA]	48	[NA]	[NA]
Benzo(a)pyrene	04-022	µg/kg	[NA]	27	[NA]	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	[NA]	29	[NA]	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	[NA]	<5.0	[NA]	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	[NA]	20	[NA]	[NA]
Coronene	04-022	µg/kg	[NA]	<10	[NA]	[NA]
Benzo(e)pyrene	04-022	µg/kg	[NA]	19	[NA]	[NA]
Perylene	04-022	µg/kg	[NA]	29	[NA]	[NA]
Total PAHs (as above)	04-022	µg/kg	[NA]	290	[NA]	[NA]
Surrogate 1 Recovery	04-022	%	[NA]	95	[NA]	[NA]
Surrogate 2 Recovery	04-022	%	[NA]	95	[NA]	[NA]
Surrogate 3 Recovery	04-022	%	[NA]	104	[NA]	[NA]
Date Extracted	04-022	-	[NA]	8/10/2014	[NA]	[NA]
Date Analysed	04-022	-	[NA]	14/10/2014	[NA]	[NA]
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-BHC	04-024	µg/kg	<2	<2	<2	<2
beta-BHC	04-024	µg/kg	<2	<2	<2	<2
gamma-BHC (Lindane)	04-024	µg/kg	<2	<2	<2	<2
delta-BHC	04-024	µg/kg	<2	<2	<2	<2
cis-Chlordane	04-024	µg/kg	<2	<2	<2	<2
trans-Chlordane	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDD	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDE	04-024	µg/kg	3.0	<2	<2	3.0
p,p'-DDT	04-024	µg/kg	5.0	3.0	3.0	6.0
Dieldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
beta-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
Endosulfan Sulphate	04-024	µg/kg	<2	<2	<2	<2

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/29** **13-5** **02/10/2014**	**/30** **13-8** **02/10/2014**	**/31** **13-9** **02/10/2014**	**/32** **RF2** **03/10/2014**
Endrin	04-024	µg/kg	<2	<2	<2	<2
Endrin ketone	04-024	µg/kg	<2	<2	<2	<2
Endrin aldehyde	04-024	µg/kg	<2	<2	<2	<2
Heptachlor	04-024	µg/kg	<2	<2	<2	<2
Heptachlor epoxide	04-024	µg/kg	<2	<2	<2	<2
Hexachlorobenzene	04-024	µg/kg	<2	<2	<2	<2
Methoxychlor	04-024	µg/kg	<2	<2	<2	<2
Oxychlordane*	04-024	µg/kg	<2	<2	<2	<2
Surrogate Recovery	04-024	%	105	104	101	102
Date Extracted	04-024	-	8/10/2014	8/10/2014	8/10/2014	8/10/2014
Date Analysed	04-024	-	14/10/2014	14/10/2014	14/10/2014	14/10/2014
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	[NA]
Di-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	[NA]
Tri-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	[NA]
Tetra-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	[NA]
Penta-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	[NA]
Hexa-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	[NA]
Hepta-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	[NA]
Octa-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	[NA]
Nona-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	[NA]
Deca-PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	[NA]
Total PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	[NA]
Surrogate 1 Recovery	04-029	%	[NA]	98	[NA]	[NA]
Surrogate 2 Recovery	04-029	%	[NA]	100	[NA]	[NA]
Date Extracted	04-029	-	[NA]	8/10/2014	[NA]	[NA]
Date Analysed	04-029	-	[NA]	14/10/2014	[NA]	[NA]
Organotins						
Monobutyl tin	04-026	µgSn/kg	<10	<10	<10	<10
Dibutyl tin	04-026	µgSn/kg	0.70	<0.50	<1.0	<1.0
Tributyl tin	04-026	µgSn/kg	<0.50	<0.50	<1.0	<1.0
Surrogate 1 Recovery	04-026	%	78	79	74	77
Date Extracted	04-026	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014

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Laboratory Reference:	-	-	/29	/30	/31	/32
Client Reference:	-	-	13-5	13-8	13-9	RF2
Date Sampled:	-	-	02/10/2014	02/10/2014	02/10/2014	03/10/2014
Analysis Description	**Method**	**Units**				
Date Analysed	04-026	-	18/10/2014	18/10/2014	18/10/2014	18/10/2014
Subcontract Analysis						
Total Organic Carbon	SUB	%	0.98	0.92	1.1	1.3
Nitrate as N	SUB	mg/kg	[NA]	<0.1	[NA]	[NA]
Nitrite as N	SUB	mg/kg	[NA]	<0.1	[NA]	[NA]
Total Kjeldahl Nitrogen	SUB	mg/kg	[NA]	820	[NA]	[NA]
Total Nitrogen	SUB	mg/kg	[NA]	820	[NA]	[NA]
Particle Size Distribution	SUB		To follow	To follow	To follow	To follow
Gross Alpha	SUB	mBq/g	[NA]	<60	[NA]	[NA]
Gross Beta	SUB	mBq/g	[NA]	<135	[NA]	[NA]
Chromium Reducible Suite	SUB		[NA]	See Comments	[NA]	[NA]

Laboratory Reference:	-	-	/33	/34	/35	/36
Client Reference:	-	-	RF3	RF4	RF6	RF7
Date Sampled:	-	-	03/10/2014	03/10/2014	03/10/2014	03/10/2014
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	66.3	56.0	61.7	64.3
Trace Elements						
Aluminium	04-001	mg/kg	28,000	21,000	24,000	30,000
Arsenic	04-001	mg/kg	6.7	5.8	6.5	6.0
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	47	37	40	48
Copper	04-001	mg/kg	23	15	19	32
Iron	04-001	mg/kg	42,000	34,000	38,000	48,000
Lead	04-001	mg/kg	15	11	13	18
Mercury	04-002	mg/kg	0.08	0.06	0.08	0.1
Nickel	04-001	mg/kg	26	20	23	33
Phosphorus*	04-001	mg/kg	670	530	600	770
Silver	04-001	mg/kg	<0.25	<0.25	<0.25	<0.25
Zinc	04-001	mg/kg	80	60	68	94
BTEX						

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/33** **RF3** **03/10/2014**	**/34** **RF4** **03/10/2014**	**/35** **RF6** **03/10/2014**	**/36** **RF7** **03/10/2014**
Total Petroleum Hydrocarbons						
Poly Aromatic Hydrocarbons						
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-BHC	04-024	µg/kg	<2	<2	<2	<2
beta-BHC	04-024	µg/kg	<2	<2	<2	<2
gamma-BHC (Lindane)	04-024	µg/kg	<2	<2	<2	<2
delta-BHC	04-024	µg/kg	<2	<2	<2	<2
cis-Chlordane	04-024	µg/kg	<2	<2	<2	<2
trans-Chlordane	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDD	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDE	04-024	µg/kg	4.0	<2	3.0	9.0
p,p'-DDT	04-024	µg/kg	4.0	<2	4.0	6.0
Dieldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
beta-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
Endosulfan Sulphate	04-024	µg/kg	<2	<2	<2	<2
Endrin	04-024	µg/kg	<2	<2	<2	<2
Endrin ketone	04-024	µg/kg	<2	<2	<2	<2
Endrin aldehyde	04-024	µg/kg	<2	<2	<2	<2
Heptachlor	04-024	µg/kg	<2	<2	<2	<2
Heptachlor epoxide	04-024	µg/kg	<2	<2	<2	<2
Hexachlorobenzene	04-024	µg/kg	<2	<2	<2	<2
Methoxychlor	04-024	µg/kg	<2	<2	<2	<2
Oxychlordane*	04-024	µg/kg	<2	<2	<2	<2
Surrogate Recovery	04-024	%	98	98	102	101
Date Extracted	04-024	-	8/10/2014	8/10/2014	8/10/2014	8/10/2014
Date Analysed	04-024	-	14/10/2014	14/10/2014	14/10/2014	14/10/2014
Polychlorinated Biphenyls						
Organotins						
Monobutyl tin	04-026	µgSn/kg	<10	<10	<10	<10
Dibutyl tin	04-026	µgSn/kg	<1.0	<0.50	<1.0	1.1
Tributyl tin	04-026	µgSn/kg	<1.0	<0.50	<1.0	<1.0

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Laboratory Reference:	-	-	**/33**	**/34**	**/35**	**/36**
Client Reference:	-	-	**RF3**	**RF4**	**RF6**	**RF7**
Date Sampled:	-	-	**03/10/2014**	**03/10/2014**	**03/10/2014**	**03/10/2014**
Analysis Description	**Method**	**Units**				
Surrogate 1 Recovery	04-026	%	74	78	77	76
Date Extracted	04-026	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014
Date Analysed	04-026	-	18/10/2014	18/10/2014	18/10/2014	18/10/2014
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.4	0.97	1.1	1.6
Particle Size Distribution	SUB		To follow	To follow	To follow	To follow

Laboratory Reference:	-	-	**/37**	**/38**	**/39**	**/41**
Client Reference:	-	-	**16-1**	**16-0**	**11-9B**	**10-6B**
Date Sampled:	-	-	**03/10/2014**	**03/10/2014**	**02/10/2014**	**02/10/2014**
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	25.4	57.4	52.1	54.7
Trace Elements						
Aluminium	04-001	mg/kg	5,900	21,000	22,000	20,000
Arsenic	04-001	mg/kg	3.7	6.7	6.9	5.9
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	15	39	39	35
Copper	04-001	mg/kg	6.7	27	25	23
Iron	04-001	mg/kg	16,000	37,000	38,000	34,000
Lead	04-001	mg/kg	3.4	15	12	11
Mercury	04-002	mg/kg	0.09	0.09	0.09	0.07
Nickel	04-001	mg/kg	12	24	26	22
Phosphorus*	04-001	mg/kg	280	740	730	680
Silver	04-001	mg/kg	<0.25	<0.25	<0.25	<0.25
Zinc	04-001	mg/kg	26	86	77	76
BTEX						
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	[NA]	[NA]	[NA]	<10
TPH C10-14	04-020	mg/kg	[NA]	[NA]	[NA]	<10
TPH C15-28	04-020	mg/kg	[NA]	[NA]	[NA]	68
TPH C29-36	04-020	mg/kg	[NA]	[NA]	[NA]	82

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/37** **16-1** **03/10/2014**	**/38** **16-0** **03/10/2014**	**/39** **11-9B** **02/10/2014**	**/41** **10-6B** **02/10/2014**
Surrogate Recovery	04-020	%	[NA]	[NA]	[NA]	120
Date Extracted	04-020	-	[NA]	[NA]	[NA]	8/10/2014
Date Analysed	04-020	-	[NA]	[NA]	[NA]	10/10/2014
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
1-Methylnaphthalene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
2-Methylnaphthalene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
Acenaphthylene	04-022	µg/kg	[NA]	[NA]	[NA]	8.0
Acenaphthene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
Fluorene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
Phenanthrene	04-022	µg/kg	[NA]	[NA]	[NA]	14
Anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
Fluoranthene	04-022	µg/kg	[NA]	[NA]	[NA]	48
Pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	53
Benz(a)anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	27
Chrysene	04-022	µg/kg	[NA]	[NA]	[NA]	27
Benzo(b)&(k)fluoranthene	04-022	µg/kg	[NA]	[NA]	[NA]	76
Benzo(a)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	44
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	57
Dibenz(a,h)anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	9.0
Benzo(g,h,i)perylene	04-022	µg/kg	[NA]	[NA]	[NA]	38
Coronene	04-022	µg/kg	[NA]	[NA]	[NA]	<10
Benzo(e)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	30
Perylene	04-022	µg/kg	[NA]	[NA]	[NA]	87
Total PAHs (as above)	04-022	µg/kg	[NA]	[NA]	[NA]	520
Surrogate 1 Recovery	04-022	%	[NA]	[NA]	[NA]	111
Surrogate 2 Recovery	04-022	%	[NA]	[NA]	[NA]	104
Surrogate 3 Recovery	04-022	%	[NA]	[NA]	[NA]	110
Date Extracted	04-022	-	[NA]	[NA]	[NA]	17/10/2014
Date Analysed	04-022	-	[NA]	[NA]	[NA]	18/10/2014
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-BHC	04-024	µg/kg	<2	<2	<2	<2

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beta-BHC	04-024	µg/kg	<2	<2	<2	<2
gamma-BHC (Lindane)	04-024	µg/kg	<2	<2	<2	<2
delta-BHC	04-024	µg/kg	<2	<2	<2	<2
cis-Chlordane	04-024	µg/kg	<2	<2	<2	<2
trans-Chlordane	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDD	04-024	µg/kg	<2	<2	<2	<2
p,p'-DDE	04-024	µg/kg	<2	4.0	5.0	5.0
p,p'-DDT	04-024	µg/kg	<2	5.0	6.0	6.0
Dieldrin	04-024	µg/kg	<2	<2	<2	<2
alpha-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
beta-Endosulfan	04-024	µg/kg	<2	<2	<2	<2
Endosulfan Sulphate	04-024	µg/kg	<2	<2	<2	<2
Endrin	04-024	µg/kg	<2	<2	<2	<2
Endrin ketone	04-024	µg/kg	<2	<2	<2	<2
Endrin aldehyde	04-024	µg/kg	<2	<2	<2	<2
Heptachlor	04-024	µg/kg	<2	<2	<2	<2
Heptachlor epoxide	04-024	µg/kg	<2	<2	<2	<2
Hexachlorobenzene	04-024	µg/kg	<2	<2	<2	<2
Methoxychlor	04-024	µg/kg	<2	<2	<2	<2
Oxychlordane*	04-024	µg/kg	<2	<2	<2	<2
Surrogate Recovery	04-024	%	98	96	104	112
Date Extracted	04-024	-	8/10/2014	8/10/2014	8/10/2014	8/10/2014
Date Analysed	04-024	-	14/10/2014	14/10/2014	14/10/2014	15/10/2014
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Di-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Tri-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Tetra-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Penta-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Hexa-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Hepta-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Octa-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Nona-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0

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Deca-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Total PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Surrogate 1 Recovery	04-029	%	[NA]	[NA]	[NA]	103
Surrogate 2 Recovery	04-029	%	[NA]	[NA]	[NA]	105
Date Extracted	04-029	-	[NA]	[NA]	[NA]	8/10/2014
Date Analysed	04-029	-	[NA]	[NA]	[NA]	15/10/2014
Organotins						
Monobutyl tin	04-026	µgSn/kg	<10	<10	<10	<10
Dibutyl tin	04-026	µgSn/kg	1.0	1.1	0.60	0.50
Tributyl tin	04-026	µgSn/kg	2.4	0.80	<0.50	<0.50
Surrogate 1 Recovery	04-026	%	87	79	74	76
Date Extracted	04-026	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014
Date Analysed	04-026	-	18/10/2014	18/10/2014	18/10/2014	18/10/2014
Subcontract Analysis						
Total Organic Carbon	SUB	%	0.25	1.3	1.6	1.1
Nitrate as N	SUB	mg/kg	[NA]	[NA]	[NA]	<0.1
Nitrite as N	SUB	mg/kg	[NA]	[NA]	[NA]	<0.1
Total Kjeldahl Nitrogen	SUB	mg/kg	[NA]	[NA]	[NA]	1,000
Total Nitrogen	SUB	mg/kg	[NA]	[NA]	[NA]	1,000
Particle Size Distribution	SUB		To follow	To follow	To follow	To follow
Gross Alpha	SUB	mBq/g	[NA]	[NA]	[NA]	<60
Gross Beta	SUB	mBq/g	[NA]	[NA]	[NA]	<135
Chromium Reducible Suite	SUB		[NA]	[NA]	[NA]	See Comments

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/43** **5-1C** **01/10/2014**	**/44** **11-9C** **02/10/2014**	**/45** **13-4C** **03/10/2014**	**/46** **Trip Blank** **01/10/2014**
Moisture Content						
Moisture Content	04-004	%	55.8	52.6	22.1	0.3
Trace Elements						
Aluminium	04-001	mg/kg	23,000	23,000	5,900	[NA]
Arsenic	04-001	mg/kg	6.0	7.3	4.6	[NA]
Cadmium	04-001	mg/kg	0.17	<0.1	<0.1	[NA]
Chromium	04-001	mg/kg	42	42	18	[NA]
Copper	04-001	mg/kg	30	28	19	[NA]
Iron	04-001	mg/kg	37,000	41,000	17,000	[NA]
Lead	04-001	mg/kg	24	13	20	[NA]
Mercury	04-002	mg/kg	0.15	0.1	0.02	[NA]
Nickel	04-001	mg/kg	22	29	9.3	[NA]
Phosphorus*	04-001	mg/kg	680	830	340	[NA]
Silver	04-001	mg/kg	0.51	<0.25	<0.25	[NA]
Zinc	04-001	mg/kg	100	84	140	[NA]
BTEX						
Benzene	04-021	mg/kg	[NA]	[NA]	[NA]	<0.20
Toluene	04-021	mg/kg	[NA]	[NA]	[NA]	<0.20
Ethyl Benzene	04-021	mg/kg	[NA]	[NA]	[NA]	<0.20
m+p xylenes	04-021	mg/kg	[NA]	[NA]	[NA]	<0.40
o-xylene	04-021	mg/kg	[NA]	[NA]	[NA]	<0.20
Total BTEX	04-021	mg/kg	[NA]	[NA]	[NA]	<1.2
Surrogate 1 Recovery	04-021	%	[NA]	[NA]	[NA]	94
Surrogate 2 Recovery	04-021	%	[NA]	[NA]	[NA]	85
Surrogate 3 Recovery	04-021	%	[NA]	[NA]	[NA]	80
Date Extracted	04-021	-	[NA]	[NA]	[NA]	8/10/2014
Date Analysed	04-021	-	[NA]	[NA]	[NA]	9/10/2014
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	[NA]	[NA]	<10
TPH C10-14	04-020	mg/kg	<10	[NA]	[NA]	[NA]
TPH C15-28	04-020	mg/kg	52	[NA]	[NA]	[NA]
TPH C29-36	04-020	mg/kg	79	[NA]	[NA]	[NA]
Surrogate Recovery	04-020	%	87	[NA]	[NA]	85

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/43** **5-1C** **01/10/2014**	**/44** **11-9C** **02/10/2014**	**/45** **13-4C** **03/10/2014**	**/46** **Trip Blank** **01/10/2014**
Date Extracted	04-020	-	8/10/2014	[NA]	[NA]	8/10/2014
Date Analysed	04-020	-	10/10/2014	[NA]	[NA]	9/10/2014
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
1-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
2-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Acenaphthylene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Acenaphthene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Fluorene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Phenanthrene	04-022	µg/kg	12	[NA]	[NA]	[NA]
Anthracene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Fluoranthene	04-022	µg/kg	43	[NA]	[NA]	[NA]
Pyrene	04-022	µg/kg	54	[NA]	[NA]	[NA]
Benz(a)anthracene	04-022	µg/kg	27	[NA]	[NA]	[NA]
Chrysene	04-022	µg/kg	24	[NA]	[NA]	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	68	[NA]	[NA]	[NA]
Benzo(a)pyrene	04-022	µg/kg	33	[NA]	[NA]	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	39	[NA]	[NA]	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	6.0	[NA]	[NA]	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	31	[NA]	[NA]	[NA]
Coronene	04-022	µg/kg	<10	[NA]	[NA]	[NA]
Benzo(e)pyrene	04-022	µg/kg	26	[NA]	[NA]	[NA]
Perylene	04-022	µg/kg	60	[NA]	[NA]	[NA]
Total PAHs (as above)	04-022	µg/kg	420	[NA]	[NA]	[NA]
Surrogate 1 Recovery	04-022	%	77	[NA]	[NA]	[NA]
Surrogate 2 Recovery	04-022	%	72	[NA]	[NA]	[NA]
Surrogate 3 Recovery	04-022	%	82	[NA]	[NA]	[NA]
Date Extracted	04-022	-	8/10/2014	[NA]	[NA]	[NA]
Date Analysed	04-022	-	15/10/2014	[NA]	[NA]	[NA]
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	<2	<2	[NA]
alpha-BHC	04-024	µg/kg	<2	<2	<2	[NA]
beta-BHC	04-024	µg/kg	<2	<2	<2	[NA]

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Laboratory Reference:	-	-	**/43**	**/44**	**/45**	**/46**
Client Reference:	-	-	**5-1C**	**11-9C**	**13-4C**	**Trip Blank**
Date Sampled:	-	-	**01/10/2014**	**02/10/2014**	**03/10/2014**	**01/10/2014**
Analysis Description	**Method**	**Units**				
gamma-BHC (Lindane)	04-024	µg/kg	<2	<2	<2	[NA]
delta-BHC	04-024	µg/kg	<2	<2	<2	[NA]
cis-Chlordane	04-024	µg/kg	<2	<2	<2	[NA]
trans-Chlordane	04-024	µg/kg	<2	<2	<2	[NA]
p,p'-DDD	04-024	µg/kg	<2	<2	<2	[NA]
p,p'-DDE	04-024	µg/kg	4.0	6.0	<2	[NA]
p,p'-DDT	04-024	µg/kg	3.0	5.0	<2	[NA]
Dieldrin	04-024	µg/kg	<2	<2	<2	[NA]
alpha-Endosulfan	04-024	µg/kg	<2	<2	<2	[NA]
beta-Endosulfan	04-024	µg/kg	<2	<2	<2	[NA]
Endosulfan Sulphate	04-024	µg/kg	<2	<2	<2	[NA]
Endrin	04-024	µg/kg	<2	<2	<2	[NA]
Endrin ketone	04-024	µg/kg	<2	<2	<2	[NA]
Endrin aldehyde	04-024	µg/kg	<2	<2	<2	[NA]
Heptachlor	04-024	µg/kg	<2	<2	<2	[NA]
Heptachlor epoxide	04-024	µg/kg	<2	<2	<2	[NA]
Hexachlorobenzene	04-024	µg/kg	<2	<2	<2	[NA]
Methoxychlor	04-024	µg/kg	<2	<2	<2	[NA]
Oxychlordane*	04-024	µg/kg	<2	<2	<2	[NA]
Surrogate Recovery	04-024	%	85	103	98	[NA]
Date Extracted	04-024	-	8/10/2014	8/10/2014	8/10/2014	[NA]
Date Analysed	04-024	-	15/10/2014	15/10/2014	15/10/2014	[NA]
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Di-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Tri-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Tetra-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Penta-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Hexa-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Hepta-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Octa-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Nona-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Deca-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/43** **5-1C** **01/10/2014**	**/44** **11-9C** **02/10/2014**	**/45** **13-4C** **03/10/2014**	**/46** **Trip Blank** **01/10/2014**
Total PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Surrogate 1 Recovery	04-029	%	75	[NA]	[NA]	[NA]
Surrogate 2 Recovery	04-029	%	80	[NA]	[NA]	[NA]
Date Extracted	04-029	-	8/10/2014	[NA]	[NA]	[NA]
Date Analysed	04-029	-	15/10/2014	[NA]	[NA]	[NA]
Organotins						
Monobutyl tin	04-026	µgSn/kg	<10	<10	<10	[NA]
Dibutyl tin	04-026	µgSn/kg	3.6	0.80	<0.50	[NA]
Tributyl tin	04-026	µgSn/kg	3.7	0.60	<0.50	[NA]
Surrogate 1 Recovery	04-026	%	74	65	87	[NA]
Date Extracted	04-026	-	17/10/2014	17/10/2014	17/10/2014	[NA]
Date Analysed	04-026	-	18/10/2014	18/10/2014	18/10/2014	[NA]
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.2	1.6	0.15	[NA]
Nitrate as N	SUB	mg/kg	<0.1	[NA]	[NA]	[NA]
Nitrite as N	SUB	mg/kg	<0.1	[NA]	[NA]	[NA]
Total Kjeldahl Nitrogen	SUB	mg/kg	910	[NA]	[NA]	[NA]
Total Nitrogen	SUB	mg/kg	910	[NA]	[NA]	[NA]
Particle Size Distribution	SUB		To follow	To follow	To follow	[NA]
Gross Alpha	SUB	mBq/g	<60	[NA]	[NA]	[NA]
Gross Beta	SUB	mBq/g	<135	[NA]	[NA]	[NA]
Chromium Reducible Suite	SUB		See Comments	[NA]	[NA]	[NA]

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Laboratory Reference:	**-**	**-**	**/47**
Client Reference:	**-**	**-**	**Trip Blank**
Date Sampled:	**-**	**-**	**02/10/2014**
Analysis Description	**Method**	**Units**	
Moisture Content			
Moisture Content	04-004	%	0.1
Trace Elements			
BTEX			
Benzene	04-021	mg/kg	<0.20
Toluene	04-021	mg/kg	<0.20
Ethyl Benzene	04-021	mg/kg	<0.20
m+p xylenes	04-021	mg/kg	<0.40
o-xylene	04-021	mg/kg	<0.20
Total BTEX	04-021	mg/kg	<1.2
Surrogate 1 Recovery	04-021	%	96
Surrogate 2 Recovery	04-021	%	93
Surrogate 3 Recovery	04-021	%	85
Date Extracted	04-021	-	8/10/2014
Date Analysed	04-021	-	9/10/2014
Total Petroleum Hydrocarbons			
TPH C6-C9	04-021	mg/kg	<10
Surrogate Recovery	04-020	%	93
Date Extracted	04-020	-	8/10/2014
Date Analysed	04-020	-	9/10/2014
Poly Aromatic Hydrocarbons			
Organochlorine Pesticides			
Polychlorinated Biphenyls			
Organotins			
Subcontract Analysis			

Method	Method Description
04-004	Moisture by gravimetric, %
04-001	Metals by ICP-OES, mg/kg
04-002	Mercury by CVAAS, mg/kg
04-021	TRH C6-9 & BTEX by P&T GCMS, mg/kg
04-020	TRH by GC-FID, mg/kg
04-022	PAHs & Phenols by GCMS

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Method	Method Description
04-024	OC & OP Pesticides by GCMS
04-029	PCBS (as congeners) by GCMS, µg/kg
04-026	Organotins by GCMS, µgSn/kg
SUB	Subcontracted Analyses

Result Comments
[<] Less than
[INS] Insufficient sample for this test
[NA] Test not required
*Analyte is not covered by NATA scope of accreditation.
Radionuclides (Gross Alpha/Beta Analysis) was subcontracted to
Western Radiation Services (NATA # 14174);
reference report number 8084 Western Radiation.pdf
Analysis was subcontracted to Sydney Analytical Laboratories (NATA Number 1884);
reference SAL report number SAL25254.
Particle size analysis was subcontracted to Microanalysis Australia; see attached report
Microanalysis Particle Counting reports.zip
sPOCAS & CRS analysis was subcontracted to Envirolab Services (NATA Number 2901);
reference Envirolab certificate number 117367.
The LOR for MBT has been raised in all samples due to spiked samples
producing low recoveries.
Spike recovery for aluminium and iron could not be accurately determined due to significant levels of analyte present in sample
LOR for Ag is raised to 0.25mg/kg.

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QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aluminium	mg/kg	<5	A14/5575-A-1	21000||22000||RPD: 5	A14/5575-A-1	#
Arsenic	mg/kg	<0.4	A14/5575-A-1	7.2||7.2||RPD: 0	A14/5575-A-1	103%
Cadmium	mg/kg	<0.1	A14/5575-A-1	<0.1||<0.1	A14/5575-A-1	107%
Chromium	mg/kg	<0.1	A14/5575-A-1	38||38||RPD: 0	A14/5575-A-1	100%
Copper	mg/kg	<0.1	A14/5575-A-1	39||40||RPD: 3	A14/5575-A-1	104%
Iron	mg/kg	<5	A14/5575-A-1	35000||36000||RPD: 3	A14/5575-A-1	#
Lead	mg/kg	<0.5	A14/5575-A-1	27||25||RPD: 8	A14/5575-A-1	90%
Mercury	mg/kg	<0.01	A14/5575-A-1	0.1||0.10||RPD: 0	A14/5575-A-1	78%
Nickel	mg/kg	<0.1	A14/5575-A-1	26||26||RPD: 0	A14/5575-A-1	92%
Phosphorus*	mg/kg	<1	A14/5575-A-1	870||860||RPD: 1	A14/5575-A-1	108%
Silver	mg/kg	<0.1	A14/5575-A-1	<0.25||<0.25	A14/5575-A-1	106%
Zinc	mg/kg	<0.5	A14/5575-A-1	140||140||RPD: 0	A14/5575-A-1	90%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Benzene	mg/kg	<0.20	[NT]	[NT]	External	78%
Toluene	mg/kg	<0.20	[NT]	[NT]	External	81%
Ethyl Benzene	mg/kg	<0.20	[NT]	[NT]	External	87%
m+p xylenes	mg/kg	<0.40	[NT]	[NT]	External	84%
o-xylene	mg/kg	<0.20	[NT]	[NT]	External	87%
Total BTEX	mg/kg	<1.2	[NT]	[NT]	External	[NA]
Surrogate 1 Recovery	%	90	[NT]	[NT]	External	85%
Surrogate 2 Recovery	%	87	[NT]	[NT]	External	89%
Surrogate 3 Recovery	%	85	[NT]	[NT]	External	86%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
TPH C6-C9	mg/kg	<10	[NT]	[NT]	External	69%
TPH C10-14	mg/kg	<10	[NT]	[NT]	External	101%
TPH C15-28	mg/kg	<50	[NT]	[NT]	External	105%
TPH C29-36	mg/kg	<50	[NT]	[NT]	External	108%
Surrogate Recovery	%	122	[NT]	[NT]	External	107%

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TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Naphthalene	µg/kg	<5.0	[NT]	[NT]	External	95%
1-Methylnaphthalene	µg/kg	<5.0	[NT]	[NT]	External	92%
2-Methylnaphthalene	µg/kg	<5.0	[NT]	[NT]	External	94%
Acenaphthylene	µg/kg	<5.0	[NT]	[NT]	External	93%
Acenaphthene	µg/kg	<5.0	[NT]	[NT]	External	94%
Fluorene	µg/kg	<5.0	[NT]	[NT]	External	99%
Phenanthrene	µg/kg	<5.0	[NT]	[NT]	External	99%
Anthracene	µg/kg	<5.0	[NT]	[NT]	External	91%
Fluoranthene	µg/kg	<5.0	[NT]	[NT]	External	94%
Pyrene	µg/kg	<5.0	[NT]	[NT]	External	95%
Benz(a)anthracene	µg/kg	<5.0	[NT]	[NT]	External	96%
Chrysene	µg/kg	<5.0	[NT]	[NT]	External	98%
Benzo(b)&(k)fluoranthene	µg/kg	<10	[NT]	[NT]	External	99%
Benzo(a)pyrene	µg/kg	<5.0	[NT]	[NT]	External	93%
Indeno(1,2,3-cd)pyrene	µg/kg	<5.0	[NT]	[NT]	External	95%
Dibenz(a,h)anthracene	µg/kg	<5.0	[NT]	[NT]	External	90%
Benzo(g,h,i)perylene	µg/kg	<5.0	[NT]	[NT]	External	96%
Coronene	µg/kg	<10	[NT]	[NT]	External	99%
Benzo(e)pyrene	µg/kg	<5.0	[NT]	[NT]	External	97%
Perylene	µg/kg	<5.0	[NT]	[NT]	External	93%
Total PAHs (as above)	µg/kg	<100	[NT]	[NT]	External	[NA]
Surrogate 1 Recovery	%	98	[NT]	[NT]	External	94%
Surrogate 2 Recovery	%	83	[NT]	[NT]	External	93%
Surrogate 3 Recovery	%	106	[NT]	[NT]	External	99%

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TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	103%
alpha-BHC	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	110%
beta-BHC	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	103%
gamma-BHC (Lindane)	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	106%
delta-BHC	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	105%
cis-Chlordane	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	106%
trans-Chlordane	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	108%
p,p'-DDD	µg/kg	<1.0	A14/5575-A-1	2.0 || 3.0 || RPD: 40	External	106%
p,p'-DDE	µg/kg	<1.0	A14/5575-A-1	6.0 || 7.0 || RPD: 15	External	111%
p,p'-DDT	µg/kg	<1.0	A14/5575-A-1	7.0 || 7.0 || RPD: 0	External	124%
Dieldrin	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	112%
alpha-Endosulfan	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	110%
beta-Endosulfan	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	111%
Endosulfan Sulphate	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	104%
Endrin	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	128%
Endrin ketone	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	104%
Endrin aldehyde	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	94%
Heptachlor	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	122%
Heptachlor epoxide	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	107%
Hexachlorobenzene	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	105%
Methoxychlor	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	124%
Oxychlordane*	µg/kg	<1.0	A14/5575-A-1	<2 || <2	External	98%
Surrogate Recovery	%	98	A14/5575-A-1	107 || 99 || RPD: 8	External	101%

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TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Mono-PCB congeners	µg/kg	<5.0	[NT]	[NT]	External	99%
Di-PCB congeners	µg/kg	<5.0	[NT]	[NT]	External	91%
Tri-PCB congeners	µg/kg	<5.0	[NT]	[NT]	External	92%
Tetra-PCB congeners	µg/kg	<5.0	[NT]	[NT]	External	91%
Penta-PCB congeners	µg/kg	<5.0	[NT]	[NT]	External	91%
Hexa-PCB congeners	µg/kg	<5.0	[NT]	[NT]	External	97%
Hepta-PCB congeners	µg/kg	<5.0	[NT]	[NT]	External	97%
Octa-PCB congeners	µg/kg	<5.0	[NT]	[NT]	External	100%
Nona-PCB congeners	µg/kg	<5.0	[NT]	[NT]	External	95%
Deca-PCB congeners	µg/kg	<5.0	[NT]	[NT]	External	94%
Total PCB congeners	µg/kg	<5.0	[NT]	[NT]	External	99%
Surrogate 1 Recovery	%	91	[NT]	[NT]	External	101%
Surrogate 2 Recovery	%	92	[NT]	[NT]	External	103%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	<0.50	A14/5575-A-1	<10||<10	External	95%
Dibutyl tin	µgSn/kg	<0.50	A14/5575-A-1	1.3||1.7||RPD: 27	External	100%
Tributyl tin	µgSn/kg	<0.50	A14/5575-A-1	2.1||2.2||RPD: 5	External	96%
Surrogate 1 Recovery	%	94	A14/5575-A-1	74||79||RPD: 7	External	95%

TEST	UNITS	Blank
Total Organic Carbon	%	<0.01
Total Nitrogen	mg/kg	<20

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aluminium	mg/kg	[NT]	A14/5575-A-11	26000||27000||RPD: 4	A14/5575-A-21	#
Arsenic	mg/kg	[NT]	A14/5575-A-11	7.3||7.2||RPD: 1	A14/5575-A-21	103%
Cadmium	mg/kg	[NT]	A14/5575-A-11	<0.1||<0.1	A14/5575-A-21	107%
Chromium	mg/kg	[NT]	A14/5575-A-11	46||46||RPD: 0	A14/5575-A-21	100%
Copper	mg/kg	[NT]	A14/5575-A-11	34||34||RPD: 0	A14/5575-A-21	107%
Iron	mg/kg	[NT]	A14/5575-A-11	45000||46000||RPD: 2	A14/5575-A-21	#
Lead	mg/kg	[NT]	A14/5575-A-11	14||14||RPD: 0	A14/5575-A-21	87%
Mercury	mg/kg	[NT]	A14/5575-A-11	0.10||0.1||RPD: 0	A14/5575-A-21	79%
Nickel	mg/kg	[NT]	A14/5575-A-11	32||32||RPD: 0	A14/5575-A-21	91%
Phosphorus*	mg/kg	[NT]	A14/5575-A-11	980||980||RPD: 0	A14/5575-A-21	108%
Silver	mg/kg	[NT]	A14/5575-A-11	<0.25||<0.25	A14/5575-A-21	107%
Zinc	mg/kg	[NT]	A14/5575-A-11	97||97||RPD: 0	A14/5575-A-21	93%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
TPH C6-C9	mg/kg	[NT]	A14/5575-A-11	<20 || <20
TPH C10-14	mg/kg	[NT]	A14/5575-A-11	<20 || <20
TPH C15-28	mg/kg	[NT]	A14/5575-A-11	<100 || <100
TPH C29-36	mg/kg	[NT]	A14/5575-A-11	<100 || <100
Surrogate Recovery	%	[NT]	A14/5575-A-11	100 || 108 || RPD: 8

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	100%
alpha-BHC	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	99%
beta-BHC	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	114%
gamma-BHC (Lindane)	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	99%
delta-BHC	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	114%
cis-Chlordane	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	94%
trans-Chlordane	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	98%
p,p'-DDD	µg/kg	[NT]	A14/5575-A-11	6.0 || 5.0 || RPD: 18	A14/5575-A-1	112%
p,p'-DDE	µg/kg	[NT]	A14/5575-A-11	6.0 || 6.0 || RPD: 0	A14/5575-A-1	98%
p,p'-DDT	µg/kg	[NT]	A14/5575-A-11	6.0 || 7.0 || RPD: 15	A14/5575-A-1	115%
Dieldrin	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	103%
alpha-Endosulfan	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	96%
beta-Endosulfan	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	109%
Endosulfan Sulphate	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	106%
Endrin	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	129%
Endrin ketone	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	100%
Endrin aldehyde	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	88%
Heptachlor	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	105%
Heptachlor epoxide	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	100%
Hexachlorobenzene	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	99%
Methoxychlor	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	139%
Oxychlordane*	µg/kg	[NT]	A14/5575-A-11	<2 || <2	A14/5575-A-1	101%
Surrogate Recovery	%	[NT]	A14/5575-A-11	98 || 102 || RPD: 4	A14/5575-A-1	91%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mono-PCB congeners	µg/kg	[NT]	A14/5575-A-11	<5.0||<5.0
Di-PCB congeners	µg/kg	[NT]	A14/5575-A-11	<5.0||<5.0
Tri-PCB congeners	µg/kg	[NT]	A14/5575-A-11	<5.0||<5.0
Tetra-PCB congeners	µg/kg	[NT]	A14/5575-A-11	<5.0||<5.0
Penta-PCB congeners	µg/kg	[NT]	A14/5575-A-11	<5.0||<5.0
Hexa-PCB congeners	µg/kg	[NT]	A14/5575-A-11	<5.0||<5.0
Hepta-PCB congeners	µg/kg	[NT]	A14/5575-A-11	<5.0||<5.0
Octa-PCB congeners	µg/kg	[NT]	A14/5575-A-11	<5.0||<5.0
Nona-PCB congeners	µg/kg	[NT]	A14/5575-A-11	<5.0||<5.0
Deca-PCB congeners	µg/kg	[NT]	A14/5575-A-11	<5.0||<5.0
Total PCB congeners	µg/kg	[NT]	A14/5575-A-11	<5.0||<5.0
Surrogate 1 Recovery	%	[NT]	A14/5575-A-11	96||101||RPD: 5
Surrogate 2 Recovery	%	[NT]	A14/5575-A-11	100||106||RPD: 6

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	[NT]	A14/5575-A-11	<10||<10	A14/5575-A-1	#
Dibutyl tin	µgSn/kg	[NT]	A14/5575-A-11	<1.0||<1.0	A14/5575-A-1	71%
Tributyl tin	µgSn/kg	[NT]	A14/5575-A-11	1.3||1.1||RPD: 17	A14/5575-A-1	66%
Surrogate 1 Recovery	%	[NT]	A14/5575-A-11	80||74||RPD: 8	A14/5575-A-1	72%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aluminium	mg/kg	[NT]	A14/5575-A-21	18000||17000||RPD: 6	A14/5575-A-43	#
Arsenic	mg/kg	[NT]	A14/5575-A-21	5.1||5.2||RPD: 2	A14/5575-A-43	99%
Cadmium	mg/kg	[NT]	A14/5575-A-21	<0.1||<0.1	A14/5575-A-43	106%
Chromium	mg/kg	[NT]	A14/5575-A-21	30||30||RPD: 0	A14/5575-A-43	98%
Copper	mg/kg	[NT]	A14/5575-A-21	17||17||RPD: 0	A14/5575-A-43	106%
Iron	mg/kg	[NT]	A14/5575-A-21	29000||29000||RPD: 0	A14/5575-A-43	#
Lead	mg/kg	[NT]	A14/5575-A-21	8.8||8.8||RPD: 0	A14/5575-A-43	86%
Mercury	mg/kg	[NT]	A14/5575-A-21	0.05||0.06||RPD: 18	A14/5575-A-43	92%
Nickel	mg/kg	[NT]	A14/5575-A-21	21||21||RPD: 0	A14/5575-A-43	89%
Phosphorus*	mg/kg	[NT]	A14/5575-A-21	600||600||RPD: 0	A14/5575-A-43	103%
Silver	mg/kg	[NT]	A14/5575-A-21	<0.25||<0.25	A14/5575-A-43	105%
Zinc	mg/kg	[NT]	A14/5575-A-21	57||58||RPD: 2	A14/5575-A-43	91%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
TPH C6-C9	mg/kg	[NT]	A14/5575-A-21	<10 || <10	A14/5575-A-21	66%
TPH C10-14	mg/kg	[NT]	A14/5575-A-21	<10 || <10	A14/5575-A-21	107%
TPH C15-28	mg/kg	[NT]	A14/5575-A-21	<50 || <50	A14/5575-A-21	118%
TPH C29-36	mg/kg	[NT]	A14/5575-A-21	<50 || <50	A14/5575-A-21	113%
Surrogate Recovery	%	[NT]	A14/5575-A-21	111 || 114 || RPD: 3	A14/5575-A-21	111%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Naphthalene	µg/kg	[NT]	A14/5575-A-21	<5.0 || <5.0	A14/5575-A-21	118%
1-Methylnaphthalene	µg/kg	[NT]	A14/5575-A-21	<5.0 || <5.0	A14/5575-A-21	120%
2-Methylnaphthalene	µg/kg	[NT]	A14/5575-A-21	<5.0 || <5.0	A14/5575-A-21	120%
Acenaphthylene	µg/kg	[NT]	A14/5575-A-21	<5.0 || <5.0	A14/5575-A-21	123%
Acenaphthene	µg/kg	[NT]	A14/5575-A-21	<5.0 || <5.0	A14/5575-A-21	119%
Fluorene	µg/kg	[NT]	A14/5575-A-21	<5.0 || <5.0	A14/5575-A-21	124%
Phenanthrene	µg/kg	[NT]	A14/5575-A-21	8.0 || 9.0 || RPD: 12	A14/5575-A-21	120%
Anthracene	µg/kg	[NT]	A14/5575-A-21	<5.0 || <5.0	A14/5575-A-21	117%
Fluoranthene	µg/kg	[NT]	A14/5575-A-21	26 || 36 || RPD: 32	A14/5575-A-21	132%
Pyrene	µg/kg	[NT]	A14/5575-A-21	30 || 39 || RPD: 26	A14/5575-A-21	132%
Benz(a)anthracene	µg/kg	[NT]	A14/5575-A-21	14 || 19 || RPD: 30	A14/5575-A-21	129%
Chrysene	µg/kg	[NT]	A14/5575-A-21	14 || 19 || RPD: 30	A14/5575-A-21	126%
Benzo(b)&(k)fluoranthene	µg/kg	[NT]	A14/5575-A-21	35 || 43 || RPD: 21	A14/5575-A-21	120%
Benzo(a)pyrene	µg/kg	[NT]	A14/5575-A-21	19 || 24 || RPD: 23	A14/5575-A-21	115%
Indeno(1,2,3-cd)pyrene	µg/kg	[NT]	A14/5575-A-21	25 || 25 || RPD: 0	A14/5575-A-21	127%
Dibenz(a,h)anthracene	µg/kg	[NT]	A14/5575-A-21	<5.0 || <5.0	A14/5575-A-21	130%
Benzo(g,h,i)perylene	µg/kg	[NT]	A14/5575-A-21	14 || 19 || RPD: 30	A14/5575-A-21	120%
Coronene	µg/kg	[NT]	A14/5575-A-21	<10 || <10	A14/5575-A-21	130%
Benzo(e)pyrene	µg/kg	[NT]	A14/5575-A-21	14 || 18 || RPD: 25	A14/5575-A-21	118%
Perylene	µg/kg	[NT]	A14/5575-A-21	76 || 50 || RPD: 41	A14/5575-A-21	114%
Total PAHs (as above)	µg/kg	[NT]	A14/5575-A-21	270 || 300 || RPD: 11	A14/5575-A-21	[NA]
Surrogate 1 Recovery	%	[NT]	A14/5575-A-21	100 || 92 || RPD: 8	A14/5575-A-21	116%
Surrogate 2 Recovery	%	[NT]	A14/5575-A-21	96 || 92 || RPD: 4	A14/5575-A-21	108%
Surrogate 3 Recovery	%	[NT]	A14/5575-A-21	107 || 100 || RPD: 7	A14/5575-A-21	120%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	116%
alpha-BHC	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	116%
beta-BHC	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	123%
gamma-BHC (Lindane)	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	114%
delta-BHC	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	129%
cis-Chlordane	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	120%
trans-Chlordane	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	123%
p,p'-DDD	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	126%
p,p'-DDE	µg/kg	[NT]	A14/5575-A-21	4.0 || 3.0 || RPD: 29	A14/5575-A-21	125%
p,p'-DDT	µg/kg	[NT]	A14/5575-A-21	4.0 || 4.0 || RPD: 0	A14/5575-A-21	144%
Dieldrin	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	128%
alpha-Endosulfan	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	123%
beta-Endosulfan	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	131%
Endosulfan Sulphate	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	123%
Endrin	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	152%
Endrin ketone	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	122%
Endrin aldehyde	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	136%
Heptachlor	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	157%
Heptachlor epoxide	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	132%
Hexachlorobenzene	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	117%
Methoxychlor	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	144%
Oxychlordane*	µg/kg	[NT]	A14/5575-A-21	<2 || <2	A14/5575-A-21	118%
Surrogate Recovery	%	[NT]	A14/5575-A-21	108 || 102 || RPD: 6	A14/5575-A-21	120%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Mono-PCB congeners	µg/kg	[NT]	A14/5575-A-21	<5.0||<5.0	A14/5575-A-21	117%
Di-PCB congeners	µg/kg	[NT]	A14/5575-A-21	<5.0||<5.0	A14/5575-A-21	115%
Tri-PCB congeners	µg/kg	[NT]	A14/5575-A-21	<5.0||<5.0	A14/5575-A-21	116%
Tetra-PCB congeners	µg/kg	[NT]	A14/5575-A-21	<5.0||<5.0	A14/5575-A-21	113%
Penta-PCB congeners	µg/kg	[NT]	A14/5575-A-21	<5.0||<5.0	A14/5575-A-21	108%
Hexa-PCB congeners	µg/kg	[NT]	A14/5575-A-21	<5.0||<5.0	A14/5575-A-21	107%
Hepta-PCB congeners	µg/kg	[NT]	A14/5575-A-21	<5.0||<5.0	A14/5575-A-21	108%
Octa-PCB congeners	µg/kg	[NT]	A14/5575-A-21	<5.0||<5.0	A14/5575-A-21	114%
Nona-PCB congeners	µg/kg	[NT]	A14/5575-A-21	<5.0||<5.0	A14/5575-A-21	107%
Deca-PCB congeners	µg/kg	[NT]	A14/5575-A-21	<5.0||<5.0	A14/5575-A-21	102%
Total PCB congeners	µg/kg	[NT]	A14/5575-A-21	<5.0||<5.0	A14/5575-A-21	111%
Surrogate 1 Recovery	%	[NT]	A14/5575-A-21	100||97||RPD: 3	A14/5575-A-21	116%
Surrogate 2 Recovery	%	[NT]	A14/5575-A-21	102||100||RPD: 2	A14/5575-A-21	116%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	[NT]	A14/5575-A-21	<10||<10	A14/5575-A-21	#
Dibutyl tin	µgSn/kg	[NT]	A14/5575-A-21	<0.50||<0.50	A14/5575-A-21	83%
Tributyl tin	µgSn/kg	[NT]	A14/5575-A-21	<0.50||<0.50	A14/5575-A-21	82%
Surrogate 1 Recovery	%	[NT]	A14/5575-A-21	80||76||RPD: 5	A14/5575-A-21	84%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aluminium	mg/kg	[NT]	A14/5575-A-31	22000||22000||RPD: 0
Arsenic	mg/kg	[NT]	A14/5575-A-31	7.9||7.8||RPD: 1
Cadmium	mg/kg	[NT]	A14/5575-A-31	<0.1||<0.1
Chromium	mg/kg	[NT]	A14/5575-A-31	37||36||RPD: 3
Copper	mg/kg	[NT]	A14/5575-A-31	15||15||RPD: 0
Iron	mg/kg	[NT]	A14/5575-A-31	35000||35000||RPD: 0
Lead	mg/kg	[NT]	A14/5575-A-31	10||10||RPD: 0
Mercury	mg/kg	[NT]	A14/5575-A-31	0.05||0.05||RPD: 0
Nickel	mg/kg	[NT]	A14/5575-A-31	20||20||RPD: 0
Phosphorus*	mg/kg	[NT]	A14/5575-A-31	560||550||RPD: 2
Silver	mg/kg	[NT]	A14/5575-A-31	<0.25||<0.25
Zinc	mg/kg	[NT]	A14/5575-A-31	56||55||RPD: 2

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	89%
alpha-BHC	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	95%
beta-BHC	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	100%
gamma-BHC (Lindane)	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	90%
delta-BHC	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	103%
cis-Chlordane	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	98%
trans-Chlordane	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	100%
p,p'-DDD	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	106%
p,p'-DDE	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	99%
p,p'-DDT	µg/kg	[NT]	A14/5575-A-31	3.0 || 3.0 || RPD: 0	A14/5575-A-41	96%
Dieldrin	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	103%
alpha-Endosulfan	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	100%
beta-Endosulfan	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	109%
Endosulfan Sulphate	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	99%
Endrin	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	125%
Endrin ketone	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	95%
Endrin aldehyde	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	104%
Heptachlor	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	122%
Heptachlor epoxide	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	102%
Hexachlorobenzene	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	92%
Methoxychlor	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	97%
Oxychlordane*	µg/kg	[NT]	A14/5575-A-31	<2 || <2	A14/5575-A-41	97%
Surrogate Recovery	%	[NT]	A14/5575-A-31	101 || 105 || RPD: 4	A14/5575-A-41	92%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Mono-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A14/5575-A-41	94%
Di-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A14/5575-A-41	90%
Tri-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A14/5575-A-41	92%
Tetra-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A14/5575-A-41	88%
Penta-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A14/5575-A-41	85%
Hexa-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A14/5575-A-41	84%
Hepta-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A14/5575-A-41	84%
Octa-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A14/5575-A-41	87%
Nona-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A14/5575-A-41	84%
Deca-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A14/5575-A-41	80%
Total PCB congeners	µg/kg	[NT]	[NT]	[NT]	A14/5575-A-41	87%
Surrogate 1 Recovery	%	[NT]	[NT]	[NT]	A14/5575-A-41	89%
Surrogate 2 Recovery	%	[NT]	[NT]	[NT]	A14/5575-A-41	90%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	[NT]	A14/5575-A-31	<10 || <10	A14/5575-A-41	#
Dibutyl tin	µgSn/kg	[NT]	A14/5575-A-31	<1.0 || <1.0	A14/5575-A-41	74%
Tributyl tin	µgSn/kg	[NT]	A14/5575-A-31	<1.0 || <1.0	A14/5575-A-41	77%
Surrogate 1 Recovery	%	[NT]	A14/5575-A-31	74 || 77 || RPD: 4	A14/5575-A-41	78%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aluminium	mg/kg	[NT]	A14/5575-A-43	23000 || 24000 || RPD: 4
Arsenic	mg/kg	[NT]	A14/5575-A-43	6.0 || 6.1 || RPD: 2
Cadmium	mg/kg	[NT]	A14/5575-A-43	0.17 || 0.17 || RPD: 0
Chromium	mg/kg	[NT]	A14/5575-A-43	42 || 42 || RPD: 0
Copper	mg/kg	[NT]	A14/5575-A-43	30 || 31 || RPD: 3
Iron	mg/kg	[NT]	A14/5575-A-43	37000 || 38000 || RPD: 3
Lead	mg/kg	[NT]	A14/5575-A-43	24 || 24 || RPD: 0
Mercury	mg/kg	[NT]	A14/5575-A-43	0.15 || 0.15 || RPD: 0
Nickel	mg/kg	[NT]	A14/5575-A-43	22 || 22 || RPD: 0
Phosphorus*	mg/kg	[NT]	A14/5575-A-43	680 || 680 || RPD: 0
Silver	mg/kg	[NT]	A14/5575-A-43	0.51 || 0.42 || RPD: 19
Zinc	mg/kg	[NT]	A14/5575-A-43	100 || 100 || RPD: 0

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Naphthalene	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
1-Methylnaphthalene	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
2-Methylnaphthalene	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Acenaphthylene	µg/kg	[NT]	A14/5575-A-41	8.0||<5.0
Acenaphthene	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Fluorene	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Phenanthrene	µg/kg	[NT]	A14/5575-A-41	14||9.0||RPD: 43
Anthracene	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Fluoranthene	µg/kg	[NT]	A14/5575-A-41	48||32||RPD: 40
Pyrene	µg/kg	[NT]	A14/5575-A-41	53||36||RPD: 38
Benz(a)anthracene	µg/kg	[NT]	A14/5575-A-41	27||20||RPD: 30
Chrysene	µg/kg	[NT]	A14/5575-A-41	27||19||RPD: 35
Benzo(b)&(k)fluoranthene	µg/kg	[NT]	A14/5575-A-41	76||49||RPD: 43
Benzo(a)pyrene	µg/kg	[NT]	A14/5575-A-41	44||24||RPD: 59
Indeno(1,2,3-cd)pyrene	µg/kg	[NT]	A14/5575-A-41	57||29||RPD: 65
Dibenz(a,h)anthracene	µg/kg	[NT]	A14/5575-A-41	9.0||<5.0
Benzo(g,h,i)perylene	µg/kg	[NT]	A14/5575-A-41	38||19||RPD: 67
Coronene	µg/kg	[NT]	A14/5575-A-41	<10||<10
Benzo(e)pyrene	µg/kg	[NT]	A14/5575-A-41	30||20||RPD: 40
Perylene	µg/kg	[NT]	A14/5575-A-41	87||77||RPD: 12
Total PAHs (as above)	µg/kg	[NT]	A14/5575-A-41	520||330||RPD: 45
Surrogate 1 Recovery	%	[NT]	A14/5575-A-41	111||106||RPD: 5
Surrogate 2 Recovery	%	[NT]	A14/5575-A-41	104||99||RPD: 5
Surrogate 3 Recovery	%	[NT]	A14/5575-A-41	110||103||RPD: 7

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Batch Number: A14/5575-A [R00]
Project Reference: Port of Brisbane - Sediments

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aldrin	µg/kg	[NT]	A14/5575-A-41	<2 || <2
alpha-BHC	µg/kg	[NT]	A14/5575-A-41	<2 || <2
beta-BHC	µg/kg	[NT]	A14/5575-A-41	<2 || <2
gamma-BHC (Lindane)	µg/kg	[NT]	A14/5575-A-41	<2 || <2
delta-BHC	µg/kg	[NT]	A14/5575-A-41	<2 || <2
cis-Chlordane	µg/kg	[NT]	A14/5575-A-41	<2 || <2
trans-Chlordane	µg/kg	[NT]	A14/5575-A-41	<2 || <2
p,p'-DDD	µg/kg	[NT]	A14/5575-A-41	<2 || <2
p,p'-DDE	µg/kg	[NT]	A14/5575-A-41	5.0 || 4.0 || RPD: 22
p,p'-DDT	µg/kg	[NT]	A14/5575-A-41	6.0 || 5.0 || RPD: 18
Dieldrin	µg/kg	[NT]	A14/5575-A-41	<2 || <2
alpha-Endosulfan	µg/kg	[NT]	A14/5575-A-41	<2 || <2
beta-Endosulfan	µg/kg	[NT]	A14/5575-A-41	<2 || <2
Endosulfan Sulphate	µg/kg	[NT]	A14/5575-A-41	<2 || <2
Endrin	µg/kg	[NT]	A14/5575-A-41	<2 || <2
Endrin ketone	µg/kg	[NT]	A14/5575-A-41	<2 || <2
Endrin aldehyde	µg/kg	[NT]	A14/5575-A-41	<2 || <2
Heptachlor	µg/kg	[NT]	A14/5575-A-41	<2 || <2
Heptachlor epoxide	µg/kg	[NT]	A14/5575-A-41	<2 || <2
Hexachlorobenzene	µg/kg	[NT]	A14/5575-A-41	<2 || <2
Methoxychlor	µg/kg	[NT]	A14/5575-A-41	<2 || <2
Oxychlordane*	µg/kg	[NT]	A14/5575-A-41	<2 || <2
Surrogate Recovery	%	[NT]	A14/5575-A-41	112 || 108 || RPD: 4

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Batch Number: A14/5575-A [R00]
Project Reference: Port of Brisbane - Sediments

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mono-PCB congeners	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Di-PCB congeners	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Tri-PCB congeners	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Tetra-PCB congeners	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Penta-PCB congeners	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Hexa-PCB congeners	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Hepta-PCB congeners	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Octa-PCB congeners	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Nona-PCB congeners	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Deca-PCB congeners	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Total PCB congeners	µg/kg	[NT]	A14/5575-A-41	<5.0||<5.0
Surrogate 1 Recovery	%	[NT]	A14/5575-A-41	103||99||RPD: 4
Surrogate 2 Recovery	%	[NT]	A14/5575-A-41	105||102||RPD: 3

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Monobutyl tin	µgSn/kg	[NT]	A14/5575-A-41	<10||<10
Dibutyl tin	µgSn/kg	[NT]	A14/5575-A-41	0.50||0.60||RPD: 18
Tributyl tin	µgSn/kg	[NT]	A14/5575-A-41	<0.50||<0.50
Surrogate 1 Recovery	%	[NT]	A14/5575-A-41	76||75||RPD: 1

Comments:
RPD = Relative Percent Deviation
[NT] = Not Tested
[N/A] = Not Applicable
'#' = Spike recovery data could not be calculated due to high levels of contaminants
Acceptable replicate reproducibility limit or RPD: Results < 10 times LOR: no limits
Results >10 times LOR: 0% - 50%
Acceptable matrix spike & LCS recovery limits: Trace elements 70-130%
Organic analyses 50-150%
SVOC & speciated phenols 10-140%
Surrogates 10-140%
When levels outside these limits are obtained, an investigation into the cause of the deviation is performed before the batch is accepted or rejected, and results are released.

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REPORT OF ANALYSIS

Laboratory Reference: A14/5575-B [R00]

Client: BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane QLD 4000

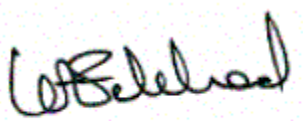
Contact: Markus Billerbeck

Order No:
Project: Port of Brisbane - Sediments - Elutriate
Sample Type: Sediment
No. of Samples: 48
Date Received: 07/10/2014
Date Completed: 23/10/2014

Laboratory Contact Details:

Client Services Manager: Trent Biggin
Technical Enquiries: Andrew Bradbury
Telephone: +61 7 3268 1228
Fax: +61 7 3268 1238
Email: brisbane@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:



Ian Eckhard
Technical Director

Comments:
All samples tested as submitted by client. All attached results have been checked and approved for release.
This is the Final Report and supersedes any reports previously issued with this reference number.
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Accreditation No.15109

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Batch Number: A14/5575-B [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/3** **4-0** **01/10/2014**	**/5** **5-0** **01/10/2014**	**/8** **6-2A** **02/10/2014**	**/11** **7-1** **01/10/2014**
Elutriate - Organotins						
Tributyl tin	04-061	µgSn/L	<0.005	<0.005	<0.005	<0.005
Surrogate 1 Recovery	04-061	%	69	84	97	69
Date Extracted	04-061	-	10/10/2014	10/10/2014	10/10/2014	10/10/2014
Date Analysed	04-061	-	10/10/2014	10/10/2014	10/10/2014	10/10/2014
Elutriate - OCP						
Aldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
gamma-BHC (Lindane)	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
delta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
cis-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
trans-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDD	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDE	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDT	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Dieldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endosulfan Sulphate	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin ketone	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin aldehyde	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Heptachlor	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Heptachlor epoxide	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Hexachlorobenzene	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Methoxychlor	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Oxychlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	92	82	90	90
Date Extracted	04-072	-	14/10/2014	14/10/2014	14/10/2014	14/10/2014
Date Analysed	04-072	-	16/10/2014	16/10/2014	16/10/2014	16/10/2014

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Batch Number: A14/5575-B [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/13** **8-3** **01/10/2014**	**/15** **10-5** **02/10/2014**	**/16** **10-6A** **02/10/2014**	**/17** **10-8** **02/10/2014**
Elutriate - Organotins						
Tributyl tin	04-061	µgSn/L	<0.005	<0.005	<0.005	<0.005
Surrogate 1 Recovery	04-061	%	72	65	66	81
Date Extracted	04-061	-	10/10/2014	10/10/2014	10/10/2014	10/10/2014
Date Analysed	04-061	-	10/10/2014	10/10/2014	10/10/2014	10/10/2014
Elutriate - OCP						
Aldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
gamma-BHC (Lindane)	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
delta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
cis-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
trans-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDD	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDE	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDT	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Dieldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endosulfan Sulphate	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin ketone	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin aldehyde	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Heptachlor	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Heptachlor epoxide	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Hexachlorobenzene	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Methoxychlor	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Oxychlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	91	93	92	87
Date Extracted	04-072	-	14/10/2014	14/10/2014	14/10/2014	14/10/2014
Date Analysed	04-072	-	16/10/2014	16/10/2014	16/10/2014	16/10/2014

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Batch Number: A14/5575-B [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/18** **11-9A** **02/10/2014**	**/19** **11-8** **02/10/2014**	**/21** **12-1** **02/10/2014**	**/39** **11-9B** **02/10/2014**
Elutriate - Organotins						
Tributyl tin	04-061	µgSn/L	<0.005	<0.005	<0.005	<0.005
Surrogate 1 Recovery	04-061	%	91	86	75	67
Date Extracted	04-061	-	10/10/2014	10/10/2014	10/10/2014	10/10/2014
Date Analysed	04-061	-	10/10/2014	10/10/2014	10/10/2014	10/10/2014
Elutriate - OCP						
Aldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
gamma-BHC (Lindane)	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
delta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
cis-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
trans-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDD	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDE	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDT	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Dieldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endosulfan Sulphate	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin ketone	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin aldehyde	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Heptachlor	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Heptachlor epoxide	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Hexachlorobenzene	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Methoxychlor	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Oxychlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	90	93	88	88
Date Extracted	04-072	-	14/10/2014	14/10/2014	14/10/2014	14/10/2014
Date Analysed	04-072	-	16/10/2014	17/10/2014	17/10/2014	17/10/2014

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Batch Number: A14/5575-B [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/40** **8-3B** **01/10/2014**	**/42** **11-8B** **02/10/2014**	**/48** **Elutriate Blank**
Elutriate - Organotins					
Tributyl tin	04-061	µgSn/L	<0.005	<0.005	<0.005
Surrogate 1 Recovery	04-061	%	65	56	85
Date Extracted	04-061	-	10/10/2014	10/10/2014	10/10/2014
Date Analysed	04-061	-	10/10/2014	10/10/2014	10/10/2014
Elutriate - OCP					
Aldrin	04-072	µg/L	<0.03	<0.03	<0.03
alpha-BHC	04-072	µg/L	<0.03	<0.03	<0.03
beta-BHC	04-072	µg/L	<0.03	<0.03	<0.03
gamma-BHC (Lindane)	04-072	µg/L	<0.03	<0.03	<0.03
delta-BHC	04-072	µg/L	<0.03	<0.03	<0.03
cis-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03
trans-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03
p,p'-DDD	04-072	µg/L	<0.03	<0.03	<0.03
p,p'-DDE	04-072	µg/L	<0.03	<0.03	<0.03
p,p'-DDT	04-072	µg/L	<0.03	<0.03	<0.03
Dieldrin	04-072	µg/L	<0.03	<0.03	<0.03
alpha-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03
beta-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03
Endosulfan Sulphate	04-072	µg/L	<0.03	<0.03	<0.03
Endrin	04-072	µg/L	<0.03	<0.03	<0.03
Endrin ketone	04-072	µg/L	<0.03	<0.03	<0.03
Endrin aldehyde	04-072	µg/L	<0.03	<0.03	<0.03
Heptachlor	04-072	µg/L	<0.03	<0.03	<0.03
Heptachlor epoxide	04-072	µg/L	<0.03	<0.03	<0.03
Hexachlorobenzene	04-072	µg/L	<0.03	<0.03	<0.03
Methoxychlor	04-072	µg/L	<0.03	<0.03	<0.03
Oxychlordane	04-072	µg/L	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	118	89	97
Date Extracted	04-072	-	14/10/2014	14/10/2014	14/10/2014
Date Analysed	04-072	-	17/10/2014	17/10/2014	16/10/2014

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Batch Number: A14/5575-B [R00]

Project Reference: Port of Brisbane - Sediments - Elutriate

Method	Method Description
04-061	Tributyltin in saline waters by GCMS, µgSn/L
04-072	Pesticides in waters by GCMS, µg/L

Result Comments

[<] Less than

[INS] Insufficient sample for this test

[NA] Test not required

*Analyte is not covered by NATA scope of accreditation.

The samples required longer than 1 hour to settle after tumbling so left overnight to settle then siphoned.

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Batch Number: A14/5575-B [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Tributyl tin	µgSn/L	<0.005	[NT]	[NT]	External	86%
Surrogate 1 Recovery	%	104	[NT]	[NT]	External	93%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/L	<0.03	[NT]	[NT]	External	84%
alpha-BHC	µg/L	<0.03	[NT]	[NT]	External	92%
beta-BHC	µg/L	<0.03	[NT]	[NT]	External	93%
gamma-BHC (Lindane)	µg/L	<0.03	[NT]	[NT]	External	91%
delta-BHC	µg/L	<0.03	[NT]	[NT]	External	95%
cis-Chlordane	µg/L	<0.03	[NT]	[NT]	External	96%
trans-Chlordane	µg/L	<0.03	[NT]	[NT]	External	94%
p,p'-DDD	µg/L	<0.03	[NT]	[NT]	External	88%
p,p'-DDE	µg/L	<0.03	[NT]	[NT]	External	96%
p,p'-DDT	µg/L	<0.03	[NT]	[NT]	External	92%
Dieldrin	µg/L	<0.03	[NT]	[NT]	External	98%
alpha-Endosulfan	µg/L	<0.03	[NT]	[NT]	External	96%
beta-Endosulfan	µg/L	<0.03	[NT]	[NT]	External	98%
Endosulfan Sulphate	µg/L	<0.03	[NT]	[NT]	External	91%
Endrin	µg/L	<0.03	[NT]	[NT]	External	103%
Endrin ketone	µg/L	<0.03	[NT]	[NT]	External	89%
Endrin aldehyde	µg/L	<0.03	[NT]	[NT]	External	93%
Heptachlor	µg/L	<0.03	[NT]	[NT]	External	93%
Heptachlor epoxide	µg/L	<0.03	[NT]	[NT]	External	94%
Hexachlorobenzene	µg/L	<0.03	[NT]	[NT]	External	86%
Methoxychlor	µg/L	<0.03	[NT]	[NT]	External	89%
Oxychlordane	µg/L	<0.03	[NT]	[NT]	External	92%
Surrogate Recovery	%	95	[NT]	[NT]	External	87%

Comments:
RPD = Relative Percent Deviation
[NT] = Not Tested
[N/A] = Not Applicable
'#' = Spike recovery data could not be calculated due to high levels of contaminants

Acceptable replicate reproducibility limit or RPD:
Results < 10 times LOR: no limits
Results >10 times LOR: 0% - 50%

Acceptable matrix spike & LCS recovery limits:
Trace elements 70-130%
Organic analyses 50-150%
SVOC & speciated phenols 10-140%
Surrogates 10-140%

When levels outside these limits are obtained, an investigation into the cause of the deviation is performed before the batch is accepted or rejected, and results are released.

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REPORT OF ANALYSIS

Laboratory Reference: A14/5575-C [R00]

Client: BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane QLD 4000

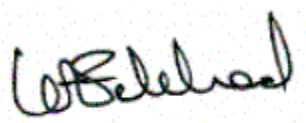
Contact: Markus Billerbeck

Order No:
Project: Port of Brisbane - Sediments - Porewater
Sample Type: Sediment
No. of Samples: 47
Date Received: 07/10/2014
Date Completed: 20/10/2014

Laboratory Contact Details:

Client Services Manager: Trent Biggin
Technical Enquiries: Andrew Bradbury
Telephone: +61 7 3268 1228
Fax: +61 7 3268 1238
Email: brisbane@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:



Ian Eckhard
Technical Director

Comments:
All samples tested as submitted by client. All attached results have been checked and approved for release.
This is the Final Report and supersedes any reports previously issued with this reference number.
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Batch Number: A14/5575-C [R00]
Project Reference: Port of Brisbane - Sediments - Porewater

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/3** **4-0** **01/10/2014**	**/5** **5-0** **01/10/2014**	**/8** **6-2A** **02/10/2014**	**/11** **7-1** **01/10/2014**
Organotins						
Tributyl tin	04-061	µgSn/L	<0.005	<0.01	<0.005	<0.005
Surrogate 1 Recovery	04-061	%	76	133	88	78
Date Extracted	04-061	-	15/10/2014	15/10/2014	15/10/2014	15/10/2014
Date Analysed	04-061	-	15/10/2014	15/10/2014	15/10/2014	15/10/2014
Organochlorine Pesticides						
Aldrin	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
alpha-BHC	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
beta-BHC	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
gamma-BHC (Lindane)	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
delta-BHC	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
cis-Chlordane	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
trans-Chlordane	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
p,p'-DDD	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
p,p'-DDE	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
p,p'-DDT	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
Dieldrin	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
alpha-Endosulfan	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
beta-Endosulfan	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
Endosulfan Sulphate	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
Endrin	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
Endrin ketone	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
Endrin aldehyde	04-072	µg/L	<0.1	<0.2	<0.1	<0.1
Heptachlor	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
Heptachlor epoxide	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
Hexachlorobenzene	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
Methoxychlor	04-072	µg/L	<0.1	<0.2	<0.1	<0.1
Mirex	04-072	µg/L	<0.03	<0.06	<0.03	<0.03
Surrogate Recovery	04-072	%	96	93	86	87
Date Extracted	04-072	-	16/10/2014	16/10/2014	16/10/2014	16/10/2014
Date Analysed	04-072	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014

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Batch Number: A14/5575-C [R00]
Project Reference: Port of Brisbane - Sediments - Porewater

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/13** **8-3** **01/10/2014**	**/15** **10-5** **02/10/2014**	**/16** **10-6A** **02/10/2014**	**/17** **10-8** **02/10/2014**
Organotins						
Tributyl tin	04-061	µgSn/L	<0.005	<0.005	<0.005	<0.005
Surrogate 1 Recovery	04-061	%	83	81	85	94
Date Extracted	04-061	-	15/10/2014	15/10/2014	15/10/2014	15/10/2014
Date Analysed	04-061	-	15/10/2014	15/10/2014	15/10/2014	15/10/2014
Organochlorine Pesticides						
Aldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
gamma-BHC (Lindane)	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
delta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
cis-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
trans-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDD	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDE	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDT	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Dieldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endosulfan Sulphate	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin ketone	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin aldehyde	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Heptachlor epoxide	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Hexachlorobenzene	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Methoxychlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Mirex	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	89	103	88	88
Date Extracted	04-072	-	16/10/2014	16/10/2014	16/10/2014	16/10/2014
Date Analysed	04-072	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014

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Batch Number: A14/5575-C [R00]
Project Reference: Port of Brisbane - Sediments - Porewater

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/18** **11-9A** **02/10/2014**	**/19** **11-8** **02/10/2014**	**/21** **12-1** **02/10/2014**	**/39** **11-9B** **02/10/2014**
Organotins						
Tributyl tin	04-061	µgSn/L	<0.005	<0.005	<0.005	<0.005
Surrogate 1 Recovery	04-061	%	98	81	74	83
Date Extracted	04-061	-	15/10/2014	15/10/2014	15/10/2014	15/10/2014
Date Analysed	04-061	-	15/10/2014	15/10/2014	15/10/2014	15/10/2014
Organochlorine Pesticides						
Aldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
gamma-BHC (Lindane)	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
delta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
cis-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
trans-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDD	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDE	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDT	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Dieldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endosulfan Sulphate	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin ketone	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin aldehyde	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Heptachlor epoxide	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Hexachlorobenzene	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Methoxychlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Mirex	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	81	86	90	84
Date Extracted	04-072	-	16/10/2014	16/10/2014	16/10/2014	16/10/2014
Date Analysed	04-072	-	17/10/2014	17/10/2014	17/10/2014	17/10/2014

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Batch Number: A14/5575-C [R00]
Project Reference: Port of Brisbane - Sediments - Porewater

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/40** **8-3B** **01/10/2014**	**/42** **11-8B** **02/10/2014**
Organotins				
Tributyl tin	04-061	µgSn/L	<0.005	<0.005
Surrogate 1 Recovery	04-061	%	97	91
Date Extracted	04-061	-	15/10/2014	15/10/2014
Date Analysed	04-061	-	15/10/2014	15/10/2014
Organochlorine Pesticides				
Aldrin	04-072	µg/L	<0.03	<0.03
alpha-BHC	04-072	µg/L	<0.03	<0.03
beta-BHC	04-072	µg/L	<0.03	<0.03
gamma-BHC (Lindane)	04-072	µg/L	<0.03	<0.03
delta-BHC	04-072	µg/L	<0.03	<0.03
cis-Chlordane	04-072	µg/L	<0.03	<0.03
trans-Chlordane	04-072	µg/L	<0.03	<0.03
p,p'-DDD	04-072	µg/L	<0.03	<0.03
p,p'-DDE	04-072	µg/L	<0.03	<0.03
p,p'-DDT	04-072	µg/L	<0.03	<0.03
Dieldrin	04-072	µg/L	<0.03	<0.03
alpha-Endosulfan	04-072	µg/L	<0.03	<0.03
beta-Endosulfan	04-072	µg/L	<0.03	<0.03
Endosulfan Sulphate	04-072	µg/L	<0.03	<0.03
Endrin	04-072	µg/L	<0.03	<0.03
Endrin ketone	04-072	µg/L	<0.03	<0.03
Endrin aldehyde	04-072	µg/L	<0.1	<0.1
Heptachlor	04-072	µg/L	<0.03	<0.03
Heptachlor epoxide	04-072	µg/L	<0.03	<0.03
Hexachlorobenzene	04-072	µg/L	<0.03	<0.03
Methoxychlor	04-072	µg/L	<0.1	<0.1
Mirex	04-072	µg/L	<0.03	<0.03
Surrogate Recovery	04-072	%	87	84
Date Extracted	04-072	-	16/10/2014	16/10/2014
Date Analysed	04-072	-	17/10/2014	17/10/2014

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Batch Number: A14/5575-C [R00]
Project Reference: Port of Brisbane - Sediments - Porewater

Method	Method Description
04-061	Tributyltin in saline waters by GCMS, µgSn/L
04-072	Pesticides in waters by GCMS, µg/L

Result Comments
[<] Less than
[INS] Insufficient sample for this test
[NA] Test not required
*Analyte is not covered by NATA scope of accreditation.
The LOR for TBT and OC was raised for sample 5 due to the porewater extraction only producing a small volume of water.

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Batch Number: A14/5575-C [R00]
Project Reference: Port of Brisbane - Sediments - Porewater

QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Tributyl tin	µgSn/L	<0.005	A14/5575-C-15	<0.005 || <0.005	A14/5575-C-17	75%
Surrogate 1 Recovery	%	52	A14/5575-C-15	81 || 92 || RPD: 13	A14/5575-C-17	89%

TEST	UNITS	Blank
Aldrin	µg/L	<0.03
alpha-BHC	µg/L	<0.03
beta-BHC	µg/L	<0.03
gamma-BHC (Lindane)	µg/L	<0.03
delta-BHC	µg/L	<0.03
cis-Chlordane	µg/L	<0.03
trans-Chlordane	µg/L	<0.03
p,p'-DDD	µg/L	<0.03
p,p'-DDE	µg/L	<0.03
p,p'-DDT	µg/L	<0.03
Dieldrin	µg/L	<0.03
alpha-Endosulfan	µg/L	<0.03
beta-Endosulfan	µg/L	<0.03
Endosulfan Sulphate	µg/L	<0.03
Endrin	µg/L	<0.03
Endrin ketone	µg/L	<0.03
Endrin aldehyde	µg/L	<0.1
Heptachlor	µg/L	<0.03
Heptachlor epoxide	µg/L	<0.03
Hexachlorobenzene	µg/L	<0.03
Methoxychlor	µg/L	<0.1
Mirex	µg/L	<0.03
Surrogate Recovery	%	94

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Tributyl tin	µgSn/L	[NT]	A14/5575-C-40	<0.005 || <0.005	External	94%
Surrogate 1 Recovery	%	[NT]	A14/5575-C-40	97 || 102 || RPD: 5	External	93%

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Batch Number: A14/5575-C [R00]

Project Reference: Port of Brisbane - Sediments - Porewater

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/L	[NT]	[NT]	[NT]	External	94%
alpha-BHC	µg/L	[NT]	[NT]	[NT]	External	98%
beta-BHC	µg/L	[NT]	[NT]	[NT]	External	101%
gamma-BHC (Lindane)	µg/L	[NT]	[NT]	[NT]	External	97%
delta-BHC	µg/L	[NT]	[NT]	[NT]	External	99%
cis-Chlordane	µg/L	[NT]	[NT]	[NT]	External	107%
trans-Chlordane	µg/L	[NT]	[NT]	[NT]	External	103%
p,p'-DDD	µg/L	[NT]	[NT]	[NT]	External	94%
p,p'-DDE	µg/L	[NT]	[NT]	[NT]	External	105%
p,p'-DDT	µg/L	[NT]	[NT]	[NT]	External	95%
Dieldrin	µg/L	[NT]	[NT]	[NT]	External	109%
alpha-Endosulfan	µg/L	[NT]	[NT]	[NT]	External	108%
beta-Endosulfan	µg/L	[NT]	[NT]	[NT]	External	104%
Endosulfan Sulphate	µg/L	[NT]	[NT]	[NT]	External	99%
Endrin	µg/L	[NT]	[NT]	[NT]	External	104%
Endrin ketone	µg/L	[NT]	[NT]	[NT]	External	99%
Endrin aldehyde	µg/L	[NT]	[NT]	[NT]	External	101%
Heptachlor	µg/L	[NT]	[NT]	[NT]	External	85%
Heptachlor epoxide	µg/L	[NT]	[NT]	[NT]	External	101%
Hexachlorobenzene	µg/L	[NT]	[NT]	[NT]	External	101%
Methoxychlor	µg/L	[NT]	[NT]	[NT]	External	92%
Mirex	µg/L	[NT]	[NT]	[NT]	External	107%
Surrogate Recovery	%	[NT]	[NT]	[NT]	External	88%

Comments:

RPD = Relative Percent Deviation

[NT] = Not Tested

[N/A] = Not Applicable

'#' = Spike recovery data could not be calculated due to high levels of contaminants

Acceptable replicate reproducibility limit or RPD:
Results < 10 times LOR: no limits
Results >10 times LOR: 0% - 50%

Acceptable matrix spike & LCS recovery limits:
Trace elements 70-130%
Organic analyses 50-150%
SVOC & speciated phenols 10-140%
Surrogates 10-140%

When levels outside these limits are obtained, an investigation into the cause of the deviation is performed before the batch is accepted or rejected, and results are released.

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REPORT OF ANALYSIS

Laboratory Reference: A14/5945 [R00]

Client: BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane QLD 4000

Contact: Markus Billerbeck

Order No:
Project: Port of Brisbane Sediment
Sample Type: Sediment
No. of Samples: 3
Date Received: 07/10/2014
Date Completed: 29/10/2014

Laboratory Contact Details:

Client Services Manager: Trent Biggin
Technical Enquiries: Andrew Bradbury
Telephone: +61 7 3268 1228
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Email: brisbane@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:

Rama Nimmagadda
Technical Manager

Comments:
All samples tested as submitted by client. All attached results have been checked and approved for release.
This is the Final Report and supersedes any reports previously issued with this reference number.
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ilac-MRA NATA Accreditation No.15109

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Batch Number: A14/5945 [R00]
Project Reference: Port of Brisbane Sediment

Laboratory Reference:	-	-	/1	/2	/3
Client Reference:	-	-	**13-4A (Formally sample 27 from A14/5575A)**	**13-4A Dup 1 (Formally sample 27 from A14/5575A)**	**13-4A Dup 2 (Formally sample 27 from A14/5575A)**
Date Sampled:	-	-	**02/10/2014**	**02/10/2014**	**02/10/2014**
Analysis Description	**Method**	**Units**			
Moisture Content					
Moisture Content	04-004	%	18.2	17.6	17.7
Trace Elements					
Copper	04-001	mg/kg	45	15	17
Lead	04-001	mg/kg	55	17	25
Zinc	04-001	mg/kg	340	100	130

Method	Method Description
04-004	Moisture by gravimetric, %
04-001	Metals by ICP-OES, mg/kg

Result Comments
[<] Less than
[INS] Insufficient sample for this test
[NA] Test not required
*Analyte is not covered by NATA scope of accreditation.
Metals triplicate values have failed the internal acceptance criteria, visual inspection occurred which showed that the sample is non-homogeneous.

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Batch Number: A14/5945 [R00]
Project Reference: Port of Brisbane Sediment

QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Copper	mg/kg	<0.1	[NT]	[NT]	A14/5945-1	104%
Lead	mg/kg	<0.5	[NT]	[NT]	A14/5945-1	86%
Zinc	mg/kg	<0.5	[NT]	[NT]	A14/5945-1	86%

Comments:
RPD = Relative Percent Deviation
[NT] = Not Tested
[N/A] = Not Applicable
'#' = Spike recovery data could not be calculated due to high levels of contaminants
Acceptable replicate reproducibility limit or RPD: Results < 10 times LOR: no limits
Results >10 times LOR: 0% - 50%
Acceptable matrix spike & LCS recovery limits: Trace elements 70-130%
Organic analyses 50-150%
SVOC & speciated phenols 10-140%
Surrogates 10-140%
When levels outside these limits are obtained, an investigation into the cause of the deviation is performed before the batch is accepted or rejected, and results are released.

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Brisbane

From: Markus Billerbeck [Markus.Billerbeck@bmtwbm.com.au]
Sent: Thursday, 30 October 2014 3:42 PM
To: Brisbane
Cc: Andrew Bradbury
Subject: RE: Results for registration 'A14/5575-A - Port of Brisbane - Sediments'

7/11

Hi Trent,

Can you please organise the following further analyses for this job (A14/5575-A - Port of Brisbane – Sediments):

From the remaining sample volume of the following samples, please undertake **elutriate analysis** and **dilute acid extraction** analyses (BMT WBM sample numbers provided)

5575/

Nickel (18 elutriate and DAE analyses)

A14/5575 D+E

D 3 • 4-0 (duplicate analysis)
4 • 4-4
5 • 5-0
8 • 6-2A
12 • 8-1
D 23 • 15-1 (duplicate analysis)
18 • 11-9A
19 • 11-8
15 • 10-5
D 22 • 12-2 (duplicate analysis)
17 • 10-8
D 31 • 13-9 (duplicate analysis)
29 • 13-5
26 • 13-1

Copper, lead and zinc (2 elutriate and DAE analyses)

27 • 13-4A (duplicate)

Best regards,
Markus

Dr Markus Billerbeck
Senior Environmental Scientist
BMT WBM Pty Ltd

Tel: +61 7 3831 6744
Mob: +61 4 0019 0358
Fax: +61 7 3832 3627
Website: www.bmtwbm.com.au

REPORT OF ANALYSIS

Laboratory Reference: A14/5575-D [R00]

Client: BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane QLD 4000

Contact: Markus Billerbeck

Order No:
Project: Port of Brisbane - Sediments - Elutriate - Metals
Sample Type: Sediment
No. of Samples: 48
Date Received: 07/10/2014
Date Completed: 14/11/2014

Laboratory Contact Details:

Client Services Manager: Trent Biggin
Technical Enquiries: Andrew Bradbury
Telephone: +61 7 3268 1228
Fax: +61 7 3268 1238
Email: brisbane@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:

Rama Nimmagadda
Technical Manager

Comments:
All samples tested as submitted by client. All attached results have been checked and approved for release.
This is the Final Report and supersedes any reports previously issued with this reference number.
Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

ilac-MRA NATA Accreditation No.15109

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Batch Number: A14/5575-D [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate - Metals

Laboratory Reference:	-	-	/3	/4	/5	/8
Client Reference:	-	-	4-0	4-4	5-0	6-2A
Date Sampled:	-	-	01/10/2014	01/10/2014	01/10/2014	02/10/2014
Analysis Description	**Method**	**Units**				
Elutriate - Metals						
Nickel	04-015	µg/L	<3.0	<3.0	<3.0	<3.0

Laboratory Reference:	-	-	/12	/15	/17	/18
Client Reference:	-	-	8-1	10-5	10-8	11-9A
Date Sampled:	-	-	01/10/2014	02/10/2014	02/10/2014	02/10/2014
Analysis Description	**Method**	**Units**				
Elutriate - Metals						
Nickel	04-015	µg/L	<3.0	<3.0	<3.0	<3.0

Laboratory Reference:	-	-	/19	/22	/23	/26
Client Reference:	-	-	11-8	12-2	15-1	13-1
Date Sampled:	-	-	02/10/2014	02/10/2014	02/10/2014	02/10/2014
Analysis Description	**Method**	**Units**				
Elutriate - Metals						
Nickel	04-015	µg/L	<3.0	<3.0	<3.0	<3.0

Laboratory Reference:	-	-	/27	/31	/48
Client Reference:	-	-	13-4A	13-9	Elutriate Blank
Date Sampled:	-	-	02/10/2014	02/10/2014	
Analysis Description	**Method**	**Units**			
Elutriate - Metals					
Copper	04-015	µg/L	<1.0	[NA]	<1.0
Nickel	04-015	µg/L	[NA]	<3.0	<3.0
Lead	04-015	µg/L	<1.0	[NA]	<1.0
Zinc	04-015	µg/L	<5.0	[NA]	<5.0

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Batch Number: A14/5575-D [R00]

Project Reference: Port of Brisbane - Sediments - Elutriate - Metals

Method	Method Description
04-015	Low level metals in waters by ICPMS, µg/L

Result Comments

[<] Less than

[INS] Insufficient sample for this test

[NA] Test not required

*Analyte is not covered by NATA scope of accreditation.

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Batch Number: A14/5575-D [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate - Metals

QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Copper	µg/L	<1.0	[NT]	[NT]	A14/5575-D-3	96%
Nickel	µg/L	<3.0	A14/5575-D-3	<3.0||<3.0	A14/5575-D-3	86%
Lead	µg/L	<1.0	[NT]	[NT]	A14/5575-D-3	82%
Zinc	µg/L	<5.0	[NT]	[NT]	A14/5575-D-3	85%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Copper	µg/L	[NT]	[NT]	[NT]
Nickel	µg/L	[NT]	A14/5575-D-22	<3.0||<3.0
Lead	µg/L	[NT]	[NT]	[NT]
Zinc	µg/L	[NT]	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Copper	µg/L	[NT]	[NT]	[NT]
Nickel	µg/L	[NT]	A14/5575-D-23	<3.0||<3.0
Lead	µg/L	[NT]	[NT]	[NT]
Zinc	µg/L	[NT]	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Copper	µg/L	[NT]	[NT]	[NT]
Nickel	µg/L	[NT]	A14/5575-D-31	<3.0||<3.0
Lead	µg/L	[NT]	[NT]	[NT]
Zinc	µg/L	[NT]	[NT]	[NT]

Comments:
RPD = Relative Percent Deviation
[NT] = Not Tested
[N/A] = Not Applicable
'#' = Spike recovery data could not be calculated due to high levels of contaminants
Acceptable replicate reproducibility limit or RPD: Results < 10 times LOR: no limits
Results >10 times LOR: 0% - 50%
Acceptable matrix spike & LCS recovery limits: Trace elements 70-130%
Organic analyses 50-150%
SVOC & speciated phenols 10-140%
Surrogates 10-140%
When levels outside these limits are obtained, an investigation into the cause of the deviation is performed before the batch is accepted or rejected, and results are released.

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REPORT OF ANALYSIS

Laboratory Reference: A14/5575-E [R00]

Client: BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane QLD 4000

Contact: Markus Billerbeck

Order No:
Project: Port of Brisbane - Sediments - DAE
Sample Type: Sediment
No. of Samples: 48
Date Received: 07/10/2014
Date Completed: 4/11/2014

Laboratory Contact Details:

Client Services Manager: Trent Biggin
Technical Enquiries: Andrew Bradbury
Telephone: +61 7 3268 1228
Fax: +61 7 3268 1238
Email: brisbane@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:

Rama Nimmagadda
Technical Manager

Comments:
All samples tested as submitted by client. All attached results have been checked and approved for release.
This is the Final Report and supersedes any reports previously issued with this reference number.
Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

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Batch Number: A14/5575-E [R00]
Project Reference: Port of Brisbane - Sediments - DAE

Laboratory Reference:	-	-	/3	/4	/5	/8
Client Reference:	-	-	4-0	4-4	5-0	6-2A
Date Sampled:	-	-	01/10/2014	01/10/2014	01/10/2014	02/10/2014
Analysis Description	**Method**	**Units**				
Dilute Acid Extraction - Metal						
Nickel	04-001	mg/kg	9.7	9.0	8.7	8.9

Laboratory Reference:	-	-	/12	/15	/17	/18
Client Reference:	-	-	8-1	10-5	10-8	11-9A
Date Sampled:	-	-	01/10/2014	02/10/2014	02/10/2014	02/10/2014
Analysis Description	**Method**	**Units**				
Dilute Acid Extraction - Metal						
Nickel	04-001	mg/kg	8.1	8.1	7.3	8.8

Laboratory Reference:	-	-	/19	/22	/23	/26
Client Reference:	-	-	11-8	12-2	15-1	13-1
Date Sampled:	-	-	02/10/2014	02/10/2014	02/10/2014	02/10/2014
Analysis Description	**Method**	**Units**				
Dilute Acid Extraction - Metal						
Nickel	04-001	mg/kg	7.8	7.2	9.3	5.9

Laboratory Reference:	-	-	/27	/29	/31
Client Reference:	-	-	13-4A	13-5	13-9
Date Sampled:	-	-	02/10/2014	02/10/2014	02/10/2014
Analysis Description	**Method**	**Units**			
Dilute Acid Extraction - Metal					
Copper	04-001	mg/kg	5.8	[NA]	[NA]
Nickel	04-001	mg/kg	[NA]	5.4	5.0
Lead	04-001	mg/kg	9.7	[NA]	[NA]
Zinc	04-001	mg/kg	44	[NA]	[NA]

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Batch Number: A14/5575-E [R00]
Project Reference: Port of Brisbane - Sediments - DAE

Method	Method Description
04-001	Metals by ICP-OES, mg/kg

Result Comments
[<] Less than
[INS] Insufficient sample for this test
[NA] Test not required
*Analyte is not covered by NATA scope of accreditation.
The samples required longer than 1 hour to settle after tumbling so left overnight to settle then siphoned.

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Batch Number: A14/5575-E [R00]
Project Reference: Port of Brisbane - Sediments - DAE

QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Copper	mg/kg	<0.1	[NT]	[NT]	A14/5575-E-3	88%
Nickel	mg/kg	<0.1	A14/5575-E-3	9.7 || 10 || RPD: 3	A14/5575-E-3	96%
Lead	mg/kg	<0.5	[NT]	[NT]	A14/5575-E-3	93%
Zinc	mg/kg	<0.5	[NT]	[NT]	A14/5575-E-3	98%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Copper	mg/kg	[NT]	[NT]	[NT]
Nickel	mg/kg	[NT]	A14/5575-E-22	7.2 || 7.6 || RPD: 5
Lead	mg/kg	[NT]	[NT]	[NT]
Zinc	mg/kg	[NT]	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Copper	mg/kg	[NT]	[NT]	[NT]
Nickel	mg/kg	[NT]	A14/5575-E-23	9.3 || 10 || RPD: 7
Lead	mg/kg	[NT]	[NT]	[NT]
Zinc	mg/kg	[NT]	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Copper	mg/kg	[NT]	[NT]	[NT]
Nickel	mg/kg	[NT]	A14/5575-E-31	5.0 || 5.0 || RPD: 0
Lead	mg/kg	[NT]	[NT]	[NT]
Zinc	mg/kg	[NT]	[NT]	[NT]

Comments:
RPD = Relative Percent Deviation
[NT] = Not Tested
[N/A] = Not Applicable
'#' = Spike recovery data could not be calculated due to high levels of contaminants
Acceptable replicate reproducibility limit or RPD: Results < 10 times LOR: no limits
Results >10 times LOR: 0% - 50%
Acceptable matrix spike & LCS recovery limits: Trace elements 70-130%
Organic analyses 50-150%
SVOC & speciated phenols 10-140%
Surrogates 10-140%
When levels outside these limits are obtained, an investigation into the cause of the deviation is performed before the batch is accepted or rejected, and results are released.

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CERTIFICATE OF ANALYSIS 117367

Client:

Advanced Analytical Aust. Pty Ltd
11 Julius Ave
North Ryde
NSW 2113

Attention: T Biggin

Sample log in details:

Your Reference:	**A14/5575A**		
No. of samples:	15 soils		
Date samples received / completed instructions received	09/10/14	/	09/10/14

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: / Issue Date:	17/10/14	/	17/10/14
Date of Preliminary Report:	Not Issued		

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

Results Approved By:

Jacinta Hurst
Laboratory Manager

Chromium Suite						
Our Reference:	UNITS	117367-1	117367-2	117367-3	117367-4	117367-5
Your Reference	----------	A14/5575A/5	A14/5575A/6	A14/5575A/7	A14/5575A/10	A14/5575A/11
Sample ID	----------	5-0	5-1A	5-1B	6-3	7-1
Date Sampled		01/10/2014	01/10/2014	01/10/2014	01/10/2014	01/10/2014
Type of sample		soil	soil	soil	soil	soil
pH kcl	pH units	8.4	8.3	8.4	8.5	8.6
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
Chromium Reducible Sulfur	%w/w	0.11	0.17	0.30	0.13	0.16
a-Chromium Reducible Sulfur	moles H^+/t	72	110	190	82	98

Chromium Suite						
Our Reference:	UNITS	117367-6	117367-7	117367-8	117367-9	117367-10
Your Reference	----------	A14/5575A/14	A14/5575A/16	A14/5575A/19	A14/5575A/21	A14/5575A/24
Sample ID	----------	9-1	10-6A	11-8	12-1	15-3
Date Sampled		01/10/2014	02/10/2014	02/10/2014	02/10/2014	02/10/2014
Type of sample		soil	soil	soil	soil	soil
pH kcl	pH units	8.8	8.8	8.7	8.9	9.4
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
Chromium Reducible Sulfur	%w/w	0.05	0.17	0.19	0.12	0.04
a-Chromium Reducible Sulfur	moles H^+/t	33	110	120	77	27

Chromium Suite						
Our Reference:	UNITS	117367-11	117367-12	117367-13	117367-14	117367-15
Your Reference	----------	A14/5575A/25	A14/5575A/26	A14/5575A/30	A14/5575A/41	A14/5575A/43
Sample ID	----------	15-2	13-1	13-8	10-6B	5-1C
Date Sampled		02/10/2014	02/10/2014	02/10/2014	02/10/2014	01/10/2014
Type of sample		soil	soil	soil	soil	soil
pH kcl	pH units	9.3	9.1	9.1	8.8	8.7
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
Chromium Reducible Sulfur	%w/w	0.05	0.14	0.17	0.26	0.37
a-Chromium Reducible Sulfur	moles H^+/t	30	90	100	160	230

Method ID	Methodology Summary
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

Client Reference: A14/5575A

QUALITY CONTROL Chromium Suite	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
pH kcl	pH units		Inorg-068	[NT]	117367-1	8.4 || 8.4 || RPD: 0	LCS-1	91%
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	117367-1	<0.01 || <0.01	[NR]	[NR]
TAA pH 6.5	moles H^+/t	5	Inorg-068	<5	117367-1	<5 || <5	LCS-1	120%
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	117367-1	0.11 || 0.11 || RPD: 0	LCS-1	105%
a-Chromium Reducible Sulfur	moles H^+/t	3	Inorg-068	<3	117367-1	72 || 66 || RPD: 9	[NR]	[NR]

QUALITY CONTROL Chromium Suite	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
pH kcl	pH units	117367-11	9.3 || 9.3 || RPD: 0
s-TAA pH 6.5	%w/w S	117367-11	<0.01 || <0.01
TAA pH 6.5	moles H^+/t	117367-11	<5 || <5
Chromium Reducible Sulfur	%w/w	117367-11	0.05 || 0.06 || RPD: 18
a-Chromium Reducible Sulfur	moles H^+/t	117367-11	30 || 39 || RPD: 26

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

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.

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: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC 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.

Appendix D Laboratory Results – Secondary Laboratory

CHAIN OF CUSTODY

ALS Laboratory: please tick →

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☐BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com

☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

☐MUDGEE 1/29 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

☐NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com

☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townesville.environmental@alsglobal.com

☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: BMT WBM	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☒ Standard TAT **(List due date):**	**FOR LABORATORY USE ONLY (Circle)**
OFFICE: Brisbane		☐ Non Standard or urgent TAT **(List due date):**	Custody Seal Intact? Yes No N/A
PROJECT: Port of Brisbane - Sediment Quality **PROJECT NO. 20259**	**ALS QUOTE NO.: BNBQ-032-14**	**COC SEQUENCE NUMBER (Circle)**	Free ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER: **PURCHASE ORDER NO.:**	**COUNTRY OF ORIGIN: Australia**	COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: Markus Billerbeck	**CONTACT PH: 07 3831 6744**	OF: 1 2 3 4 5 6 7	Other comment:

SAMPLER: Bowen Conor Jones	**SAMPLER MOBILE:** 0411352572	**RELINQUISHED BY:**	**RECEIVED BY:**	**RELINQUISHED BY:** / **RECEIVED BY:**
COC Emailed to ALS? (YES / (NO)	**EDD FORMAT (or default):**			
Email Reports to (will default to PM if no other addresses are listed): brad.hiles@bmtwbm.com.au		DATE/TIME: 07/10/2014 13:00	DATE/TIME: 7/10/14 1300	DATE/TIME: / DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed): "				

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Marine sediments

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).															Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL BOTTLES	PSD (EA150-H) including hydrometer	Moisture content (EA055)	Total organic caron (EP003)	TPH (C6-C9, C10-14, C15-C28 and C29-C36) (EP071)	Trace metals (As, Cd, Cr, Cu, Pb, Ni, Zn, Ag, Al, Fe) (EG020-SD)	Mercury (EG035L- low level)	Nutrients - TN (EK062), NO3+NO2 (EK059G), TKN (EK061G), TP (EK067G)	Organotins (TBT, DBT, MBT) (EP090)	Organochlorine pesticides (EP131A)	PAH (plus total PAHS)(EP132-SD)	Total PCBs (EP131B)	Acid sulfate soils (CRS/TAA) (EA033 Cr suite)		Radionuclides (sum of gross alpha/beta (EA250)			All analyses required in accordance with National Assessment Guidelines for Dredging 2009 (NAGD)
1	C-2C	2/10/14	S		3	X	X	X		X	X		X	X								
2	10-6C	2/10/14	S		5	X	X	X	X	X	X	X	X	X	X	X	X		X			
				TOTAL	8																	

ALS GROUP - Brisbane
EB1443856

Telephone : +61-7-3243 7222

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = 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 Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1443856**	Page	: 1 of 7
Amendment	: **(Preliminary Report)**		
Client	: **BMT WBM GROUP LTD**	Laboratory	: Environmental Division Brisbane
Contact	: DR MARKUS BILLERBECK	Contact	: Customer Services EB
Address	: PO BOX 203 SPRING HILL BRISBANE QLD 4004	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: markus.billerbeck@bmtwbm.com.au	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3831 6744	Telephone	: +61-7-3243 7222
Facsimile	: +61 07 3832 3627	Facsimile	: +61-7-3243 7218
Project	: Port of Brisbane - Sediment Quality 20259	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 07-Oct-2014 13:00
C-O-C number	: ----	Date Analysis Commenced	: 10-Oct-2014
Sampler	: CONOR JONES	Issue Date	: 17-Oct-2014 13:06
Site	: ----		
		No. of samples received	: 2
Quote number	: ----	No. of samples analysed	: 2

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Ryan Story	2IC Organic Instrument Chemist	Brisbane Inorganics
Ryan Story	2IC Organic Instrument Chemist	Brisbane Organics
Satishkumar Trivedi	2 IC Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

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.

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.

- **ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.**
- **ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5**
- **EP090: Sample '10-6C' shows poor matrix spike recovery for MBT due to matrix interference.**
- **Radiological work undertaken by ALS Laboratory Group (Ceska Lipa) under CAI accreditation No. L1163. Report No. $$. NATA and CAI accreditations' are both recognised under ILAC.**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	6-2C	10-6C	----	----	----
			Client sampling date / time	[02-Oct-2014]	[02-Oct-2014]	----	----	----
Compound	CAS Number	LOR	Unit	EB1443856-001	EB1443856-002	--------	--------	--------
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	8.7	----	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	<2	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	<0.02	----	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	0.276	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	172	----	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	----	6.06	----	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	----	1210	----	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	----	1.94	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	1.5	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	----	<0.02	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	----	<10	----	----	----
Liming Rate	----	1	kg CaCO3/t	----	<1	----	----	----
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1	%	62.1	52.6	----	----	----
EA150: Particle Sizing								
+75µm	----	-	%	Not Authorised	Not Authorised	----	----	----
+150µm	----	-	%	Not Authorised	Not Authorised	----	----	----
+300µm	----	-	%	Not Authorised	Not Authorised	----	----	----
+425µm	----	-	%	Not Authorised	Not Authorised	----	----	----
+600µm	----	-	%	Not Authorised	Not Authorised	----	----	----
+1180µm	----	-	%	Not Authorised	Not Authorised	----	----	----
+2.36mm	----	-	%	Not Authorised	Not Authorised	----	----	----
+4.75mm	----	-	%	Not Authorised	Not Authorised	----	----	----
+9.5mm	----	-	%	Not Authorised	Not Authorised	----	----	----
+19.0mm	----	-	%	Not Authorised	Not Authorised	----	----	----
+37.5mm	----	-	%	Not Authorised	Not Authorised	----	----	----
+75.0mm	----	-	%	Not Authorised	Not Authorised	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	-	%	Not Authorised	Not Authorised	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	6-2C	10-6C	----	----	----
				Client sampling date / time	[02-Oct-2014]	[02-Oct-2014]	----	----	----
Compound	CAS Number	LOR	Unit		EB1443856-001	EB1443856-002	--------	--------	--------
					Result	Result	Result	Result	Result
EA150: Soil Classification based on Particle Size - Continued									
Silt (2-60 µm)	----	-	%		Not Authorised	Not Authorised	----	----	----
Sand (0.06-2.00 mm)	----	-	%		Not Authorised	Not Authorised	----	----	----
Gravel (>2mm)	----	-	%		Not Authorised	Not Authorised	----	----	----
Cobbles (>6cm)	----	-	%		Not Authorised	Not Authorised	----	----	----
EA152: Soil Particle Density									
ø Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		Not Authorised	Not Authorised	----	----	----
EG005-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		28100	20600	----	----	----
Iron	7439-89-6	50	mg/kg		52200	40500	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1	mg/kg		7.98	7.41	----	----	----
Cadmium	7440-43-9	0.1	mg/kg		0.1	0.1	----	----	----
Chromium	7440-47-3	1	mg/kg		46.9	37.4	----	----	----
Copper	7440-50-8	1	mg/kg		38.0	24.4	----	----	----
Lead	7439-92-1	1	mg/kg		19.0	15.8	----	----	----
Nickel	7440-02-0	1	mg/kg		42.6	29.4	----	----	----
Silver	7440-22-4	0.1	mg/kg		0.2	0.2	----	----	----
Zinc	7440-66-6	1	mg/kg		136	99.2	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.09	0.09	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	----	0.1	mg/kg		----	<0.1	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
^ Nitrate as N (Sol.)	----	0.1	mg/kg		----	<0.1	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		----	<0.1	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		----	720	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		----	720	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		----	487	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		1.30	0.93	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	6-2C	10-6C	----	----	----
				Client sampling date / time	[02-Oct-2014]	[02-Oct-2014]	----	----	----
Compound	CAS Number	LOR	Unit		EB1443856-001	EB1443856-002	--------	--------	--------
					Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		----	<10	----	----	----
C10 - C14 Fraction	----	50	mg/kg		----	<50	----	----	----
C15 - C28 Fraction	----	100	mg/kg		----	<100	----	----	----
C29 - C36 Fraction	----	100	mg/kg		----	<100	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		----	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		----	<10	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		----	<10	----	----	----
>C10 - C16 Fraction	>C10_C16	50	mg/kg		----	<50	----	----	----
>C16 - C34 Fraction	----	100	mg/kg		----	<100	----	----	----
>C34 - C40 Fraction	----	100	mg/kg		----	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		----	<50	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		----	<50	----	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		----	<0.2	----	----	----
Toluene	108-88-3	0.5	mg/kg		----	<0.5	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		----	<0.5	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		----	<0.5	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		----	<0.5	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		----	<0.2	----	----	----
^ Total Xylenes	1330-20-7	0.5	mg/kg		----	<0.5	----	----	----
Naphthalene	91-20-3	1	mg/kg		----	<1	----	----	----
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	----	----	----
Dibutyltin	1002-53-5	1	µgSn/kg		<1	<1	----	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg		**1.4**	**0.5**	----	----	----
EP131A: Organochlorine Pesticides									
Aldrin	309-00-2	0.5	µg/kg		**Not Authorised**	**Not Authorised**	----	----	----
alpha-BHC	319-84-6	0.5	µg/kg		**Not Authorised**	**Not Authorised**	----	----	----
beta-BHC	319-85-7	0.5	µg/kg		**Not Authorised**	**Not Authorised**	----	----	----
delta-BHC	319-86-8	0.5	µg/kg		**Not Authorised**	**Not Authorised**	----	----	----
4.4`-DDD	72-54-8	0.5	µg/kg		**Not Authorised**	**Not Authorised**	----	----	----
4.4`-DDE	72-55-9	0.5	µg/kg		**Not Authorised**	**Not Authorised**	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	6-2C	10-6C	----	----	----
				Client sampling date / time	[02-Oct-2014]	[02-Oct-2014]	----	----	----
Compound	CAS Number	LOR	Unit		EB1443856-001	EB1443856-002	--------	--------	--------
					Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued									
4.4`-DDT	50-29-3	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
^ Sum of DDD + DDE + DDT	----	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
Dieldrin	60-57-1	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
alpha-Endosulfan	959-98-8	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
beta-Endosulfan	33213-65-9	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
Endosulfan sulfate	1031-07-8	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
^ Endosulfan (sum)	115-29-7	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
Endrin	72-20-8	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
Endrin aldehyde	7421-93-4	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
Endrin ketone	53494-70-5	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
Heptachlor	76-44-8	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
Heptachlor epoxide	1024-57-3	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
gamma-BHC	58-89-9	0.25	µg/kg		Not Authorised	Not Authorised	----	----	----
Methoxychlor	72-43-5	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
cis-Chlordane	5103-71-9	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
trans-Chlordane	5103-74-2	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
^ Total Chlordane (sum)	----	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
Oxychlordane	27304-13-8	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/kg		Not Authorised	Not Authorised	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors)									
^ Total Polychlorinated biphenyls	----	5	µg/kg		----	Not Authorised	----	----	----
Aroclor 1016	12674-11-2	5	µg/kg		----	Not Authorised	----	----	----
Aroclor 1221	11104-28-2	5	µg/kg		----	Not Authorised	----	----	----
Aroclor 1232	11141-16-5	5	µg/kg		----	Not Authorised	----	----	----
Aroclor 1242	53469-21-9	5	µg/kg		----	Not Authorised	----	----	----
Aroclor 1248	12672-29-6	5	µg/kg		----	Not Authorised	----	----	----
Aroclor 1254	11097-69-1	5	µg/kg		----	Not Authorised	----	----	----
Aroclor 1260	11096-82-5	5	µg/kg		----	Not Authorised	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		----	Not Authorised	----	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg		----	Not Authorised	----	----	----
Acenaphthylene	208-96-8	4	µg/kg		----	Not Authorised	----	----	----
Acenaphthene	83-32-9	4	µg/kg		----	Not Authorised	----	----	----
Fluorene	86-73-7	4	µg/kg		----	Not Authorised	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	6-2C	10-6C	----	----	----
				Client sampling date / time	[02-Oct-2014]	[02-Oct-2014]	----	----	----
Compound	CAS Number	LOR	Unit		EB1443856-001	EB1443856-002	--------	--------	--------
					Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Phenanthrene	85-01-8	4	µg/kg		----	Not Authorised	----	----	----
Anthracene	120-12-7	4	µg/kg		----	Not Authorised	----	----	----
Fluoranthene	206-44-0	4	µg/kg		----	Not Authorised	----	----	----
Pyrene	129-00-0	4	µg/kg		----	Not Authorised	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg		----	Not Authorised	----	----	----
Chrysene	218-01-9	4	µg/kg		----	Not Authorised	----	----	----
Benzo(b+j)fluoranthene	205-99-2	4	µg/kg		----	Not Authorised	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg		----	Not Authorised	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg		----	Not Authorised	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg		----	Not Authorised	----	----	----
Perylene	198-55-0	4	µg/kg		----	Not Authorised	----	----	----
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		----	Not Authorised	----	----	----
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		----	Not Authorised	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		----	Not Authorised	----	----	----
Coronene	191-07-1	5	µg/kg		----	Not Authorised	----	----	----
^ Sum of PAHs	----	4	µg/kg		----	Not Authorised	----	----	----
Radionucleides / Activity									
Gross alpha	----	500	Bq/kg DW		----	Not Authorised	----	----	----
Gross beta	----	500	Bq/kg DW		----	Not Authorised	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		----	61.2	----	----	----
Toluene-D8	2037-26-5	0.2	%		----	65.4	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		----	72.8	----	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		87.6	101	----	----	----
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.5	%		Not Authorised	Not Authorised	----	----	----
EP131T: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.5	%		----	Not Authorised	----	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		----	Not Authorised	----	----	----
Anthracene-d10	1719-06-8	10	%		----	Not Authorised	----	----	----
4-Terphenyl-d14	1718-51-0	10	%		----	Not Authorised	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1443856**	Page	: 1 of 8
Amendment	: **(Preliminary Report)**		
Client	: **BMT WBM GROUP LTD**	Laboratory	: Environmental Division Brisbane
Contact	: DR MARKUS BILLERBECK	Contact	: Customer Services EB
Address	: PO BOX 203 SPRING HILL BRISBANE QLD 4004	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: markus.billerbeck@bmtwbm.com.au	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3831 6744	Telephone	: +61-7-3243 7222
Facsimile	: +61 07 3832 3627	Facsimile	: +61-7-3243 7218
Project	: Port of Brisbane - Sediment Quality 20259	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 07-Oct-2014 13:00
C-O-C number	: ----	Date Analysis Commenced	: 10-Oct-2014
Sampler	: CONOR JONES	Issue Date	: 21-Oct-2014 17:24
Site	: ----		
		No. of samples received	: 2
Quote number	: ----	No. of samples analysed	: 2

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Signatories

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

Signatories	Position	Accreditation Category
Hamish Murray	Supervisor - Soils	Newcastle - Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils Brisbane Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Ryan Story	2IC Organic Instrument Chemist	Brisbane Inorganics Brisbane Organics
Satishkumar Trivedi	2 IC Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

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.

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.

- **ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.**
- **ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5**
- **EP090: Sample '10-6C' shows poor matrix spike recovery for MBT due to matrix interference.**
- **Radiological work undertaken by ALS Laboratory Group (Ceska Lipa) under CAI accreditation No. L1163. Report No. $$. NATA and CAI accreditations' are both recognised under ILAC.**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	6-2C	10-6C	----	----	----
			Client sampling date / time	[02-Oct-2014]	[02-Oct-2014]	----	----	----
Compound	CAS Number	LOR	Unit	EB1443856-001	EB1443856-002	--------	--------	--------
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	8.7	----	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	<2	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	<0.02	----	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	0.276	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	172	----	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	----	6.06	----	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	----	1210	----	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	----	1.94	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	1.5	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	----	<0.02	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	----	<10	----	----	----
Liming Rate	----	1	kg CaCO3/t	----	<1	----	----	----
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1	%	62.1	52.6	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	10	32	----	----	----
+150µm	----	1	%	8	26	----	----	----
+300µm	----	1	%	5	19	----	----	----
+425µm	----	1	%	4	13	----	----	----
+600µm	----	1	%	3	8	----	----	----
+1180µm	----	1	%	3	6	----	----	----
+2.36mm	----	1	%	2	5	----	----	----
+4.75mm	----	1	%	1	3	----	----	----
+9.5mm	----	1	%	<1	<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	%	42	39	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	6-2C	10-6C	----	----	----
				Client sampling date / time	[02-Oct-2014]	[02-Oct-2014]	----	----	----
Compound	CAS Number	LOR	Unit		EB1443856-001	EB1443856-002	--------	--------	--------
					Result	Result	Result	Result	Result
EA150: Soil Classification based on Particle Size - Continued									
Silt (2-60 µm)	----	1	%		48	26	----	----	----
Sand (0.06-2.00 mm)	----	1	%		8	30	----	----	----
Gravel (>2mm)	----	1	%		2	5	----	----	----
Cobbles (>6cm)	----	1	%		<1	<1	----	----	----
EA152: Soil Particle Density									
ø Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.77	2.61	----	----	----
EG005-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		28100	20600	----	----	----
Iron	7439-89-6	50	mg/kg		52200	40500	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1	mg/kg		7.98	7.41	----	----	----
Cadmium	7440-43-9	0.1	mg/kg		0.1	0.1	----	----	----
Chromium	7440-47-3	1	mg/kg		46.9	37.4	----	----	----
Copper	7440-50-8	1	mg/kg		38.0	24.4	----	----	----
Lead	7439-92-1	1	mg/kg		19.0	15.8	----	----	----
Nickel	7440-02-0	1	mg/kg		42.6	29.4	----	----	----
Silver	7440-22-4	0.1	mg/kg		0.2	0.2	----	----	----
Zinc	7440-66-6	1	mg/kg		136	99.2	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.09	0.09	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	----	0.1	mg/kg		----	<0.1	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
^ Nitrate as N (Sol.)	----	0.1	mg/kg		----	<0.1	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		----	<0.1	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		----	720	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		----	720	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		----	487	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		1.30	0.93	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	6-2C	10-6C	----	----	----
			Client sampling date / time	[02-Oct-2014]	[02-Oct-2014]	----	----	----
Compound	CAS Number	LOR	Unit	EB1443856-001	EB1443856-002	--------	--------	--------
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	----	<10	----	----	----
C10 - C14 Fraction	----	50	mg/kg	----	<50	----	----	----
C15 - C28 Fraction	----	100	mg/kg	----	<100	----	----	----
C29 - C36 Fraction	----	100	mg/kg	----	<100	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	----	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	----	<10	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	----	<10	----	----	----
>C10 - C16 Fraction	>C10_C16	50	mg/kg	----	<50	----	----	----
>C16 - C34 Fraction	----	100	mg/kg	----	<100	----	----	----
>C34 - C40 Fraction	----	100	mg/kg	----	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	----	<50	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	----	<50	----	----	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	----	<0.2	----	----	----
Toluene	108-88-3	0.5	mg/kg	----	<0.5	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg	----	<0.5	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	<0.5	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg	----	<0.5	----	----	----
^ Sum of BTEX	----	0.2	mg/kg	----	<0.2	----	----	----
^ Total Xylenes	1330-20-7	0.5	mg/kg	----	<0.5	----	----	----
Naphthalene	91-20-3	1	mg/kg	----	<1	----	----	----
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	----	----	----
Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	----	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg	**1.4**	**0.5**	----	----	----
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.5	µg/kg	<0.50	<0.50	----	----	----
alpha-BHC	319-84-6	0.5	µg/kg	<0.50	<0.50	----	----	----
beta-BHC	319-85-7	0.5	µg/kg	<0.50	<0.50	----	----	----
delta-BHC	319-86-8	0.5	µg/kg	<0.50	<0.50	----	----	----
4.4`-DDD	72-54-8	0.5	µg/kg	<0.50	<0.50	----	----	----
4.4`-DDE	72-55-9	0.5	µg/kg	<0.50	<0.50	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	6-2C	10-6C	----	----	----
				Client sampling date / time	[02-Oct-2014]	[02-Oct-2014]	----	----	----
Compound	CAS Number	LOR	Unit		EB1443856-001	EB1443856-002	--------	--------	--------
					Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued									
4.4`-DDT	50-29-3	0.5	µg/kg		<0.50	<0.50	----	----	----
^ Sum of DDD + DDE + DDT	----	0.5	µg/kg		<0.50	<0.50	----	----	----
Dieldrin	60-57-1	0.5	µg/kg		<0.50	<0.50	----	----	----
alpha-Endosulfan	959-98-8	0.5	µg/kg		<0.50	<0.50	----	----	----
beta-Endosulfan	33213-65-9	0.5	µg/kg		<0.50	<0.50	----	----	----
Endosulfan sulfate	1031-07-8	0.5	µg/kg		<0.50	<0.50	----	----	----
^ Endosulfan (sum)	115-29-7	0.5	µg/kg		<0.50	<0.50	----	----	----
Endrin	72-20-8	0.5	µg/kg		<0.50	<0.50	----	----	----
Endrin aldehyde	7421-93-4	0.5	µg/kg		<0.50	<0.50	----	----	----
Endrin ketone	53494-70-5	0.5	µg/kg		<0.50	<0.50	----	----	----
Heptachlor	76-44-8	0.5	µg/kg		<0.50	<0.50	----	----	----
Heptachlor epoxide	1024-57-3	0.5	µg/kg		<0.50	<0.50	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg		<0.50	<0.50	----	----	----
gamma-BHC	58-89-9	0.25	µg/kg		<0.25	<0.25	----	----	----
Methoxychlor	72-43-5	0.5	µg/kg		<0.50	<0.50	----	----	----
cis-Chlordane	5103-71-9	0.5	µg/kg		<0.50	<0.50	----	----	----
trans-Chlordane	5103-74-2	0.5	µg/kg		<0.50	<0.50	----	----	----
^ Total Chlordane (sum)	----	0.5	µg/kg		<0.50	<0.50	----	----	----
Oxychlordane	27304-13-8	0.5	µg/kg		<0.50	<0.50	----	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/kg		<0.50	<0.50	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors)									
^ Total Polychlorinated biphenyls	----	5	µg/kg		----	<5.0	----	----	----
Aroclor 1016	12674-11-2	5	µg/kg		----	<5.0	----	----	----
Aroclor 1221	11104-28-2	5	µg/kg		----	<5.0	----	----	----
Aroclor 1232	11141-16-5	5	µg/kg		----	<5.0	----	----	----
Aroclor 1242	53469-21-9	5	µg/kg		----	<5.0	----	----	----
Aroclor 1248	12672-29-6	5	µg/kg		----	<5.0	----	----	----
Aroclor 1254	11097-69-1	5	µg/kg		----	<5.0	----	----	----
Aroclor 1260	11096-82-5	5	µg/kg		----	<5.0	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		----	<5	----	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg		----	<5	----	----	----
Acenaphthylene	208-96-8	4	µg/kg		----	9	----	----	----
Acenaphthene	83-32-9	4	µg/kg		----	<5	----	----	----
Fluorene	86-73-7	4	µg/kg		----	<5	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	6-2C	10-6C	----	----	----
				Client sampling date / time	[02-Oct-2014]	[02-Oct-2014]	----	----	----
Compound	CAS Number	LOR	Unit		EB1443856-001	EB1443856-002	--------	--------	--------
					Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Phenanthrene	85-01-8	4	µg/kg		----	11	----	----	----
Anthracene	120-12-7	4	µg/kg		----	6	----	----	----
Fluoranthene	206-44-0	4	µg/kg		----	34	----	----	----
Pyrene	129-00-0	4	µg/kg		----	35	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg		----	21	----	----	----
Chrysene	218-01-9	4	µg/kg		----	25	----	----	----
Benzo(b+j)fluoranthene	205-99-2	4	µg/kg		----	21	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg		----	18	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg		----	23	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg		----	33	----	----	----
Perylene	198-55-0	4	µg/kg		----	31	----	----	----
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		----	30	----	----	----
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		----	11	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		----	31	----	----	----
Coronene	191-07-1	5	µg/kg		----	10	----	----	----
^ Sum of PAHs	----	4	µg/kg		----	349	----	----	----
Radionucleides / Activity									
Gross alpha	----	500	Bq/kg DW		----	Not Authorised	----	----	----
Gross beta	----	500	Bq/kg DW		----	Not Authorised	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		----	61.2	----	----	----
Toluene-D8	2037-26-5	0.2	%		----	65.4	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		----	72.8	----	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		87.6	101	----	----	----
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.5	%		54.4	57.8	----	----	----
EP131T: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.5	%		----	75.0	----	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		----	110	----	----	----
Anthracene-d10	1719-06-8	10	%		----	116	----	----	----
4-Terphenyl-d14	1718-51-0	10	%		----	121	----	----	----

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