BMT WBM

Port of Brisbane Maintenance Dredging - Sediment Quality Report - 2015

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Synopsis: **A report describing the sampling and analysis of sediment quality in the Port of Brisbane during 2015 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. The dredged material will either be placed at sea at the Mud Island Dredge Material Placement Area (MIDMPA) or in the Future Port Expansion (FPE) reclamation area.

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 Moreton Bay reference sites, including those sites at the MIDMPA, were characterised by a high proportion of fines.

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 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 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.

- Organochlorine pesticides were detected throughout the study area. *p,p'*-DDD was detected within 22% of sites in the overall study area and *p,p'*-DDE was detected within 83% of sites in the overall study area. Across all dredge areas the overall 95% UCL was below the screening level for *p,p'*-DDD but was above the screening level for *p,p'*-DDE. The concentrations and spatial distribution of *p,p'*-DDE and *p,p'*-DDD were consistent with that reported by BMT WBM (2013, 2015a, 2015b). 95% UCL concentrations of *p,p'*-DDT residues were widespread and were above the screening level in all dredge zones. *p,p'*-DDT levels were similar to that recorded at reference sites and the MIDMPA, suggesting broad-scale contamination throughout western Moreton Bay. Despite being consistently identified over recent years, there have been inconsistencies in the concentrations of *p,p'*-DDT which have been detected (see BMT WBM 2013, 2015a, 2015b) and *p,p'*-DDT should be monitored closely in future sediment investigations. In addition, *trans*-Chlordane exceeded the screening levels at three sites and Dieldrin was detected at 4 sites (below screening levels).
- 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, DDE, Dieldrin or Chlordane. 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 slightly elevated for Total Nitrogen and Total Kjeldahl Nitrogen compared to previous investigations but were consistent with previous results for all other parameters. NAGD does not provide screening levels for nutrients. However, given that nutrient concentrations were in the typical range of coastal sediments and harbour areas in Moreton Bay, the risk of adverse impacts caused by nutrients during dredging and disposal is considered to be low.
- Acid Sulfate Soil testing indicated that while sediments were characterised as potential acid sulfate soils (PASS), the acid neutralizing capacity at most sites was sufficient for neutralising acids upon oxidation. The exception to this was site 5-1, which did not have sufficient acid neutralizing capacity, and would therefore potentially require treatment using a liming rate of 9 - 24 kg/CaCO3 per tonne of dredge material if the material were placed on land. However, the material would be suitable for ocean disposal where sediments will remain saturated with seawater and oxidation is unlikely.

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. 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 placed at sea within the Mud Island Dredge Material Placement Area (MIDMPA) or in the Future Port Expansion (FPE) reclamation area. To assess suitability of dredged material for unconfined ocean placement, 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 October/November 2015. 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 (if required). 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 locations on the basis of the water body type, navigable depths and nature of dredged material:

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

This SAP specifically focusses on sediments in the Brisbane River dredge area, as well as the MIDMPA and 'reference' areas in western Moreton Bay. The Brisbane River dredge area 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, as occurred 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 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 mix 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 29 October to 2 November 2015, inclusive. Sampling was undertaken during daytime hours.

2.3 Sampling Locations and Sample Numbers

2.3.1 Sampling Locations

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

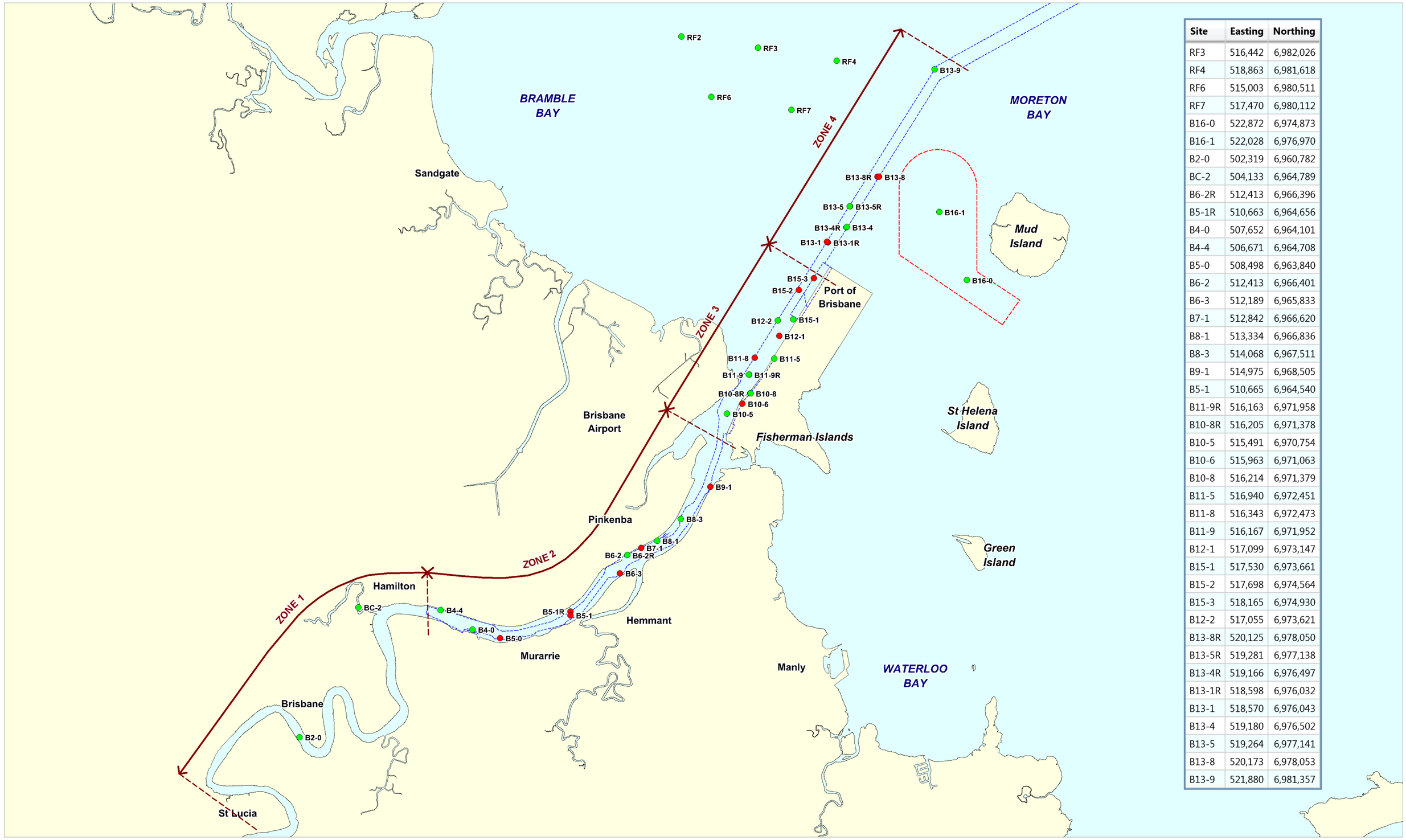
As per the SAP, all samples were analysed for a basic suite with a detailed suite analysed at selected study locations (refer to Figure 2-1 and Section 2.5).

2.3.2 Additional Field 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

2.3.3 Elutriate and Bioavailability Analyses

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 Sample Collection and Handling

2.4.1 Survey Vessel, Sampling Equipment and Personnel

The BMT WBM vessel *Resolution II* was used for sampling the sediments. Both handheld GPS and differential GPS (dGPS) was used on the survey vessel for position fixing and navigation to each sampling location.

All sediment sampling was undertaken by a team of three qualified marine scientists and field technicians with experience in the implementation of sediment sampling and analysis programs.

2.4.2 Sampling Procedure

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.

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.

2.4.3 Survey Vessel and Equipment House-Keeping

The vessel was thoroughly inspected and washed down prior to the beginning of sediment sampling each day. 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.

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.

2.4.4 Sample Collection, Handling and Storage

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).

2.5 Laboratory Analysis

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 Appendix A).

2.5.1 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 (Microanalysis Australia) 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).

2.5.2 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.

2.5.2.1 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.

2.5.2.2 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. NAGD also notes that RPDs may not always agree within these limits where sediments are very inhomogeneous or vary greatly in grain size.

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.

2.5.2.3 *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.

2.6 Data Analysis

2.6.1 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.

2.6.2 Elutriate and Bioavailability Testing

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.

2.6.3 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 and 2014, sediments within Zones 2 and 3 were generally characterised by a high proportion of fines (silt and clay), with most samples having greater than 80% of fine material. Several sites within Zone 3 (including 15-2 and 15-3) were notably different to others with respect to fines, having only approximately 20% fine material, but the results from these sites is also consistent with previous years. The average proportion of silts was 36.3% and 36.2% for Zones 2 and 3, respectively, which is similar to results from 2014 (40% and 33%, respectively) and 2013 (40% and 32%, respectively). In 2015 clay comprised an average of 48.1% and 32.4% at Zones 2 and 3 respectively, compared to 45% and 36% in 2014 which was similar to 2015, and 48% and 49% in 2013. Sands comprised 15% and 30 % on average for Zones 2 and 3 in 2015, compared to 14% and 30% in 2014 and 14% and 18% in 2013.

In 2015 Zone 4 was characterised by coarser sediments with an average sand content of 47.1% and 1% gravel, with 51.9% fines. This tendency towards coarser materials in Zone 3 is consistent with previous years, although the proportions are slightly different with less sand and gravel than 2014 (59% and 3% respectively) and more fines (37% reported in 2014).

The MIDMPA sediments were comparable to Zone 2 and Zone 3 sediments with respect to their PSD. In 2015 there was 29% sand and 70.3% fines in the MIDMPA. The proportion of fine sediment recorded was lower in 2014 (44%) and higher in 2013 (90%). This variation is most likely due to small scale sediment heterogeneity and low sampling effort (two sites only) at this location.

Similarly, the Moreton Bay reference sites were characterised by a high proportion of fines in 2015 (85.2%) which is similar to results from 2013 (89.9%) and 2014 (85.8%). Silts and clays contributed 30.3% and 55% respectively in 2015 compared with 32-34% and 53-55% on average for 2013 and 2014.

Sediments within Zone 1 had high proportions of sandy sediment comprising between 97.8% and 24.2% for the upstream reference location 2-0 and the Breakfast Creek site BC-2, respectively. This is similar to values recorded in 2014 (98% sand at location 2-0 and 22% at BC-2) and is higher than values recorded in 2013, most likely reflecting small scale sediment heterogeneity and low sampling effort at this location.

Results

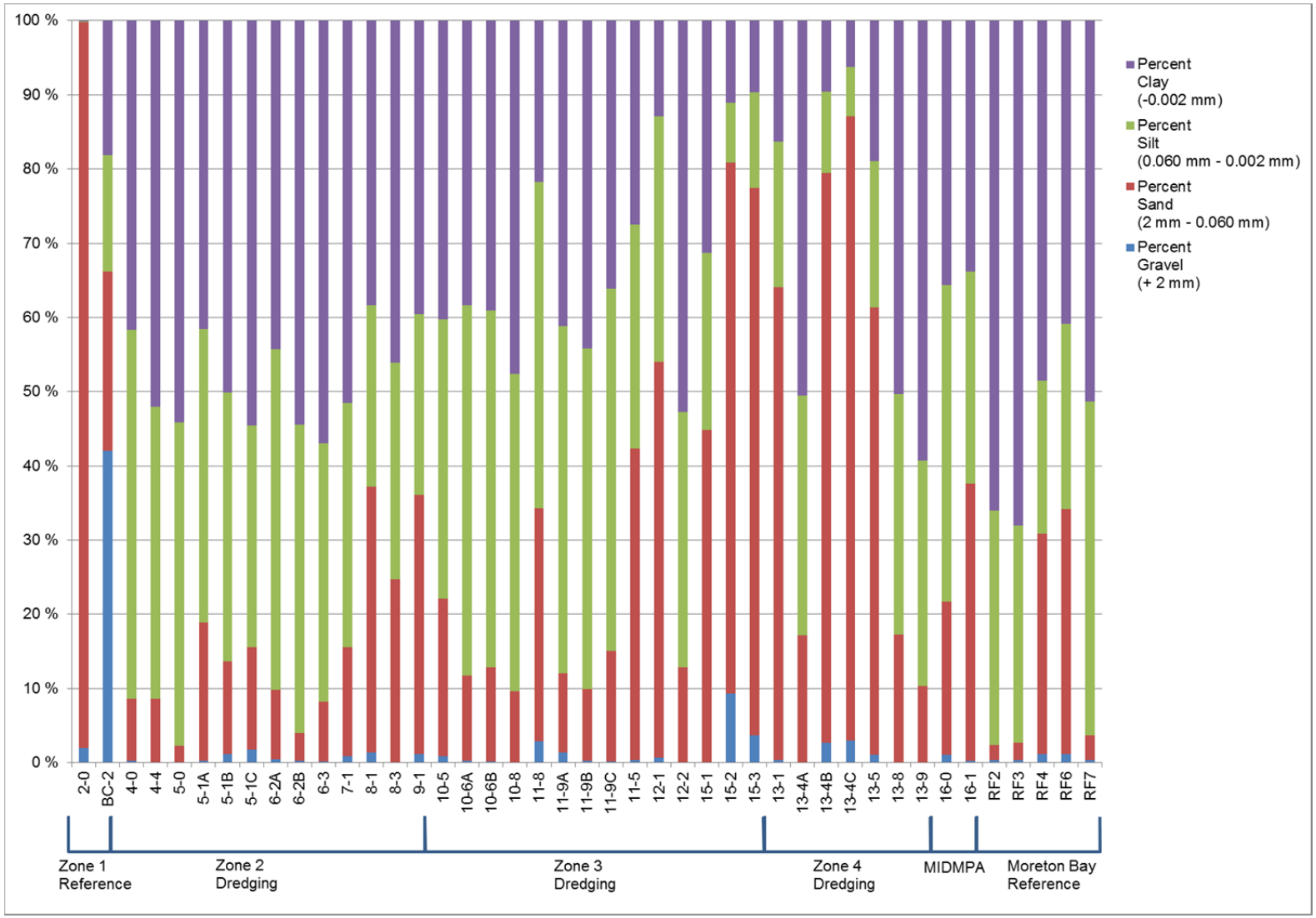

Figure 3-1 Particle Size Distribution Results

3.2 Trace Elements

3.2.1 Bulk Sediment Analysis

All trace metals and metalloids tested for were detected in the present study. Cadmium (6 of 48 samples) and silver (27 of 48 primary samples) had the least number of detections, consistent with the results of the 2014 sampling campaign.

Concentrations of most metals and metalloids were generally below NAGD screening levels across the study area), with the following exceptions:

- 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 28.6 mg/kg, which was similar to 2014 (28.3 mg/kg) and 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 34.3, 28.8 and 26.8 mg/kg for Zones 2, 3 and 4, respectively.
- Mercury - the 95% UCL was less than the screening level (0.15 mg/kg) in Zone 2 (0.13 mg/kg), Zone 3 (0.09 mg/kg), Zone 4 (0.10 mg/kg) and the overall dredge area (0.10 mg/kg). Three samples collected from site 5-1 exceeded the NAGD screening level for mercury, but were less than the screening level elsewhere. In the 2014 survey, no samples exceeded the screening level, whereas in 2013 when one sample (at location 13.5) exceeded the screening level (BMT WBM 2013, 2015a).
- Lead - The 95% UCL did not exceed the screening level (50 mg/kg) in any zone (Zone 2 = 21.9, Zone 3 = 13.9, Z4 = 15.4 mg/kg) or the dredge area overall (16.2 mg/kg). Lead concentrations recorded in 2015 were similar to 2014 (14.7 mg/kg) and 2013 (13.4 mg/kg) surveys. One sample collected from Breakfast Creek (BC-2), outside the dredge area, had a lead concentration of 100 mg/kg, which exceeded the screening level but was below the maximum level (220 mg/kg).

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 three of the five Moreton Bay reference locations. These results are consistent with the 2013 and 2014 surveys.

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 – Trace Metals/Metalloids

Analytes	Units	LOR	NAGD	% detections	% >NAGD	Mean	Geomean	Standard deviation	Distribution	95% UCL
Trace Metals/Metalloids										
Aluminium	mg/kg	5	-	100		22,481.5	21,759.03	5,352.0	-	-
Arsenic	mg/kg	0.4	20	100	0	7.44	7.36	1.11	N	7.8
Cadmium	mg/kg	0.1	1.5	7	0	0.06	0.06	0.05	NC2	NC2
Chromium	mg/kg	0.1	80	100	0	41.41	40.58	7.97	X	44.02
Copper	mg/kg	0.1	65	100	0	28.27	25.86	10.66	N	31.77
Iron	mg/kg	5	-	100		39,814.8	38,993.3	7,839.9	-	-
Lead	mg/kg	0.5	50	100	0	14.6	13.76	5.0	N	16.21
Mercury	mg/kg	0.01	0.15	100	4	0.09	0.08	0.04	X	0.101
Nickel	mg/kg	0.1	21	100	74	26.48	25.41	7.62	N	28.98
Silver	mg/kg	0.1	1	63	0	0.12	0.10	0.08	X	0.188
Zinc	mg/kg	0.5	200	100	0	89.5	84.86	28.1	N	98.7
Other Parameters										
Moisture Content	%	0.1	-	100	-	53.98	53.09	9.28	-	-
Total Organic Carbon	%	0.01	-	100	-	1.327	1.21	0.471	-	-
Phosphorus*	mg/kg	1	-	100	-	757.8	731.89	197.7	-	-
Nitrate as N	mg/kg	0.1	-	0	-	NC1	NC1	NC1	-	-
Nitrite as N	mg/kg	0.1	-	17	-	0.06	0.06	0.02	-	-
Total Kjeldahl Nitrogen	mg/kg	20	-	100	-	930.0	837.67	393.6	-	-
Total Nitrogen	mg/kg	20	-	100	-	930.0	837.67	393.6	-	-

Blue shading = parameter not detected; Orange shading = UCL95% > screening level

NC1 = not calculated due to no detections; NC2 = not calculated due to >30% of values being non-detects (applicable only to parameters with screening levels);

Data distribution: N = Normal; L = log-normal; X = follows no statistical distribution

3.2.2 Elutriate and Bioavailability Testing

Phase III elutriate and dilute acid extraction (bioavailability) tests were undertaken to further investigate the elevated overall 95% UCL's for nickel and the potential impact on water quality and sediment biota. Samples with the highest recorded nickel concentrations were selected for all dredge zones.

Elutriate test results (Table 3-2) were below the ANZECC/ARMCANZ (2000) marine trigger limit of 7 µg/L (99% species protection) for all tested samples. The dilute acid extraction results (Table 3-2) were also below the NAGD screening level for all samples, and were consistent with levels recorded by BMT WBM (2013, 2015a).

Table 3-2 Nickel Bioavailability and Elutriate Testing Results

Zone	Sample	Dilute Acid Extraction (mg/kg)	Elutriate (µg/l)
		Nickel	Nickel
2	4-4	6.3	<3
2	4-4	-	<3
2	4-0	12	4.4
2	4-0	12	-
2	5-0	6	6.2
2	5-1A	5.2	<3
2	5-1B	5.4	<3
2	6-2A	7.7	3.8
4	13-9	6.4	<3
4	13-4A	4.6	<3
4	13-4B	2.2	<3
4	13-1	3.5	<3
3	12-2	8	3.5
3	12-2	7.8	<3
3	11-5	4.6	<3
3	11-9A	5.2	<3
3	11-9B	5.5	<3
3	11-9C	5.2	<3
3	10-8	5.5	<3
3	10-6A	6	<3
3	10-5	6.4	<3
LOR		0.1	0.1
Guideline		21 mg/kg	7 µg/L

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.

3.2.3 Total Petroleum Hydrocarbons (TPHs)

Concentrations of TPHs were below the LOR for the C6-C9 and C10-C14 fractions at all locations, similar to 2014 survey results. A few low level detections of TPHs C15-C28 and C29-C36 were recorded at location 5-1, and C29-C36 was detected at location 7-1. The maximum normalised concentration of 61 mg/kg is well below the NAGD screening level of 550 mg/kg. This is consistent with the results of BMT WBM (2013, 2015a).

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.

3.2.4 Polyaromatic Hydrocarbons (PAHs)

Relatively low level detections of PAHs were noted at all investigated study locations within all dredge zones. Total PAHs concentrations were well below the NAGD screening level of 10,000 µg/kg in all samples. The 95% UCL for total PAHs across all dredge zones was 969 µg/kg. These results are consistent with sampling results in 2013 and 2014 (BMT WBM 2013, 2015a).

On 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.

Table 3-3 Summary Statistics and 95% UCLs for Combined Locations in Zones 2, 3 and 4. Values Highlighted in Orange Indicate Exceedance of NAGD Screening Levels – Organic Compounds (Normalised to 1% TOC)

Analytes	Units	LOR	NAGD	% detections	% >NAGD	Mean	Geomean	Standard deviation	Distribution	95% UCL
Moisture Content	%	0.1	-	100	-	53.98	53.09	9.28	-	-
Total Organic Carbon	%	0.01	-	100	0	1.327	1.21	0.471	-	-
Organo-tins										
Monobutyl tin	µgSn/kg	0.5	-	93	-	2.25	1.71	2.88	-	-
Dibutyl tin	µgSn/kg	0.5	-	93	-	1.86	1.43	2.20	-	-
Tributyl tin	µgSn/kg	0.5	9	85	0	1.56	1.07	1.59	L	3.62
Organo-chlorine pesticides										
Aldrin	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
alpha-BHC	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
beta-BHC	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
gamma-BHC (Lindane)	µg/kg	1	0.32	0	0	NC1	NC1	NC1	NC1	NC1
delta-BHC	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
cis-Chlordane	µg/kg	1	0.5	0	0	NC1	NC1	NC1	NC1	NC1
trans-Chlordane	µg/kg	1	0.5	7	0	0.5	0.43	0.3	NC1	NC1
p,p'-DDD	µg/kg	1	2	41	5	1.2	0.85	1.2	L	1.66
p,p'-DDE	µg/kg	1	2.2	89	16	2.8	2.51	1.2	L	3.16
p,p'-DDT	µg/kg	1	1.6	11	0	2.7	2.31	1.7	NC2	NC2
Dieldrin	µg/kg	1	280	0	0	NC1	NC1	NC1	NC1	NC1
alpha-Endosulfan	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
beta-Endosulfan	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
Endosulfan Sulphate	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
Endrin	µg/kg	1	10	0	0	NC1	NC1	NC1	NC1	NC1
Endrin ketone	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
Endrin aldehyde	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
Heptachlor	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-

Results

Analytes	Units	LOR	NAGD	% detections	% >NAGD	Mean	Geomean	Standard deviation	Distribution	95% UCL
Heptachlor epoxide	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
Hexachlorobenzene	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
Methoxychlor	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
Oxychlordane*	µg/kg	1	-	0	-	NC1	NC1	NC1	-	-
Total Petroleum Hydrocarbons										
TPH C6-C9	mg/kg	10	550	0	0				NC1	NC1
TPH C10-14	mg/kg	10	550	0	0				NC1	NC1
TPH C15-28	mg/kg	50	550	8	0	16.6	8.47	17.0	NC2	NC2
TPH C29-36	mg/kg	50	550	17	0	20.1	11.17	18.5	NC2	NC2
PAHs										
Naphthalene	µg/kg	5	-	8	-	3.6	3.17	1.9	-	-
1-Methylnaphthalene	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
2-Methylnaphthalene	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Acenaphthylene	µg/kg	5	-	33	-	4.1	3.83	1.7	-	-
Acenaphthene	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Fluorene	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Phenanthrene	µg/kg	5	-	83	-	20.3	14.13	25.0	-	-
Anthracene	µg/kg	5	-	50	-	6.7	5.33	5.7	-	-
Fluoranthene	µg/kg	5	-	83	-	16.3	9.75	26.1	-	-
Pyrene	µg/kg	5	-	92	-	77.0	44.66	116.9	-	-
Benz(a)anthracene	µg/kg	5	-	83	-	38.4	23.67	53.5	-	-
Chrysene	µg/kg	5	-	83	-	41.9	26.12	50.7	-	-
Benzo(b)&(k)fluoranthene	µg/kg	10	-	83	-	77.6	52.08	87.5	-	-
Benzo(a)pyrene	µg/kg	5	-	92	-	43.4	28.98	52.8	-	-
Indeno(1,2,3-cd)pyrene	µg/kg	5	-	83	-	33.9	23.27	38.5	-	-
Dibenz(a,h)anthracene	µg/kg	5	-	75	-	7.3	5.65	6.7	-	-
Benzo(g,h,i)perylene	µg/kg	5	-	83	-	29.8	21.34	31.9	-	-

Results

Analytes	Units	LOR	NAGD	% detections	% >NAGD	Mean	Geomean	Standard deviation	Distribution	95% UCL
Coronene	µg/kg	10	-	17	-	8.4	6.92	6.1	-	-
Benzo(e)pyrene	µg/kg	5	-	83	-	31.3	22.37	32.3	-	-
Perylene	µg/kg	5	-	100	-	54.8	52.62	16.4	-	-
Total PAHs (as above)	µg/kg	100	10000	83	0	545.1	378.70	647.5	L	969
PCBs										
Mono-PCB congeners	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Di-PCB congeners	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Tri-PCB congeners	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Tetra-PCB congeners	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Penta-PCB congeners	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Hexa-PCB congeners	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Hepta-PCB congeners	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Octa-PCB congeners	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Nona-PCB congeners	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Deca-PCB congeners	µg/kg	5	-	0	-	NC1	NC1	NC1	-	-
Total PCB congeners	µg/kg	5	23	0	0	NC1	NC1	NC1	NC1	NC1

Blue shading = parameter not detected; Orange shading = UCL95% > screening level

NC1 = not calculated due to no detections; NC2 = not calculated due to >30% of values being non-detects (applicable only to parameters with screening levels)

Data distribution: N = Normal; L = log-normal; X = follows no statistical distribution

3.2.5 Organochlorine Pesticides (OCPs)

3.2.5.1 Bulk Sediment

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

- *p,p'*-DDD was detected within 17 of the 48 samples within the overall study area (22%). Within the dredged area (Zones 2, 3 and 4), the 95% UCL was 1.7 µg/kg which was less than the screening level of 2 µg/kg. Within dredged areas the 95% UCL for DDD were 2.9 µg/kg (Zone 2), 1.2 µg/kg (Zone 3) and 0.8 µg/kg. DDD was not detected at reference locations, and was detected in one of three samples (16-0 = 2.1 µg/kg) from MIDMPA, and one of two locations upstream of the dredge area (Breakfast Creek BC-2 = 0.95 µg/kg).
- *p,p'*-DDE was detected within 40 of the 48 samples within the overall study area (83%). Within the dredged area (Zones 2, 3 and 4), the 95% UCL was 3.2 µg/kg which exceeded the screening level of 2 µg/kg. Within dredged areas the 95% UCLs for DDE ranged from 4.0 µg/kg (Zone 2), to 3.0 µg/kg (Zone 3) and 3.8 µg/kg. DDE was detected at all reference locations, and concentrations recorded in the dredged areas were within the range recorded at reference locations (0.8-4.7 µg/kg). DDE was also detected in one of three samples (16-0 = 3.6 µg/kg) at the MIDMPA, and one of two locations upstream of the dredge area (Breakfast Creek BC-2 = 2.8 µg/kg). This indicates that DDE was uniformly elevated throughout the study area, including reference locations in western Moreton Bay.
- Due to matrix interferences the laboratory detection limit for *p,p'*-DDT was raised to 5 µg/kg, which is well above the screening level of 1.6 µg/kg. *p,p'*-DDT was detected in three samples: 4-0 (9.0 µg/kg), 9-1 (6.0 µg/kg), 6-3 (6.0 µg/kg) and 7-1 (6.0 µg/kg). Assuming a value of half detection limit is adopted for non-detects (i.e. 2.5 µg/kg), the 95% UCL screening level would be exceeded (Zone 2 = 4.1, 3 = 5.9, 4 = 3.8 µg/kg; overall dredge area = 4.1 µg/kg).

The concentrations and spatial distribution of *p,p'*-DDE and *p,p'*-DDD were consistent with that reported by BMT WBM (2013, 2015a, 2015b). Concentrations of *p,p'*-DDT residues were similar to that recorded at reference sites and the MIDMPA, suggesting broad-scale contamination for these parameters in western Moreton Bay.

However, there were inconsistencies in *p,p'*-DDT concentrations over time:

- BMT WBM (2013) did not detect *p,p'*-DDT in the study area
- BMT WBM (2015a) recorded *p,p'*-DDT throughout the study area, despite considering the same locations and levels of reporting (1 µg/kg) as BMT WBM (2013). The 95% UCL for the study area was 4.2 µg/kg, similar to that recorded in the present study, noting an elevated value for non-detects.
- BMT WBM (2015b) sampled OCPs at locations throughout the lower Brisbane River (not dredged), and detected *p,p'*-DDT in low concentrations in 19 of the 70 (27%) of samples. Most *p,p'*-DDT detections were within the Brisbane River between Breakfast Creek and Pinkenba, at concentrations similar to that recorded by BMT WBM (2015a).

In accordance with NAGD, Phase III testing was undertaken to further assess potential effects of DDT and residues, and their suitability of offshore placement of dredged material.

In addition to DDT and its residues, the following OCPs were also detected:

- *trans*-Chlordane – detected at low levels in Breakfast Creek (BC2: 0.95 µg/kg), 5-0 (0.55 µg/kg) and 9-1 (0.66 µg/kg). The NAGD screening level is 0.5 µg/kg, which was exceeded in these three samples only. The 95% UCL for the dredge area was 0.87 µg/kg, but due to the large number of non-detections this number should be considered indicative only.
- Dieldrin – detected at low levels in Breakfast Creek (BC2: 0.95 µg/kg) 7-1 (0.59 µg/kg), 5-0 (1.33 µg/kg) and 4-4 (0.52 µg/kg). The NAGD screening level is 280 µg/kg. The 95% UCL for the dredge area was 0.60 µg/kg, but due to the large number of non-detections this number should be considered indicative.

3.2.5.2 Elutriate and Bioavailability Testing

Phase III elutriate and bioavailability (porewater) testing was undertaken to investigate the potential bioavailability of OCPs. As outlined in Section 2.6.2, 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 (detection limit = 0.03 µg/L) 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, DDE, Dieldrin or Chlordane.

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.

3.2.6 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 6.8 µgSn/kg, 1.0 µgSn/kg and 0.9 µgSn/kg for Zone 2, 3 and 4, respectively. Across the combined dredge zones, the 95% UCL for TBT was 3.6 µgSn/kg, compared to 0.7 µgSn/kg in 2013 and 0.9 µgSn/kg in 2014. 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.

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. Furthermore, elutriate and porewater testing did not detect TBT (<0.03 mg/l), suggesting low bioavailability.

3.2.7 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.

3.2.8 Radionuclides

Measurements of gross alpha and gross beta activity were below the laboratory LOR at all investigated locations (gross alpha <60 mBq/g; gross beta <135 mBq/g). The screening level for the sum of gross alpha and gross beta is 35 Bq/g (= 350 mBq/g). 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.

3.2.9 Nutrients and Carbon Content

Total Nitrogen and Total Kjeldahl Nitrogen concentrations ranged between 320 and 1530 mg/kg across the dredge zones, compared to 220 mg/kg and 1320 mg/kg in 2014. Total Phosphorus concentrations ranged between 390 to 1200 mg/kg, similar to 2014 results (260 - 1300 mg/kg). Nitrate and Nitrite concentrations were below the LOR in all samples, similar to 2013 and 2014. TOC content ranged between 0.3 to 2% across the dredge zones, similar to 2014 (0.15- 2%).

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).

3.2.10 Acid Sulfate Soils

Acid Sulfate Soil testing indicated that no management would be required for sediments at most investigated locations (except site 5-1) within dredge Zones 2, 3 and 4 (Figure 2-1).

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). Taking into account Acid Neutralising Capacity (ANC), the net acidity was less than the laboratory limit of reporting (10 moles H+/t) at all locations except for site 5-1 (including all three field triplicate samples). This indicates that most sediments have sufficient capacity for neutralising acids upon oxidation except in the vicinity of site 5-1 where liming rates of 9 - 24 kg/CaCO3 per tonne of dredge material may be required for land based placement options.

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.

Table 3-4 Acid Sulfate Soil Results (Chromium Suite and SPOCAS)

Site	Rep	pH_{kcl}	TAA pH 6.5	s-TAA pH 6.5	CRS	a-CRS	S_{KCl}	ANCE	a-ANCE	s-ANCE	a-Net Acidity	Liming rate	a-Net Acidity without ANCE	Liming rate without ANCE
		pH units	moles H+/t	%w/w S	%w/w	moles H+/t	%w/w S	% CaCO3	moles H+/t	%w/w S	moles H+/t	kg CaCO3/t	moles H+/t	kg CaCO3/t
LOR			*5*	*0.01*	*0.005*	*3*	*0.005*	*0.05*	*5*	*0.05*	*10*	*0.75*	*10*	*0.75*
5-0	0	8.2	<5	<0.01	0.24	150	0.19	0.66	130	0.21	<10	<0.75	130	9.6
9-1	0	8.1	<5	<0.01	0.17	110	0.2	0.59	120	0.19	<10	<0.75	48	3.6
5-1A	0	8.5	<5	<0.01	0.56	350	0.24	<0.05	<5	<0.05	130	9.4	NA	NA
5-1B	0	8.5	<5	<0.01	0.44	270	0.22	<0.05	<5	<0.05	310	24	NA	NA
5-1C	0	8.2	<5	<0.01	0.35	220	0.19	<0.05	<5	<0.05	190	14	NA	NA
6-3	0	8.2	<5	<0.01	0.24	150	0.14	0.65	130	0.21	<10	<0.75	180	13
7-1	0	8.2	<5	<0.01	0.21	130	0.35	0.67	130	0.21	<10	<0.75	25	1.9
13-8	0	8.6	<5	<0.01	0.15	94	0.16	1.5	310	0.49	<10	<0.75	100	7.7
13-1	0	8.9	<5	<0.01	0.12	74	0.06	0.66	130	0.21	<10	<0.75	63	4.7
13-1	1	8.9	<5		0.12	75								
15-3	0	9.1	<5	<0.01	0.14	89	0.15	0.72	140	0.23	<10	<0.75	41	3.1
15-2	0	9.1	<5	<0.01	0.05	34	0.1	0.58	120	0.19	<10	<0.75	41	3.1
12-1	0	8.9	<5	<0.01	0.18	120	0.13	0.56	110	0.18	<10	<0.75	85	6.4
12-1	1	8.9	<5	<0.01	0.19	120	0.12	0.61	120	0.2	<10	<0.75	89	6.7
11-8	0	8.7	<5	<0.01	0.21	130	0.17	0.7	140	0.22	<10	<0.75	110	8
10-6A	0	8.2	<5	<0.01	0.23	140	0.24	0.75	150	0.24	<10	<0.75	130	9.4
10-6B	0	8.4	<5	<0.01	0.21	130	0.21	0.91	180	0.29	<10	<0.75	140	10

4 Data Validation

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 2.5.2 for a description of laboratory QA/QC procedures.

4.1.1 Limits of Reporting (LORs)

Where the moisture factor was greater than 2.5% (i.e. all samples), the primary laboratory LOR was raised by a factor of two (2) for organic tests. Furthermore, for organochlorine pesticide analysis, the primary laboratory raised the LORs for DDT and endrin aldehyde due to sample matrix interference. The raised LORs resulted from inherent sediment properties in the study area.

The LORs for DDT (5 µg/kg) were raised above the screening level (1.6 µg/kg). In accordance with NAGD, a value of the half the detection limit was adopted (2.5 µg/kg), and therefore all samples exceeded the screening level. On this basis, the 95% UCL for DDT exceeded the screening level.

Recent assessments of OCPs in the lower Brisbane River estuary found that the 95% UCL concentration for DDT across all samples was 1.8 µg/kg (BMT WBM 2015b), which exceeded the screening level but was less than the Sediment Quality High Level of 46 µg/kg. The DDT concentrations measured by BMT WBM (2015b) are likely to be more representative of actual contaminant status then the derived values calculated in the present study.

For TBT analysis, there was suspected sample matrix interference and heterogeneity for BC-2. The TBT concentration measured at this location was 22 µgSn/kg. This location was outside the dredged area, and therefore does not present an issue with respect to the assessment of suitability of dredged material for sea disposal.

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

Trace elements RPD duplicate failed for location 2-0 for copper, lead and zinc, and location 6-2 for cadmium. The low RPD value was due to sample heterogeneity, as confirmed by re-extraction.

For all other chemical analyses conducted by the primary laboratory, RPDs 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 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 collected at Locations 5-1, 11-9 and 13-4 indicated relatively homogenous sediment contaminant concentrations over smaller scales with the RSD generally below the 50% NAGD criterion (Table 4-1). The exceptions to this were:

- Aluminium, chromium, copper, lead, mercury, nickel, MBT, DBT and TOC at location 13-4. This location had heterogeneous sediments – sample 13-4A had a fines content (i.e. sub-clay, clay, silt) of 82%, compared to 12-20% for the other two replicate samples. Sample 13-4A had correspondingly higher concentrations metals and MBT/DBT. Note that sample selection within locations was undertaken randomly, hence the variability observed here is representative of contaminant concentrations at this location.
- MBT, DBT, TBT, Perylene and total PAHs at location 5-1. Sediment within this location were homogenous (fines content 81-86%). TBT and its residues can show great variation at fine spatial scales, particularly when it is associated with paint flakes (from ship hulls). The presence of high concentrations of the paint additive Perylene in samples containing higher TBT concentrations supports this finding.

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 exceptions were:

- Cadmium at location 6-2. Sediment grain size was homogenous at this location, and the greatest variability occurred within (i.e. between the two primary laboratory samples) rather than between laboratories. The source of variation is not known, noting that all other metals at this location displayed a high degree of consistency. Cadmium concentrations at this location (0.05 to 0.26 mg/kg) were well below screening level of 1.5 mg/kg.
- MBT/DBT, and the PAHs Fluoranthene, Benzo(a)Pyrene and Perylene at location 10-6. The high degree of heterogeneity in TBT, Perylene and the other PAHs most likely reflects the presence of small paint flecks in the sediment.

The exceedance of the NAGD criterion for these parameters was not considered problematic given that it had low concentrations that were well below the screening levels.

4.3 Summary of Data Validation

The evaluation of laboratory and field QA/QC procedures and assessments indicates that sampling, sample handling and storage 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. The raised LOR for DDT required the adoption of half the detection limit (2.5 µg/kg) for all non-detects, which is conservative in the context of more precise measurements undertaken in this region by BMT WBM (2015b).

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)

Parameter	Units	5-1A	5-1B	5-1C	RSD	13-4A	13-4B	13-4C	RSD	11-9A	11-9B	11-9C	RSD
Aluminium	mg/kg	24000	24000	25000	**2.4**	23000	9200	6400	**69.1**	24000	26000	26000	**4.6**
Arsenic	mg/kg	7.9	8.3	8.5	**3.7**	9.3	6.3	5.4	**29.2**	8.9	9.3	9.1	**2.2**
Cadmium	mg/kg	0.22	0.21	0.12	**30.0**	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-
Chromium	mg/kg	47	47	44	**3.8**	43	22	17	**50.5**	45	46	46	**1.3**
Copper	mg/kg	35	36	32	**6.1**	21	8.8	5.4	**69.9**	31	32	32	**1.8**
Iron	mg/kg	40000	41000	42000	**2.4**	41000	22000	17000	**47.5**	41000	45000	44000	**4.8**
Lead	mg/kg	26	26	21	**11.9**	14	6.8	5.8	**50.5**	18	17	17	**3.3**
Mercury	mg/kg	0.21	0.18	0.19	**7.9**	0.09	0.04	0.02	**72.1**	0.1	0.12	0.1	**10.8**
Nickel	mg/kg	23	24	25	**4.2**	24	12	8.9	**53.3**	25	27	26	**3.8**
Phosphorus*	mg/kg	780	810	730	**5.2**	640	340	260	**48.5**	750	800	770	**3.3**
Silver	mg/kg	0.45	0.41	0.33	**15.4**	<0.1	<0.1	<0.1	-	0.14	0.13	0.14	**4.2**
Zinc	mg/kg	120	120	110	**4.9**	74	38	34	**45.3**	100	99	100	**0.6**
Monobutyl tin	µgSn/kg	21	16	1.9	**76.4**	1.6	1.1	0.25	**69.4**	2.6	1.9	3	**22.3**
Dibutyl tin	µgSn/kg	16	13	1.7	**73.7**	1.4	1.4	0.25	**65.3**	1.8	2	2.1	**7.8**
Tributyl tin	µgSn/kg	5.8	4.4	1.4	**58.1**	<1.0	<0.5	<0.5	-	1.6	2.1	1.5	**18.5**
Aldrin	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
alpha-BHC	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
beta-BHC	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
gamma-BHC (Lindane)	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
delta-BHC	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
cis-Chlordane	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
trans-Chlordane	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
p,p'-DDD	µg/kg	1	2	3	**50.0**	<1	<1	<1	-	<1	<1	<1	-
p,p'-DDE	µg/kg	8	5	4	**36.7**	2	<1	<1	-	3	3	3	**0**
p,p'-DDT	µg/kg	6	<5	<5	-	<5	<5	<5	-	<5	<5	<5	-
Dieldrin	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-

Data Validation

Parameter	Units	5-1A	5-1B	5-1C	RSD	13-4A	13-4B	13-4C	RSD	11-9A	11-9B	11-9C	RSD
alpha-Endosulfan	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
beta-Endosulfan	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
Endosulfan Sulphate	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
Endrin	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
Endrin ketone	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
Endrin aldehyde	µg/kg	<5	<5	<5	-	<5	<5	<5	-	<5	<5	<5	-
Heptachlor	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
Heptachlor epoxide	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
Hexachlorobenzene	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
Methoxychlor	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
Oxychlordane*	µg/kg	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-
Total Organic Carbon	%	1.3	1.5	1.8	**16.4**	1.2	0.34	0.17	**96.9**	1.5	1.6	1.6	**3.7**
TPH C15-28	mg/kg	65	72	<100	**7.2**	-	-	-	-	-	-	-	-
TPH C29-36	mg/kg	76	80	<100	**3.6**	-	-	-	-	-	-	-	-
Naphthalene	µg/kg	5	<5	8	**32.6**	-	-	-	-	-	-	-	-
Acenaphthylene	µg/kg	5	8	8	**24.7**	-	-	-	-	-	-	-	-
Fluorene	µg/kg	<5	<5	7	-	-	-	-	-	-	-	-	-
Phenanthrene	µg/kg	25	19	28	**19.1**	-	-	-	-	-	-	-	-
Anthracene	µg/kg	8	7	13	**34.4**	-	-	-	-	-	-	-	-
Fluoranthene	µg/kg	13	12	18	**22.4**	-	-	-	-	-	-	-	-
Pyrene	µg/kg	73	74	120	**30.2**	-	-	-	-	-	-	-	-
Benz(a)anthracene	µg/kg	40	41	57	**20.7**	-	-	-	-	-	-	-	-
Chrysene	µg/kg	40	40	54	**18.1**	-	-	-	-	-	-	-	-
Benzo(b)&(k)fluoranthene	µg/kg	95	100	130	**17.5**	-	-	-	-	-	-	-	-
Benzo(a)pyrene	µg/kg	51	58	76	**20.9**	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/kg	42	50	60	**17.8**	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	µg/kg	9	10	11	**10.0**	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	µg/kg	38	47	54	**17.3**	-	-	-	-	-	-	-	-

Data Validation

Parameter	Units	5-1A	5-1B	5-1C	RSD	13-4A	13-4B	13-4C	RSD	11-9A	11-9B	11-9C	RSD
Coronene	µg/kg	10	12	13	**13.1**	-	-	-	**-**	-	-	-	**-**
Benzo(e)pyrene	µg/kg	39	44	59	**22.0**	-	-	-	**-**	-	-	-	**-**
Perylene	µg/kg	55	77	620	**127.7**	-	-	-	**-**	-	-	-	**-**
Total PAHs (as above)	µg/kg	600	650	1420	**51.6**	-	-	-	**-**	-	-	-	**-**
Total Kjeldahl Nitrogen	mg/kg	900	950	1220	**16.8**	-	-	-	**-**	-	-	-	**-**
Total Nitrogen	mg/kg	900	950	1220	**16.8**	-	-	-	**-**	-	-	-	**-**

(-) not calculated as values either below detection limit, or parameter not measured

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)

Sample	Units	6-2A	6-2B	6_2c ALS	RSD	10-6A	10-6B	10_6C ALS	RSD
Aluminium	mg/kg	29000	28000	29500	**2.6**	26000	27000	32400	**12.1**
Arsenic	mg/kg	7.3	7.3	7.36	**0.5**	7.8	8	8.5	**4.5**
Cadmium	mg/kg	0.26	0.05	0.1	**80.3**	<0.1	<0.1	<0.1	-
Chromium	mg/kg	49	49	50.4	**1.6**	45	45	51.9	**8.4**
Copper	mg/kg	40	42	38.1	**4.9**	34	34	30	**7.1**
Iron	mg/kg	48000	50000	49100	**2.0**	43000	46000	51300	**9.0**
Lead	mg/kg	15	15	20.4	**18.6**	15	15	18	**10.8**
Mercury	mg/kg	0.09	0.1	0.08	**11.1**	0.1	0.1	0.09	**6.0**
Nickel	mg/kg	35	35	37.8	**4.5**	29	29	36.8	**14.3**
Phosphorus*	mg/kg	1200	1000	-	**12.9**	810	820	-	**0.9**
Silver	mg/kg	0.14	0.16	0.1	**22.9**	0.13	0.14	0.2	**24.2**
Zinc	mg/kg	110	110	132	**10.8**	99	100	119	**10.6**
Monobutyl tin	µgSn/kg	2.3	2.1	<1	**6.4**	2.1	2.5	0.5	**62.3**
Dibutyl tin	µgSn/kg	2	1.6	<1	**15.7**	1.6	1.6	0.5	**51.5**
Tributyl tin	µgSn/kg	2.2	1.4	1.1	**36.3**	1.2	1.5	0.5	**48.1**
Aldrin	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
alpha-BHC	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
beta-BHC	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
gamma-BHC (Lindane)	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
delta-BHC	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
cis-Chlordane	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
trans-Chlordane	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
p,p'-DDD	µg/kg	3	3	1.39	**0.0**	<1	<1	<0.5	-
p,p'-DDE	µg/kg	7	7	2.32	**0.0**	4	4	<0.5	**0.0**

Data Validation

Sample	Units	6-2A	6-2B	6_2c ALS	RSD	10-6A	10-6B	10_6C ALS	RSD
p,p'-DDT	µg/kg	<5	<5	<0.5	-	<5	<5	<0.5	-
Dieldrin	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
alpha-Endosulfan	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
beta-Endosulfan	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
Endosulfan Sulphate	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
Endrin	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
Endrin ketone	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
Endrin aldehyde	µg/kg	<5	<5	<0.5	-	<5	<5	<0.5	-
Heptachlor	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
Heptachlor epoxide	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
Hexachlorobenzene	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
Methoxychlor	µg/kg	<1	<1	<0.5	-	<1	<1	<0.5	-
Oxychlordane*	µg/kg	<1	<1	-	-	<1	<1	<0.5	-
Total Organic Carbon	%	1.7	1.7	1.14	**21.4**	1.6	1.6	1.16	**17.5**
TPH C15-28	mg/kg	-	-	<100	-	<100	<100	<100	-
TPH C29-36	mg/kg	-	-	<100	-	<100	<100	<100	-
Naphthalene	µg/kg	-	-	<1	-	<10	<10	<5	-
Acenaphthylene	µg/kg	-	-	-	-	<10	<10	6	-
Fluorene	µg/kg	-	-	-	-	<10	<10	<5	-
Phenanthrene	µg/kg	-	-	-	-	18	17	10	**29.1**
Anthracene	µg/kg	-	-	-	-	<10	<10	6	-
Fluoranthene	µg/kg	-	-	-	-	13	11	31	**60.1**
Pyrene	µg/kg	-	-	-	-	69	54	57	**13.2**
Benz(a)anthracene	µg/kg	-	-	-	-	33	24	18	**30.2**
Chrysene	µg/kg	-	-	-	-	34	26	15	**38.2**

Data Validation

Sample	Units	6-2A	6-2B	6_2c ALS	RSD	10-6A	10-6B	10_6C ALS	RSD
Benzo(b)&(k)fluoranthene	µg/kg	-	-	-	-	73	59	25	**47.2**
Benzo(a)pyrene	µg/kg	-	-	-	-	42	33	12	**53.1**
Indeno(1,2,3-cd)pyrene	µg/kg	-	-	-	-	33	27	14	**39.4**
Dibenz(a,h)anthracene	µg/kg	-	-	-	-	<10	<10	<5	-
Benzo(g,h,i)perylene	µg/kg	-	-	-	-	31	25	17	**28.9**
Coronene	µg/kg	-	-	-	-	<20	<20	5	-
Benzo(e)pyrene	µg/kg	-	-	-	-	31	25	16	**31.5**
Perylene	µg/kg	-	-	-	-	75	66	23	**50.8**
Total PAHs (as above)	µg/kg	-	-	-	-	520	420	279	**29.8**
Total Kjeldahl Nitrogen	mg/kg	-	-	1660	-	1210	1320	-	**6.1**
Total Nitrogen	mg/kg	-	-	1660	-	1210	1320	-	**6.1**

(-) not calculated as values either below detection limit, or parameter not measured

5 References

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Appendix A Sampling and Analysis Plan

BMT WBM

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

Reference: R.B20259.001.02.SAP.docx
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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BMT WBM File	PDF	PDF									
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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.

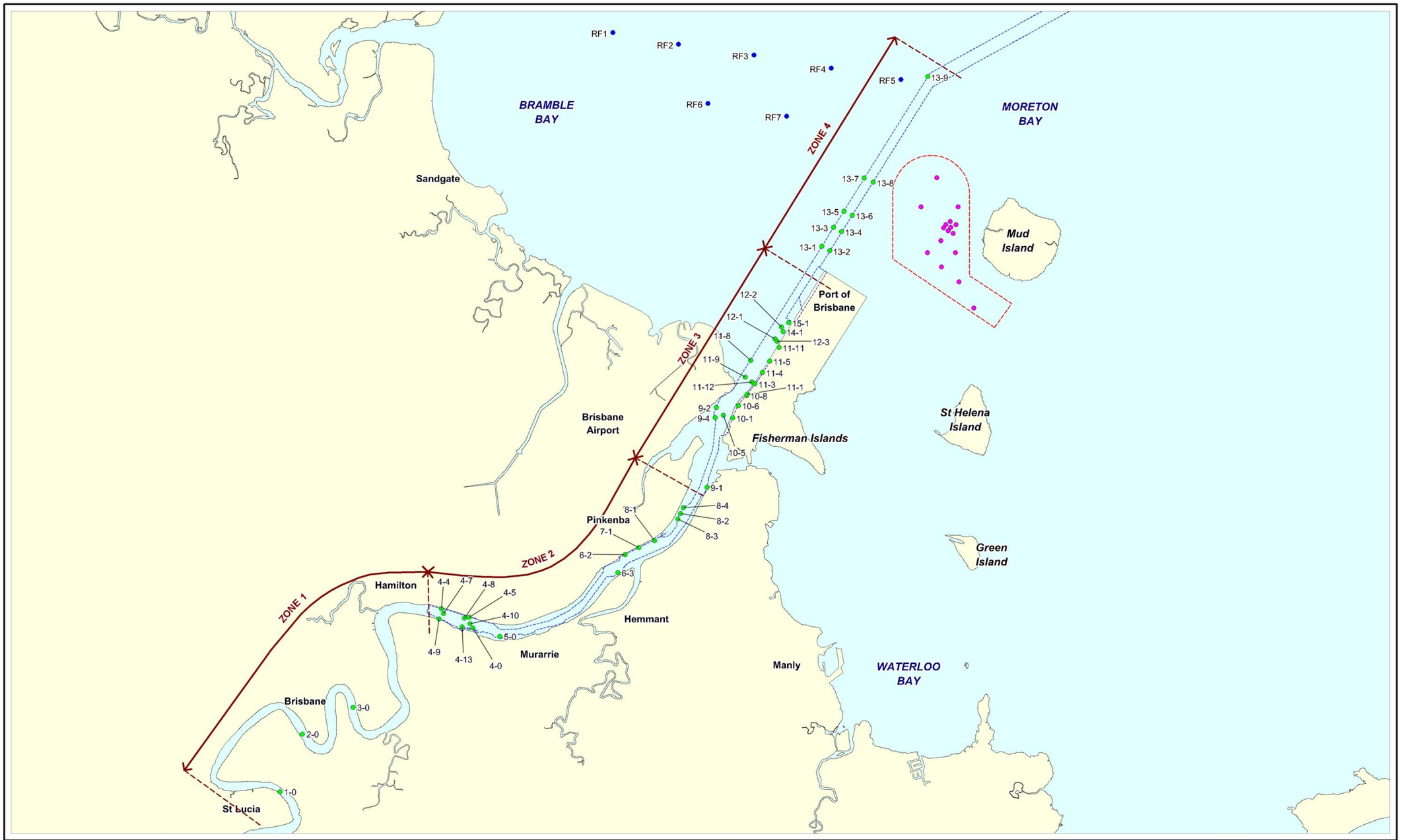
Table 2-1 Previous Routine Annual Sediment Quality Studies

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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Filepath : I:\B20259_I_BRH Port of Brisbane DLR\DRG\ECO_019_130923 Sediment Sampling Plan.wor

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.

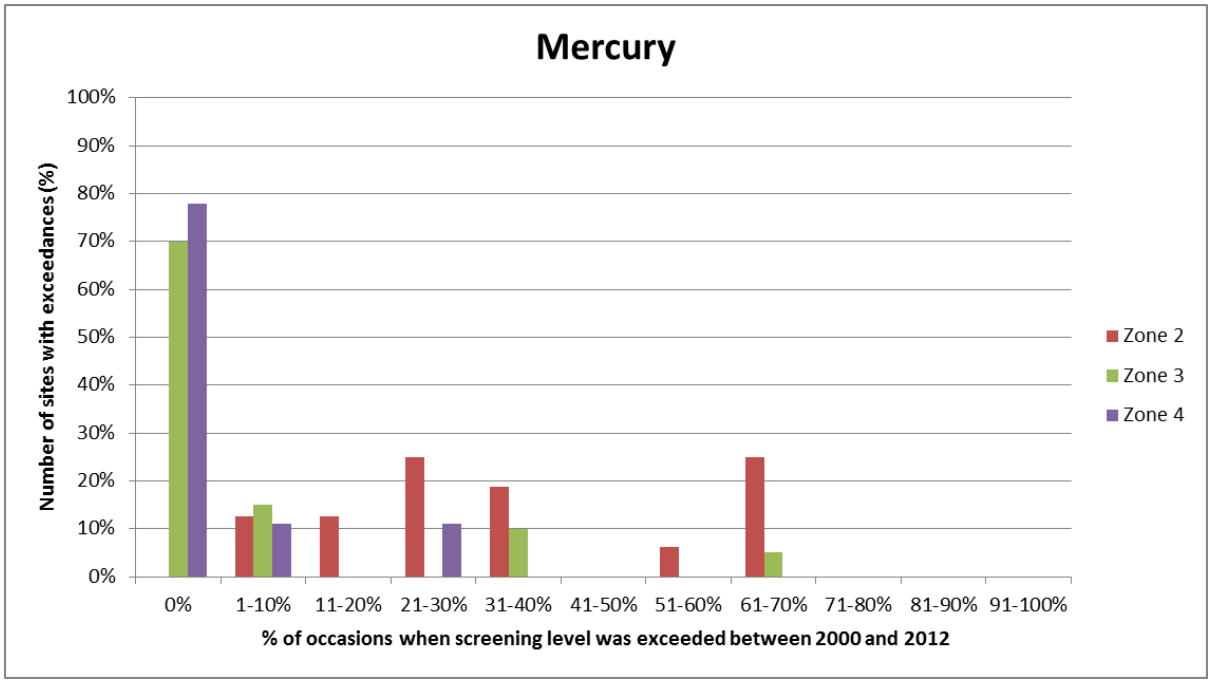


Figure 2-2 Exceedances of the NAGD Screening Level for Mercury between 2000 and 2012 in Dredge Zones 2, 3 and 4

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).

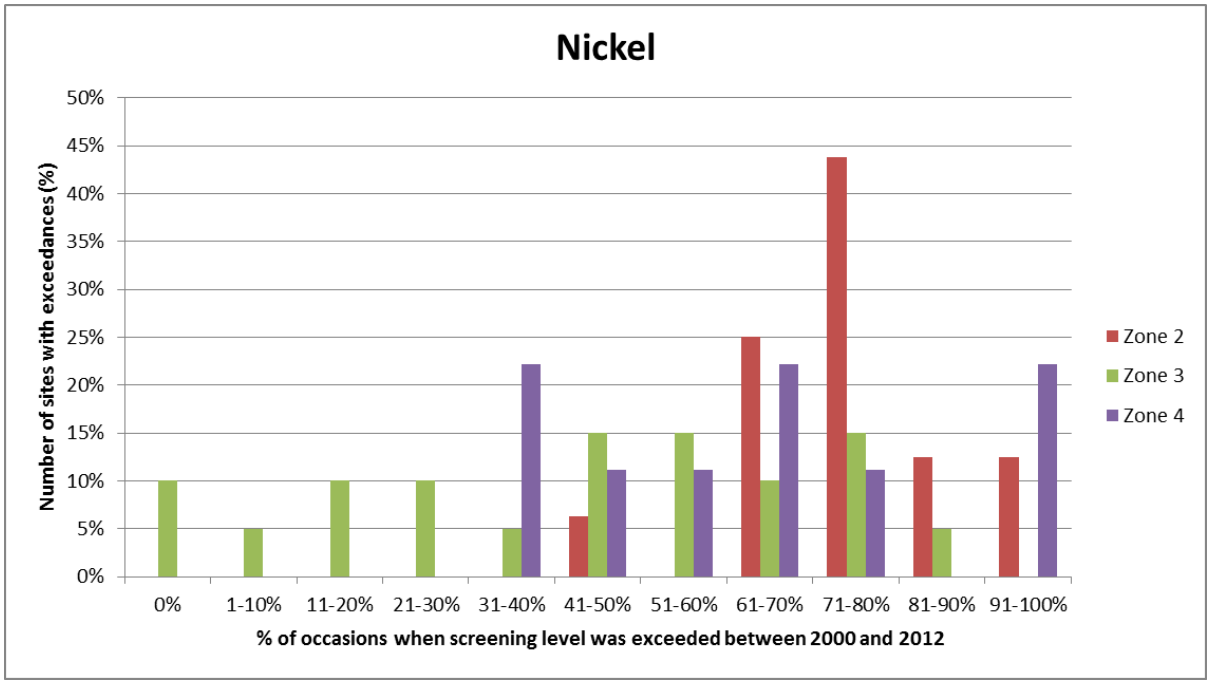


Figure 2-3 Exceedances of the NAGD Screening Level for Nickel between 2000 and 2012 in Dredge Zones 2, 3 and 4

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.

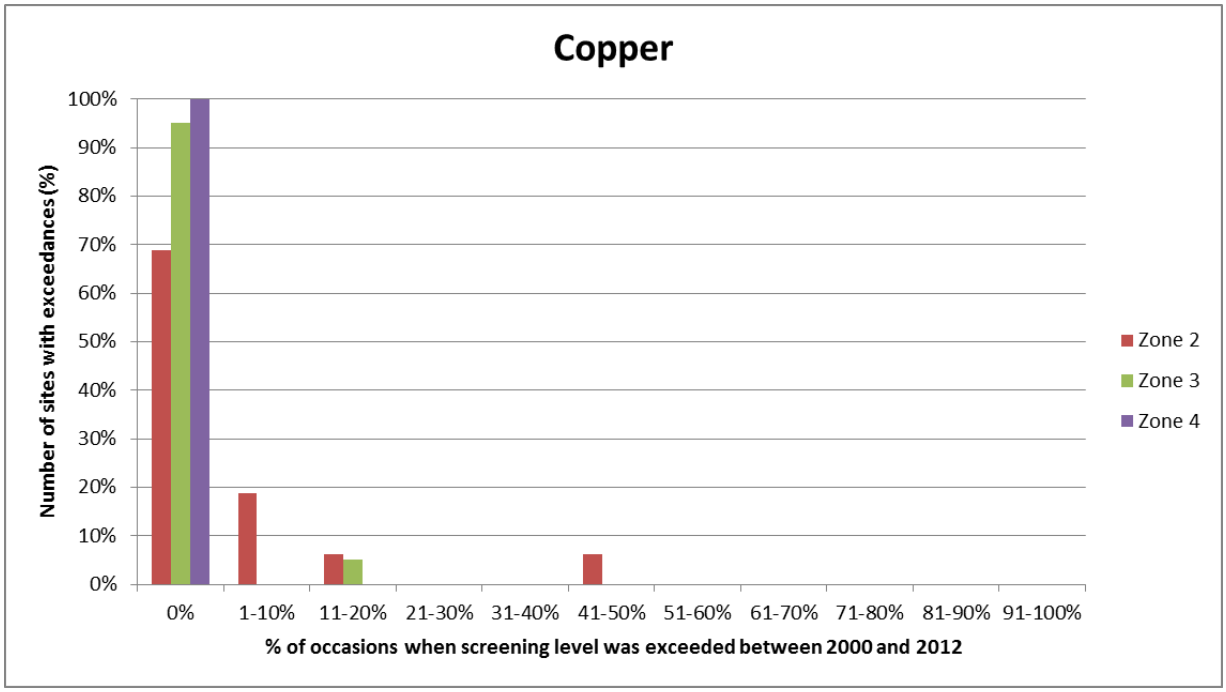


Figure 2-4 Exceedances of the NAGD Screening Level for Copper between 2000 and 2012 in Dredge Zones 2, 3 and 4

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.

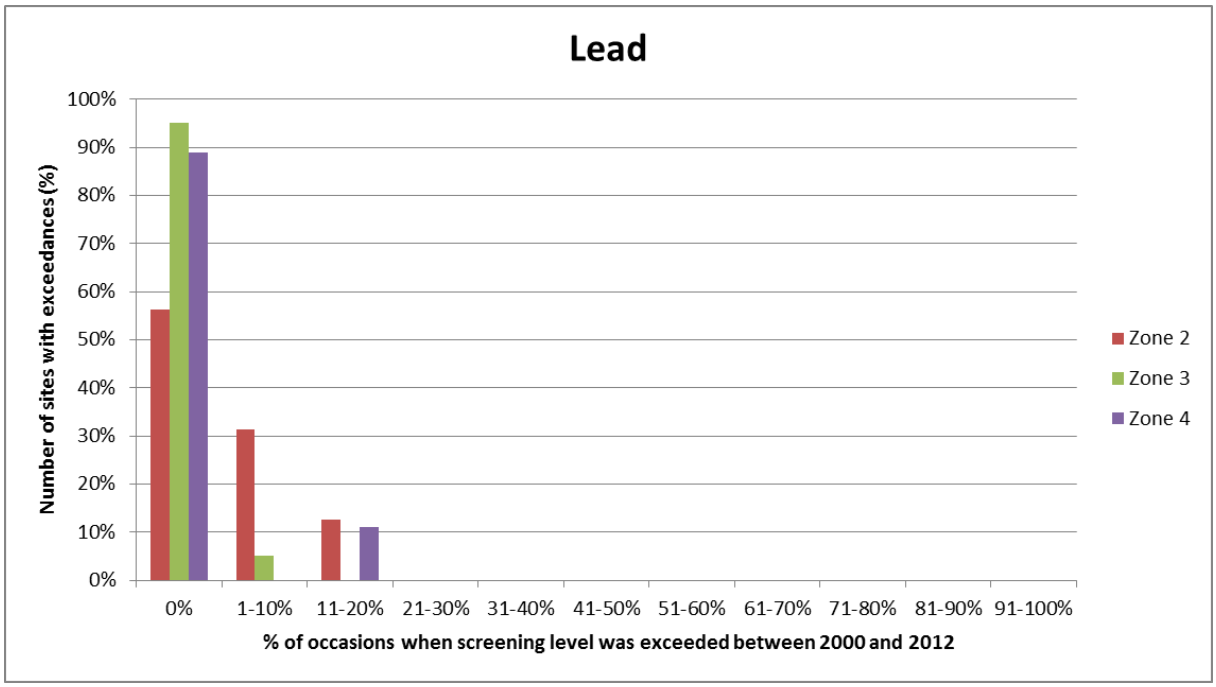


Figure 2-5 Exceedances of the NAGD Screening Level for Lead between 2000 and 2012 in Dredge Zones 2, 3 and 4

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.

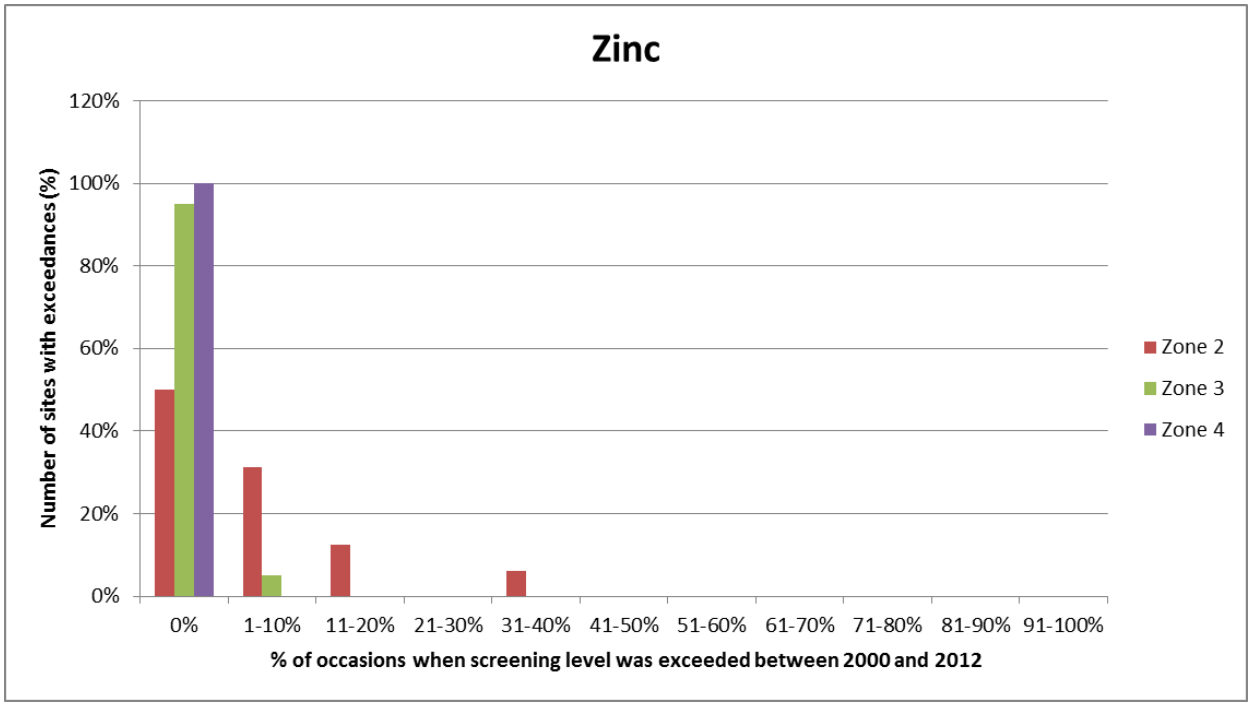


Figure 2-6 Exceedances of the NAGD Screening Level for Zinc between 2000 and 2012 in Dredge Zones 2, 3 and 4

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.

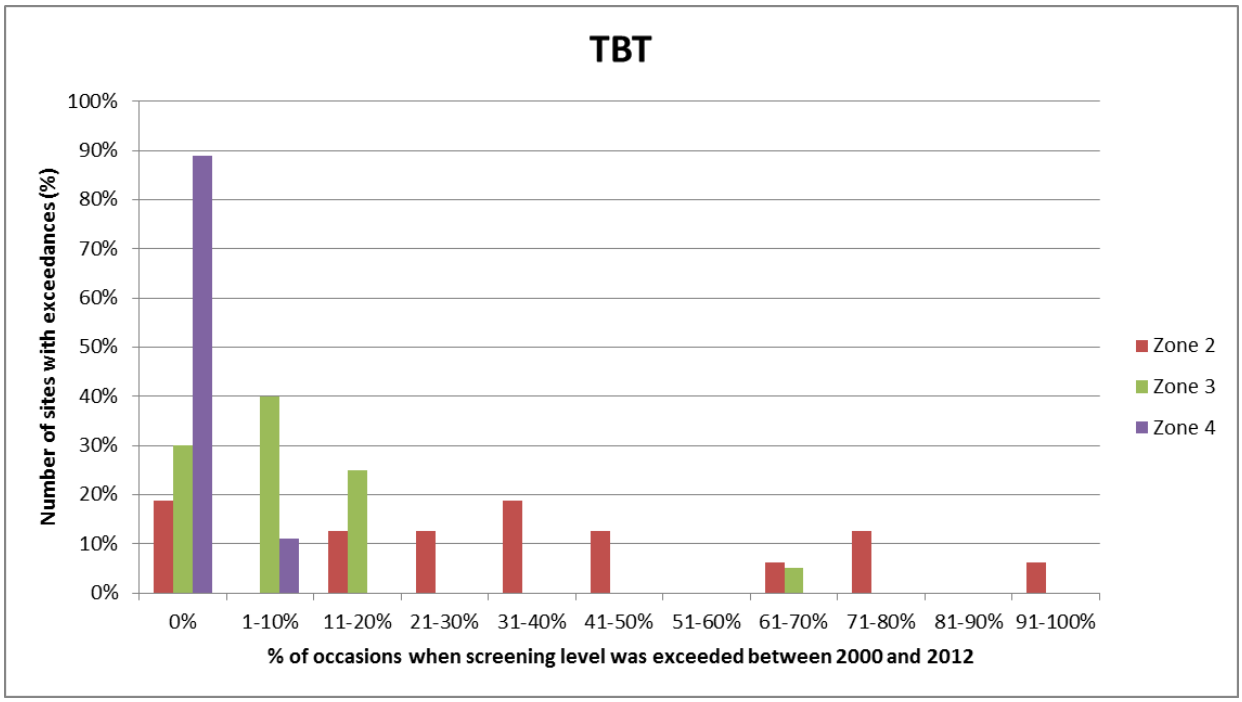


Figure 2-7 Exceedances of the NAGD Screening Level for TBT between 2000 and 2012 in Dredge Zones 2, 3 and 4

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.

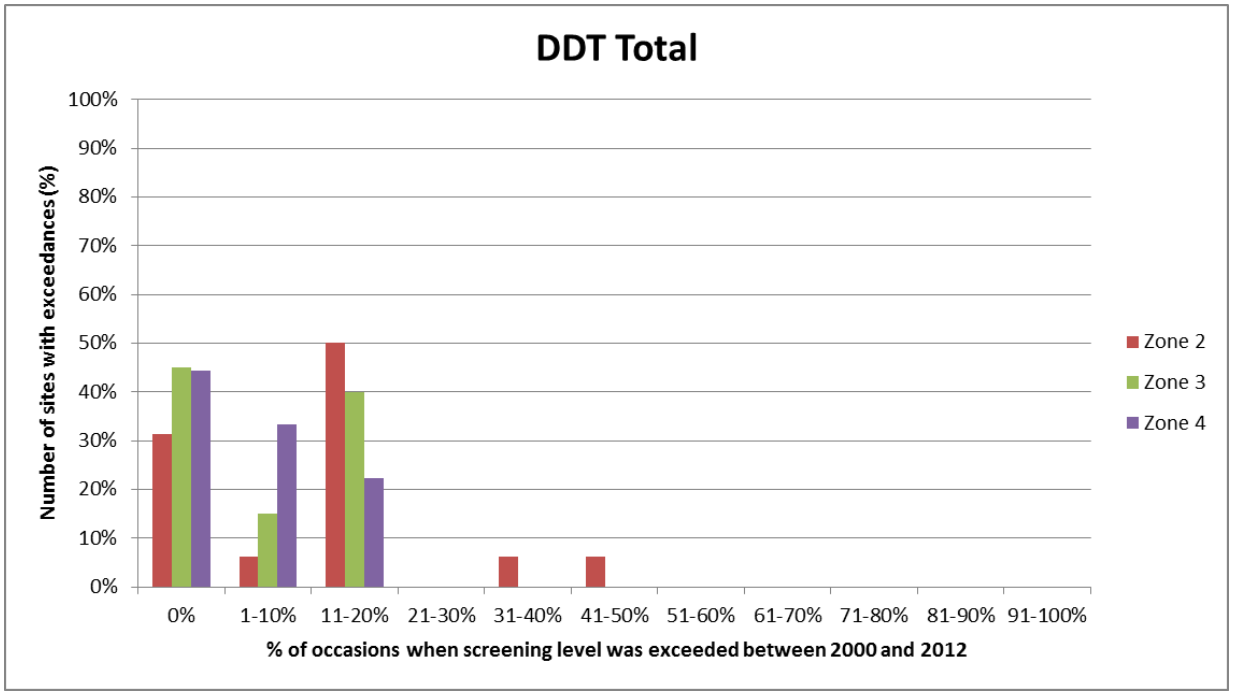
Total DDT concentrations and its metabolites DDD and DDE exceeded their respective screening levels (1.6, 2 and 2.2 µg/kg for DDT, DDD and DDE, respectively) on numerous occasions across all dredge zones (). This includes some exceedances of the NAGD high levels for DDT (46 µg/kg) and DDD (20 µg/kg), 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).



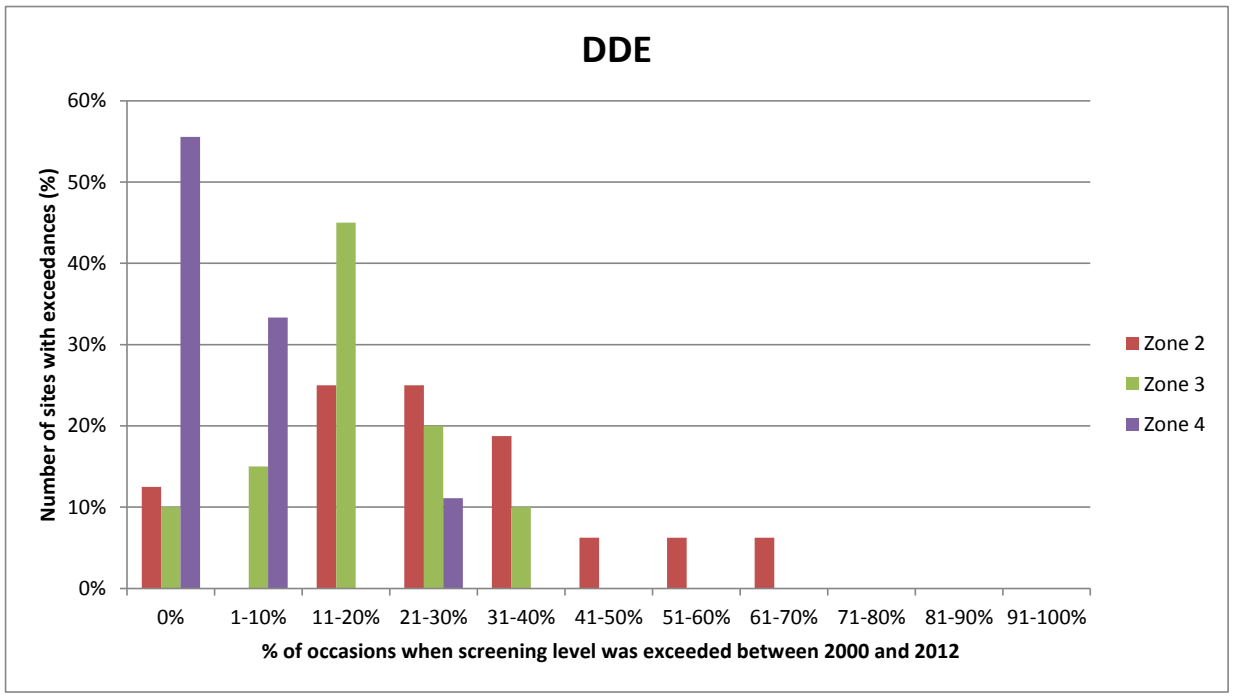


Figure 2-8 Exceedances of the NAGD Screening Level for total DDT (upper plot) and DDE (lower plot) between 2000 and 2012 in Dredge Zones 2, 3 and 4. Similar Trends for DDD.

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

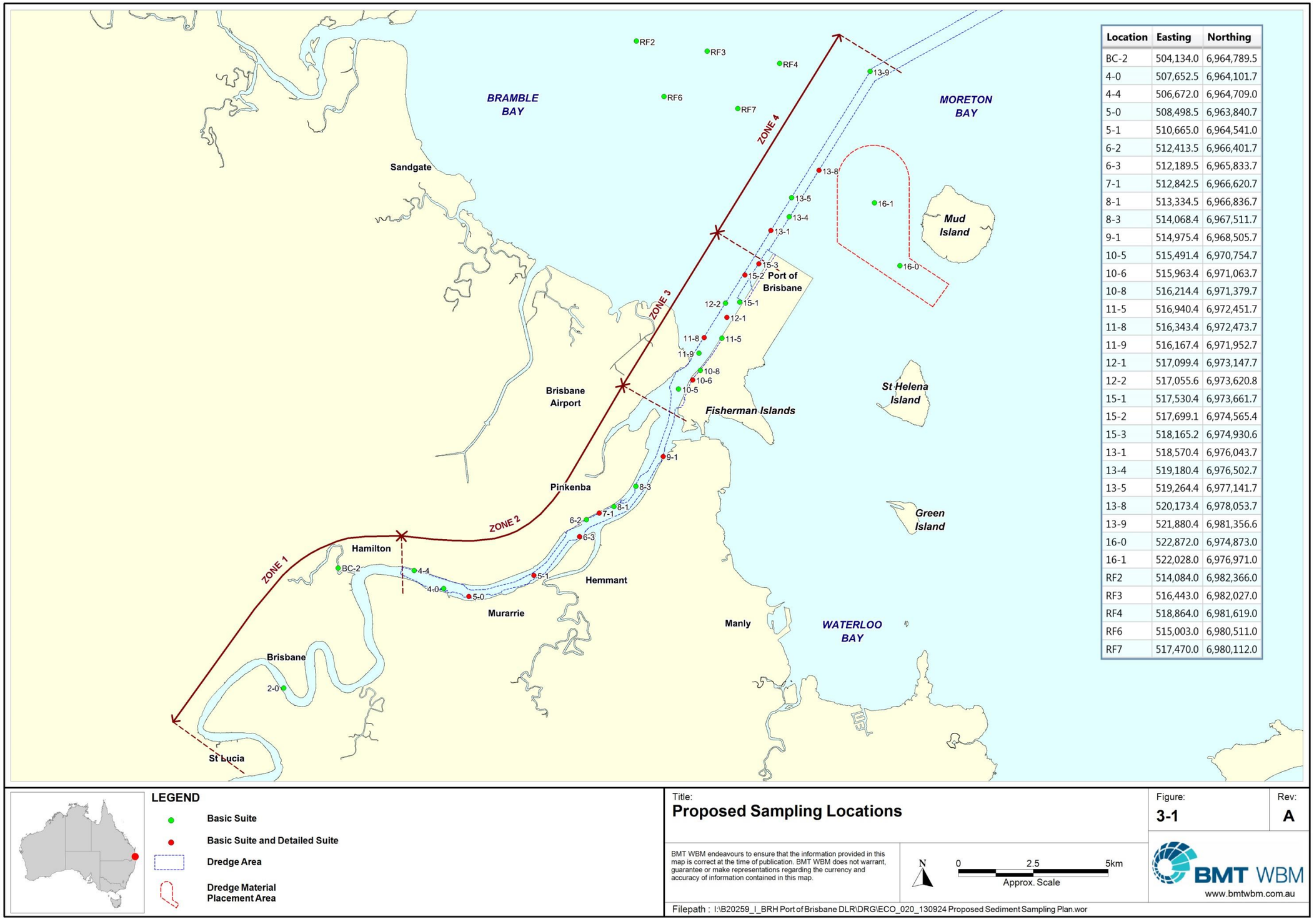
Additional sediment samples will be collected at selected locations for pore water testing of organic contaminants as part of the Phase III elutriate and bioavailability assessments (refer to Section 3.1.3).

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.

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Appendix B Sediment Sample Logs

Sediment Sample Logs

Table B-1 Sediment Log

Site No.	Date	Time	Depth (m)	Weather conditions	Colour	Field texture	Plasticity	Odour	Shell grit (%)	Biota (%)
2_0	29-10-15	905	12	Cloudy, calm	Grey	99% coarse sand, 1 % pebble	Nil	Nil	3	0
BC_2	29-10-15	957	3.7	Cloudy, calm	Grey and dark brown, some black streaks	5% medium sand , 5% clay, 85% silt	Moderate	Anoxic	2	5
4_4	29-10-15	1029	10.9	Cloudy, calm	Dark grey	100% silt	Moderate	Nil	0	3
4_0	29-10-15	1101	10.8	Cloudy, calm	Dark grey, black streaks	surface: 99% silt, 1% sand: rest 100% silt	Moderate	Nil	0	3
5_0	29-10-15	1140	10.2	Cloudy, calm	Brown/ light grey	100% silt	Low	Nil	0	1
9_1	29-10-15	1232	11.6	Cloudy, calm	Medium grey	surface: 30% sand, 20% shell grit, 50% silt, rest: 100% silt	High	Nil	2	0
5_1A	29-10-15	1311	6.3	Cloudy, calm	Dark grey, some black streaks	100% silt	High	Nil	5	1
5_1B	29-10-15	1314	6.5	Cloudy, calm	Dark grey, some black streaks	100% silt	High	Nil	5	1
5_1C	29-10-15	1338	6.4	Cloudy, calm	Dark/medium grey, some black streaks	100% silt	High	Nil	2	2
6_3	29-10-15	1357	12.2	Cloudy, calm	Grey	100% silt	Low	Nil	0	1
6_2	29-10-15	1418	10.8	Cloudy, calm, moderate wind	Grey, black streaks	surface: 2% sand, 98% silt, rest: 100% silt	Moderate	Nil	2	5
7_1	29-10-15	1454	11.6	Cloudy, calm, moderate wind	Grey	surface: 2% sand, 98% silt, rest: 100% silt	Moderate	Nil	2	2
8_1	29-10-15	1526	11.7	Cloudy, calm, moderate wind	Grey	99% silt, 1% sand , very soft	Low	Nil	1	1
8_3	29-10-15	1545	6.3	Cloudy, calm, moderate wind	Grey/ brown layer	surface: sand 1%, silt 99%, rest: 100% silt, very soft	Low	Nil	1	1
RF_2	30-10-15	825	8	Cloudy, mild	Grey	100% silt	Low	Nil	7	1
RF_3	30-10-15	850	9.2	Cloudy, mild	Grey/ brown	100% silt	Low	Nil	1	0
RF_6	30-10-15	915	7.7	Cloudy, mild	Grey/ brown	95% silt, 5% sand	Moderate	Nil	10	1
RF_7	30-10-15	940	8	Cloudy, mild	Grey/ brown	100% silt	Moderate	Nil	0	1
RF_4	30-10-15	1005	10.2	Cloudy, mild	Grey/ brown	100% silt	Moderate	Nil	3	0
13_9	30-10-15	1035	13	Cloudy, mild	Grey/ brown	100% silt	Moderate	Nil	2	0
16_1	30-10-15	1105	9.6	Cloudy, mild	Grey	60 % sand, 40% silt	Nil	Nil	20	5
16_0	30-10-15	1125	10	Cloudy, mild	Grey	100% silt	Soft	Nil	0	0
13_8	30-10-15	1206	16	Cloudy, mild	Grey	100% silt	Soft	Nil	0	0
13_5	30-10-15	1225	10	Cloudy, mild	Grey	95% silt, 5% sand	Moderate	Nil	10	1
13_4A	30-10-15	1240	15.1	Cloudy, mild	Grey/ brown	99% silt, 1% sand	Low	Nil	1	0
13_4B	30-10-15	1240	15.1	Cloudy, mild	Grey/ brown	85% silt, 15% sand	Low	Nil	5	0
13_4C	30-10-15	1300	15.2	Cloudy, mild	Grey/ brown	60% silt, 40% sand	Low	Nil	5	0
13_1	30-10-15	1340	15	Cloudy, mild	Grey/ brown	90% silt, 10% sand	Low	Nil	5	1
15_3	02-11-15	806	13.2	Sunny	Grey	70% silt, 30% sand	Low	Nil	10	2
15_2	02-11-15	835	12	Sunny	Grey/ brown	60% silt, 40% sand	Low	Nil	15	2
15_1	02-11-15	857	14	Sunny	Grey/ brown	99% silt, 1% sand	Low	Nil	0	0
12_2	02-11-15	920	7	Sunny	Grey/ brown	100% silt	Moderate	Nil	0	0
12_1	02-11-15	942	14.3	Sunny	Grey	80% silt, 20% sand	Moderate	Nil	5	3
11_5	02-11-15	1000	14.5	Sunny	Grey/ brown	95% silt, 5% sand	Moderate	Nil	0	1
11_8	02-11-15	1020	3.7	Sunny	Grey/ brown	95% silt, 5% sand	Moderate-low	Nil	5	2
11_9A	02-11-15	1045	15	Sunny	Grey/ brown	100% silt	Moderate	Nil	0	0
11_9B	02-11-15	1045	15	Sunny	Grey/ brown	100% silt	Moderate	Nil	0	0
11_9C	02-11-15	1120	15	Sunny	Grey/ brown	100% silt	Moderate	Nil	0	0
10_8	02-11-15	1140	15.6	Sunny	Grey/ brown	100% silt	Moderate-high	Nil	0	1
10_6	02-11-15	1155	6	Sunny	Grey/ brown	100% silt	Low-moderate	Nil	0	0
10_5	02-11-15	1240	15	Sunny	Grey/ brown	99% silt, 1% sand	Low	Nil	1	0

Sediment Grab Photographs

2_0

BC_2

4_4

4_0

5_0

9_1

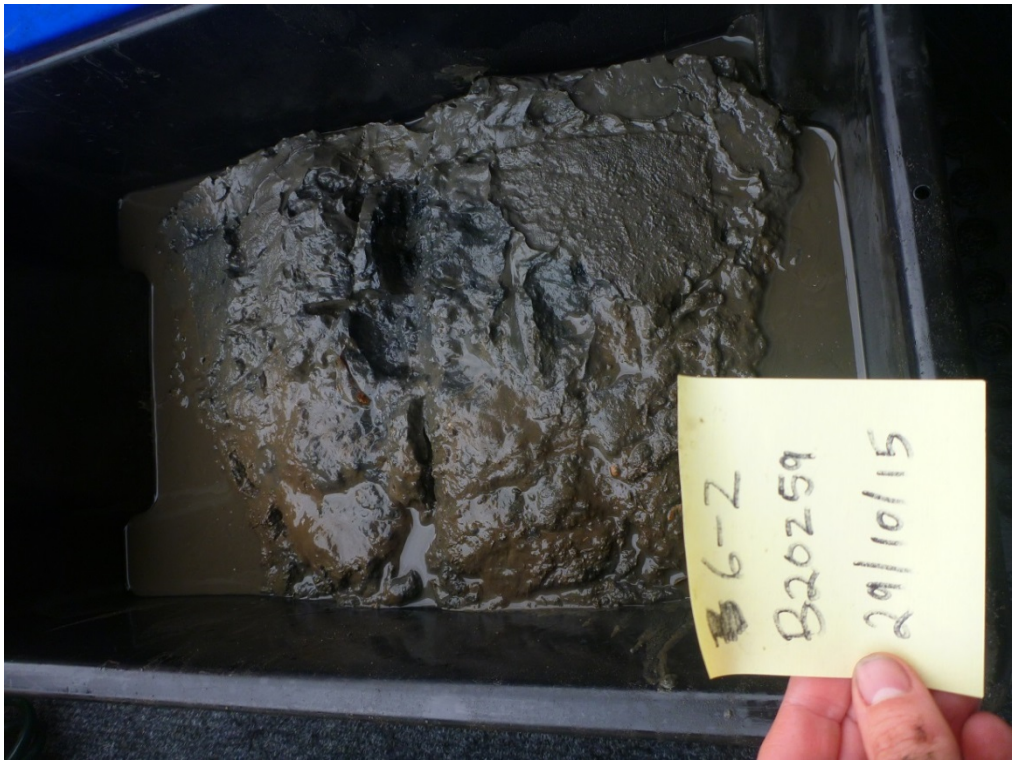
5_1A

5_1B

5_1C

6_3

6_2

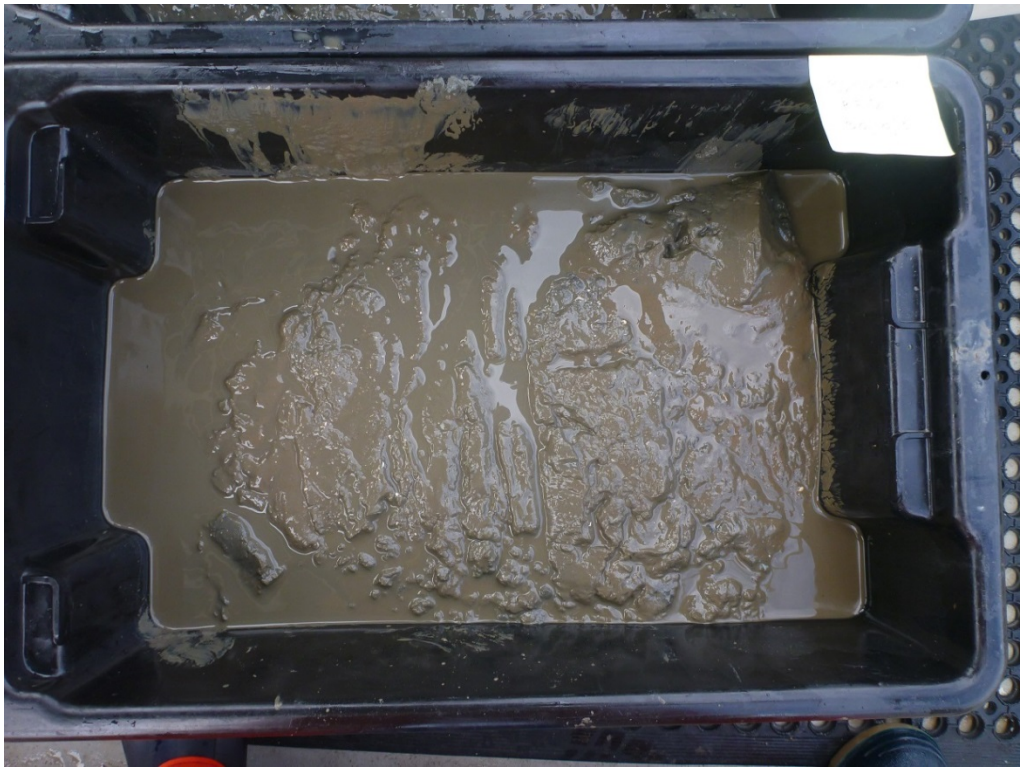


7_1

8_1

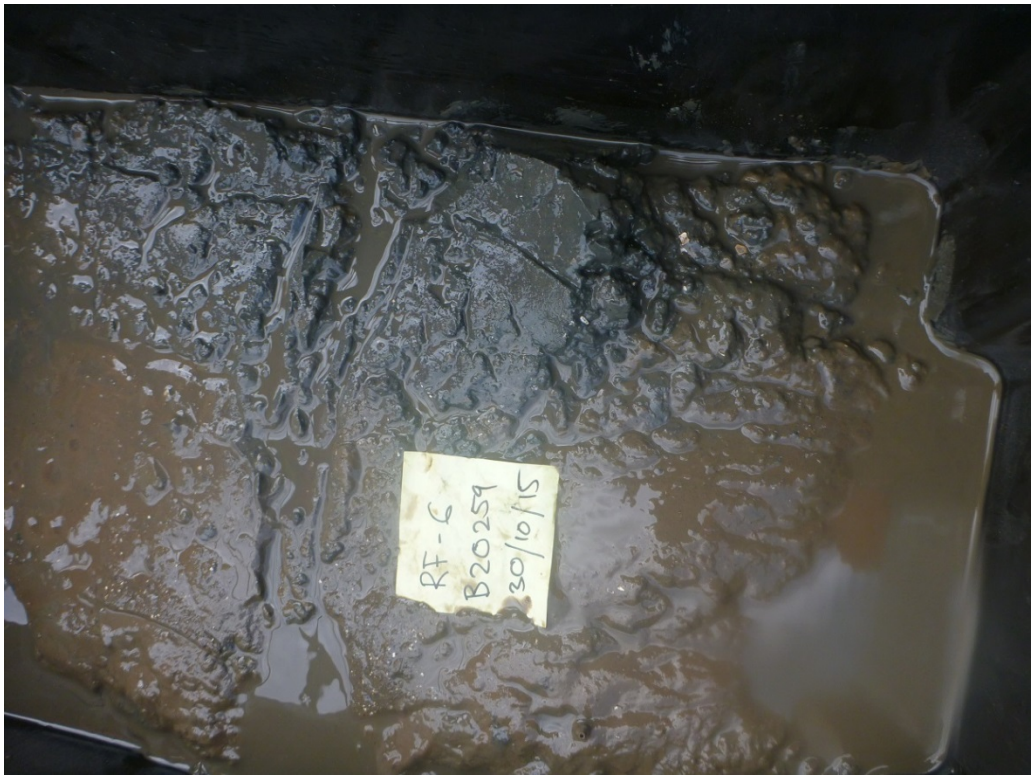
8_3

RF_2



RF_3

RF_6



RF_7

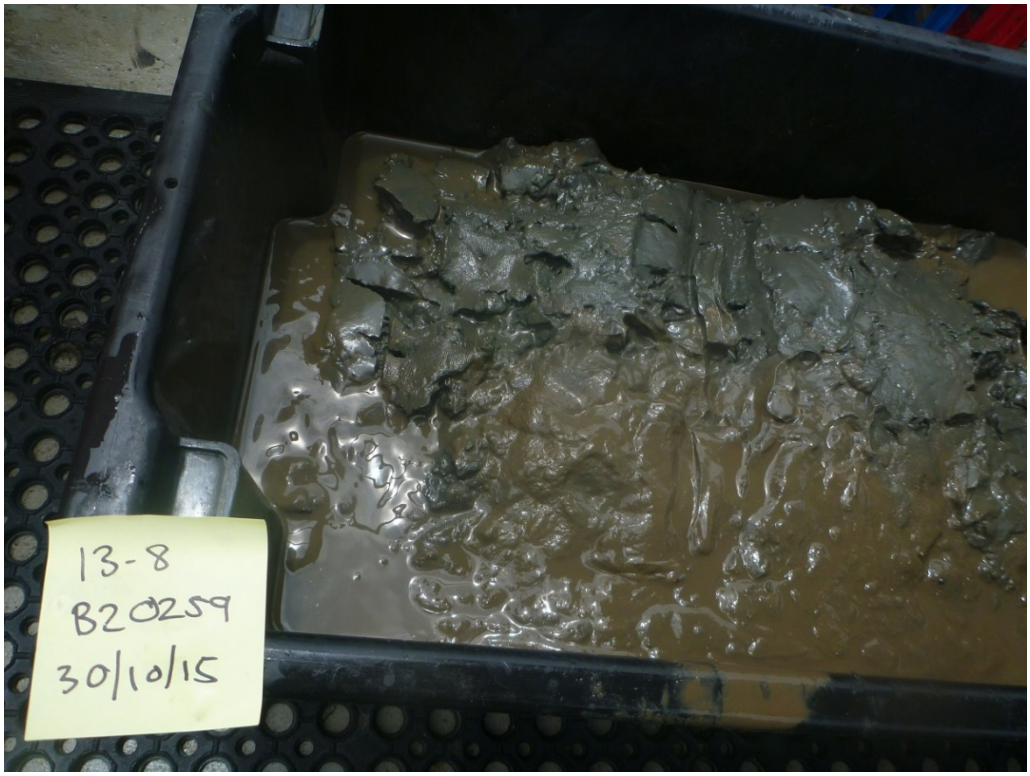
RF_4

13_9

16_1

16_0

13_8



13_5

13_4A

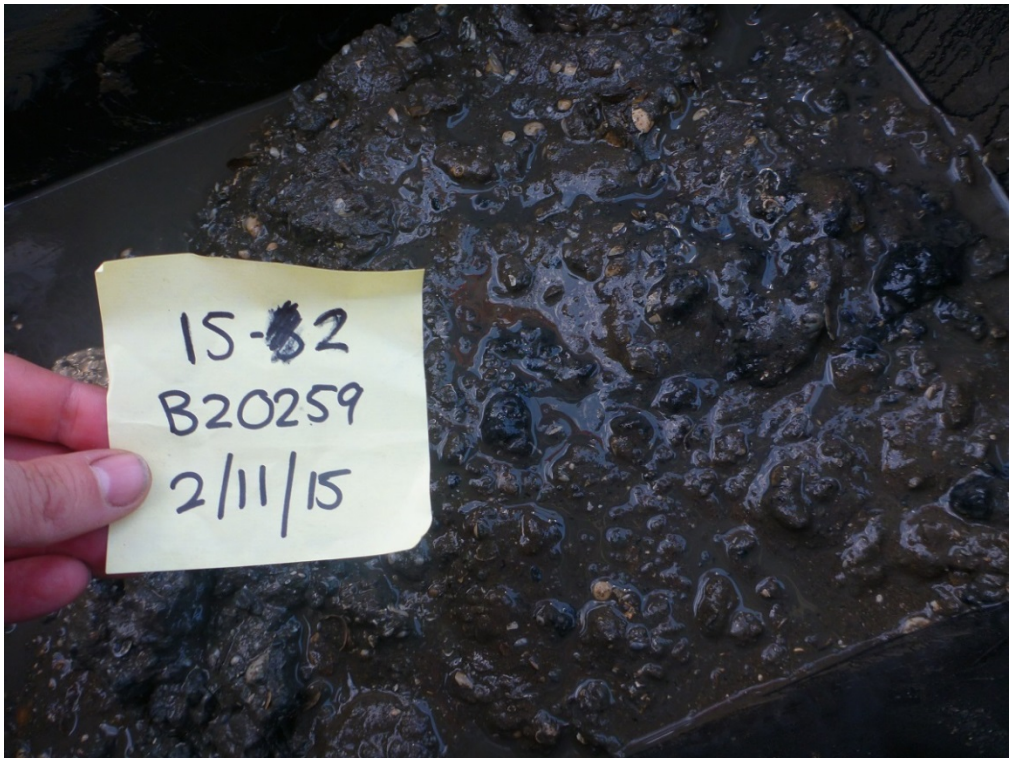
13_4B

13_4C

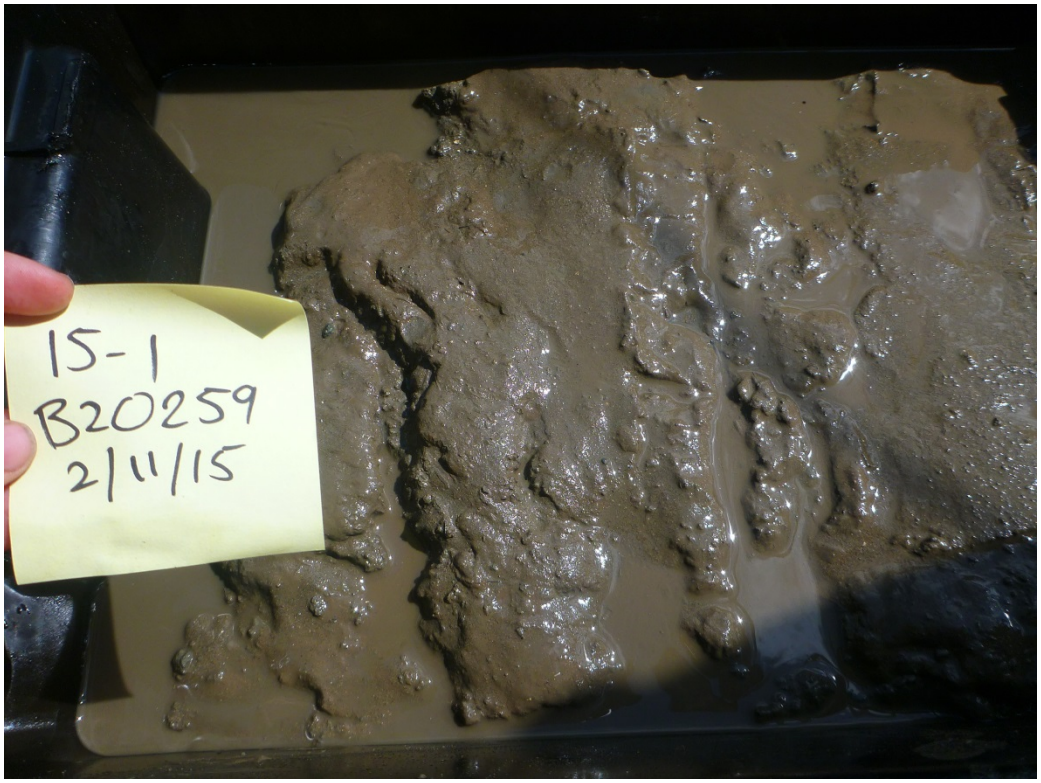
13_1

15_3

15_2



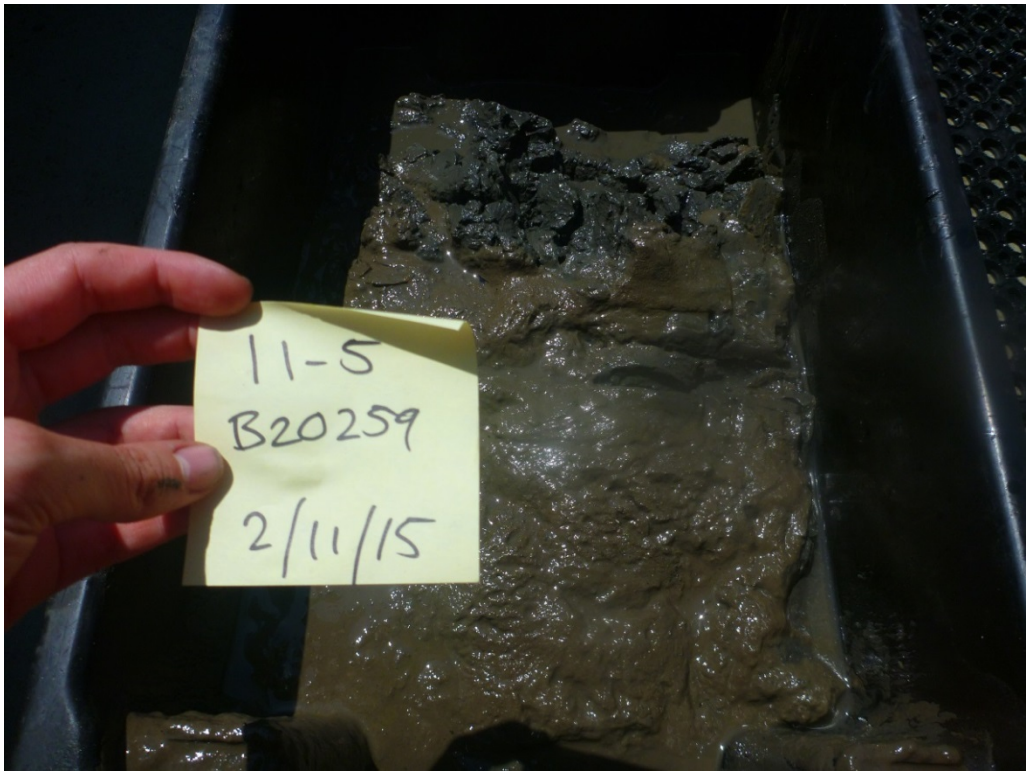
15_1



12_2

12_1

11_5



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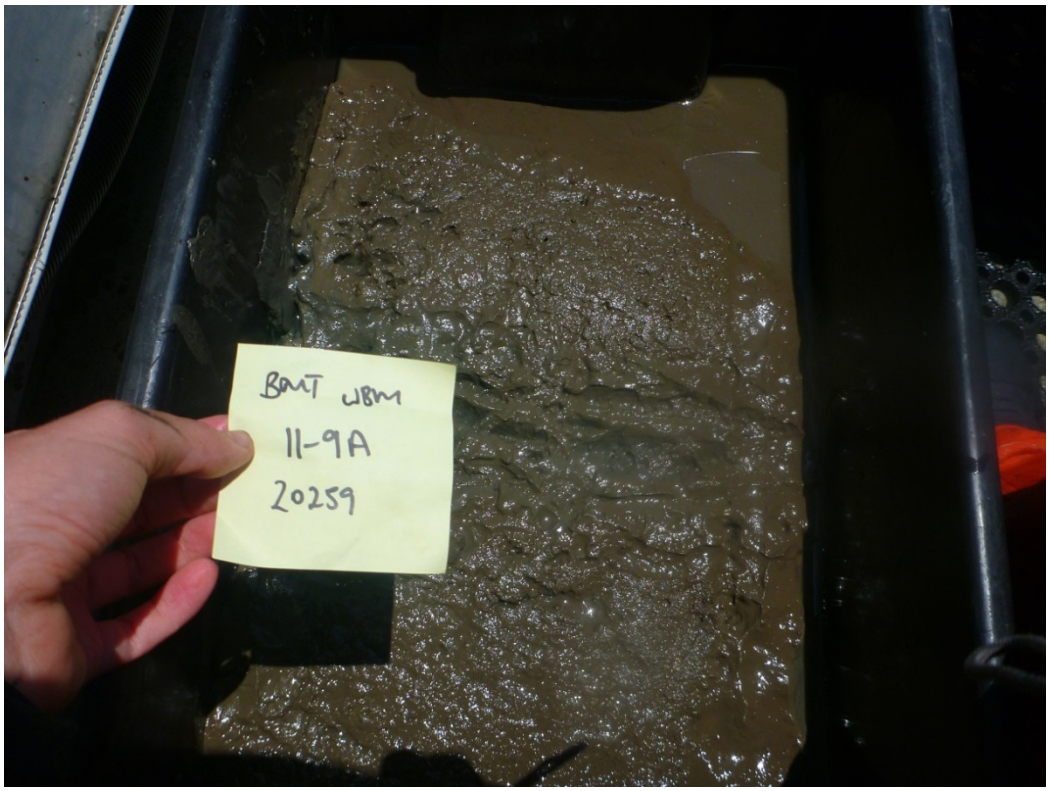
11_9A



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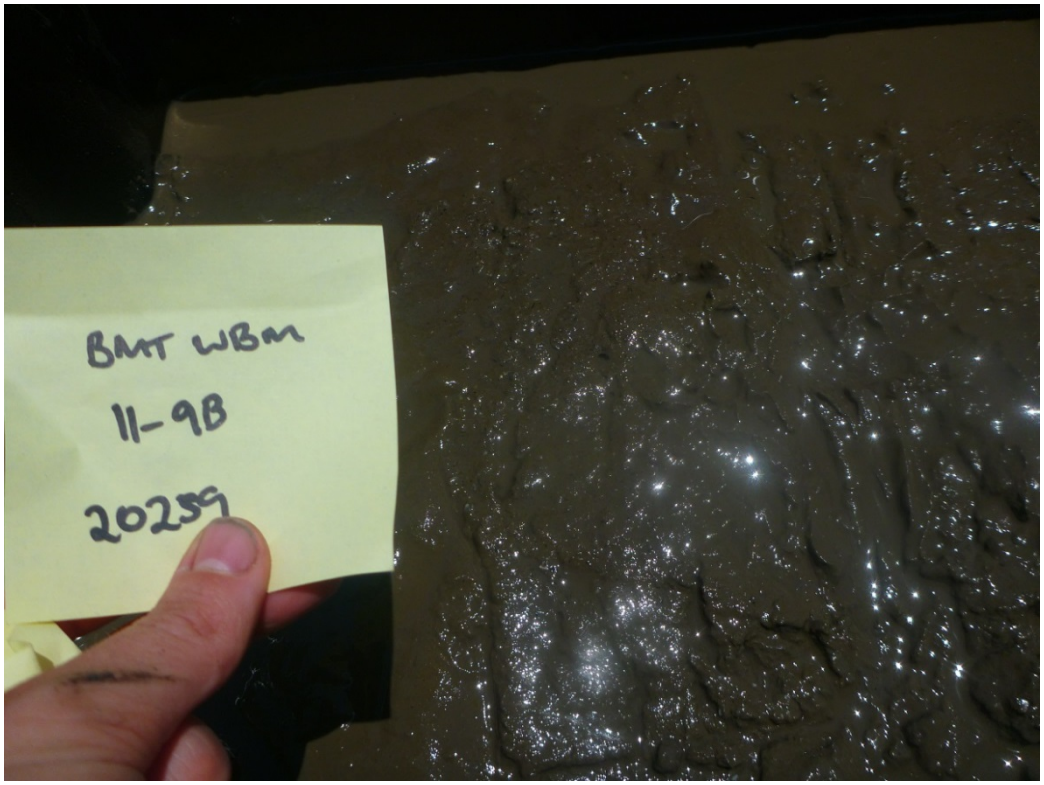

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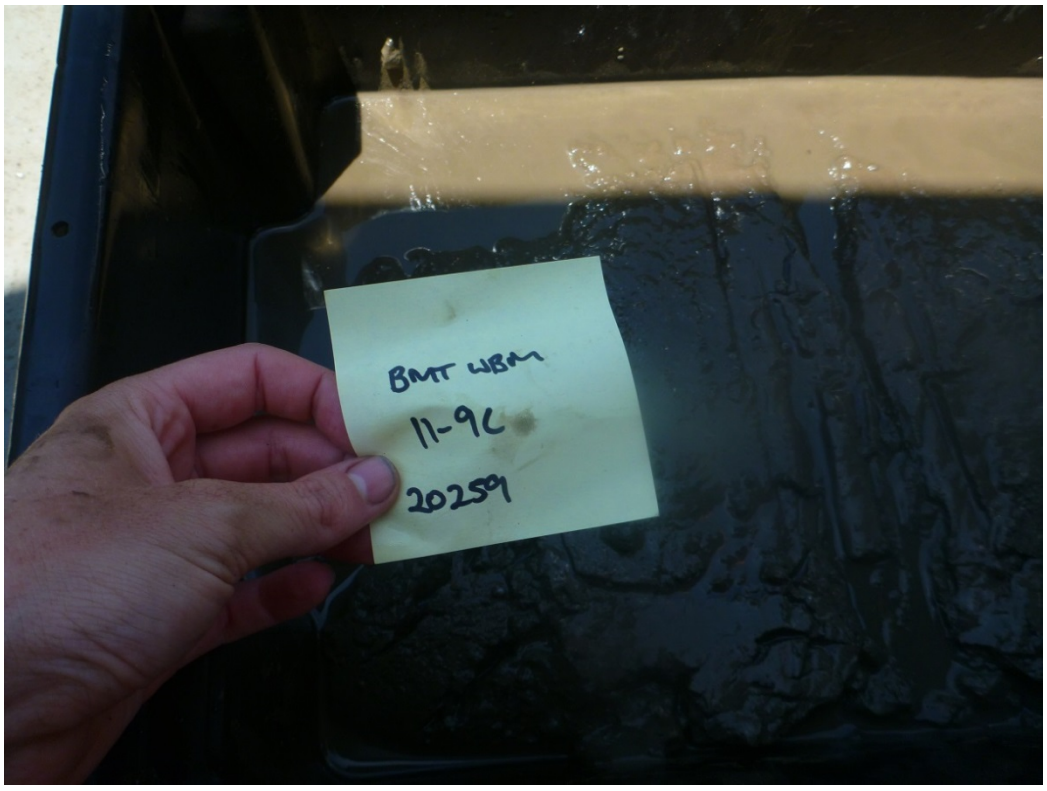

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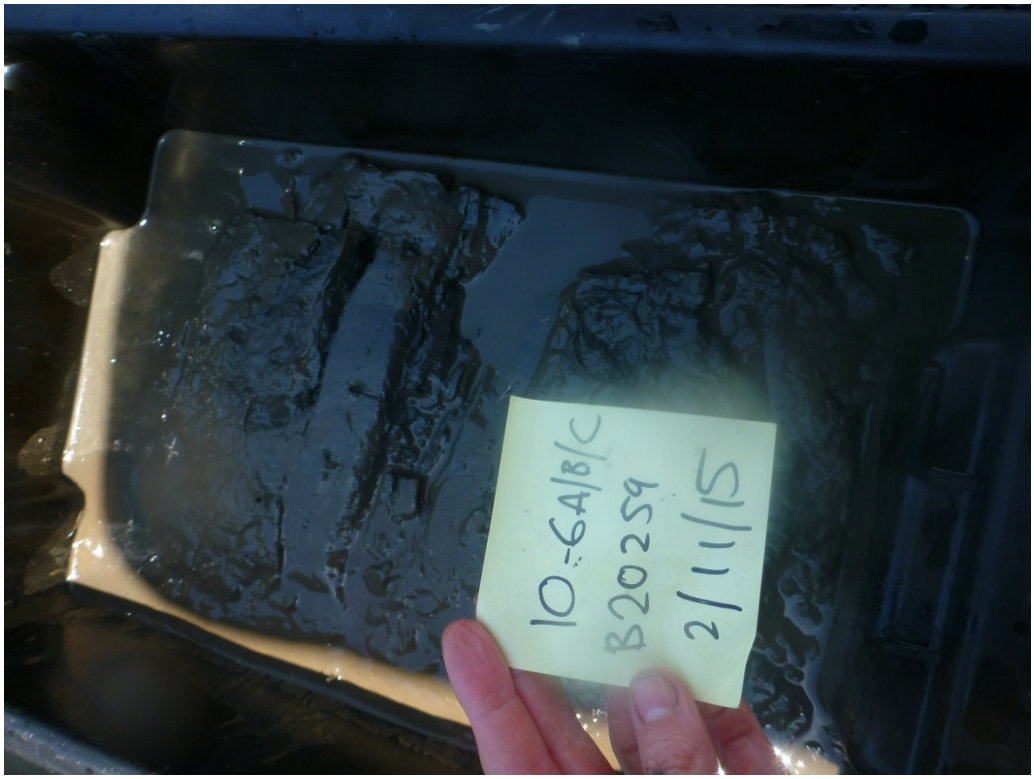
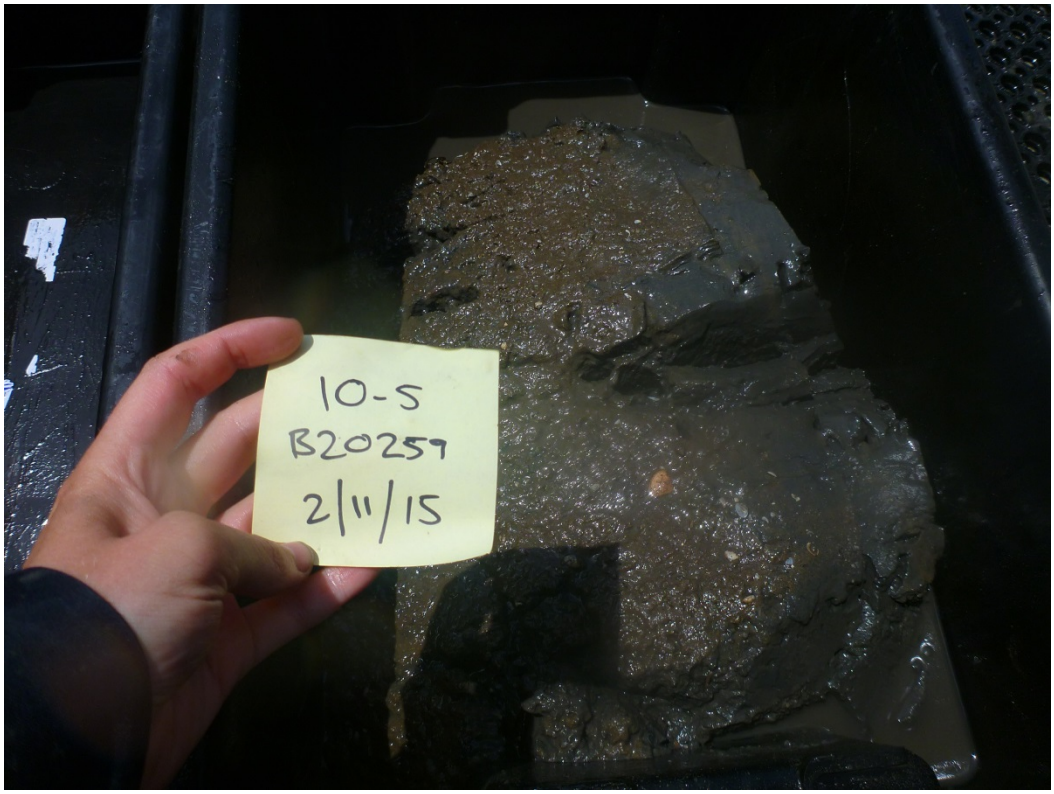
10_6



10_5



Seagrass found in samples

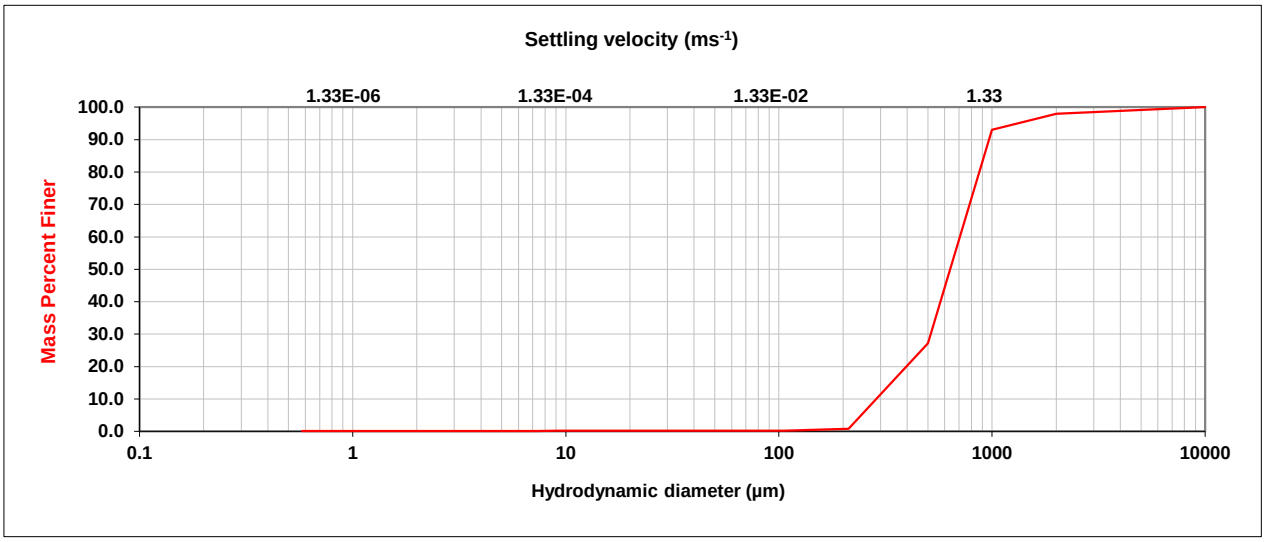
Appendix C Laboratory Results – Primary Laboratory

Suite 6
642 Albany Hwy
Victoria Park
WA 6100

Client:	Advanced Analytical
Client ID:	A15 5628A 1 2-0 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_01

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	2.0	4.50E+01
Sand	2000	60	97.8	1.33E+00
Silt	60	2	0.1	1.20E-03
Clay	2	1	0.0	2.81E-06
Sub-clay	1	0	0.1	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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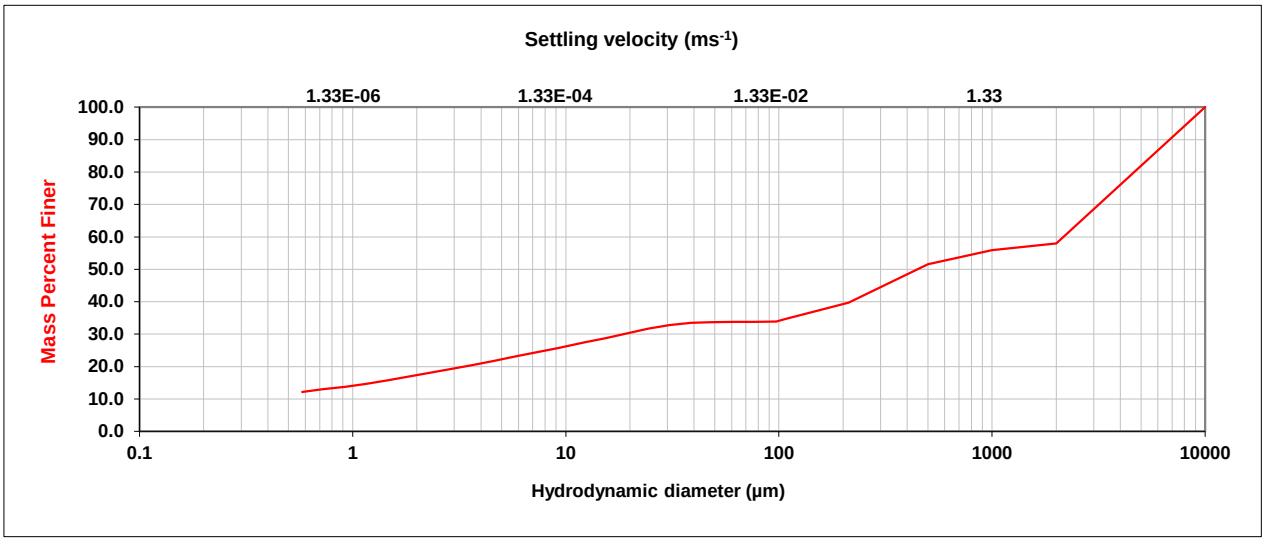
Client:	Advanced Analytical
Client ID:	A15 5628A 2 BC-2 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_02

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	42.0	4.50E+01
Sand	2000	60	24.2	1.33E+00
Silt	60	2	15.7	1.20E-03
Clay	2	1	3.5	2.81E-06
Sub-clay	1	0	14.6	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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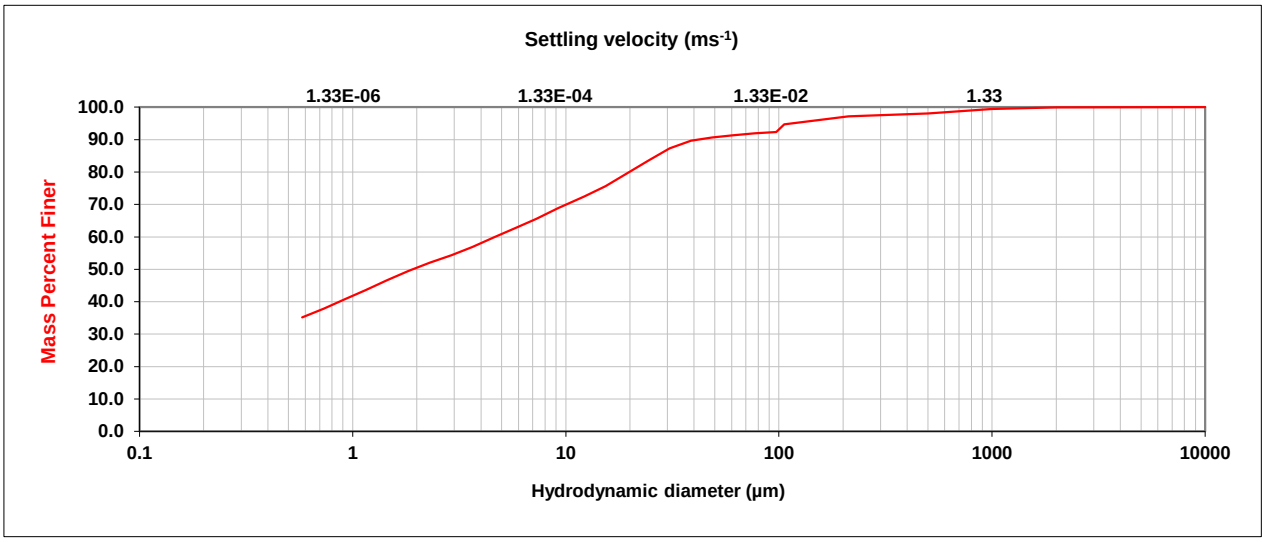
Client:	Advanced Analytical
Client ID:	A15 5628A 3 4 4 2015 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_03

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.33 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.0	4.50E+01
Sand	2000	60	8.6	1.33E+00
Silt	60	2	39.3	1.20E-03
Clay	2	1	8.4	2.81E-06
Sub-clay	1	0	43.6	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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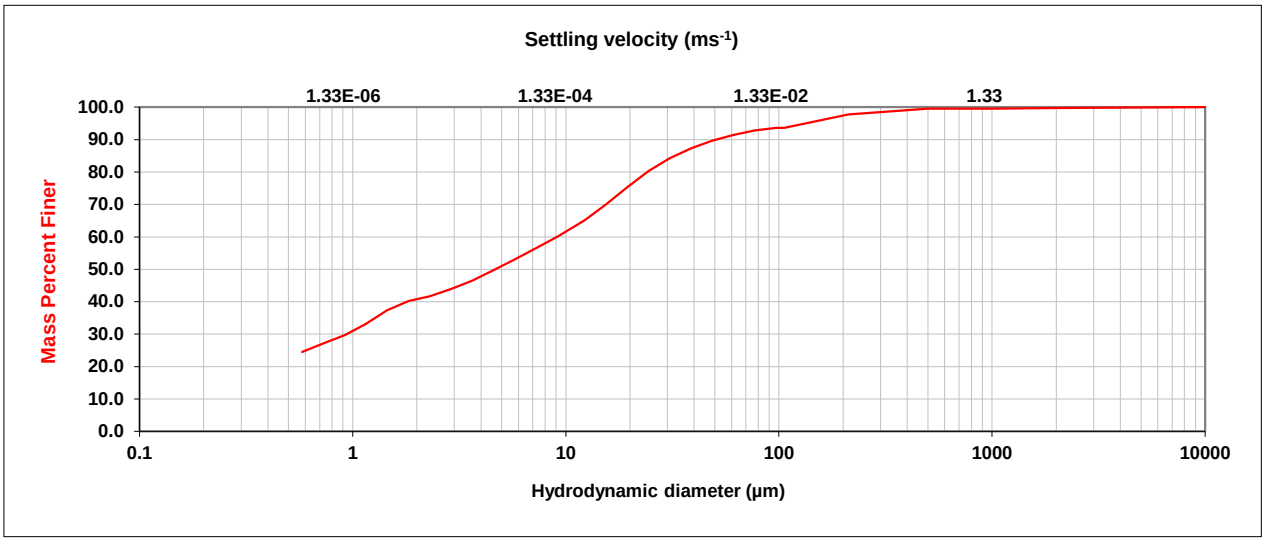
Client:	Advanced Analytical
Client ID:	A15 5628A 4 4-0 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_04

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.725 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.2	4.50E+01
Sand	2000	60	8.4	1.33E+00
Silt	60	2	49.7	1.20E-03
Clay	2	1	8.6	2.81E-06
Sub-clay	1	0	33.1	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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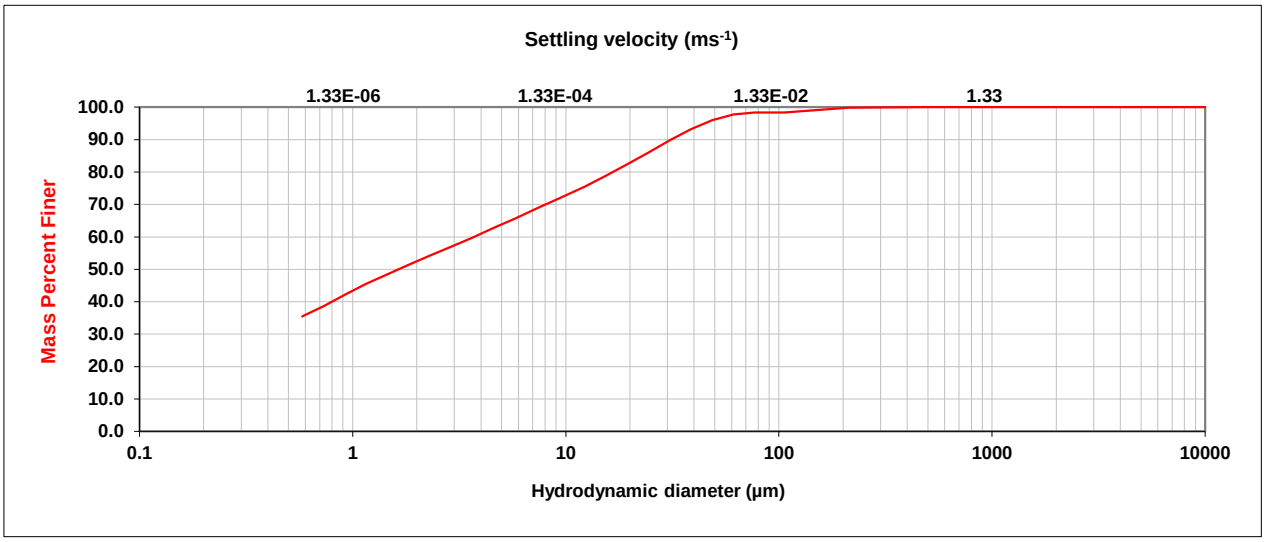
Client:	Advanced Analytical
Client ID:	A15 5628A 5 5-0 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_05

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.33 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.0	4.50E+01
Sand	2000	60	2.3	1.33E+00
Silt	60	2	43.6	1.20E-03
Clay	2	1	8.8	2.81E-06
Sub-clay	1	0	45.4	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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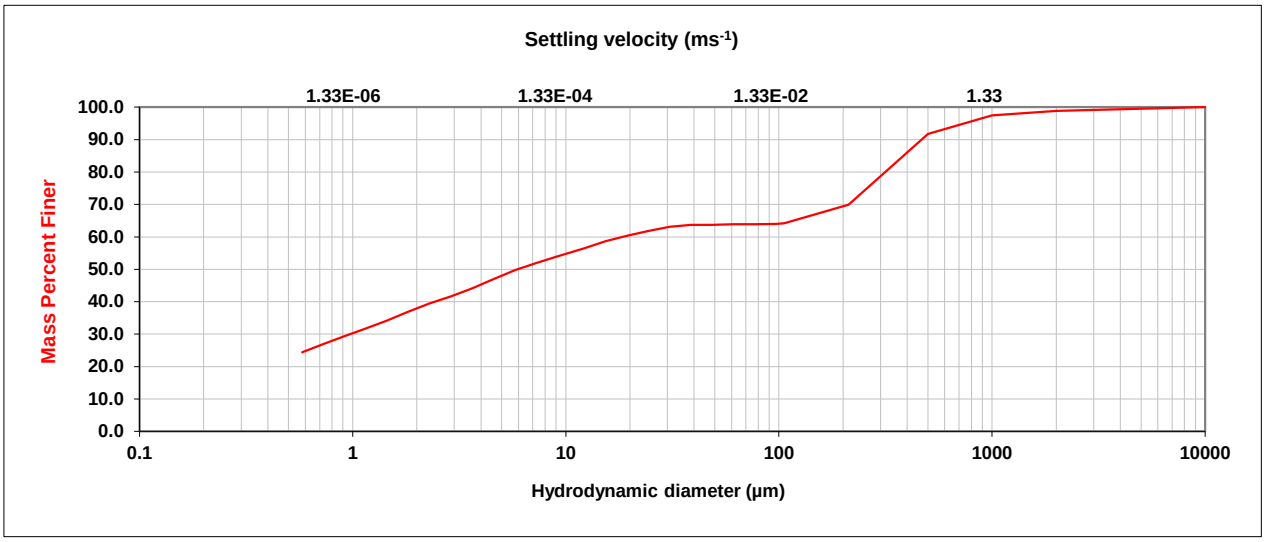
Client:	Advanced Analytical
Client ID:	A15 5628A 6 1 9 2015 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_06

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	1.1	4.50E+01
Sand	2000	60	34.9	1.33E+00
Silt	60	2	24.4	1.20E-03
Clay	2	1	7.8	2.81E-06
Sub-clay	1	0	31.7	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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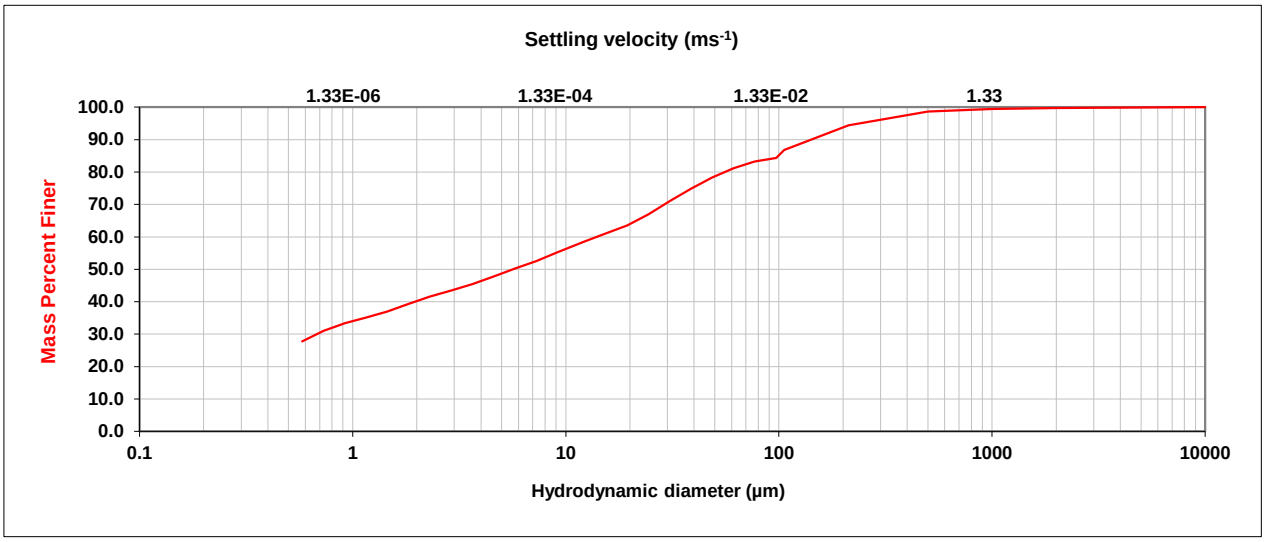
Client:	Advanced Analytical
Client ID:	A15 5628A 7 5-1A 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_07

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.3	4.50E+01
Sand	2000	60	18.6	1.33E+00
Silt	60	2	39.6	1.20E-03
Clay	2	1	6.5	2.81E-06
Sub-clay	1	0	35.1	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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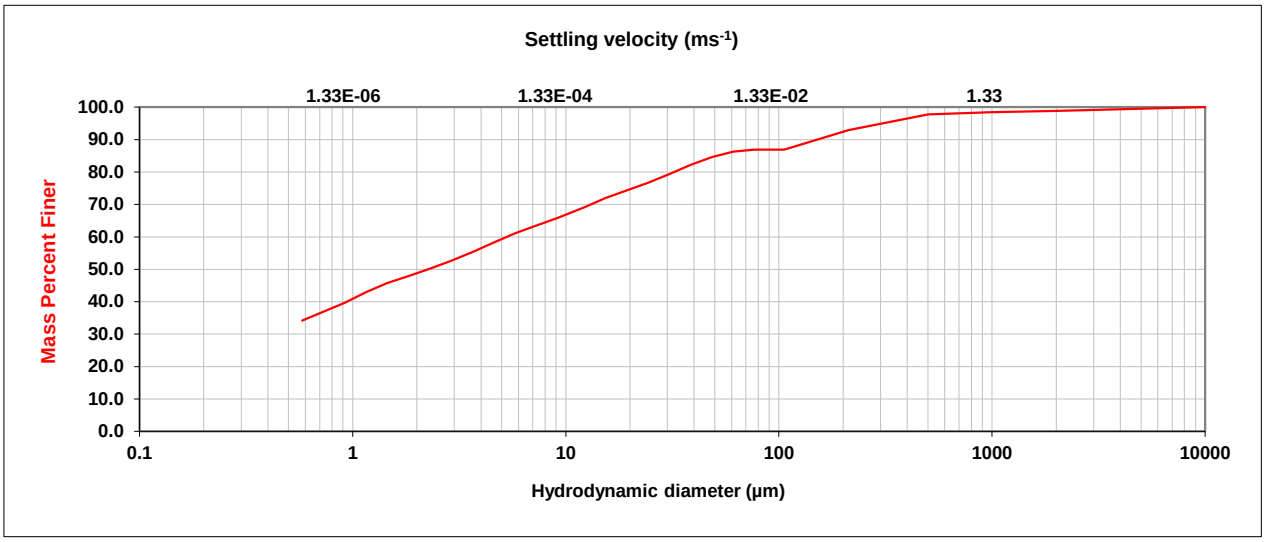
Client:	Advanced Analytical
Client ID:	A15 5628A 8 5-1B 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_08

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	1.2	4.50E+01
Sand	2000	60	12.5	1.33E+00
Silt	60	2	36.2	1.20E-03
Clay	2	1	7.3	2.81E-06
Sub-clay	1	0	42.8	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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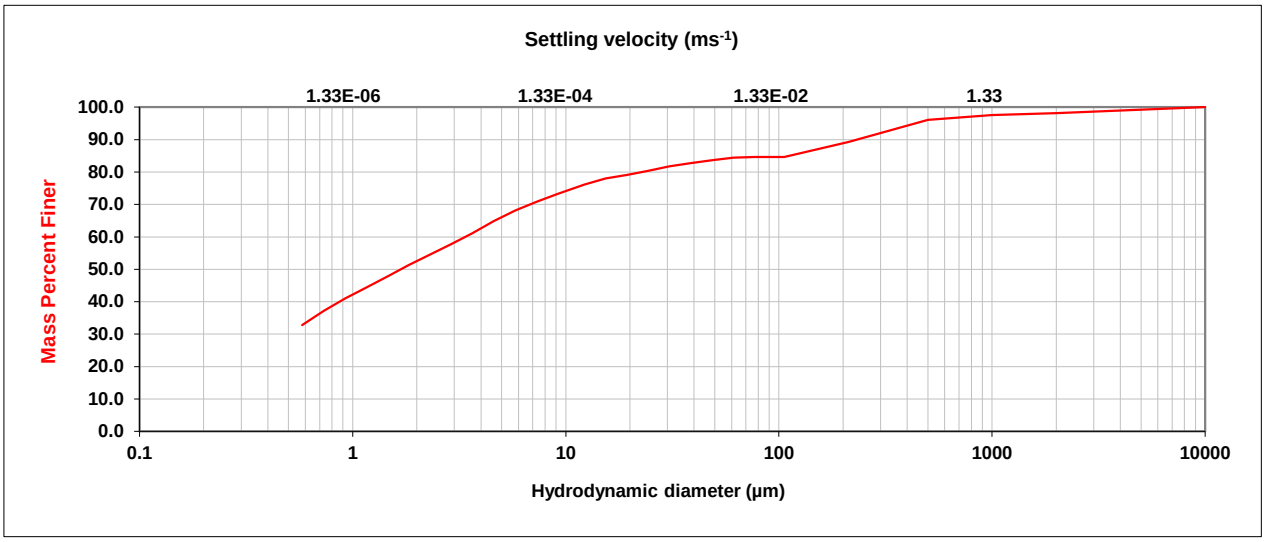
Client:	Advanced Analytical
Client ID:	A15 5628a 9 5-1C 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_09

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	1.8	4.50E+01
Sand	2000	60	13.7	1.33E+00
Silt	60	2	30.0	1.20E-03
Clay	2	1	10.2	2.81E-06
Sub-clay	1	0	44.3	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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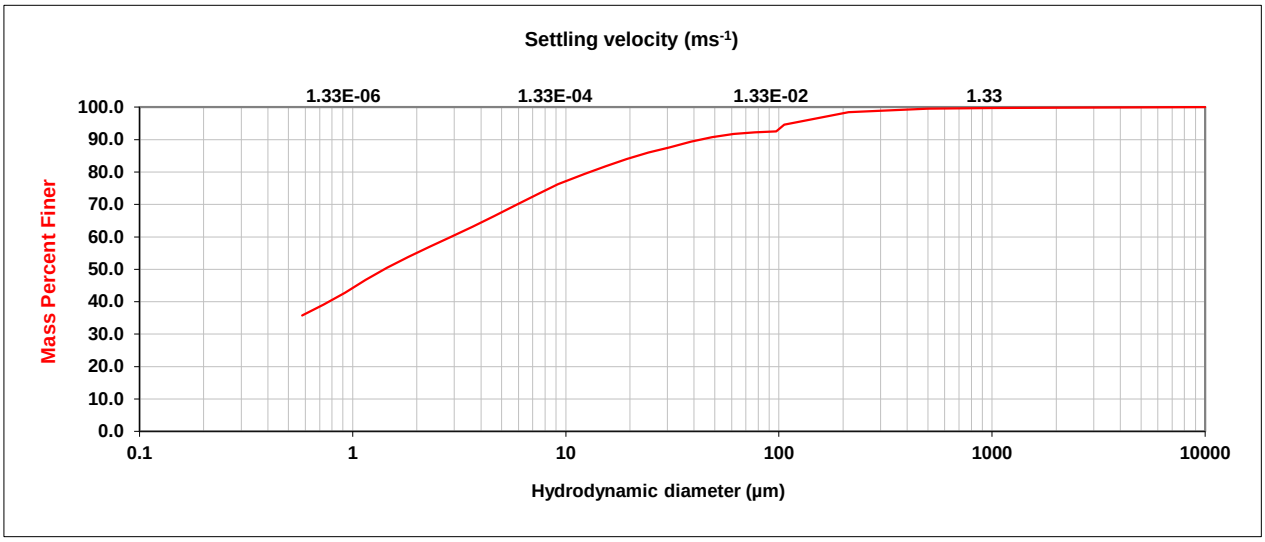
Client:	Advanced Analytical
Client ID:	A15 5628A 10 3 6 2015 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_10

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.33 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.1	4.50E+01
Sand	2000	60	8.1	1.33E+00
Silt	60	2	34.8	1.20E-03
Clay	2	1	10.2	2.81E-06
Sub-clay	1	0	46.7	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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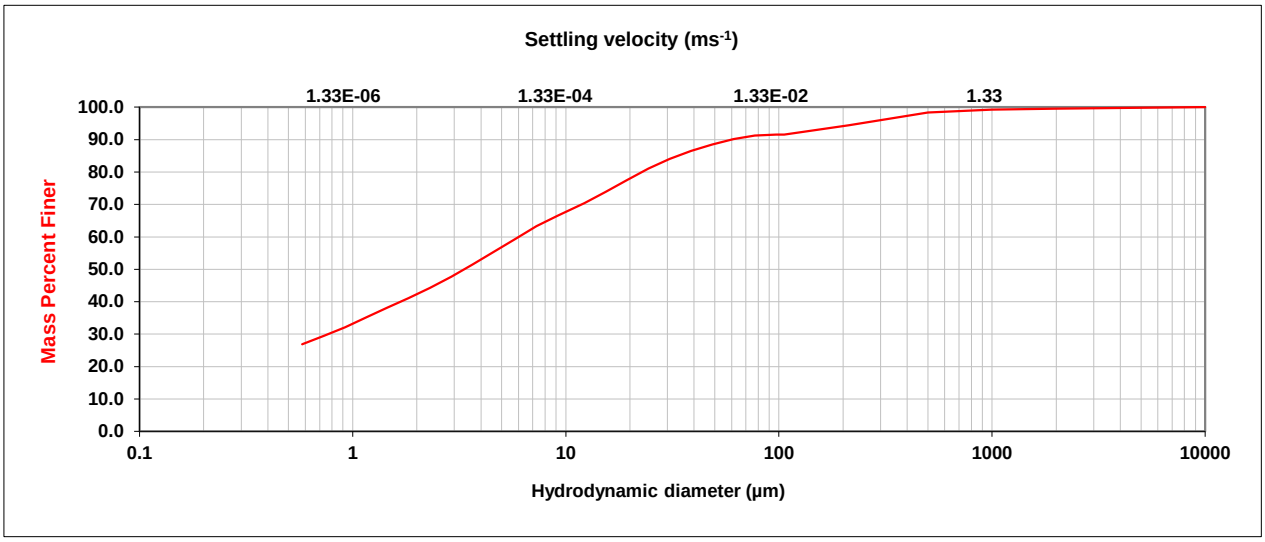
Client:	Advanced Analytical
Client ID:	A15 5628A 11 6-2A 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_11

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.725 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.4	4.50E+01
Sand	2000	60	9.4	1.33E+00
Silt	60	2	45.9	1.20E-03
Clay	2	1	9.2	2.81E-06
Sub-clay	1	0	35.1	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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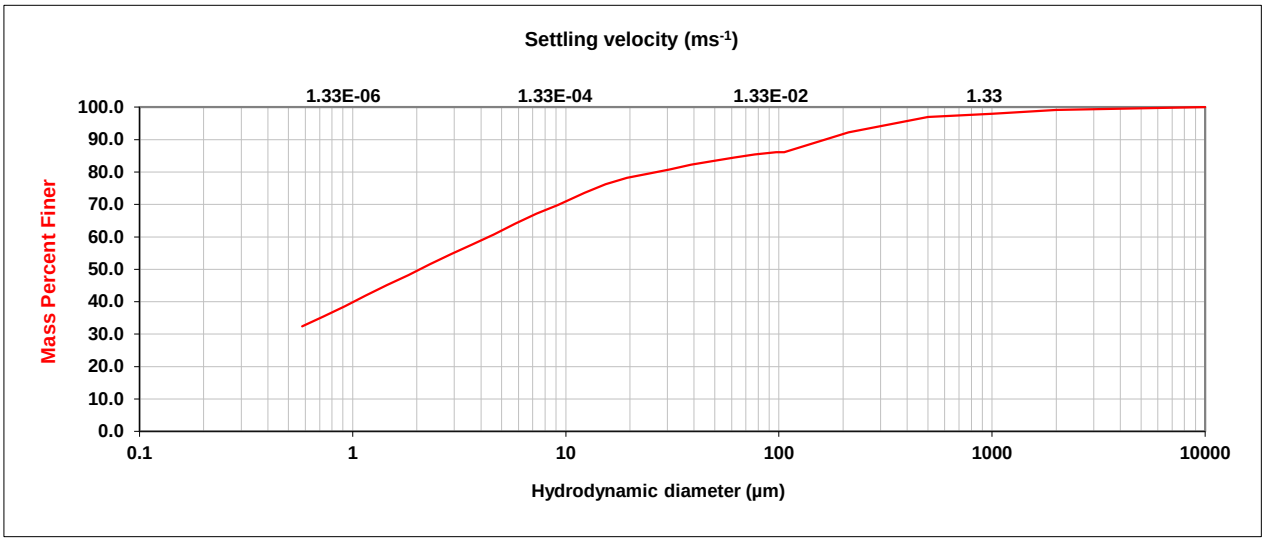
Client:	Advanced Analytical
Client ID:	A15 5628A 12 1 7 2015 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_12

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.9	4.50E+01
Sand	2000	60	14.7	1.33E+00
Silt	60	2	32.9	1.20E-03
Clay	2	1	9.7	2.81E-06
Sub-clay	1	0	41.9	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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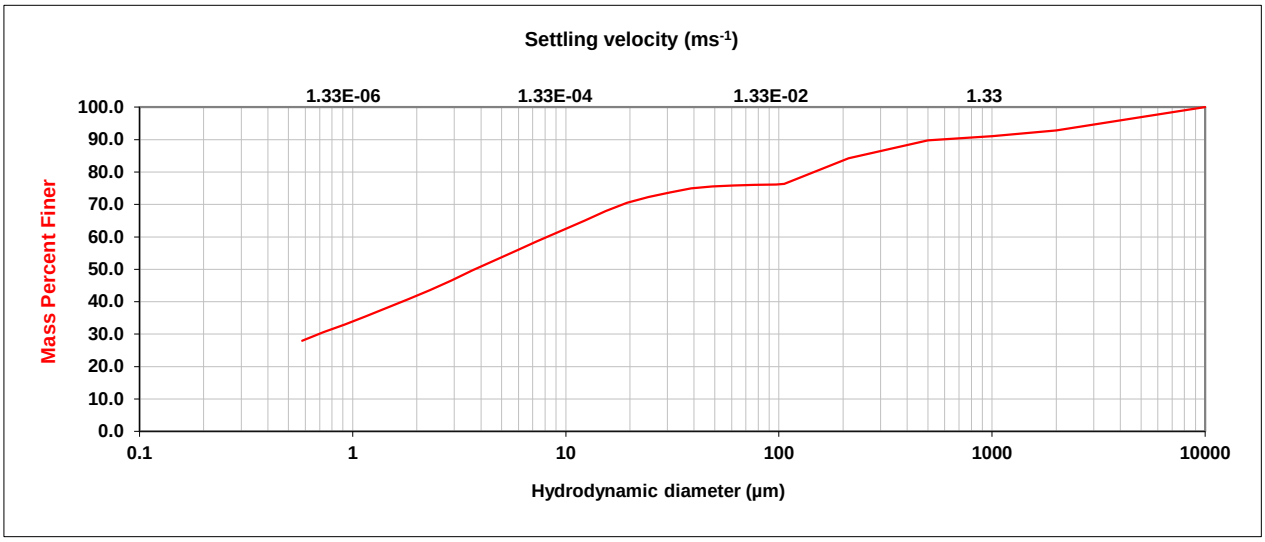
Client:	Advanced Analytical
Client ID:	A15 5628A 12 1 7 2015 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_12Q

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.33 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	7.2	4.50E+01
Sand	2000	60	17.0	1.33E+00
Silt	60	2	32.3	1.20E-03
Clay	2	1	8.1	2.81E-06
Sub-clay	1	0	35.5	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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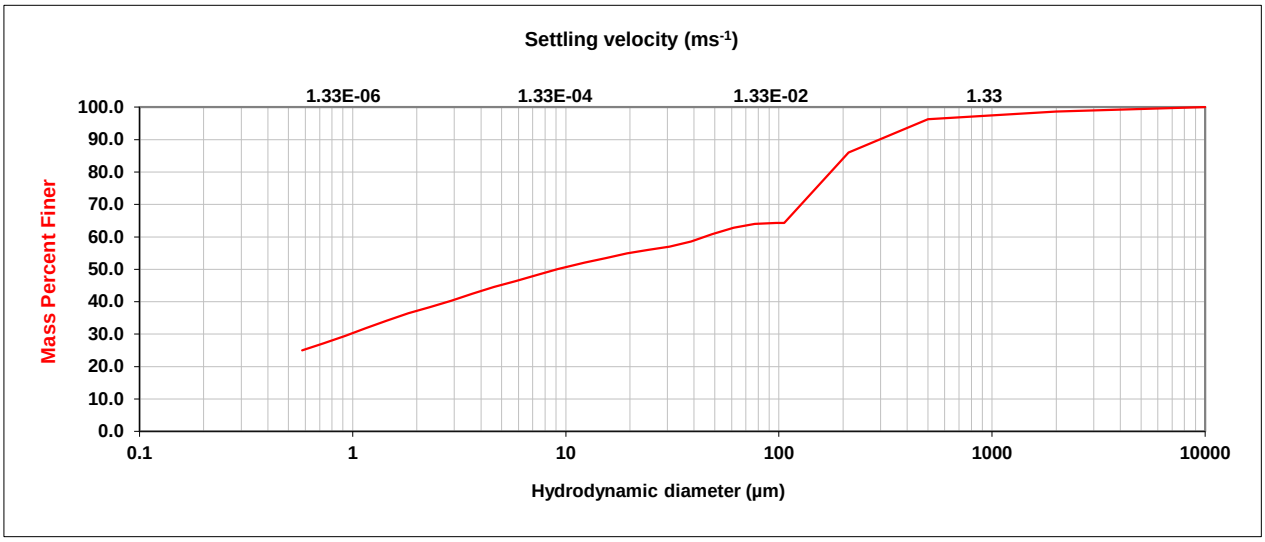
Client:	Advanced Analytical
Client ID:	A15 5628A 13 1 8 2015 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_13

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	1.3	4.50E+01
Sand	2000	60	35.8	1.33E+00
Silt	60	2	24.5	1.20E-03
Clay	2	1	6.6	2.81E-06
Sub-clay	1	0	31.8	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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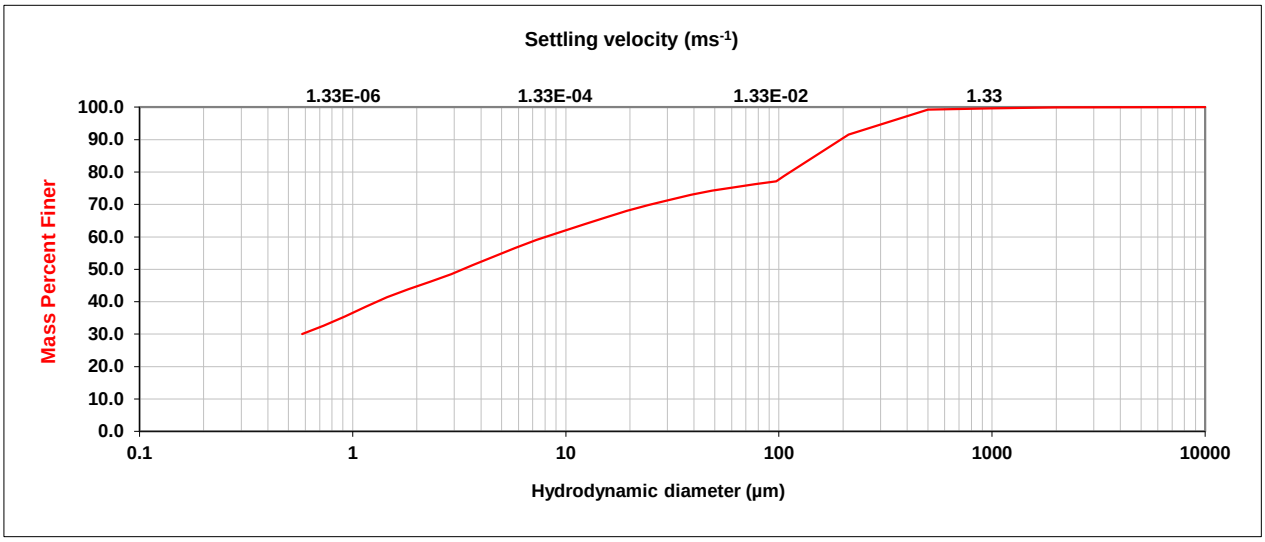
Client:	Advanced Analytical
Client ID:	A15 5628A 14 3 8 2015 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_14

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.1	4.50E+01
Sand	2000	60	24.6	1.33E+00
Silt	60	2	29.2	1.20E-03
Clay	2	1	7.6	2.81E-06
Sub-clay	1	0	38.4	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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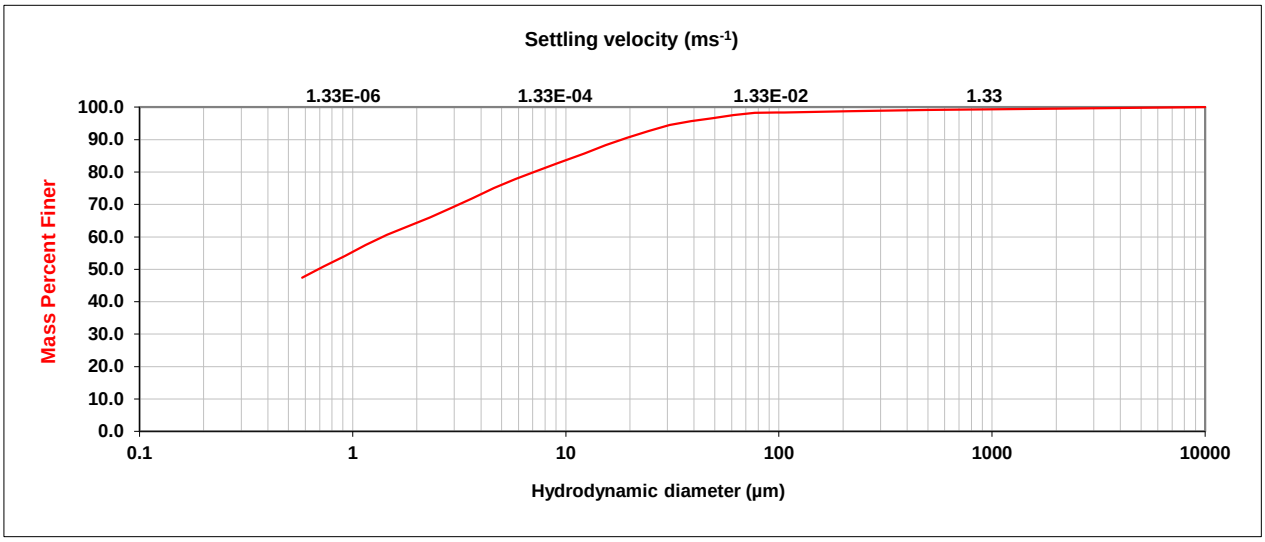
Client:	Advanced Analytical
Client ID:	A15 5628A 15 RF-2 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_15

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.4	4.50E+01
Sand	2000	60	2.0	1.33E+00
Silt	60	2	31.6	1.20E-03
Clay	2	1	8.6	2.81E-06
Sub-clay	1	0	57.5	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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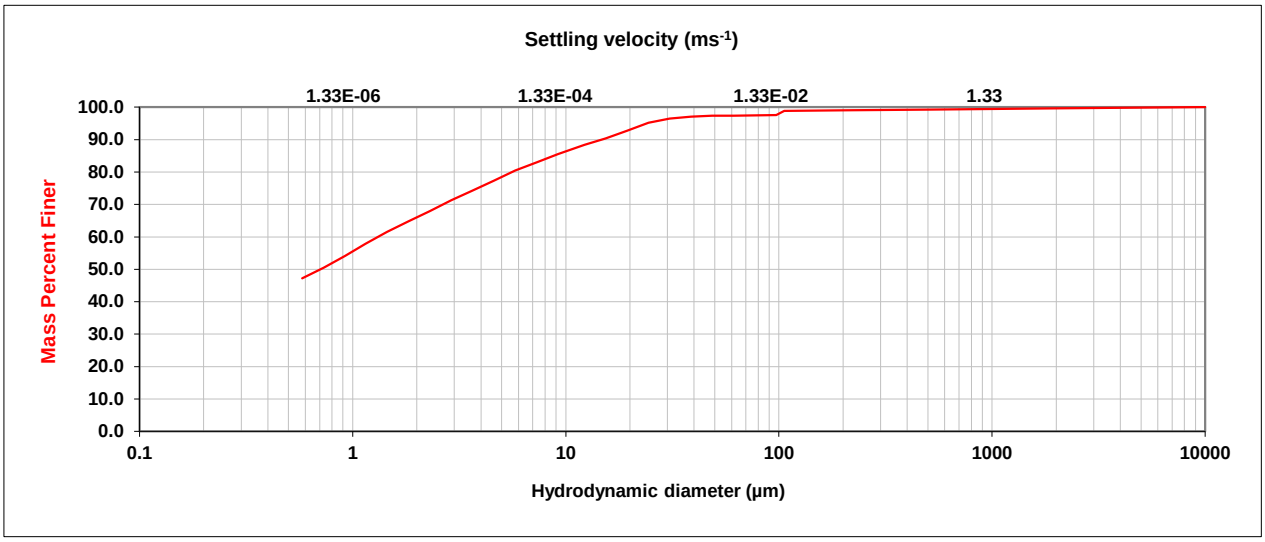
Client:	Advanced Analytical
Client ID:	A15 5628A 16 RF-3 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_16

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.4	4.50E+01
Sand	2000	60	2.3	1.33E+00
Silt	60	2	29.4	1.20E-03
Clay	2	1	10.1	2.81E-06
Sub-clay	1	0	57.9	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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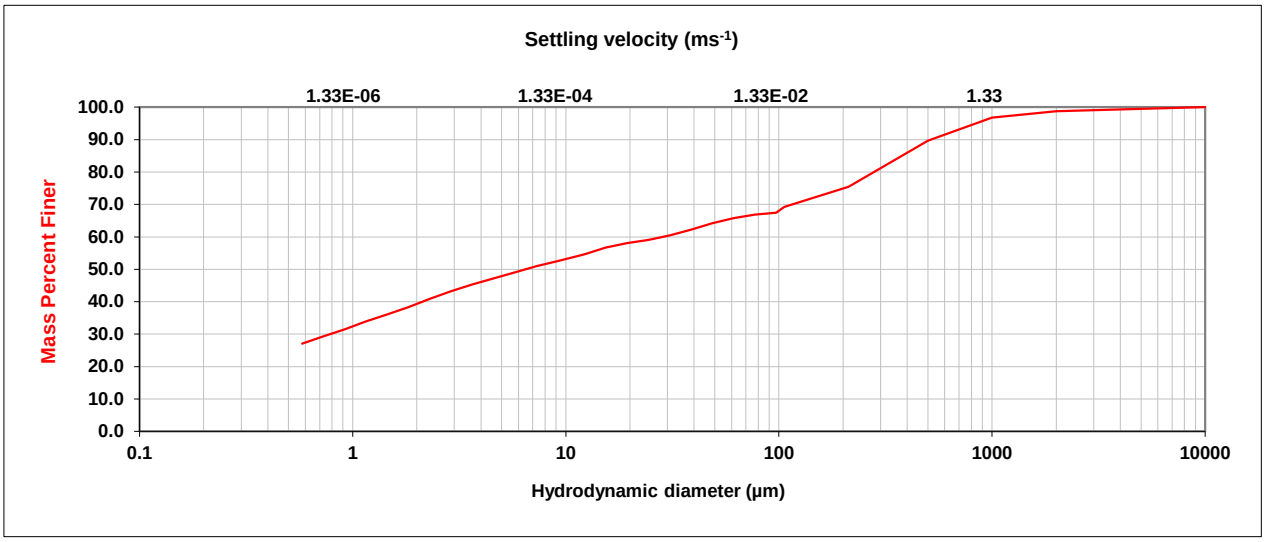
Client:	Advanced Analytical
Client ID:	A15 5628A 17 RF-6 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_17

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	1.2	4.50E+01
Sand	2000	60	33.0	1.33E+00
Silt	60	2	24.9	1.20E-03
Clay	2	1	7.1	2.81E-06
Sub-clay	1	0	33.8	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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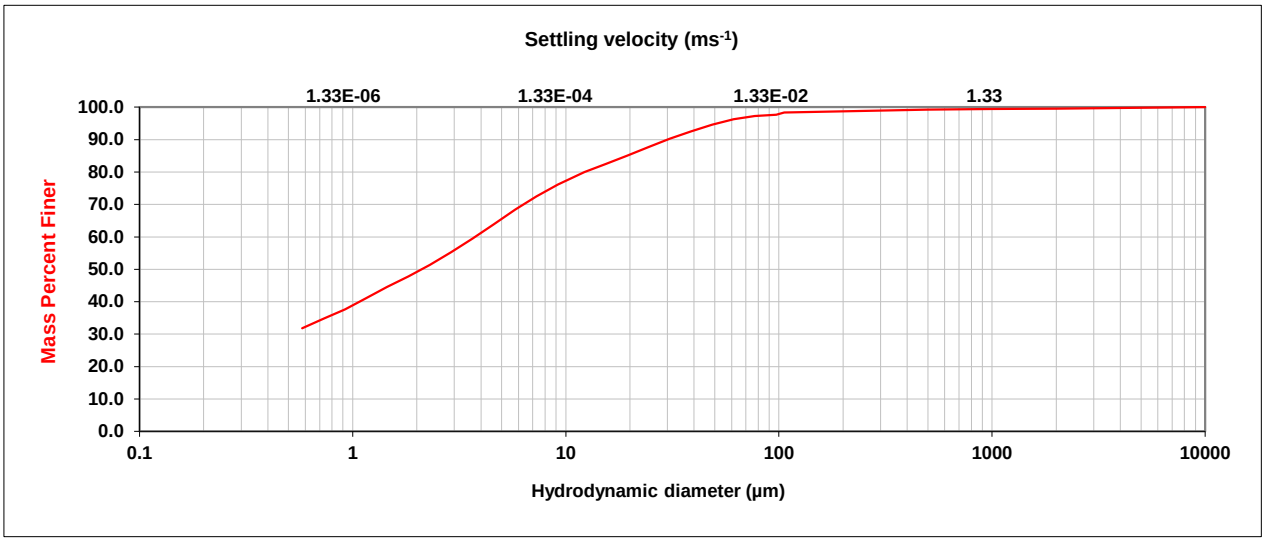
Client:	Advanced Analytical
Client ID:	A15 5628A 18 RF-7 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_18

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.4	4.50E+01
Sand	2000	60	3.3	1.33E+00
Silt	60	2	45.0	1.20E-03
Clay	2	1	10.3	2.81E-06
Sub-clay	1	0	41.0	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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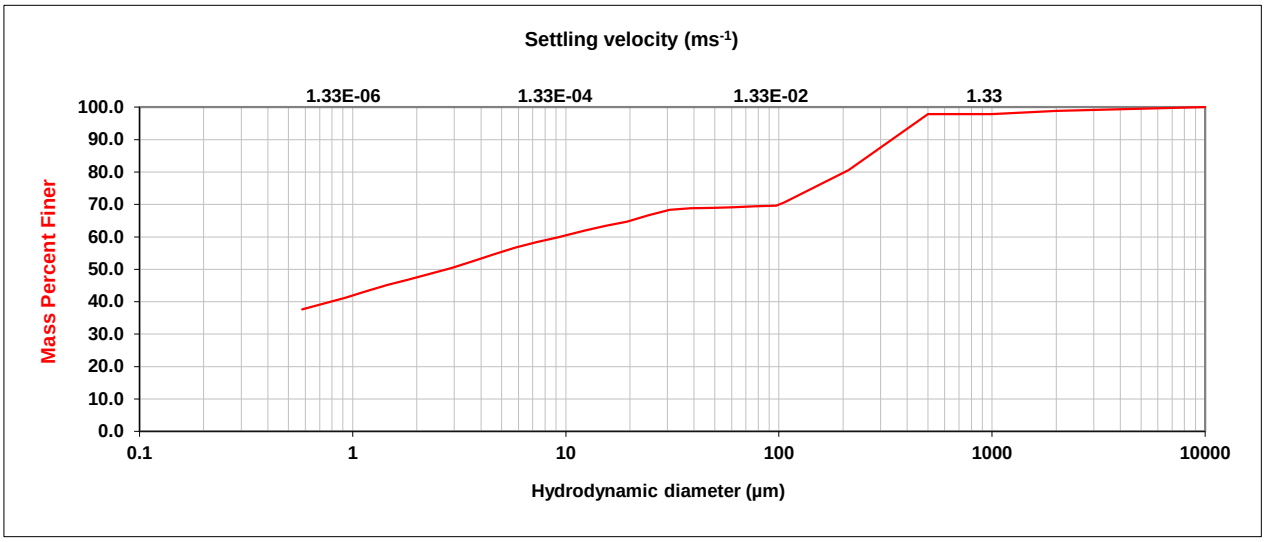
Client:	Advanced Analytical
Client ID:	A15 5628A 19 RF-4 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_19

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	1.1	4.50E+01
Sand	2000	60	29.7	1.33E+00
Silt	60	2	20.6	1.20E-03
Clay	2	1	5.4	2.81E-06
Sub-clay	1	0	43.1	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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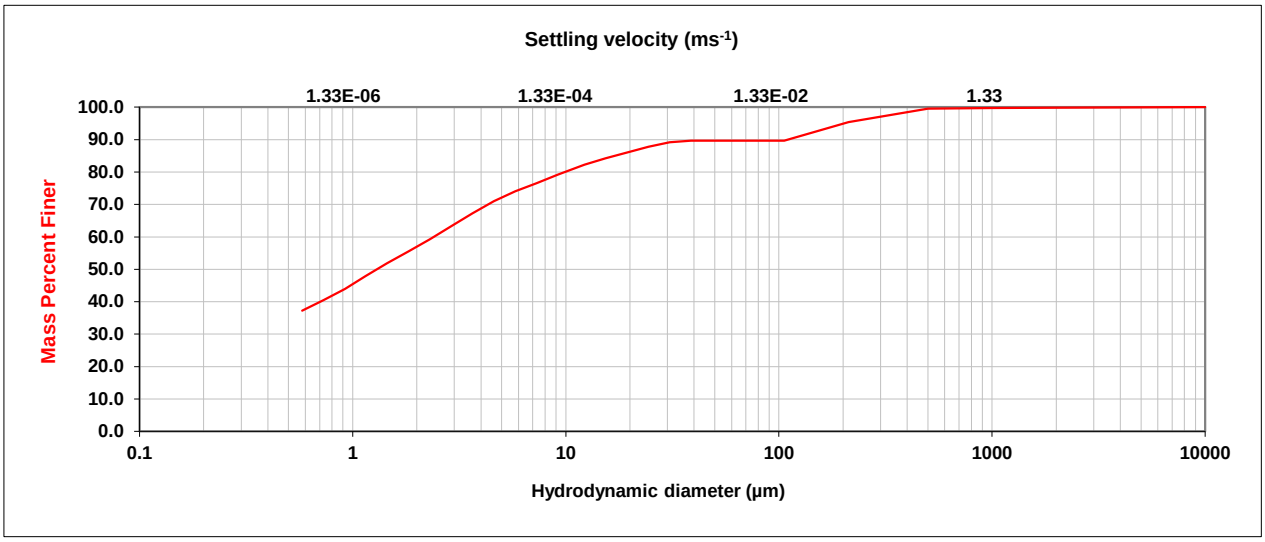
Client:	Advanced Analytical
Client ID:	A15 5628A 20 9 13 2015 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_20

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.33 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.1	4.50E+01
Sand	2000	60	10.2	1.33E+00
Silt	60	2	30.4	1.20E-03
Clay	2	1	11.4	2.81E-06
Sub-clay	1	0	47.9	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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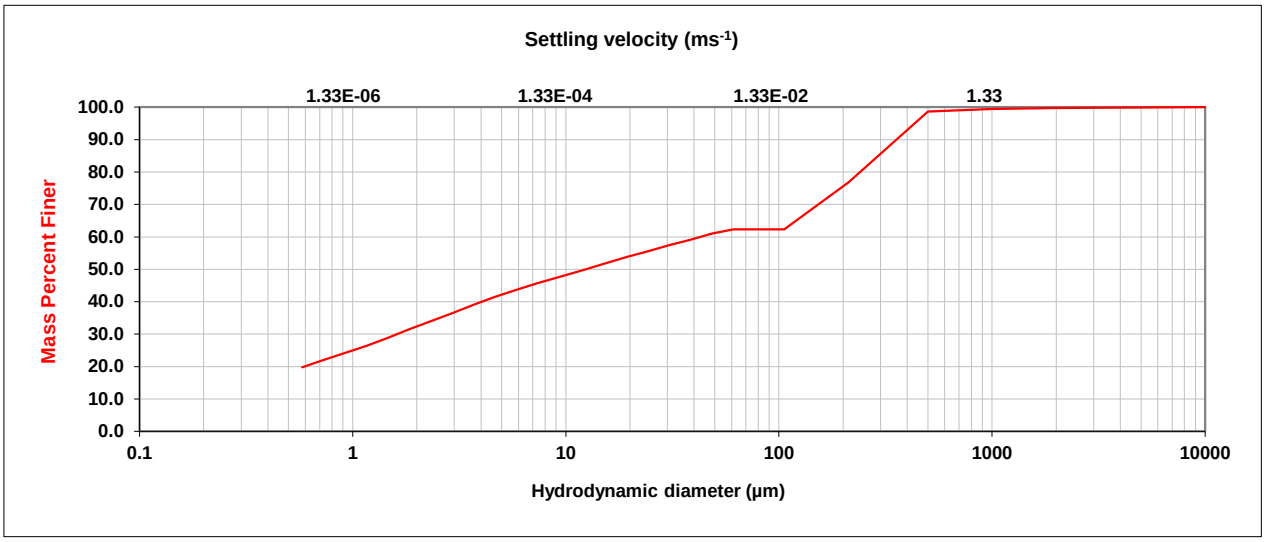
Client:	Advanced Analytical
Client ID:	A15 5628A 21 1 16 2015 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_21

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.3	4.50E+01
Sand	2000	60	37.4	1.33E+00
Silt	60	2	28.5	1.20E-03
Clay	2	1	7.5	2.81E-06
Sub-clay	1	0	26.3	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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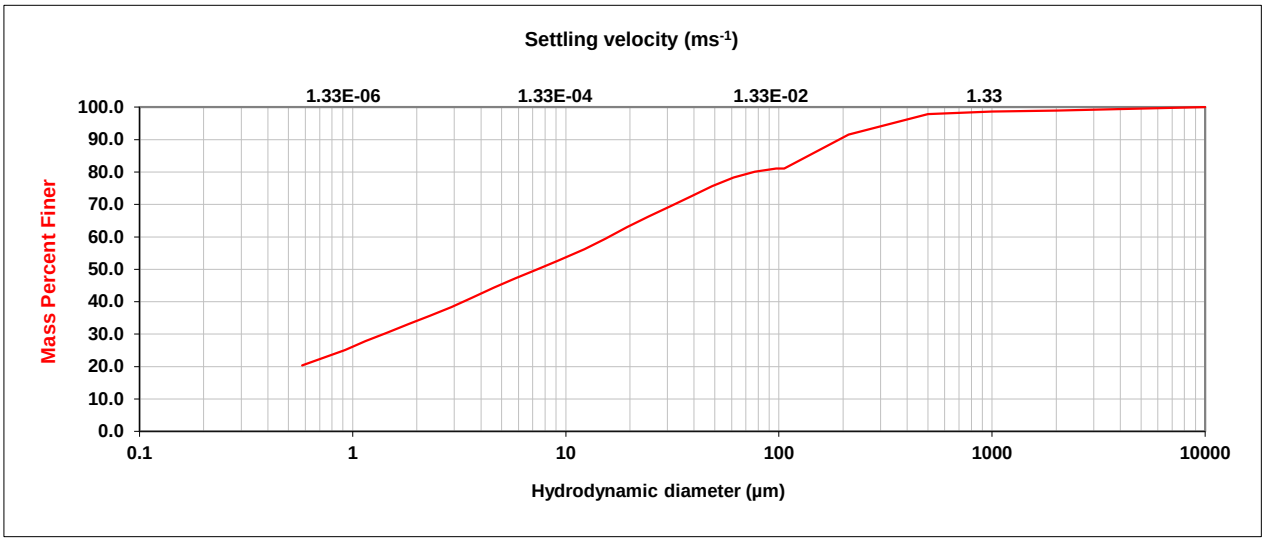
Client:	Advanced Analytical
Client ID:	A15 5628A 22 16-0 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_22

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	1.1	4.50E+01
Sand	2000	60	20.7	1.33E+00
Silt	60	2	42.6	1.20E-03
Clay	2	1	7.8	2.81E-06
Sub-clay	1	0	27.9	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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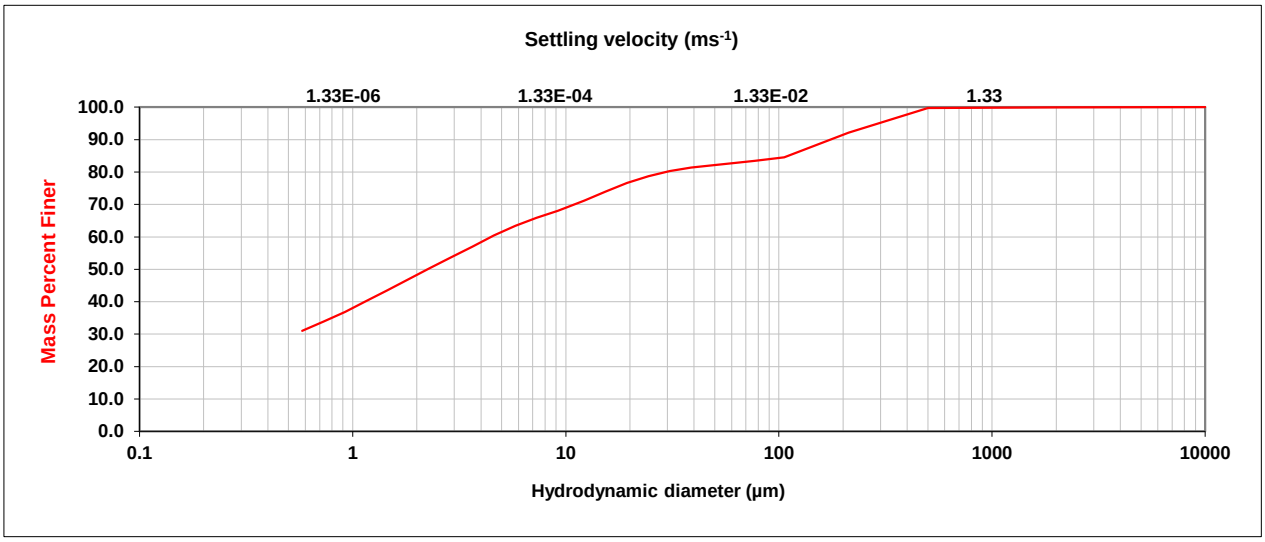
Client:	Advanced Analytical
Client ID:	A15 5628A 23 8 13 2015 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_23

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.33 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.0	4.50E+01
Sand	2000	60	17.2	1.33E+00
Silt	60	2	32.4	1.20E-03
Clay	2	1	10.2	2.81E-06
Sub-clay	1	0	40.1	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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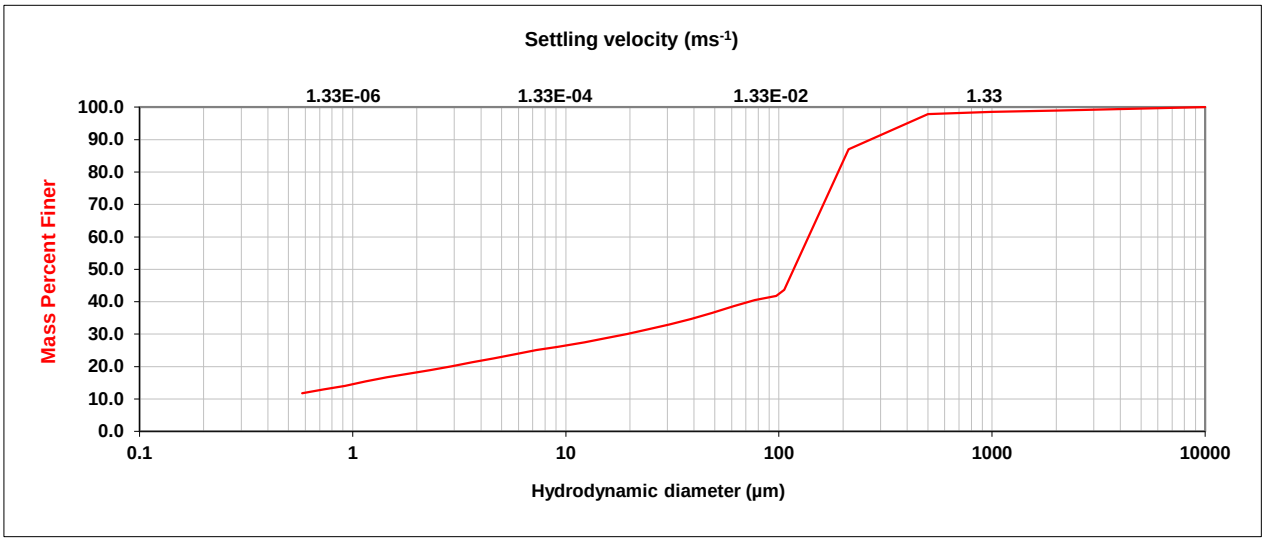
Client:	Advanced Analytical
Client ID:	A15 5628A 24 5 13 2015 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_24

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	1.1	4.50E+01
Sand	2000	60	60.3	1.33E+00
Silt	60	2	19.7	1.20E-03
Clay	2	1	3.5	2.81E-06
Sub-clay	1	0	15.4	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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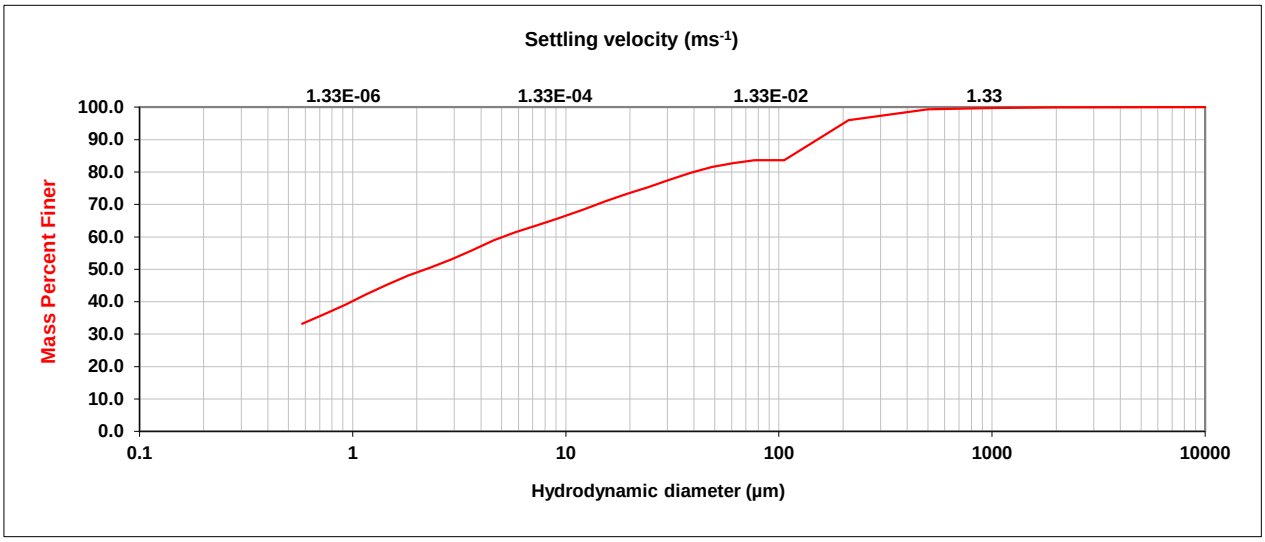
Client:	Advanced Analytical
Client ID:	A15 5628A 25 13-4A 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_25

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.33 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.1	4.50E+01
Sand	2000	60	17.1	1.33E+00
Silt	60	2	32.3	1.20E-03
Clay	2	1	8.4	2.81E-06
Sub-clay	1	0	42.2	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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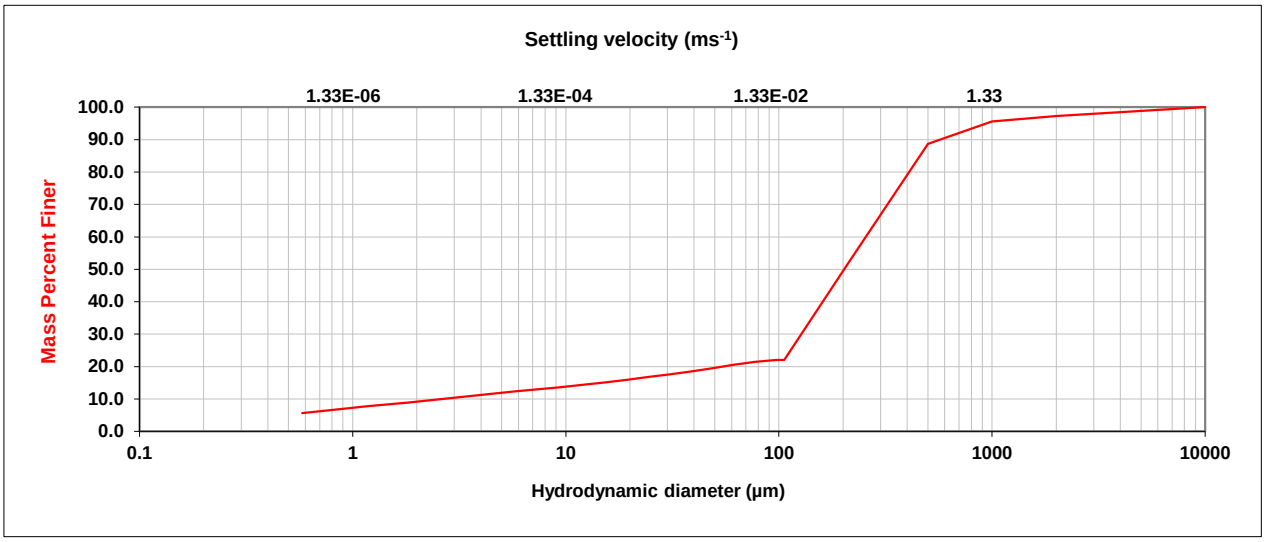
Client:	Advanced Analytical
Client ID:	A15 5628A 26 13-4B 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_26

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	2.7	4.50E+01
Sand	2000	60	76.8	1.33E+00
Silt	60	2	11.0	1.20E-03
Clay	2	1	1.8	2.81E-06
Sub-clay	1	0	7.7	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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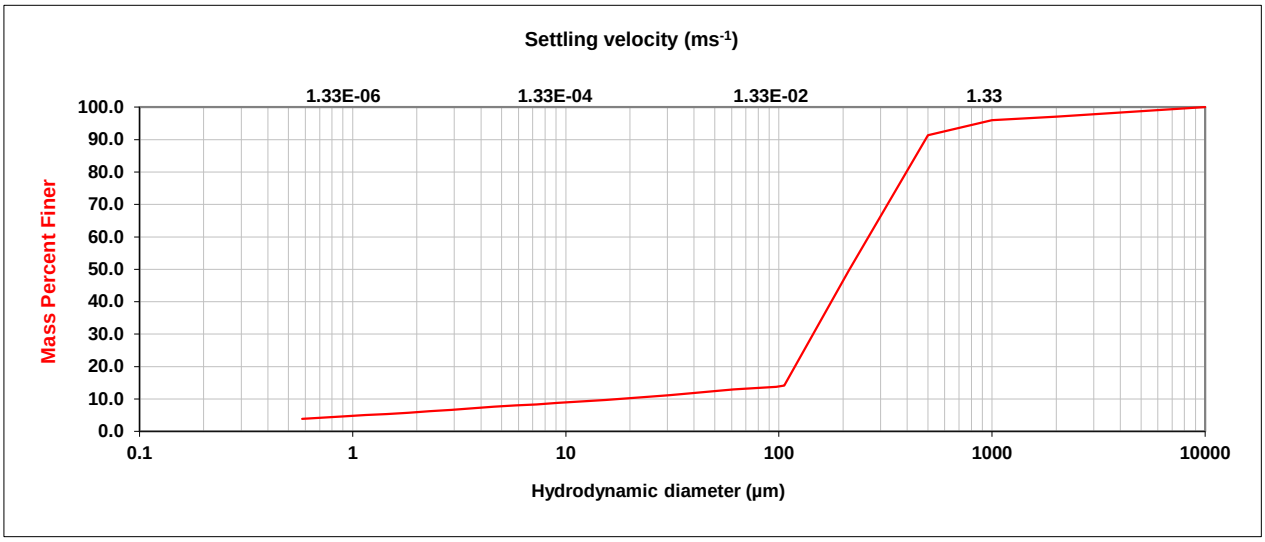
Client:	Advanced Analytical
Client ID:	A15 5628A 27 13-4C 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_27

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	2.9	4.50E+01
Sand	2000	60	84.2	1.33E+00
Silt	60	2	6.7	1.20E-03
Clay	2	1	1.2	2.81E-06
Sub-clay	1	0	5.0	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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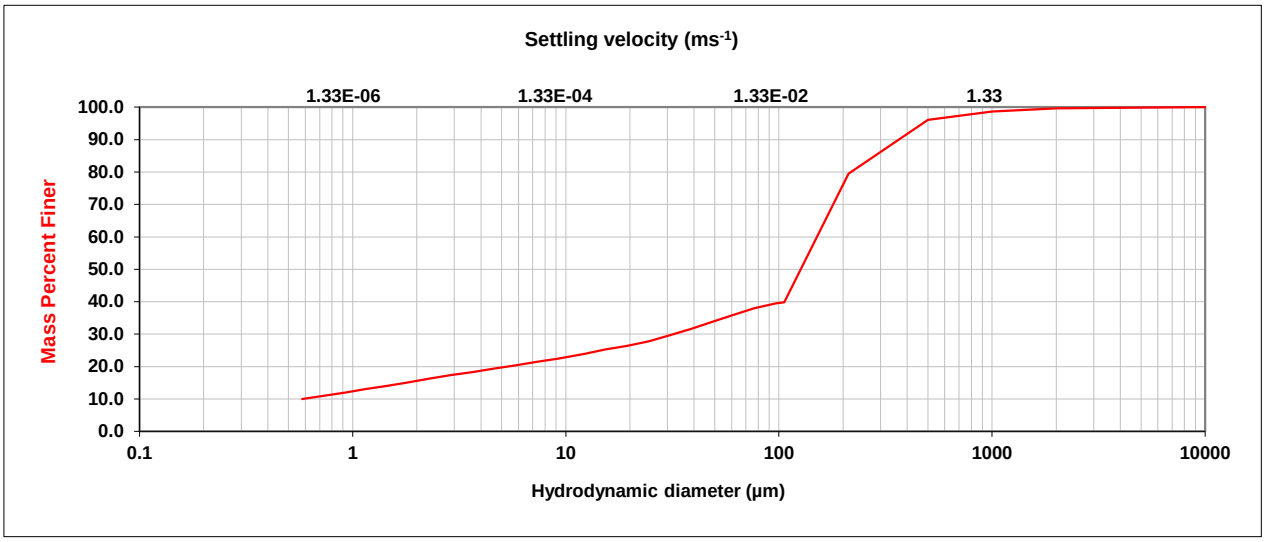
Client:	Advanced Analytical
Client ID:	A15 5628A 28 1 13 2015 10 30 2015
Job No:	15_1343
Laboratory ID:	15_1343_28

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.4	4.50E+01
Sand	2000	60	63.7	1.33E+00
Silt	60	2	19.7	1.20E-03
Clay	2	1	3.3	2.81E-06
Sub-clay	1	0	13.0	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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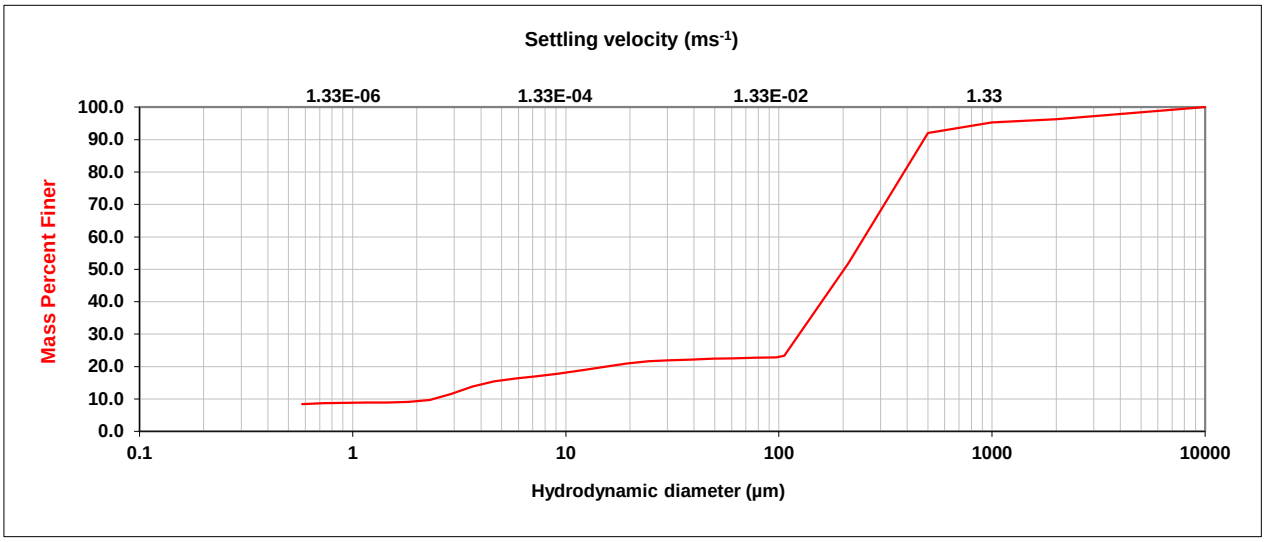
Client:	Advanced Analytical
Client ID:	A15 5628A 29 3 15 2015 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_29

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.725 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	3.7	4.50E+01
Sand	2000	60	73.7	1.33E+00
Silt	60	2	12.8	1.20E-03
Clay	2	1	0.8	2.81E-06
Sub-clay	1	0	8.9	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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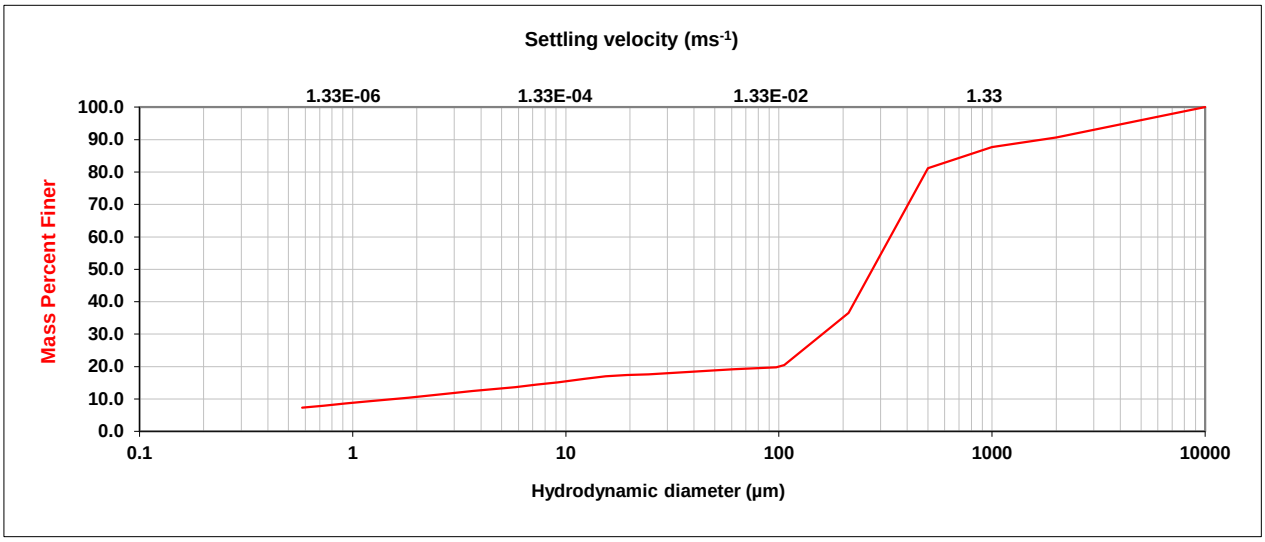
Client:	Advanced Analytical
Client ID:	A15 5628A 30 2 15 2015 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_30

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	9.3	4.50E+01
Sand	2000	60	71.5	1.33E+00
Silt	60	2	8.1	1.20E-03
Clay	2	1	1.8	2.81E-06
Sub-clay	1	0	9.2	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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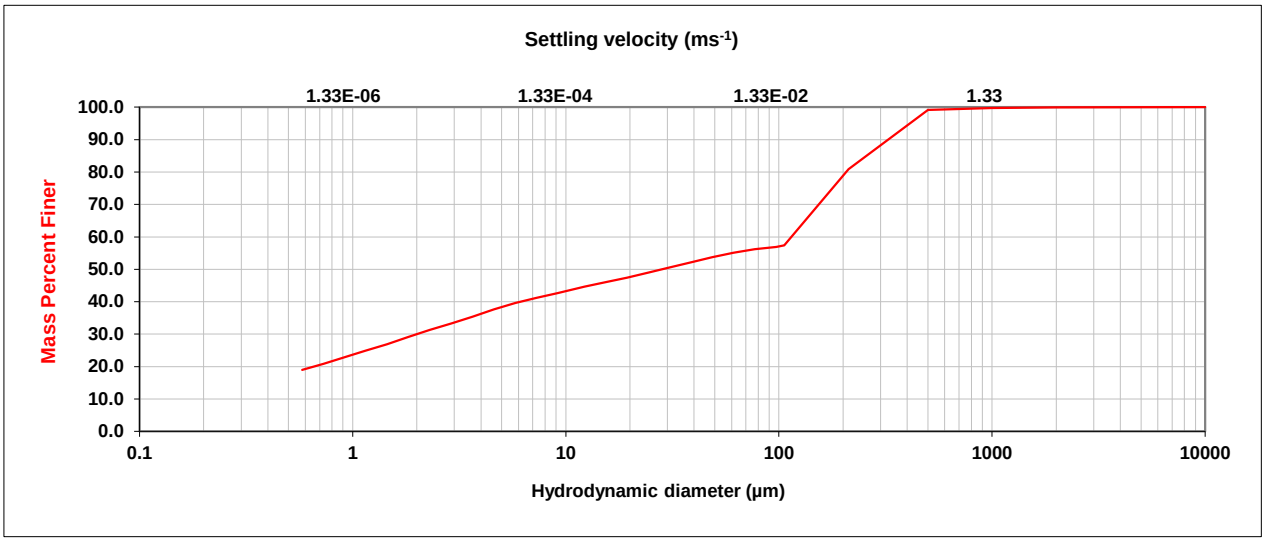
Client:	Advanced Analytical
Client ID:	A15 5628A 31 1 15 2015 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_31

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.1	4.50E+01
Sand	2000	60	44.8	1.33E+00
Silt	60	2	23.8	1.20E-03
Clay	2	1	6.4	2.81E-06
Sub-clay	1	0	24.9	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

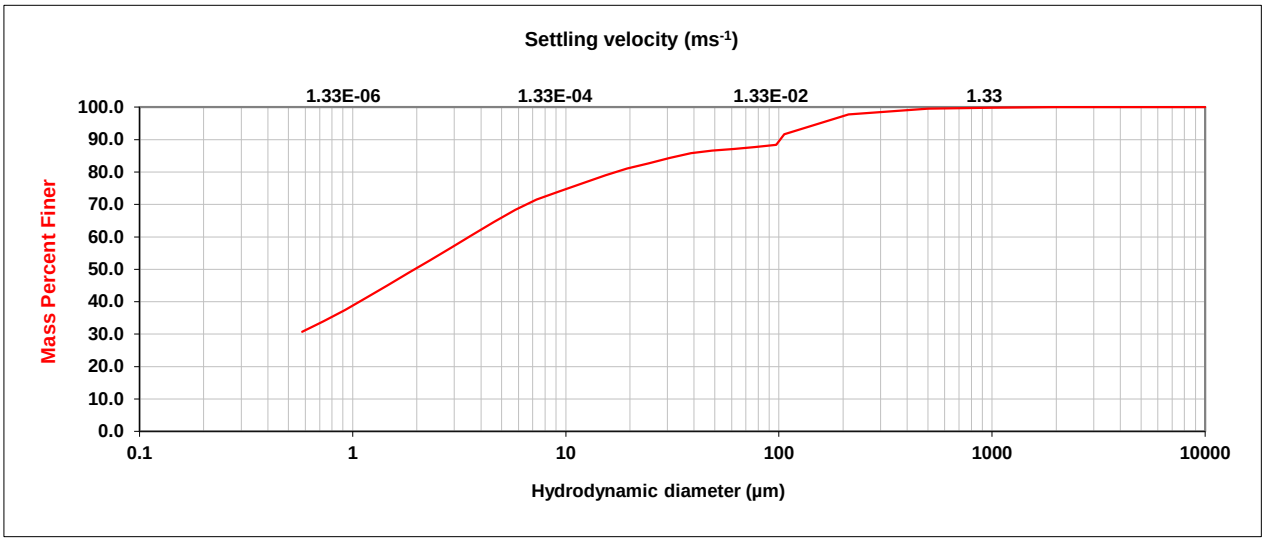
* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

Suite 6
642 Albany Hwy
Victoria Park
WA 6100

Client:	Advanced Analytical
Client ID:	A15 5628A 32 2 12 2015 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_32

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.0	4.50E+01
Sand	2000	60	12.9	1.33E+00
Silt	60	2	34.4	1.20E-03
Clay	2	1	11.6	2.81E-06
Sub-clay	1	0	41.1	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

Suite 6
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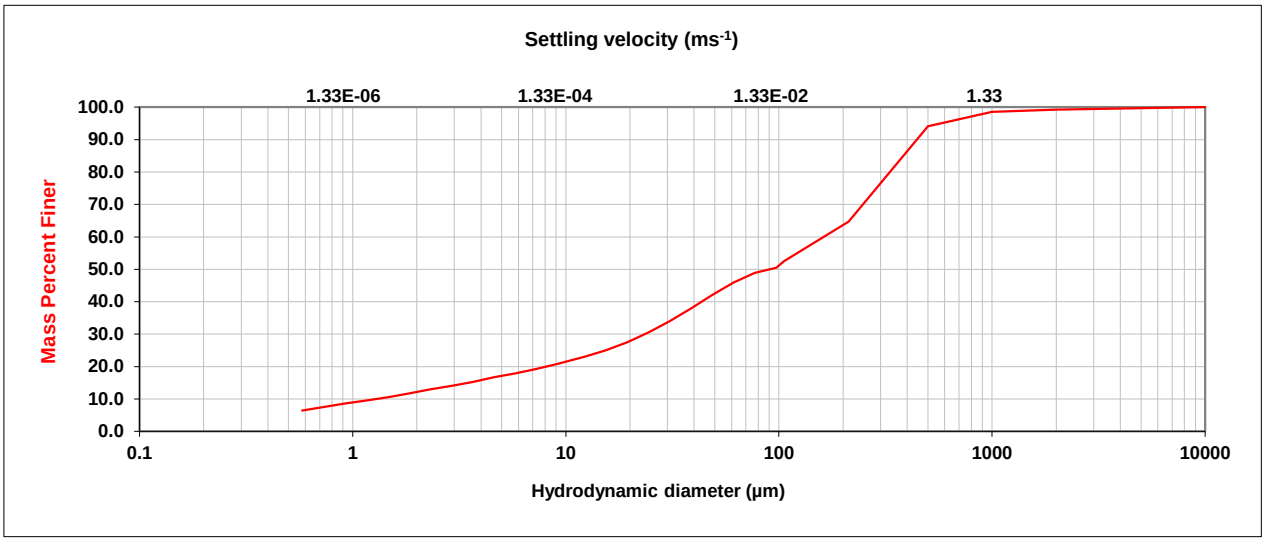
Victoria Park
WA 6100

Client:	Advanced Analytical
Client ID:	A15 5628A 33 1 12 2015 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_33

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.7	4.50E+01
Sand	2000	60	53.3	1.33E+00
Silt	60	2	33.1	1.20E-03
Clay	2	1	3.5	2.81E-06
Sub-clay	1	0	9.5	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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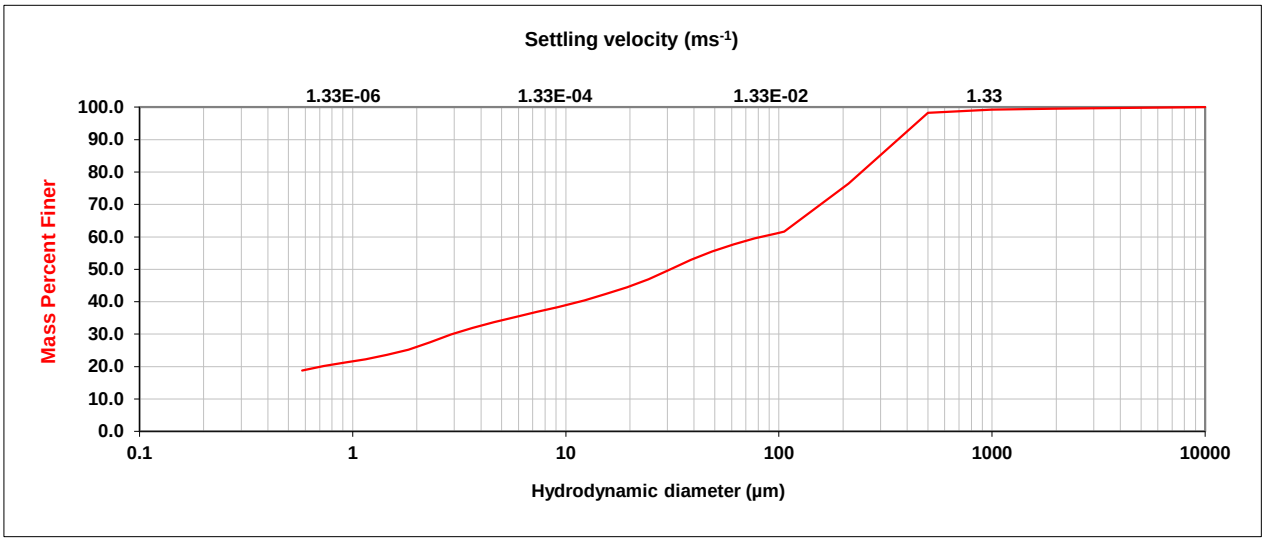
Client:	Advanced Analytical
Client ID:	A15 5628A 34 5 11 2015 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_34

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.4	4.50E+01
Sand	2000	60	41.9	1.33E+00
Silt	60	2	30.2	1.20E-03
Clay	2	1	5.2	2.81E-06
Sub-clay	1	0	22.3	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

Suite 6
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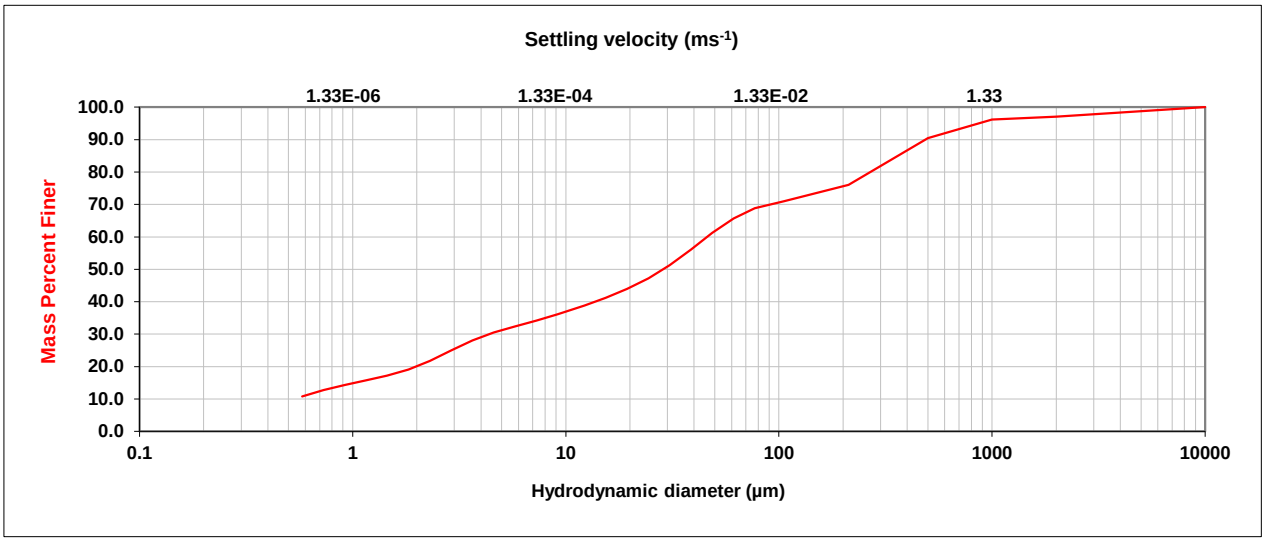
Victoria Park
WA 6100

Client:	Advanced Analytical
Client ID:	A15 5628A 35 8 11 2015 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_35

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	2.9	4.50E+01
Sand	2000	60	31.4	1.33E+00
Silt	60	2	44.0	1.20E-03
Clay	2	1	6.0	2.81E-06
Sub-clay	1	0	15.7	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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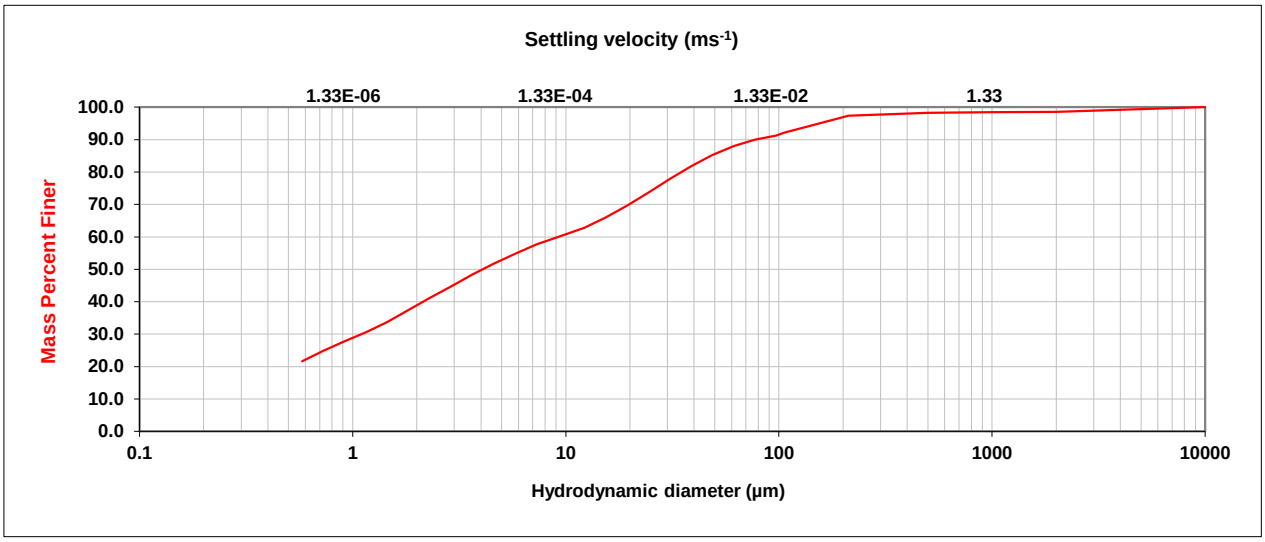
WA 6100

Client:	Advanced Analytical
Client ID:	A15 5628A 36 11-9A 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_36

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	1.4	4.50E+01
Sand	2000	60	10.6	1.33E+00
Silt	60	2	46.8	1.20E-03
Clay	2	1	10.7	2.81E-06
Sub-clay	1	0	30.5	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

Suite 6
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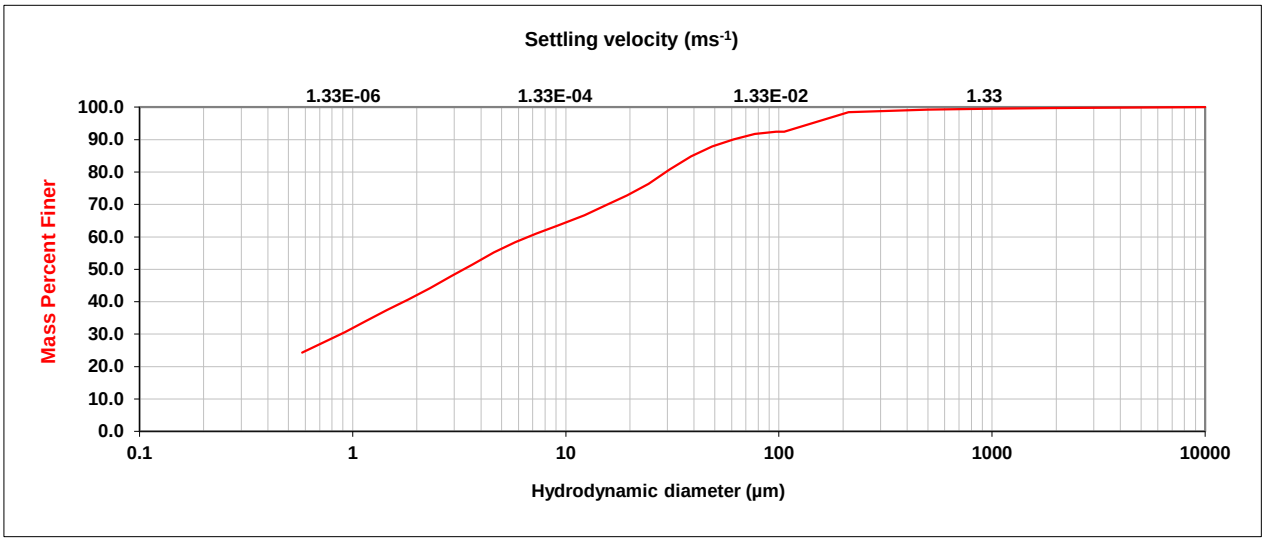
Victoria Park
WA 6100

Client:	Advanced Analytical
Client ID:	A15 5628A 37 11-9B 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_37

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.3	4.50E+01
Sand	2000	60	9.7	1.33E+00
Silt	60	2	45.9	1.20E-03
Clay	2	1	10.2	2.81E-06
Sub-clay	1	0	34.0	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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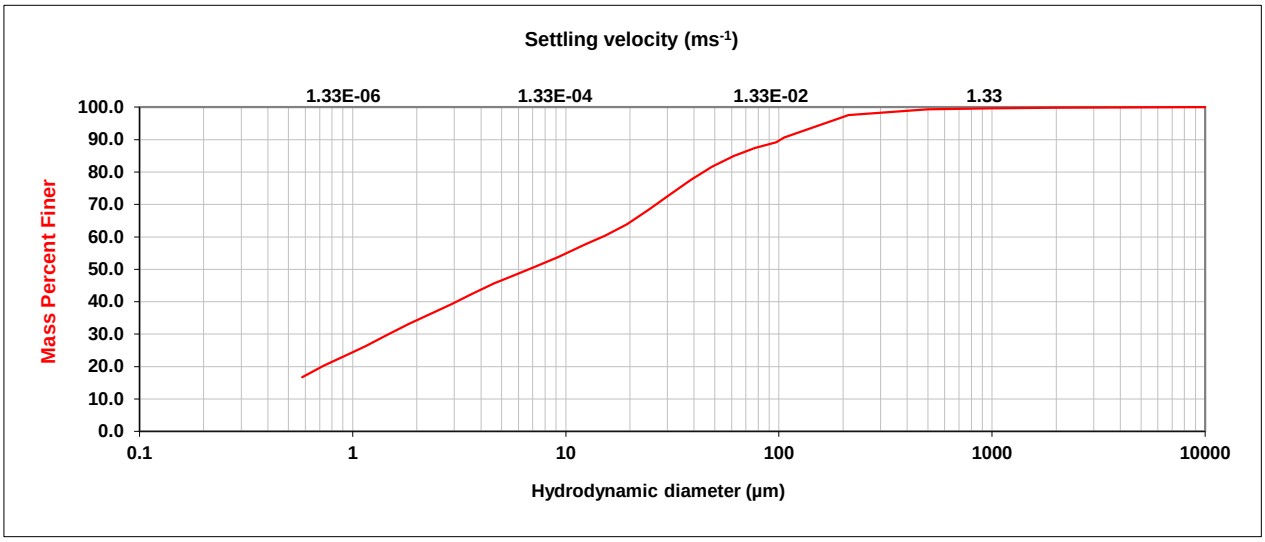
Victoria Park
WA 6100

Client:	Advanced Analytical
Client ID:	A15 5628A 38 11-9C 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_38

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.1	4.50E+01
Sand	2000	60	14.9	1.33E+00
Silt	60	2	48.8	1.20E-03
Clay	2	1	9.9	2.81E-06
Sub-clay	1	0	26.3	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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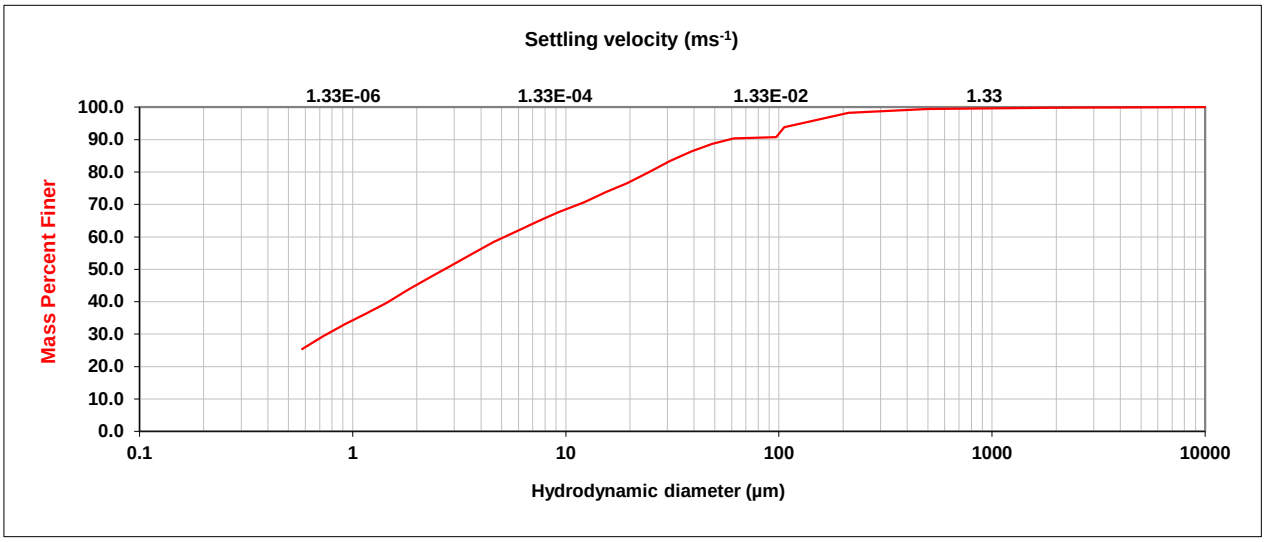
WA 6100

Client:	Advanced Analytical
Client ID:	A15 5628A 39 8 10 2015 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_39

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.725 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.1	4.50E+01
Sand	2000	60	9.6	1.33E+00
Silt	60	2	42.8	1.20E-03
Clay	2	1	11.4	2.81E-06
Sub-clay	1	0	36.2	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

Suite 6
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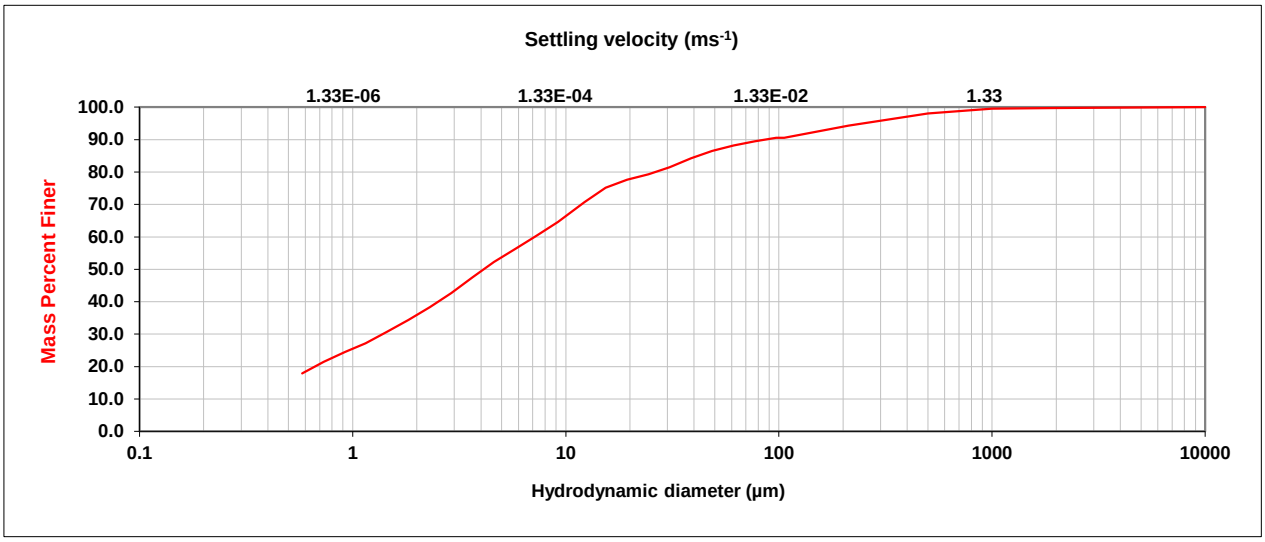
Victoria Park
WA 6100

Client:	Advanced Analytical
Client ID:	A15 5628A 40 10-6A 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_40

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.2	4.50E+01
Sand	2000	60	11.5	1.33E+00
Silt	60	2	49.9	1.20E-03
Clay	2	1	11.1	2.81E-06
Sub-clay	1	0	27.2	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

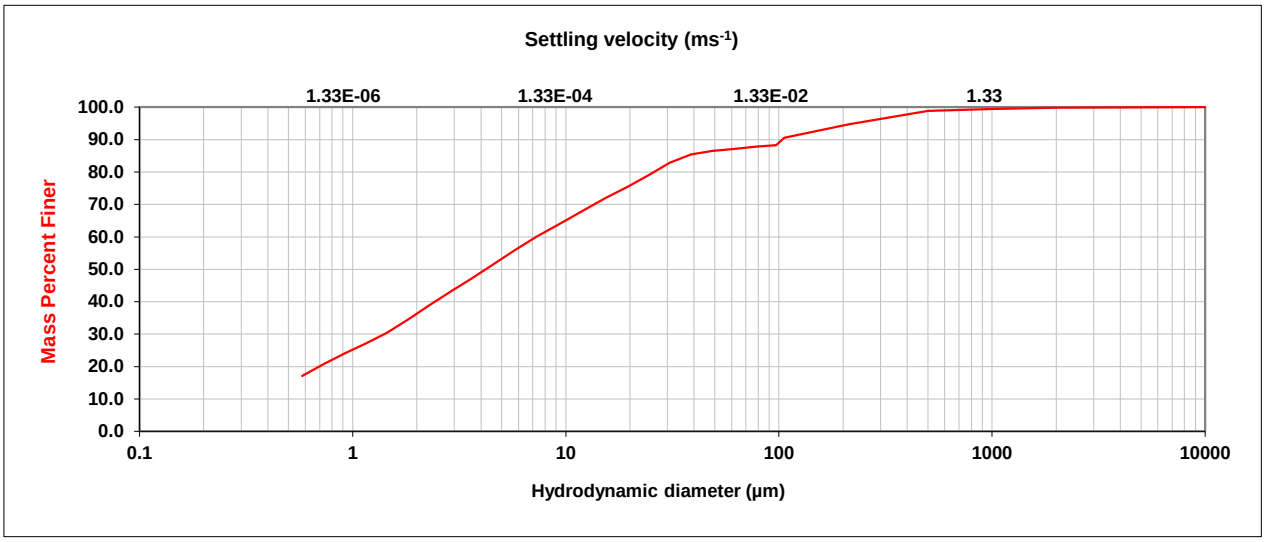
* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

Suite 6
642 Albany Hwy
Victoria Park
WA 6100

Client:	Advanced Analytical
Client ID:	A15 5628A 41 10-6B 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_41

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.2	4.50E+01
Sand	2000	60	12.7	1.33E+00
Silt	60	2	48.1	1.20E-03
Clay	2	1	12.0	2.81E-06
Sub-clay	1	0	27.1	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

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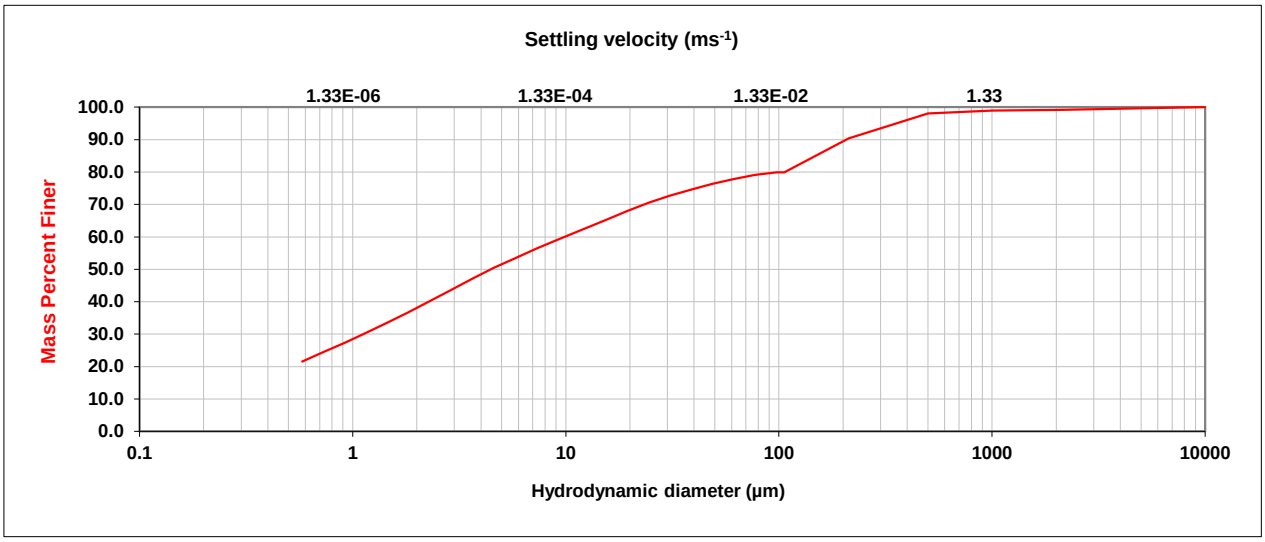
Victoria Park
WA 6100

Client:	Advanced Analytical
Client ID:	A15 5628A 42 5 10 2015 11 2 2015
Job No:	15_1343
Laboratory ID:	15_1343_42

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.35 µm
Liquid viscosity:	0.725 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.8	4.50E+01
Sand	2000	60	21.3	1.33E+00
Silt	60	2	37.7	1.20E-03
Clay	2	1	9.9	2.81E-06
Sub-clay	1	0	30.3	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

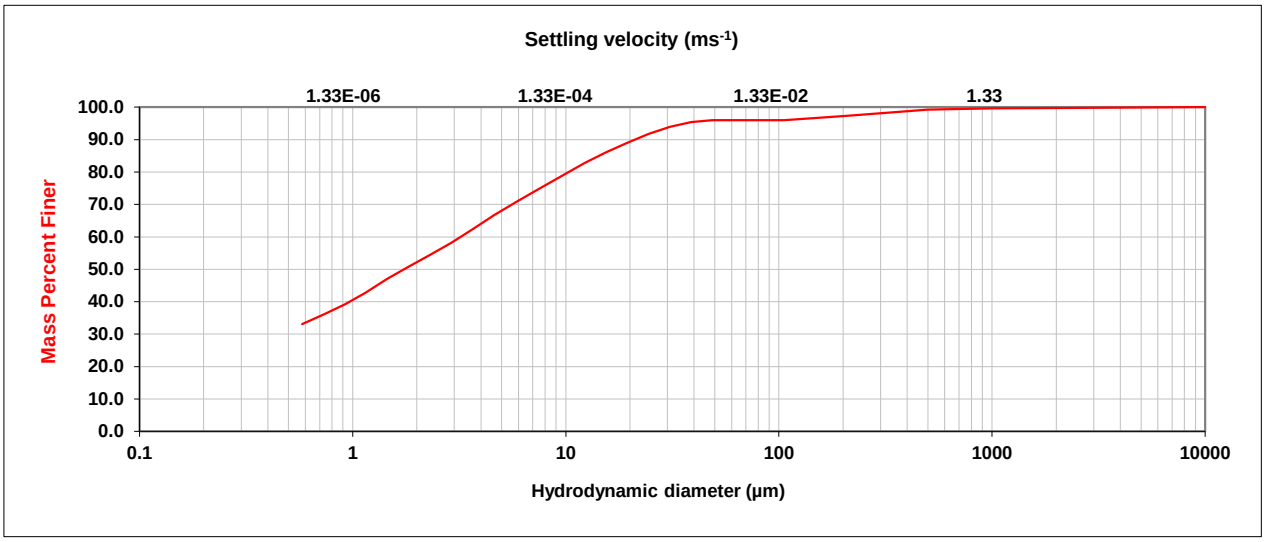
* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

Suite 6
642 Albany Hwy
Victoria Park
WA 6100

Client:	Advanced Analytical
Client ID:	A15 5628A 43 6-2B 10 29 2015
Job No:	15_1343
Laboratory ID:	15_1343_43

Analysis:	X-ray sedimentation by Sedigraph 5100	**Analysis temp.:**	35.7ºC
Dispersant:	Water	**Sonication:**	10 min
Additives:	10 mL sodium hexametaphosphate	**Concentration:**	~5 % w/w

Sample density:	2.650 g/cm^3 (assumed)		
Liquid density:	0.994 g/cm^3	**Critical diameter:**	54.34 µm
Liquid viscosity:	0.724 cp		



Fraction name	Max size (µm)	Min size (µm)	In %	Settling velocity (ms^{-1})*
Gravel	10000	2000	0.3	4.50E+01
Sand	2000	60	3.7	1.33E+00
Silt	60	2	41.6	1.20E-03
Clay	2	1	11.6	2.81E-06
Sub-clay	1	0	42.8	3.12E-07
Total			100.0	

Note : Data from 106 µm to 10,000 µm by wet screening , from 0.3µm to 106 µm by Sedimentation.

* based on the mean of the size interval and on the the calculations and variables in the 'settling velocity worksheet

REPORT OF ANALYSIS

Laboratory Reference: A15/5628-A [R00]

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

Contact: Brad Grant

Order No:
Project: Port of Brisbane - Sediments
Sample Type: Sediment
No. of Samples: 46
Date Received: 02/11/2015
Date Completed: 1/12/2015

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.
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ilac-MRA NATA Accreditation No.15109

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contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A15/5628-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference:	-	-	/1	/2	/3	/4
Client Reference:	-	-	2-0	BC-2	4-4	4-0
Date Sampled:	-	-	29/10/2015	29/10/2015	29/10/2015	29/10/2015
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	16.4	55.1	61.0	54.3
Trace Elements						
Aluminium	04-001	mg/kg	2,600	20,000	27,000	26,000
Arsenic	04-001	mg/kg	1.4	9.4	8.6	5.4
Cadmium	04-001	mg/kg	<0.1	0.18	<0.1	<0.1
Chromium	04-001	mg/kg	8.9	40	49	53
Copper	04-001	mg/kg	7.7	56	48	34
Iron	04-001	mg/kg	9,800	36,000	46,000	51,000
Lead	04-001	mg/kg	2.7	100	25	12
Mercury	04-002	mg/kg	0.01	0.15	0.15	0.07
Nickel	04-001	mg/kg	6.3	22	30	45
Phosphorus*	04-001	mg/kg	180	660	990	1,100
Silver	04-001	mg/kg	<0.1	0.48	0.21	0.11
Zinc	04-001	mg/kg	15	190	150	96
BTEX						
Total Petroleum Hydrocarbons						
Poly Aromatic Hydrocarbons						
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	2.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	2.0	4.0	<1.0
p,p'-DDE	04-024	µg/kg	<1.0	6.0	5.0	6.0
p,p'-DDT	04-024	µg/kg	<5	<5	<5	9.0
Dieldrin	04-024	µg/kg	<1.0	2.0	1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
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North Ryde NSW 2113 Australia
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Fax: + 61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A15/5628-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference:	-	-	/1	/2	/3	/4
Client Reference:	-	-	2-0	BC-2	4-4	4-0
Date Sampled:	-	-	29/10/2015	29/10/2015	29/10/2015	29/10/2015
Analysis Description	**Method**	**Units**				
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin aldehyde	04-024	µg/kg	<5	<5	<5	<5
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	71	98	102	80
Date Extracted	04-024	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-024	-	12/11/2015	12/11/2015	12/11/2015	12/11/2015
Polychlorinated Biphenyls						
Organotins						
Monobutyl tin	04-026	µgSn/kg	<0.50	22	6.5	1.6
Dibutyl tin	04-026	µgSn/kg	<0.50	23	5.4	1.6
Tributyl tin	04-026	µgSn/kg	<0.50	22	12	2.0
Surrogate 1 Recovery	04-026	%	90	137	148	92
Date Extracted	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015
Date Analysed	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015
Subcontract Analysis						
Total Organic Carbon	SUB	%	0.05	2.1	1.9	1.8
Particle Size Distribution	SUB		See Comments	See Comments	See Comments	See Comments

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Batch Number: A15/5628-A [R00]
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Laboratory Reference:	-	-	/5	/6	/7	/8
Client Reference:	-	-	5-0	9-1	5-1A	5-1B
Date Sampled:	-	-	29/10/2015	29/10/2015	29/10/2015	29/10/2015
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	61.1	54.2	54.9	55.8
Trace Elements						
Aluminium	04-001	mg/kg	26,000	26,000	24,000	24,000
Arsenic	04-001	mg/kg	8.5	5.3	7.9	8.3
Cadmium	04-001	mg/kg	<0.1	<0.1	0.22	0.21
Chromium	04-001	mg/kg	50	47	47	47
Copper	04-001	mg/kg	43	31	35	36
Iron	04-001	mg/kg	46,000	47,000	40,000	41,000
Lead	04-001	mg/kg	24	11	26	26
Mercury	04-002	mg/kg	0.12	0.07	0.21	0.18
Nickel	04-001	mg/kg	30	40	23	24
Phosphorus*	04-001	mg/kg	930	920	780	810
Silver	04-001	mg/kg	0.18	<0.1	0.45	0.41
Zinc	04-001	mg/kg	140	97	120	120
BTEX						
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<20	<10	<10	<10
TPH C10-14	04-020	mg/kg	<20	<10	<10	<10
TPH C15-28	04-020	mg/kg	<100	<50	65	72
TPH C29-36	04-020	mg/kg	<100	<50	76	80
Surrogate Recovery	04-020	%	101	99	105	99
Date Extracted	04-020	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-020	-	5/11/2015	6/11/2015	6/11/2015	6/11/2015
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<10	<5.0	5.0	<5.0
1-Methylnaphthalene	04-022	µg/kg	<10	<5.0	<5.0	<5.0
2-Methylnaphthalene	04-022	µg/kg	<10	<5.0	<5.0	<5.0
Acenaphthylene	04-022	µg/kg	<10	<5.0	5.0	8.0
Acenaphthene	04-022	µg/kg	<10	<5.0	<5.0	<5.0
Fluorene	04-022	µg/kg	<10	<5.0	<5.0	<5.0
Phenanthrene	04-022	µg/kg	31	9.0	25	19
Anthracene	04-022	µg/kg	11	<5.0	8.0	7.0

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Batch Number: A15/5628-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/5** **5-0** **29/10/2015**	**/6** **9-1** **29/10/2015**	**/7** **5-1A** **29/10/2015**	**/8** **5-1B** **29/10/2015**
Fluoranthene	04-022	µg/kg	23	5.0	13	12
Pyrene	04-022	µg/kg	120	29	73	74
Benz(a)anthracene	04-022	µg/kg	58	14	40	41
Chrysene	04-022	µg/kg	61	16	40	40
Benzo(b)&(k)fluoranthene	04-022	µg/kg	130	32	95	100
Benzo(a)pyrene	04-022	µg/kg	73	17	51	58
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	59	16	42	50
Dibenz(a,h)anthracene	04-022	µg/kg	12	<5.0	9.0	10
Benzo(g,h,i)perylene	04-022	µg/kg	56	15	38	47
Coronene	04-022	µg/kg	<20	<10	10	12
Benzo(e)pyrene	04-022	µg/kg	56	15	39	44
Perylene	04-022	µg/kg	140	47	55	77
Total PAHs (as above)	04-022	µg/kg	960	240	600	650
Surrogate 1 Recovery	04-022	%	100	98	94	93
Surrogate 2 Recovery	04-022	%	95	98	90	91
Surrogate 3 Recovery	04-022	%	109	107	104	105
Date Extracted	04-022	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-022	-	5/11/2015	5/11/2015	5/11/2015	5/11/2015
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	2.0	1.0	2.0	3.0
p,p'-DDE	04-024	µg/kg	5.0	8.0	5.0	4.0
p,p'-DDT	04-024	µg/kg	<5	6.0	<5	<5
Dieldrin	04-024	µg/kg	2.0	<1.0	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0

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Project Reference: Port of Brisbane - Sediments

Laboratory Reference:	-	-	/5	/6	/7	/8
Client Reference:	-	-	5-0	9-1	5-1A	5-1B
Date Sampled:	-	-	29/10/2015	29/10/2015	29/10/2015	29/10/2015
Analysis Description	**Method**	**Units**				
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin aldehyde	04-024	µg/kg	<5	<5	<5	<5
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	100	91	101	103
Date Extracted	04-024	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-024	-	12/11/2015	12/11/2015	12/11/2015	12/11/2015
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	<10	<5.0	<5.0	<5.0
Di-PCB congeners	04-029	µg/kg	<10	<5.0	<5.0	<5.0
Tri-PCB congeners	04-029	µg/kg	<10	<5.0	<5.0	<5.0
Tetra-PCB congeners	04-029	µg/kg	<10	<5.0	<5.0	<5.0
Penta-PCB congeners	04-029	µg/kg	<10	<5.0	<5.0	<5.0
Hexa-PCB congeners	04-029	µg/kg	<10	<5.0	<5.0	<5.0
Hepta-PCB congeners	04-029	µg/kg	<10	<5.0	<5.0	<5.0
Octa-PCB congeners	04-029	µg/kg	<10	<5.0	<5.0	<5.0
Nona-PCB congeners	04-029	µg/kg	<10	<5.0	<5.0	<5.0
Deca-PCB congeners	04-029	µg/kg	<10	<5.0	<5.0	<5.0
Total PCB congeners	04-029	µg/kg	<10	<5.0	<5.0	<5.0
Surrogate 1 Recovery	04-029	%	104	105	101	101
Surrogate 2 Recovery	04-029	%	110	110	111	106
Date Extracted	04-029	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-029	-	5/11/2015	5/11/2015	5/11/2015	5/11/2015
Organotins						
Monobutyl tin	04-026	µgSn/kg	5.2	2.2	21	16
Dibutyl tin	04-026	µgSn/kg	4.0	3.0	16	13
Tributyl tin	04-026	µgSn/kg	5.9	4.3	5.8	4.4
Surrogate 1 Recovery	04-026	%	126	95	148	139
Date Extracted	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015

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Laboratory Reference:	-	-	/5	/6	/7	/8
Client Reference:	-	-	5-0	9-1	5-1A	5-1B
Date Sampled:	-	-	29/10/2015	29/10/2015	29/10/2015	29/10/2015
Analysis Description	**Method**	**Units**				
Date Analysed	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.8	1.5	1.3	1.5
Nitrate as N	SUB	mg/kg	<0.1	<0.1	<0.1	<0.1
Nitrite as N	SUB	mg/kg	<0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen	SUB	mg/kg	1,340	1,120	900	950
Total Nitrogen	SUB	mg/kg	1,340	1,120	900	950
Particle Size Distribution	SUB		See Comments	See Comments	See Comments	See Comments
Gross Alpha	SUB	mBq/g	<60	<60	<60	<60
Gross Beta	SUB	mBq/g	<135	<135	<135	<135
Chromium Reducible Suite	SUB		See Comments	See Comments	See Comments	See Comments

Laboratory Reference:	-	-	/9	/10	/11	/12
Client Reference:	-	-	5-1C	6-3	6-2A	7-1
Date Sampled:	-	-	29/10/2015	29/10/2015	29/10/2015	29/10/2015
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	59.5	63.6	59.6	58.7
Trace Elements						
Aluminium	04-001	mg/kg	25,000	26,000	29,000	25,000
Arsenic	04-001	mg/kg	8.5	9.2	7.3	6.4
Cadmium	04-001	mg/kg	0.12	<0.1	0.26	<0.1
Chromium	04-001	mg/kg	44	48	49	42
Copper	04-001	mg/kg	32	43	40	32
Iron	04-001	mg/kg	42,000	47,000	48,000	41,000
Lead	04-001	mg/kg	21	20	15	15
Mercury	04-002	mg/kg	0.19	0.12	0.09	0.09
Nickel	04-001	mg/kg	25	29	35	29
Phosphorus*	04-001	mg/kg	730	930	1,200	830
Silver	04-001	mg/kg	0.33	0.18	0.14	0.13
Zinc	04-001	mg/kg	110	130	110	100
BTEX						

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/9** **5-1C** **29/10/2015**	**/10** **6-3** **29/10/2015**	**/11** **6-2A** **29/10/2015**	**/12** **7-1** **29/10/2015**
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<20	<20	[NA]	<10
TPH C10-14	04-020	mg/kg	<20	<20	[NA]	<10
TPH C15-28	04-020	mg/kg	<100	<100	[NA]	<50
TPH C29-36	04-020	mg/kg	<100	<100	[NA]	59
Surrogate Recovery	04-020	%	94	85	[NA]	95
Date Extracted	04-020	-	4/11/2015	4/11/2015	[NA]	4/11/2015
Date Analysed	04-020	-	6/11/2015	6/11/2015	[NA]	6/11/2015
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	8.0	<10	[NA]	<5.0
1-Methylnaphthalene	04-022	µg/kg	<5.0	<10	[NA]	<5.0
2-Methylnaphthalene	04-022	µg/kg	<5.0	<10	[NA]	<5.0
Acenaphthylene	04-022	µg/kg	8.0	<10	[NA]	6.0
Acenaphthene	04-022	µg/kg	<5.0	<10	[NA]	<5.0
Fluorene	04-022	µg/kg	7.0	<10	[NA]	<5.0
Phenanthrene	04-022	µg/kg	28	19	[NA]	29
Anthracene	04-022	µg/kg	13	<10	[NA]	10
Fluoranthene	04-022	µg/kg	18	11	[NA]	17
Pyrene	04-022	µg/kg	120	62	[NA]	86
Benz(a)anthracene	04-022	µg/kg	57	30	[NA]	51
Chrysene	04-022	µg/kg	54	35	[NA]	150
Benzo(b)&(k)fluoranthene	04-022	µg/kg	130	72	[NA]	150
Benzo(a)pyrene	04-022	µg/kg	76	37	[NA]	48
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	60	31	[NA]	42
Dibenz(a,h)anthracene	04-022	µg/kg	11	<10	[NA]	8.0
Benzo(g,h,i)perylene	04-022	µg/kg	54	30	[NA]	37
Coronene	04-022	µg/kg	13	<20	[NA]	<10
Benzo(e)pyrene	04-022	µg/kg	59	31	[NA]	56
Perylene	04-022	µg/kg	620	120	[NA]	97
Total PAHs (as above)	04-022	µg/kg	1,420	540	[NA]	850
Surrogate 1 Recovery	04-022	%	101	88	[NA]	94
Surrogate 2 Recovery	04-022	%	97	85	[NA]	94
Surrogate 3 Recovery	04-022	%	107	95	[NA]	102

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Laboratory Reference:	**-**	**-**	**/9**	**/10**	**/11**	**/12**
Client Reference:	**-**	**-**	**5-1C**	**6-3**	**6-2A**	**7-1**
Date Sampled:	**-**	**-**	**29/10/2015**	**29/10/2015**	**29/10/2015**	**29/10/2015**
Analysis Description	**Method**	**Units**				
Date Extracted	04-022	-	4/11/2015	4/11/2015	[NA]	4/11/2015
Date Analysed	04-022	-	5/11/2015	5/11/2015	[NA]	5/11/2015
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	11	1.0	3.0	6.0
p,p'-DDE	04-024	µg/kg	4.0	4.0	7.0	5.0
p,p'-DDT	04-024	µg/kg	<5	6.0	<5	6.0
Dieldrin	04-024	µg/kg	<1.0	<1.0	<1.0	1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin aldehyde	04-024	µg/kg	<5	<5	<5	<5
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	111	75	91	96
Date Extracted	04-024	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-024	-	12/11/2015	12/11/2015	12/11/2015	12/11/2015
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	<5.0
Di-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	<5.0
Tri-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	<5.0
Tetra-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	<5.0

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Laboratory Reference:	-	-	**/9**	**/10**	**/11**	**/12**
Client Reference:	-	-	**5-1C**	**6-3**	**6-2A**	**7-1**
Date Sampled:	-	-	**29/10/2015**	**29/10/2015**	**29/10/2015**	**29/10/2015**
Analysis Description	**Method**	**Units**				
Penta-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	<5.0
Hexa-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	<5.0
Hepta-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	<5.0
Octa-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	<5.0
Nona-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	<5.0
Deca-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	<5.0
Total PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	<5.0
Surrogate 1 Recovery	04-029	%	104	93	[NA]	98
Surrogate 2 Recovery	04-029	%	114	97	[NA]	105
Date Extracted	04-029	-	4/11/2015	4/11/2015	[NA]	4/11/2015
Date Analysed	04-029	-	5/11/2015	5/11/2015	[NA]	5/11/2015
Organotins						
Monobutyl tin	04-026	µgSn/kg	1.9	6.6	2.3	2.4
Dibutyl tin	04-026	µgSn/kg	1.7	6.7	2.0	2.1
Tributyl tin	04-026	µgSn/kg	1.4	11	2.2	2.3
Surrogate 1 Recovery	04-026	%	99	160	98	109
Date Extracted	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015
Date Analysed	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.8	2.0	1.7	1.7
Nitrate as N	SUB	mg/kg	<0.1	<0.1	[NA]	<0.1
Nitrite as N	SUB	mg/kg	<0.1	0.1	[NA]	<0.1
Total Kjeldahl Nitrogen	SUB	mg/kg	1,220	1,530	[NA]	1,210
Total Nitrogen	SUB	mg/kg	1,220	1,530	[NA]	1,210
Particle Size Distribution	SUB		See Comments	See Comments	See Comments	See Comments
Gross Alpha	SUB	mBq/g	<60	<60	[NA]	<60
Gross Beta	SUB	mBq/g	<135	<135	[NA]	<135
Chromium Reducible Suite	SUB		See Comments	See Comments	[NA]	See Comments

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Batch Number: A15/5628-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference:	-	-	/13	/14	/15	/16
Client Reference:	-	-	8-1	8-3	RF-2	RF-3
Date Sampled:	-	-	29/10/2015	29/10/2015	30/10/2015	30/10/2015
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	53.8	59.3	62.7	64.1
Trace Elements						
Aluminium	04-001	mg/kg	20,000	23,000	28,000	29,000
Arsenic	04-001	mg/kg	7.6	6.9	6.8	7.6
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	37	44	48	49
Copper	04-001	mg/kg	30	33	22	23
Iron	04-001	mg/kg	36,000	40,000	45,000	46,000
Lead	04-001	mg/kg	16	16	17	17
Mercury	04-002	mg/kg	0.10	0.09	0.1	0.10
Nickel	04-001	mg/kg	22	28	25	26
Phosphorus*	04-001	mg/kg	700	810	590	620
Silver	04-001	mg/kg	0.12	0.13	<0.1	<0.1
Zinc	04-001	mg/kg	96	100	84	84
BTEX						
Total Petroleum Hydrocarbons						
Poly Aromatic Hydrocarbons						
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	4.0	4.0	<1.0	<1.0
p,p'-DDE	04-024	µg/kg	4.0	6.0	1.0	2.0
p,p'-DDT	04-024	µg/kg	<5	<5	<5	<5
Dieldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0

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Batch Number: A15/5628-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/13** **8-1** **29/10/2015**	**/14** **8-3** **29/10/2015**	**/15** **RF-2** **30/10/2015**	**/16** **RF-3** **30/10/2015**
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin aldehyde	04-024	µg/kg	<5	<5	<5	<5
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	101	101	93	100
Date Extracted	04-024	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-024	-	12/11/2015	10/11/2015	10/11/2015	10/11/2015
Polychlorinated Biphenyls						
Organotins						
Monobutyl tin	04-026	µgSn/kg	4.1	4.5	1.4	1.3
Dibutyl tin	04-026	µgSn/kg	4.4	3.4	0.80	0.80
Tributyl tin	04-026	µgSn/kg	3.5	3.2	0.60	<0.50
Surrogate 1 Recovery	04-026	%	115	133	169	117
Date Extracted	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015
Date Analysed	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.7	1.6	1.2	1.3
Particle Size Distribution	SUB		See Comments	See Comments	See Comments	See Comments

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/17** **RF-6** **30/10/2015**	**/18** **RF-7** **30/10/2015**	**/19** **RF-4** **30/10/2015**	**/20** **13-9** **30/10/2015**
Moisture Content						
Moisture Content	04-004	%	53.8	62.5	58.5	59.9
Trace Elements						
Aluminium	04-001	mg/kg	20,000	30,000	21,000	26,000
Arsenic	04-001	mg/kg	7.3	7.1	7.5	6.8
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	37	49	39	45
Copper	04-001	mg/kg	17	32	17	29
Iron	04-001	mg/kg	36,000	48,000	37,000	42,000
Lead	04-001	mg/kg	13	20	13	17
Mercury	04-002	mg/kg	0.08	0.11	0.07	0.1
Nickel	04-001	mg/kg	21	32	21	30
Phosphorus*	04-001	mg/kg	530	710	560	680
Silver	04-001	mg/kg	<0.1	0.15	<0.1	0.13
Zinc	04-001	mg/kg	63	96	65	87
BTEX						
Total Petroleum Hydrocarbons						
Poly Aromatic Hydrocarbons						
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDE	04-024	µg/kg	1.0	7.0	1.0	7.0
p,p'-DDT	04-024	µg/kg	<5	<5	<5	<5
Dieldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0

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Project Reference: Port of Brisbane - Sediments

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/17** **RF-6** **30/10/2015**	**/18** **RF-7** **30/10/2015**	**/19** **RF-4** **30/10/2015**	**/20** **13-9** **30/10/2015**
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin aldehyde	04-024	µg/kg	<5	<5	<5	<5
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	88	93	89	101
Date Extracted	04-024	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-024	-	10/11/2015	10/11/2015	10/11/2015	10/11/2015
Polychlorinated Biphenyls						
Organotins						
Monobutyl tin	04-026	µgSn/kg	1.0	3.8	0.90	2.4
Dibutyl tin	04-026	µgSn/kg	0.60	3.1	0.60	2.2
Tributyl tin	04-026	µgSn/kg	<0.50	1.2	0.50	1.2
Surrogate 1 Recovery	04-026	%	108	128	120	107
Date Extracted	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015
Date Analysed	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015
Subcontract Analysis						
Total Organic Carbon	SUB	%	0.92	1.5	1.0	1.4
Particle Size Distribution	SUB		See Comments	See Comments	See Comments	See Comments

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/21** **16-1** **30/10/2015**	**/22** **16-0** **30/10/2015**	**/23** **13-8** **30/10/2015**	**/24** **13-5** **30/10/2015**
Moisture Content						
Moisture Content	04-004	%	32.6	57.3	61.3	38.6
Trace Elements						
Aluminium	04-001	mg/kg	10,000	24,000	26,000	14,000
Arsenic	04-001	mg/kg	5.3	7.5	8.8	6.9
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	25	43	44	29
Copper	04-001	mg/kg	11	28	24	13
Iron	04-001	mg/kg	23,000	42,000	42,000	27,000
Lead	04-001	mg/kg	6.0	15	15	10
Mercury	04-002	mg/kg	0.03	0.11	0.09	0.07
Nickel	04-001	mg/kg	17	27	26	15
Phosphorus*	04-001	mg/kg	390	750	670	430
Silver	04-001	mg/kg	<0.1	0.13	<0.1	<0.1
Zinc	04-001	mg/kg	41	89	78	52
BTEX						
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	[NA]	[NA]	<20	[NA]
TPH C10-14	04-020	mg/kg	[NA]	[NA]	<20	[NA]
TPH C15-28	04-020	mg/kg	[NA]	[NA]	<100	[NA]
TPH C29-36	04-020	mg/kg	[NA]	[NA]	<100	[NA]
Surrogate Recovery	04-020	%	[NA]	[NA]	96	[NA]
Date Extracted	04-020	-	[NA]	[NA]	4/11/2015	[NA]
Date Analysed	04-020	-	[NA]	[NA]	6/11/2015	[NA]
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	[NA]	[NA]	<10	[NA]
1-Methylnaphthalene	04-022	µg/kg	[NA]	[NA]	<10	[NA]
2-Methylnaphthalene	04-022	µg/kg	[NA]	[NA]	<10	[NA]
Acenaphthylene	04-022	µg/kg	[NA]	[NA]	<10	[NA]
Acenaphthene	04-022	µg/kg	[NA]	[NA]	<10	[NA]
Fluorene	04-022	µg/kg	[NA]	[NA]	<10	[NA]
Phenanthrene	04-022	µg/kg	[NA]	[NA]	12	[NA]
Anthracene	04-022	µg/kg	[NA]	[NA]	<10	[NA]

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/21** **16-1** **30/10/2015**	**/22** **16-0** **30/10/2015**	**/23** **13-8** **30/10/2015**	**/24** **13-5** **30/10/2015**
Fluoranthene	04-022	µg/kg	[NA]	[NA]	<10	[NA]
Pyrene	04-022	µg/kg	[NA]	[NA]	46	[NA]
Benz(a)anthracene	04-022	µg/kg	[NA]	[NA]	25	[NA]
Chrysene	04-022	µg/kg	[NA]	[NA]	23	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	[NA]	[NA]	55	[NA]
Benzo(a)pyrene	04-022	µg/kg	[NA]	[NA]	31	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	[NA]	[NA]	26	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	[NA]	[NA]	<10	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	[NA]	[NA]	24	[NA]
Coronene	04-022	µg/kg	[NA]	[NA]	<20	[NA]
Benzo(e)pyrene	04-022	µg/kg	[NA]	[NA]	24	[NA]
Perylene	04-022	µg/kg	[NA]	[NA]	46	[NA]
Total PAHs (as above)	04-022	µg/kg	[NA]	[NA]	360	[NA]
Surrogate 1 Recovery	04-022	%	[NA]	[NA]	47	[NA]
Surrogate 2 Recovery	04-022	%	[NA]	[NA]	45	[NA]
Surrogate 3 Recovery	04-022	%	[NA]	[NA]	53	[NA]
Date Extracted	04-022	-	[NA]	[NA]	4/11/2015	[NA]
Date Analysed	04-022	-	[NA]	[NA]	5/11/2015	[NA]
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	3.0	1.0	<1.0
p,p'-DDE	04-024	µg/kg	<1.0	5.0	3.0	1.0
p,p'-DDT	04-024	µg/kg	<5	<5	<5	<5
Dieldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/21** **16-1** **30/10/2015**	**/22** **16-0** **30/10/2015**	**/23** **13-8** **30/10/2015**	**/24** **13-5** **30/10/2015**
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin aldehyde	04-024	µg/kg	<5	<5	<5	<5
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	91	95	46	123
Date Extracted	04-024	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-024	-	10/11/2015	10/11/2015	12/11/2015	10/11/2015
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	[NA]	[NA]	<10	[NA]
Di-PCB congeners	04-029	µg/kg	[NA]	[NA]	<10	[NA]
Tri-PCB congeners	04-029	µg/kg	[NA]	[NA]	<10	[NA]
Tetra-PCB congeners	04-029	µg/kg	[NA]	[NA]	<10	[NA]
Penta-PCB congeners	04-029	µg/kg	[NA]	[NA]	<10	[NA]
Hexa-PCB congeners	04-029	µg/kg	[NA]	[NA]	<10	[NA]
Hepta-PCB congeners	04-029	µg/kg	[NA]	[NA]	<10	[NA]
Octa-PCB congeners	04-029	µg/kg	[NA]	[NA]	<10	[NA]
Nona-PCB congeners	04-029	µg/kg	[NA]	[NA]	<10	[NA]
Deca-PCB congeners	04-029	µg/kg	[NA]	[NA]	<10	[NA]
Total PCB congeners	04-029	µg/kg	[NA]	[NA]	<10	[NA]
Surrogate 1 Recovery	04-029	%	[NA]	[NA]	49	[NA]
Surrogate 2 Recovery	04-029	%	[NA]	[NA]	52	[NA]
Date Extracted	04-029	-	[NA]	[NA]	4/11/2015	[NA]
Date Analysed	04-029	-	[NA]	[NA]	5/11/2015	[NA]
Organotins						
Monobutyl tin	04-026	µgSn/kg	0.80	6.7	1.7	1.0
Dibutyl tin	04-026	µgSn/kg	0.70	4.6	1.2	0.50
Tributyl tin	04-026	µgSn/kg	0.50	2.2	<1.0	<0.50
Surrogate 1 Recovery	04-026	%	115	105	135	86
Date Extracted	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015

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Laboratory Reference:	-	-	/21	/22	/23	/24
Client Reference:	-	-	16-1	16-0	13-8	13-5
Date Sampled:	-	-	30/10/2015	30/10/2015	30/10/2015	30/10/2015
Analysis Description	**Method**	**Units**				
Date Analysed	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015
Subcontract Analysis						
Total Organic Carbon	SUB	%	0.43	1.4	1.3	0.71
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]	1,170	[NA]
Total Nitrogen	SUB	mg/kg	[NA]	[NA]	1,170	[NA]
Particle Size Distribution	SUB		See Comments	See Comments	See Comments	See Comments
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]

Laboratory Reference:	-	-	/25	/26	/27	/28
Client Reference:	-	-	13-4A	13-4B	13-4C	13-1
Date Sampled:	-	-	30/10/2015	30/10/2015	30/10/2015	30/10/2015
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	60.0	29.6	20.3	38.4
Trace Elements						
Aluminium	04-001	mg/kg	23,000	9,200	6,400	14,000
Arsenic	04-001	mg/kg	9.3	6.3	5.4	7.7
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	43	22	17	31
Copper	04-001	mg/kg	21	8.8	5.4	13
Iron	04-001	mg/kg	41,000	22,000	17,000	29,000
Lead	04-001	mg/kg	14	6.8	5.8	9.4
Mercury	04-002	mg/kg	0.09	0.04	0.02	0.05
Nickel	04-001	mg/kg	24	12	8.9	17
Phosphorus*	04-001	mg/kg	640	340	260	490
Silver	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Zinc	04-001	mg/kg	74	38	34	53
BTEX						

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Batch Number: A15/5628-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/25** **13-4A** **30/10/2015**	**/26** **13-4B** **30/10/2015**	**/27** **13-4C** **30/10/2015**	**/28** **13-1** **30/10/2015**
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]	<50
TPH C29-36	04-020	mg/kg	[NA]	[NA]	[NA]	<50
Surrogate Recovery	04-020	%	[NA]	[NA]	[NA]	101
Date Extracted	04-020	-	[NA]	[NA]	[NA]	4/11/2015
Date Analysed	04-020	-	[NA]	[NA]	[NA]	6/11/2015
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]	<5.0
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]	57
Anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	14
Fluoranthene	04-022	µg/kg	[NA]	[NA]	[NA]	58
Pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	260
Benz(a)anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	120
Chrysene	04-022	µg/kg	[NA]	[NA]	[NA]	110
Benzo(b)&(k)fluoranthene	04-022	µg/kg	[NA]	[NA]	[NA]	200
Benzo(a)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	120
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	88
Dibenz(a,h)anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	16
Benzo(g,h,i)perylene	04-022	µg/kg	[NA]	[NA]	[NA]	74
Coronene	04-022	µg/kg	[NA]	[NA]	[NA]	14
Benzo(e)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	75
Perylene	04-022	µg/kg	[NA]	[NA]	[NA]	52
Total PAHs (as above)	04-022	µg/kg	[NA]	[NA]	[NA]	1,490
Surrogate 1 Recovery	04-022	%	[NA]	[NA]	[NA]	98
Surrogate 2 Recovery	04-022	%	[NA]	[NA]	[NA]	91
Surrogate 3 Recovery	04-022	%	[NA]	[NA]	[NA]	103

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/25** **13-4A** **30/10/2015**	**/26** **13-4B** **30/10/2015**	**/27** **13-4C** **30/10/2015**	**/28** **13-1** **30/10/2015**
Date Extracted	04-022	-	[NA]	[NA]	[NA]	4/11/2015
Date Analysed	04-022	-	[NA]	[NA]	[NA]	5/11/2015
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDE	04-024	µg/kg	2.0	<1.0	<1.0	<1.0
p,p'-DDT	04-024	µg/kg	<5	<5	<5	<5
Dieldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin aldehyde	04-024	µg/kg	<5	<5	<5	<5
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	78	80	77	78
Date Extracted	04-024	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-024	-	10/11/2015	10/11/2015	10/11/2015	12/11/2015
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

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/25** **13-4A** **30/10/2015**	**/26** **13-4B** **30/10/2015**	**/27** **13-4C** **30/10/2015**	**/28** **13-1** **30/10/2015**
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
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]	100
Surrogate 2 Recovery	04-029	%	[NA]	[NA]	[NA]	103
Date Extracted	04-029	-	[NA]	[NA]	[NA]	4/11/2015
Date Analysed	04-029	-	[NA]	[NA]	[NA]	5/11/2015
Organotins						
Monobutyl tin	04-026	µgSn/kg	1.6	1.1	<0.50	0.70
Dibutyl tin	04-026	µgSn/kg	1.4	1.4	<0.50	0.60
Tributyl tin	04-026	µgSn/kg	<1.0	<0.50	<0.50	<0.50
Surrogate 1 Recovery	04-026	%	114	94	159	113
Date Extracted	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015
Date Analysed	04-026	-	9/11/2015	9/11/2015	9/11/2015	10/11/2015
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.2	0.34	0.17	0.59
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]	540
Total Nitrogen	SUB	mg/kg	[NA]	[NA]	[NA]	540
Particle Size Distribution	SUB		See Comments	See Comments	See Comments	See Comments
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**	**/29** **15-3** **02/11/2015**	**/30** **15-2** **02/11/2015**	**/31** **15-1** **02/11/2015**	**/32** **12-2** **02/11/2015**
Moisture Content						
Moisture Content	04-004	%	40.4	31.8	49.6	61.4
Trace Elements						
Aluminium	04-001	mg/kg	13,000	12,000	17,000	29,000
Arsenic	04-001	mg/kg	7.1	7.0	6.2	6.5
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	28	25	31	46
Copper	04-001	mg/kg	7.8	9.5	16	30
Iron	04-001	mg/kg	29,000	24,000	29,000	49,000
Lead	04-001	mg/kg	5.3	6.9	10	13
Mercury	04-002	mg/kg	0.02	0.03	0.05	0.08
Nickel	04-001	mg/kg	15	15	19	35
Phosphorus*	04-001	mg/kg	650	390	510	860
Silver	04-001	mg/kg	<0.1	<0.1	<0.1	0.12
Zinc	04-001	mg/kg	37	44	59	89
BTEX						
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	%	105	107	[NA]	[NA]
Date Extracted	04-020	-	4/11/2015	4/11/2015	[NA]	[NA]
Date Analysed	04-020	-	6/11/2015	6/11/2015	[NA]	[NA]
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
1-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
2-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Acenaphthylene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Acenaphthene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Fluorene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Phenanthrene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Anthracene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/29** **15-3** **02/11/2015**	**/30** **15-2** **02/11/2015**	**/31** **15-1** **02/11/2015**	**/32** **12-2** **02/11/2015**
Fluoranthene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Pyrene	04-022	µg/kg	<5.0	7.0	[NA]	[NA]
Benz(a)anthracene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Chrysene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	<10	<10	[NA]	[NA]
Benzo(a)pyrene	04-022	µg/kg	<5.0	5.0	[NA]	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Coronene	04-022	µg/kg	<10	<10	[NA]	[NA]
Benzo(e)pyrene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Perylene	04-022	µg/kg	18	17	[NA]	[NA]
Total PAHs (as above)	04-022	µg/kg	<100	<100	[NA]	[NA]
Surrogate 1 Recovery	04-022	%	98	100	[NA]	[NA]
Surrogate 2 Recovery	04-022	%	92	93	[NA]	[NA]
Surrogate 3 Recovery	04-022	%	108	109	[NA]	[NA]
Date Extracted	04-022	-	4/11/2015	4/11/2015	[NA]	[NA]
Date Analysed	04-022	-	5/11/2015	5/11/2015	[NA]	[NA]
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDE	04-024	µg/kg	<1.0	<1.0	2.0	5.0
p,p'-DDT	04-024	µg/kg	<5	<5	<5	<5
Dieldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/29** **15-3** **02/11/2015**	**/30** **15-2** **02/11/2015**	**/31** **15-1** **02/11/2015**	**/32** **12-2** **02/11/2015**
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin aldehyde	04-024	µg/kg	<5	<5	<5	<5
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	73	77	84	75
Date Extracted	04-024	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-024	-	12/11/2015	12/11/2015	10/11/2015	11/11/2015
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]
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	%	102	102	[NA]	[NA]
Surrogate 2 Recovery	04-029	%	105	105	[NA]	[NA]
Date Extracted	04-029	-	4/11/2015	4/11/2015	[NA]	[NA]
Date Analysed	04-029	-	5/11/2015	5/11/2015	[NA]	[NA]
Organotins						
Monobutyl tin	04-026	µgSn/kg	<0.50	<0.50	1.3	1.5
Dibutyl tin	04-026	µgSn/kg	<0.50	<0.50	1.0	1.2
Tributyl tin	04-026	µgSn/kg	<0.50	<0.50	0.70	<1.0
Surrogate 1 Recovery	04-026	%	81	139	108	103
Date Extracted	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015

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Client Reference:	-	-	15-3	15-2	15-1	12-2
Date Sampled:	-	-	02/11/2015	02/11/2015	02/11/2015	02/11/2015
Analysis Description	**Method**	**Units**				
Date Analysed	04-026	-	10/11/2015	10/11/2015	10/11/2015	10/11/2015
Subcontract Analysis						
Total Organic Carbon	SUB	%	0.33	0.38	0.54	1.4
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	320	380	[NA]	[NA]
Total Nitrogen	SUB	mg/kg	320	380	[NA]	[NA]
Particle Size Distribution	SUB		See Comments	See Comments	See Comments	See Comments
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]

Laboratory Reference:	-	-	/33	/34	/35	/36
Client Reference:	-	-	12-1	11-5	11-8	11-9A
Date Sampled:	-	-	02/11/2015	02/11/2015	02/11/2015	02/11/2015
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	36.5	53.0	45.9	60.7
Trace Elements						
Aluminium	04-001	mg/kg	14,000	19,000	18,000	24,000
Arsenic	04-001	mg/kg	6.2	7.2	7.3	8.9
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	29	37	35	45
Copper	04-001	mg/kg	19	22	22	31
Iron	04-001	mg/kg	28,000	35,000	35,000	41,000
Lead	04-001	mg/kg	12	12	12	18
Mercury	04-002	mg/kg	0.07	0.07	0.09	0.1
Nickel	04-001	mg/kg	18	23	21	25
Phosphorus*	04-001	mg/kg	570	610	670	750
Silver	04-001	mg/kg	<0.1	<0.1	0.13	0.14
Zinc	04-001	mg/kg	60	78	72	100
BTEX						

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/33** **12-1** **02/11/2015**	**/34** **11-5** **02/11/2015**	**/35** **11-8** **02/11/2015**	**/36** **11-9A** **02/11/2015**
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	[NA]	<10	[NA]
TPH C10-14	04-020	mg/kg	<10	[NA]	<10	[NA]
TPH C15-28	04-020	mg/kg	<50	[NA]	<50	[NA]
TPH C29-36	04-020	mg/kg	<50	[NA]	<50	[NA]
Surrogate Recovery	04-020	%	100	[NA]	96	[NA]
Date Extracted	04-020	-	4/11/2015	[NA]	4/11/2015	[NA]
Date Analysed	04-020	-	6/11/2015	[NA]	6/11/2015	[NA]
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<5.0	[NA]	<5.0	[NA]
1-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	<5.0	[NA]
2-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	<5.0	[NA]
Acenaphthylene	04-022	µg/kg	5.0	[NA]	5.0	[NA]
Acenaphthene	04-022	µg/kg	<5.0	[NA]	<5.0	[NA]
Fluorene	04-022	µg/kg	<5.0	[NA]	<5.0	[NA]
Phenanthrene	04-022	µg/kg	13	[NA]	30	[NA]
Anthracene	04-022	µg/kg	5.0	[NA]	8.0	[NA]
Fluoranthene	04-022	µg/kg	12	[NA]	17	[NA]
Pyrene	04-022	µg/kg	68	[NA]	86	[NA]
Benz(a)anthracene	04-022	µg/kg	39	[NA]	47	[NA]
Chrysene	04-022	µg/kg	37	[NA]	45	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	89	[NA]	95	[NA]
Benzo(a)pyrene	04-022	µg/kg	52	[NA]	56	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	40	[NA]	47	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	8.0	[NA]	9.0	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	35	[NA]	38	[NA]
Coronene	04-022	µg/kg	<10	[NA]	<10	[NA]
Benzo(e)pyrene	04-022	µg/kg	37	[NA]	39	[NA]
Perylene	04-022	µg/kg	60	[NA]	59	[NA]
Total PAHs (as above)	04-022	µg/kg	550	[NA]	650	[NA]
Surrogate 1 Recovery	04-022	%	96	[NA]	94	[NA]
Surrogate 2 Recovery	04-022	%	91	[NA]	88	[NA]
Surrogate 3 Recovery	04-022	%	102	[NA]	102	[NA]

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Batch Number: A15/5628-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/33** **12-1** **02/11/2015**	**/34** **11-5** **02/11/2015**	**/35** **11-8** **02/11/2015**	**/36** **11-9A** **02/11/2015**
Date Extracted	04-022	-	4/11/2015	[NA]	4/11/2015	[NA]
Date Analysed	04-022	-	5/11/2015	[NA]	5/11/2015	[NA]
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDE	04-024	µg/kg	2.0	2.0	2.0	3.0
p,p'-DDT	04-024	µg/kg	<5	<5	<5	<5
Dieldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin aldehyde	04-024	µg/kg	<5	<5	<5	<5
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	88	57	87	91
Date Extracted	04-024	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-024	-	12/11/2015	11/11/2015	12/11/2015	11/11/2015
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	[NA]
Di-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	[NA]
Tri-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	[NA]
Tetra-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	[NA]

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Batch Number: A15/5628-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/33** **12-1** **02/11/2015**	**/34** **11-5** **02/11/2015**	**/35** **11-8** **02/11/2015**	**/36** **11-9A** **02/11/2015**
Penta-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	[NA]
Hexa-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	[NA]
Hepta-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	[NA]
Octa-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	[NA]
Nona-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	[NA]
Deca-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	[NA]
Total PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	[NA]
Surrogate 1 Recovery	04-029	%	98	[NA]	98	[NA]
Surrogate 2 Recovery	04-029	%	103	[NA]	103	[NA]
Date Extracted	04-029	-	4/11/2015	[NA]	4/11/2015	[NA]
Date Analysed	04-029	-	5/11/2015	[NA]	5/11/2015	[NA]
Organotins						
Monobutyl tin	04-026	µgSn/kg	2.3	1.5	2.4	2.6
Dibutyl tin	04-026	µgSn/kg	1.7	1.1	1.9	1.8
Tributyl tin	04-026	µgSn/kg	0.60	0.70	1.0	1.6
Surrogate 1 Recovery	04-026	%	63	94	110	122
Date Extracted	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015
Date Analysed	04-026	-	10/11/2015	10/11/2015	10/11/2015	10/11/2015
Subcontract Analysis						
Total Organic Carbon	SUB	%	0.99	1.2	1.0	1.5
Nitrate as N	SUB	mg/kg	<0.1	[NA]	<0.1	[NA]
Nitrite as N	SUB	mg/kg	<0.1	[NA]	<0.1	[NA]
Total Kjeldahl Nitrogen	SUB	mg/kg	650	[NA]	790	[NA]
Total Nitrogen	SUB	mg/kg	650	[NA]	790	[NA]
Particle Size Distribution	SUB		See Comments	See Comments	See Comments	See Comments
Gross Alpha	SUB	mBq/g	<60	[NA]	<60	[NA]
Gross Beta	SUB	mBq/g	<135	[NA]	<135	[NA]
Chromium Reducible Suite	SUB		See Comments	[NA]	See Comments	[NA]

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Laboratory Reference:	-	-	/37	/38	/39	/40
Client Reference:	-	-	11-9B	11-9C	10-8	10-6A
Date Sampled:	-	-	02/11/2015	02/11/2015	02/11/2015	02/11/2015
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	62.4	62.4	62.5	64.5
Trace Elements						
Aluminium	04-001	mg/kg	26,000	26,000	27,000	26,000
Arsenic	04-001	mg/kg	9.3	9.1	9.2	7.8
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	46	46	47	45
Copper	04-001	mg/kg	32	32	32	34
Iron	04-001	mg/kg	45,000	44,000	46,000	43,000
Lead	04-001	mg/kg	17	17	16	15
Mercury	04-002	mg/kg	0.12	0.10	0.10	0.1
Nickel	04-001	mg/kg	27	26	27	29
Phosphorus*	04-001	mg/kg	800	770	770	810
Silver	04-001	mg/kg	0.13	0.14	0.12	0.13
Zinc	04-001	mg/kg	99	100	100	99
BTEX						
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	[NA]	[NA]	[NA]	<20
TPH C10-14	04-020	mg/kg	[NA]	[NA]	[NA]	<20
TPH C15-28	04-020	mg/kg	[NA]	[NA]	[NA]	<100
TPH C29-36	04-020	mg/kg	[NA]	[NA]	[NA]	<100
Surrogate Recovery	04-020	%	[NA]	[NA]	[NA]	92
Date Extracted	04-020	-	[NA]	[NA]	[NA]	4/11/2015
Date Analysed	04-020	-	[NA]	[NA]	[NA]	6/11/2015
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	[NA]	[NA]	[NA]	<10
1-Methylnaphthalene	04-022	µg/kg	[NA]	[NA]	[NA]	<10
2-Methylnaphthalene	04-022	µg/kg	[NA]	[NA]	[NA]	<10
Acenaphthylene	04-022	µg/kg	[NA]	[NA]	[NA]	<10
Acenaphthene	04-022	µg/kg	[NA]	[NA]	[NA]	<10
Fluorene	04-022	µg/kg	[NA]	[NA]	[NA]	<10
Phenanthrene	04-022	µg/kg	[NA]	[NA]	[NA]	18
Anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	<10

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/37** **11-9B** **02/11/2015**	**/38** **11-9C** **02/11/2015**	**/39** **10-8** **02/11/2015**	**/40** **10-6A** **02/11/2015**
Fluoranthene	04-022	µg/kg	[NA]	[NA]	[NA]	13
Pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	69
Benz(a)anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	33
Chrysene	04-022	µg/kg	[NA]	[NA]	[NA]	34
Benzo(b)&(k)fluoranthene	04-022	µg/kg	[NA]	[NA]	[NA]	73
Benzo(a)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	42
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	33
Dibenz(a,h)anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	<10
Benzo(g,h,i)perylene	04-022	µg/kg	[NA]	[NA]	[NA]	31
Coronene	04-022	µg/kg	[NA]	[NA]	[NA]	<20
Benzo(e)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	31
Perylene	04-022	µg/kg	[NA]	[NA]	[NA]	75
Total PAHs (as above)	04-022	µg/kg	[NA]	[NA]	[NA]	520
Surrogate 1 Recovery	04-022	%	[NA]	[NA]	[NA]	89
Surrogate 2 Recovery	04-022	%	[NA]	[NA]	[NA]	85
Surrogate 3 Recovery	04-022	%	[NA]	[NA]	[NA]	94
Date Extracted	04-022	-	[NA]	[NA]	[NA]	4/11/2015
Date Analysed	04-022	-	[NA]	[NA]	[NA]	6/11/2015
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDE	04-024	µg/kg	3.0	3.0	3.0	4.0
p,p'-DDT	04-024	µg/kg	<5	<5	<5	<5
Dieldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/37** **11-9B** **02/11/2015**	**/38** **11-9C** **02/11/2015**	**/39** **10-8** **02/11/2015**	**/40** **10-6A** **02/11/2015**
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin aldehyde	04-024	µg/kg	<5	<5	<5	<5
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	87	88	88	83
Date Extracted	04-024	-	4/11/2015	4/11/2015	4/11/2015	4/11/2015
Date Analysed	04-024	-	11/11/2015	11/11/2015	11/11/2015	12/11/2015
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<10
Di-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<10
Tri-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<10
Tetra-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<10
Penta-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<10
Hexa-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<10
Hepta-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<10
Octa-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<10
Nona-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<10
Deca-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<10
Total PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<10
Surrogate 1 Recovery	04-029	%	[NA]	[NA]	[NA]	92
Surrogate 2 Recovery	04-029	%	[NA]	[NA]	[NA]	97
Date Extracted	04-029	-	[NA]	[NA]	[NA]	4/11/2015
Date Analysed	04-029	-	[NA]	[NA]	[NA]	6/11/2015
Organotins						
Monobutyl tin	04-026	µgSn/kg	1.9	3.0	1.9	2.1
Dibutyl tin	04-026	µgSn/kg	2.0	2.1	1.4	1.6
Tributyl tin	04-026	µgSn/kg	2.1	1.5	1.1	1.2
Surrogate 1 Recovery	04-026	%	123	110	108	108
Date Extracted	04-026	-	9/11/2015	9/11/2015	9/11/2015	9/11/2015

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Laboratory Reference:	-	-	/37	/38	/39	/40
Client Reference:	-	-	11-9B	11-9C	10-8	10-6A
Date Sampled:	-	-	02/11/2015	02/11/2015	02/11/2015	02/11/2015
Analysis Description	**Method**	**Units**				
Date Analysed	04-026	-	10/11/2015	10/11/2015	10/11/2015	10/11/2015
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.6	1.6	1.6	1.6
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]	1,210
Total Nitrogen	SUB	mg/kg	[NA]	[NA]	[NA]	1,210
Particle Size Distribution	SUB		See Comments	See Comments	See Comments	See Comments
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

Laboratory Reference:	-	-	/41	/42	/43	/44
Client Reference:	-	-	10-6B	10-5	6-2B	Trip Blank
Date Sampled:	-	-	02/11/2015	02/11/2015	29/10/2015	29/10/2015
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	64.1	56.2	56.3	0.1
Trace Elements						
Aluminium	04-001	mg/kg	27,000	25,000	28,000	[NA]
Arsenic	04-001	mg/kg	8.0	7.6	7.3	[NA]
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	[NA]
Chromium	04-001	mg/kg	45	43	49	[NA]
Copper	04-001	mg/kg	34	29	42	[NA]
Iron	04-001	mg/kg	46,000	43,000	50,000	[NA]
Lead	04-001	mg/kg	15	13	15	[NA]
Mercury	04-002	mg/kg	0.1	0.08	0.10	[NA]
Nickel	04-001	mg/kg	29	30	35	[NA]
Phosphorus*	04-001	mg/kg	820	770	1,000	[NA]
Silver	04-001	mg/kg	0.14	0.13	0.16	[NA]
Zinc	04-001	mg/kg	100	85	110	[NA]
BTEX						

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/41** **10-6B** **02/11/2015**	**/42** **10-5** **02/11/2015**	**/43** **6-2B** **29/10/2015**	**/44** **Trip Blank** **29/10/2015**
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]	99
Surrogate 2 Recovery	04-021	%	[NA]	[NA]	[NA]	91
Surrogate 3 Recovery	04-021	%	[NA]	[NA]	[NA]	76
Date Extracted	04-021	-	[NA]	[NA]	[NA]	4/11/2015
Date Analysed	04-021	-	[NA]	[NA]	[NA]	5/11/2015
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<20	[NA]	[NA]	<10
TPH C10-14	04-020	mg/kg	<20	[NA]	[NA]	[NA]
TPH C15-28	04-020	mg/kg	<100	[NA]	[NA]	[NA]
TPH C29-36	04-020	mg/kg	<100	[NA]	[NA]	[NA]
Surrogate Recovery	04-020	%	89	[NA]	[NA]	91
Date Extracted	04-020	-	4/11/2015	[NA]	[NA]	4/11/2015
Date Analysed	04-020	-	6/11/2015	[NA]	[NA]	5/11/2015
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<10	[NA]	[NA]	[NA]
1-Methylnaphthalene	04-022	µg/kg	<10	[NA]	[NA]	[NA]
2-Methylnaphthalene	04-022	µg/kg	<10	[NA]	[NA]	[NA]
Acenaphthylene	04-022	µg/kg	<10	[NA]	[NA]	[NA]
Acenaphthene	04-022	µg/kg	<10	[NA]	[NA]	[NA]
Fluorene	04-022	µg/kg	<10	[NA]	[NA]	[NA]
Phenanthrene	04-022	µg/kg	17	[NA]	[NA]	[NA]
Anthracene	04-022	µg/kg	<10	[NA]	[NA]	[NA]
Fluoranthene	04-022	µg/kg	11	[NA]	[NA]	[NA]
Pyrene	04-022	µg/kg	54	[NA]	[NA]	[NA]
Benz(a)anthracene	04-022	µg/kg	24	[NA]	[NA]	[NA]
Chrysene	04-022	µg/kg	26	[NA]	[NA]	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	59	[NA]	[NA]	[NA]

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Batch Number: A15/5628-A [R00]
Project Reference: Port of Brisbane - Sediments

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/41** **10-6B** **02/11/2015**	**/42** **10-5** **02/11/2015**	**/43** **6-2B** **29/10/2015**	**/44** **Trip Blank** **29/10/2015**
Benzo(a)pyrene	04-022	µg/kg	33	[NA]	[NA]	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	27	[NA]	[NA]	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	<10	[NA]	[NA]	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	25	[NA]	[NA]	[NA]
Coronene	04-022	µg/kg	<20	[NA]	[NA]	[NA]
Benzo(e)pyrene	04-022	µg/kg	25	[NA]	[NA]	[NA]
Perylene	04-022	µg/kg	66	[NA]	[NA]	[NA]
Total PAHs (as above)	04-022	µg/kg	420	[NA]	[NA]	[NA]
Surrogate 1 Recovery	04-022	%	92	[NA]	[NA]	[NA]
Surrogate 2 Recovery	04-022	%	86	[NA]	[NA]	[NA]
Surrogate 3 Recovery	04-022	%	97	[NA]	[NA]	[NA]
Date Extracted	04-022	-	4/11/2015	[NA]	[NA]	[NA]
Date Analysed	04-022	-	6/11/2015	[NA]	[NA]	[NA]
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
p,p'-DDD	04-024	µg/kg	<1.0	<1.0	3.0	[NA]
p,p'-DDE	04-024	µg/kg	4.0	5.0	7.0	[NA]
p,p'-DDT	04-024	µg/kg	<5	<5	<5	[NA]
Dieldrin	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
Endrin aldehyde	04-024	µg/kg	<5	<5	<5	[NA]
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/41** **10-6B** **02/11/2015**	**/42** **10-5** **02/11/2015**	**/43** **6-2B** **29/10/2015**	**/44** **Trip Blank** **29/10/2015**
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
Methoxychlor	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	[NA]
Surrogate Recovery	04-024	%	85	90	115	[NA]
Date Extracted	04-024	-	4/11/2015	4/11/2015	4/11/2015	[NA]
Date Analysed	04-024	-	12/11/2015	11/11/2015	11/11/2015	[NA]
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	<10	[NA]	[NA]	[NA]
Di-PCB congeners	04-029	µg/kg	<10	[NA]	[NA]	[NA]
Tri-PCB congeners	04-029	µg/kg	<10	[NA]	[NA]	[NA]
Tetra-PCB congeners	04-029	µg/kg	<10	[NA]	[NA]	[NA]
Penta-PCB congeners	04-029	µg/kg	<10	[NA]	[NA]	[NA]
Hexa-PCB congeners	04-029	µg/kg	<10	[NA]	[NA]	[NA]
Hepta-PCB congeners	04-029	µg/kg	<10	[NA]	[NA]	[NA]
Octa-PCB congeners	04-029	µg/kg	<10	[NA]	[NA]	[NA]
Nona-PCB congeners	04-029	µg/kg	<10	[NA]	[NA]	[NA]
Deca-PCB congeners	04-029	µg/kg	<10	[NA]	[NA]	[NA]
Total PCB congeners	04-029	µg/kg	<10	[NA]	[NA]	[NA]
Surrogate 1 Recovery	04-029	%	93	[NA]	[NA]	[NA]
Surrogate 2 Recovery	04-029	%	96	[NA]	[NA]	[NA]
Date Extracted	04-029	-	4/11/2015	[NA]	[NA]	[NA]
Date Analysed	04-029	-	6/11/2015	[NA]	[NA]	[NA]
Organotins						
Monobutyl tin	04-026	µgSn/kg	2.5	2.0	2.1	[NA]
Dibutyl tin	04-026	µgSn/kg	1.6	1.9	1.6	[NA]
Tributyl tin	04-026	µgSn/kg	1.5	1.1	1.4	[NA]
Surrogate 1 Recovery	04-026	%	114	94	94	[NA]
Date Extracted	04-026	-	9/11/2015	9/11/2015	9/11/2015	[NA]
Date Analysed	04-026	-	10/11/2015	10/11/2015	10/11/2015	[NA]
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.6	1.4	1.7	[NA]
Nitrate as N	SUB	mg/kg	<0.1	[NA]	[NA]	[NA]
Nitrite as N	SUB	mg/kg	<0.1	[NA]	[NA]	[NA]

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Laboratory Reference:	-	-	/41	/42	/43	/44
Client Reference:	-	-	10-6B	10-5	6-2B	Trip Blank
Date Sampled:	-	-	02/11/2015	02/11/2015	29/10/2015	29/10/2015
Analysis Description	**Method**	**Units**				
Total Kjeldahl Nitrogen	SUB	mg/kg	1,320	[NA]	[NA]	[NA]
Total Nitrogen	SUB	mg/kg	1,320	[NA]	[NA]	[NA]
Particle Size Distribution	SUB		See Comments	See Comments	See Comments	[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]

Laboratory Reference:	-	-	/45	/46
Client Reference:	-	-	Trip Blank	Trip Blank
Date Sampled:	-	-	30/10/2015	02/11/2015
Analysis Description	**Method**	**Units**		
Moisture Content				
Moisture Content	04-004	%	0.1	<0.1
Trace Elements				
BTEX				
Benzene	04-021	mg/kg	<0.20	<0.20
Toluene	04-021	mg/kg	<0.20	<0.20
Ethyl Benzene	04-021	mg/kg	<0.20	<0.20
m+p xylenes	04-021	mg/kg	<0.40	<0.40
o-xylene	04-021	mg/kg	<0.20	<0.20
Total BTEX	04-021	mg/kg	<1.2	<1.2
Surrogate 1 Recovery	04-021	%	102	97
Surrogate 2 Recovery	04-021	%	93	92
Surrogate 3 Recovery	04-021	%	78	78
Date Extracted	04-021	-	4/11/2015	4/11/2015
Date Analysed	04-021	-	5/11/2015	5/11/2015
Total Petroleum Hydrocarbons				
TPH C6-C9	04-021	mg/kg	<10	<10
Surrogate Recovery	04-020	%	93	92
Date Extracted	04-020	-	4/11/2015	4/11/2015
Date Analysed	04-020	-	5/11/2015	5/11/2015
Poly Aromatic Hydrocarbons				

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Laboratory Reference:	-	-	/45	/46
Client Reference:	-	-	Trip Blank	Trip Blank
Date Sampled:	-	-	30/10/2015	02/11/2015
Analysis Description	**Method**	**Units**		
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 & P&T GCMS, mg/kg
04-022	PAHs & Phenols by GCMS
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 Analysis

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 9484 Western Radiation.pdf
Analysis was subcontracted to Sydney Analytical Laboratories (NATA Number 1884);
reference SAL report number SAL25718.
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 .
If the moisture factor was greater than 2.5 the LOR has been raised by a factor 2 for Organic Tests.
For TBT analysis, there is suspected sample matrix interference and heterogenity for sample 2.
For OC analysis, LORs have been raised for DDT and endrin aldehyde due to sample matrix interference.
- Spike recovery for Al and Fe could not be accurately determined due to a significant
background analyte concentration.
Trace elements RPD duplicate failed for sample one for Copper, Lead and Zinc. Sample eleven for Cadmium.
This was due to sample heterogeneity. Confirmed by re-extraction.

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QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aluminium	mg/kg	<5	A15/5628-A-1	2600 || 2500 || RPD: 4	A15/5628-A-1	#
Arsenic	mg/kg	<0.4	A15/5628-A-1	1.4 || 1.4 || RPD: 0	A15/5628-A-1	101%
Cadmium	mg/kg	<0.1	A15/5628-A-1	<0.1 || <0.1	A15/5628-A-1	102%
Chromium	mg/kg	<0.1	A15/5628-A-1	8.9 || 9.2 || RPD: 3	A15/5628-A-1	101%
Copper	mg/kg	<0.1	A15/5628-A-1	7.7 || 2.5 || RPD: 102	A15/5628-A-1	98%
Iron	mg/kg	<5	A15/5628-A-1	9800 || 9700 || RPD: 1	A15/5628-A-1	#
Lead	mg/kg	<0.5	A15/5628-A-1	2.7 || 12 || RPD: 127	A15/5628-A-1	94%
Mercury	mg/kg	<0.01	A15/5628-A-1	0.01 || 0.01 || RPD: 0	A15/5628-A-1	104%
Nickel	mg/kg	<0.1	A15/5628-A-1	6.3 || 6.1 || RPD: 3	A15/5628-A-1	96%
Phosphorus*	mg/kg	<1	A15/5628-A-1	180 || 170 || RPD: 6	A15/5628-A-1	105%
Silver	mg/kg	<0.1	A15/5628-A-1	<0.1 || <0.1	A15/5628-A-1	105%
Zinc	mg/kg	<0.5	A15/5628-A-1	15 || 21 || RPD: 33	A15/5628-A-1	97%

TEST	UNITS	Blank
Benzene	mg/kg	<0.20
Toluene	mg/kg	<0.20
Ethyl Benzene	mg/kg	<0.20
m+p xylenes	mg/kg	<0.40
o-xylene	mg/kg	<0.20
Total BTEX	mg/kg	<1.2
Surrogate 1 Recovery	%	113
Surrogate 2 Recovery	%	108
Surrogate 3 Recovery	%	88

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
TPH C6-C9	mg/kg	<10	A15/5628-A-5	<20 || <20	A15/5628-A-5	81%
TPH C10-14	mg/kg	<10	A15/5628-A-5	<20 || <20	A15/5628-A-5	101%
TPH C15-28	mg/kg	<50	A15/5628-A-5	<100 || <100	A15/5628-A-5	105%
TPH C29-36	mg/kg	<50	A15/5628-A-5	<100 || <100	A15/5628-A-5	106%
Surrogate Recovery	%	93	A15/5628-A-5	101 || 94 || RPD: 7	A15/5628-A-5	95%

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TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Naphthalene	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	106%
1-Methylnaphthalene	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	99%
2-Methylnaphthalene	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	100%
Acenaphthylene	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	110%
Acenaphthene	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	104%
Fluorene	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	110%
Phenanthrene	µg/kg	<5.0	A15/5628-A-5	31 || 22 || RPD: 34	A15/5628-A-5	99%
Anthracene	µg/kg	<5.0	A15/5628-A-5	11 || <10	A15/5628-A-5	96%
Fluoranthene	µg/kg	<5.0	A15/5628-A-5	23 || 16 || RPD: 36	A15/5628-A-5	107%
Pyrene	µg/kg	<5.0	A15/5628-A-5	120 || 92 || RPD: 26	A15/5628-A-5	93%
Benz(a)anthracene	µg/kg	<5.0	A15/5628-A-5	58 || 44 || RPD: 27	A15/5628-A-5	100%
Chrysene	µg/kg	<5.0	A15/5628-A-5	61 || 46 || RPD: 28	A15/5628-A-5	96%
Benzo(b)&(k)fluoranthene	µg/kg	<10	A15/5628-A-5	130 || 100 || RPD: 26	A15/5628-A-5	94%
Benzo(a)pyrene	µg/kg	<5.0	A15/5628-A-5	73 || 58 || RPD: 23	A15/5628-A-5	90%
Indeno(1,2,3-cd)pyrene	µg/kg	<5.0	A15/5628-A-5	59 || 48 || RPD: 21	A15/5628-A-5	101%
Dibenz(a,h)anthracene	µg/kg	<5.0	A15/5628-A-5	12 || 10 || RPD: 18	A15/5628-A-5	96%
Benzo(g,h,i)perylene	µg/kg	<5.0	A15/5628-A-5	56 || 46 || RPD: 20	A15/5628-A-5	94%
Coronene	µg/kg	<10	A15/5628-A-5	<20 || <20	A15/5628-A-5	103%
Benzo(e)pyrene	µg/kg	<5.0	A15/5628-A-5	56 || 46 || RPD: 20	A15/5628-A-5	93%
Perylene	µg/kg	<5.0	A15/5628-A-5	140 || 120 || RPD: 15	A15/5628-A-5	98%
Total PAHs (as above)	µg/kg	<100	A15/5628-A-5	960 || 750 || RPD: 25	A15/5628-A-5	[NA]
Surrogate 1 Recovery	%	103	A15/5628-A-5	100 || 94 || RPD: 6	A15/5628-A-5	99%
Surrogate 2 Recovery	%	88	A15/5628-A-5	95 || 90 || RPD: 5	A15/5628-A-5	96%
Surrogate 3 Recovery	%	111	A15/5628-A-5	109 || 100 || RPD: 9	A15/5628-A-5	103%

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TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	102%
alpha-BHC	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	97%
beta-BHC	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	96%
gamma-BHC (Lindane)	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	92%
delta-BHC	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	91%
cis-Chlordane	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	100%
trans-Chlordane	µg/kg	<1.0	A15/5628-A-5	1.0 || 1.0 || RPD: 0	A15/5628-A-5	102%
p,p'-DDD	µg/kg	<1.0	A15/5628-A-5	2.0 || 2.0 || RPD: 0	A15/5628-A-5	92%
p,p'-DDE	µg/kg	<1.0	A15/5628-A-5	5.0 || 5.0 || RPD: 0	A15/5628-A-5	94%
p,p'-DDT	µg/kg	<1.0	A15/5628-A-5	<5 || <5	A15/5628-A-5	105%
Dieldrin	µg/kg	<1.0	A15/5628-A-5	2.0 || 2.0 || RPD: 0	A15/5628-A-5	93%
alpha-Endosulfan	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	97%
beta-Endosulfan	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	94%
Endosulfan Sulphate	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	83%
Endrin	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	108%
Endrin ketone	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	95%
Endrin aldehyde	µg/kg	<1.0	A15/5628-A-5	<5 || <5	A15/5628-A-5	87%
Heptachlor	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	94%
Heptachlor epoxide	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	57%
Hexachlorobenzene	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	114%
Methoxychlor	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	89%
Oxychlordane*	µg/kg	<1.0	A15/5628-A-5	<1.0 || <1.0	A15/5628-A-5	54%
Surrogate Recovery	%	81	A15/5628-A-5	100 || 94 || RPD: 6	A15/5628-A-5	94%

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TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Mono-PCB congeners	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	105%
Di-PCB congeners	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	103%
Tri-PCB congeners	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	106%
Tetra-PCB congeners	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	101%
Penta-PCB congeners	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	96%
Hexa-PCB congeners	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	91%
Hepta-PCB congeners	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	93%
Octa-PCB congeners	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	100%
Nona-PCB congeners	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	96%
Deca-PCB congeners	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	90%
Total PCB congeners	µg/kg	<5.0	A15/5628-A-5	<10 || <10	A15/5628-A-5	98%
Surrogate 1 Recovery	%	103	A15/5628-A-5	104 || 98 || RPD: 6	A15/5628-A-5	102%
Surrogate 2 Recovery	%	104	A15/5628-A-5	110 || 101 || RPD: 9	A15/5628-A-5	105%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	<0.50	A15/5628-A-2	22 || 23 || RPD: 4	A15/5628-A-2	127%
Dibutyl tin	µgSn/kg	<0.50	A15/5628-A-2	23 || 21 || RPD: 9	A15/5628-A-2	136%
Tributyl tin	µgSn/kg	<0.50	A15/5628-A-2	22 || 16 || RPD: 32	A15/5628-A-2	143%
Surrogate 1 Recovery	%	88	A15/5628-A-2	137 || 147 || RPD: 7	A15/5628-A-2	127%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results
Total Organic Carbon	%	<0.01	A15/5628-A-10	2.0 || 1.9 || RPD: 5
Total Nitrogen	mg/kg	<20	A15/5628-A-10	1530 || 1460 || RPD: 5

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aluminium	mg/kg	<5	A15/5628-A-11	29000 || 29000 || RPD: 0	A15/5628-A-21	111%
Arsenic	mg/kg	<0.4	A15/5628-A-11	7.3 || 7.4 || RPD: 1	A15/5628-A-21	102%
Cadmium	mg/kg	<0.1	A15/5628-A-11	0.26 || 0.12 || RPD: 74	A15/5628-A-21	104%
Chromium	mg/kg	<0.1	A15/5628-A-11	49 || 49 || RPD: 0	A15/5628-A-21	96%
Copper	mg/kg	<0.1	A15/5628-A-11	40 || 44 || RPD: 10	A15/5628-A-21	103%
Iron	mg/kg	<5	A15/5628-A-11	48000 || 49000 || RPD: 2	A15/5628-A-21	#
Lead	mg/kg	<0.5	A15/5628-A-11	15 || 15 || RPD: 0	A15/5628-A-21	88%
Mercury	mg/kg	<0.01	A15/5628-A-11	0.09 || 0.10 || RPD: 11	A15/5628-A-21	94%
Nickel	mg/kg	<0.1	A15/5628-A-11	35 || 35 || RPD: 0	A15/5628-A-21	90%
Phosphorus*	mg/kg	<1	A15/5628-A-11	1200 || 1100 || RPD: 9	A15/5628-A-21	100%
Silver	mg/kg	<0.1	A15/5628-A-11	0.14 || 0.15 || RPD: 7	A15/5628-A-21	108%
Zinc	mg/kg	<0.5	A15/5628-A-11	110 || 110 || RPD: 0	A15/5628-A-21	90%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	99%
alpha-BHC	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	102%
beta-BHC	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	92%
gamma-BHC (Lindane)	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	90%
delta-BHC	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	84%
cis-Chlordane	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	101%
trans-Chlordane	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	100%
p,p'-DDD	µg/kg	<1.0	A15/5628-A-11	3.0 || 4.0 || RPD: 29	A15/5628-A-21	117%
p,p'-DDE	µg/kg	<1.0	A15/5628-A-11	7.0 || 6.0 || RPD: 15	A15/5628-A-21	85%
p,p'-DDT	µg/kg	<1.0	A15/5628-A-11	<5 || <5	A15/5628-A-21	96%
Dieldrin	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	94%
alpha-Endosulfan	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	99%
beta-Endosulfan	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	92%
Endosulfan Sulphate	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	83%
Endrin	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	100%
Endrin ketone	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	79%
Endrin aldehyde	µg/kg	<1.0	A15/5628-A-11	<5 || <5	A15/5628-A-21	78%
Heptachlor	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	78%
Heptachlor epoxide	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	101%
Hexachlorobenzene	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	121%
Methoxychlor	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	14%
Oxychlordane*	µg/kg	<1.0	A15/5628-A-11	<1.0 || <1.0	A15/5628-A-21	97%
Surrogate Recovery	%	86	A15/5628-A-11	91 || 93 || RPD: 2	A15/5628-A-21	85%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	<0.50	A15/5628-A-11	2.3||2.4||RPD: 4	A15/5628-A-21	94%
Dibutyl tin	µgSn/kg	<0.50	A15/5628-A-11	2.0||1.9||RPD: 5	A15/5628-A-21	101%
Tributyl tin	µgSn/kg	<0.50	A15/5628-A-11	2.2||1.9||RPD: 15	A15/5628-A-21	92%
Surrogate 1 Recovery	%	87	A15/5628-A-11	98||99||RPD: 1	A15/5628-A-21	88%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Total Organic Carbon	%	<0.01	A15/5628-A-20	1.4||1.4||RPD: 0
Total Nitrogen	mg/kg	<20	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aluminium	mg/kg	<5	A15/5628-A-21	10000||9800||RPD: 2	A15/5628-A-42	#
Arsenic	mg/kg	<0.4	A15/5628-A-21	5.3||5.3||RPD: 0	A15/5628-A-42	97%
Cadmium	mg/kg	<0.1	A15/5628-A-21	<0.1||<0.1	A15/5628-A-42	104%
Chromium	mg/kg	<0.1	A15/5628-A-21	25||25||RPD: 0	A15/5628-A-42	96%
Copper	mg/kg	<0.1	A15/5628-A-21	11||11||RPD: 0	A15/5628-A-42	104%
Iron	mg/kg	<5	A15/5628-A-21	23000||23000||RPD: 0	A15/5628-A-42	#
Lead	mg/kg	<0.5	A15/5628-A-21	6.0||5.9||RPD: 2	A15/5628-A-42	84%
Mercury	mg/kg	<0.01	A15/5628-A-21	0.03||0.03||RPD: 0	A15/5628-A-42	104%
Nickel	mg/kg	<0.1	A15/5628-A-21	17||18||RPD: 6	A15/5628-A-42	87%
Phosphorus*	mg/kg	<1	A15/5628-A-21	390||350||RPD: 11	A15/5628-A-42	101%
Silver	mg/kg	<0.1	A15/5628-A-21	<0.1||<0.1	A15/5628-A-42	111%
Zinc	mg/kg	<0.5	A15/5628-A-21	41||40||RPD: 2	A15/5628-A-42	84%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	99%
alpha-BHC	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	96%
beta-BHC	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	95%
gamma-BHC (Lindane)	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	91%
delta-BHC	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	87%
cis-Chlordane	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	94%
trans-Chlordane	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	91%
p,p'-DDD	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	90%
p,p'-DDE	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	92%
p,p'-DDT	µg/kg	<1.0	A15/5628-A-21	<5||<5	External	113%
Dieldrin	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	94%
alpha-Endosulfan	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	93%
beta-Endosulfan	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	89%
Endosulfan Sulphate	µg/kg	<1.0	A15/5628-A-21	<1.0||<1.0	External	88%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Endrin	µg/kg	<1.0	A15/5628-A-21	<1.0 || <1.0	External	115%
Endrin ketone	µg/kg	<1.0	A15/5628-A-21	<1.0 || <1.0	External	90%
Endrin aldehyde	µg/kg	<1.0	A15/5628-A-21	<5 || <5	External	80%
Heptachlor	µg/kg	<1.0	A15/5628-A-21	<1.0 || <1.0	External	90%
Heptachlor epoxide	µg/kg	<1.0	A15/5628-A-21	<1.0 || <1.0	External	100%
Hexachlorobenzene	µg/kg	<1.0	A15/5628-A-21	<1.0 || <1.0	External	105%
Methoxychlor	µg/kg	<1.0	A15/5628-A-21	<1.0 || <1.0	External	94%
Oxychlordane*	µg/kg	<1.0	A15/5628-A-21	<1.0 || <1.0	External	96%
Surrogate Recovery	%	80	A15/5628-A-21	91 || 83 || RPD: 9	External	83%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	<0.50	A15/5628-A-21	0.80 || 0.70 || RPD: 13	External	85%
Dibutyl tin	µgSn/kg	<0.50	A15/5628-A-21	0.70 || 0.70 || RPD: 0	External	88%
Tributyl tin	µgSn/kg	<0.50	A15/5628-A-21	0.50 || 0.60 || RPD: 18	External	91%
Surrogate 1 Recovery	%	78	A15/5628-A-21	115 || 96 || RPD: 18	External	92%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Total Organic Carbon	%	<0.01	A15/5628-A-30	0.38 || 0.36 || RPD: 5
Total Nitrogen	mg/kg	<20	A15/5628-A-30	380 || 370 || RPD: 3

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aluminium	mg/kg	[NT]	A15/5628-A-31	17000 || 17000 || RPD: 0
Arsenic	mg/kg	[NT]	A15/5628-A-31	6.2 || 6.3 || RPD: 2
Cadmium	mg/kg	[NT]	A15/5628-A-31	<0.1 || <0.1
Chromium	mg/kg	[NT]	A15/5628-A-31	31 || 30 || RPD: 3
Copper	mg/kg	[NT]	A15/5628-A-31	16 || 16 || RPD: 0
Iron	mg/kg	[NT]	A15/5628-A-31	29000 || 30000 || RPD: 3
Lead	mg/kg	[NT]	A15/5628-A-31	10 || 9.9 || RPD: 1
Mercury	mg/kg	[NT]	A15/5628-A-31	0.05 || 0.07 || RPD: 33
Nickel	mg/kg	[NT]	A15/5628-A-31	19 || 19 || RPD: 0
Phosphorus*	mg/kg	[NT]	A15/5628-A-31	510 || 520 || RPD: 2
Silver	mg/kg	[NT]	A15/5628-A-31	<0.1 || <0.1
Zinc	mg/kg	[NT]	A15/5628-A-31	59 || 59 || RPD: 0

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Naphthalene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	107%
1-Methylnaphthalene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	102%
2-Methylnaphthalene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	100%
Acenaphthylene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	108%
Acenaphthene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	104%
Fluorene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	106%
Phenanthrene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	98%
Anthracene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	102%
Fluoranthene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	105%
Pyrene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	103%
Benz(a)anthracene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	104%
Chrysene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	104%
Benzo(b)&(k)fluoranthene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	96%
Benzo(a)pyrene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	92%
Indeno(1,2,3-cd)pyrene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	99%
Dibenz(a,h)anthracene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	105%
Benzo(g,h,i)perylene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	95%
Coronene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	101%
Benzo(e)pyrene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	97%
Perylene	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	102%
Total PAHs (as above)	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	[NA]
Surrogate 1 Recovery	%	[NT]	[NT]	[NT]	A15/5628-A-41	92%
Surrogate 2 Recovery	%	[NT]	[NT]	[NT]	A15/5628-A-41	89%
Surrogate 3 Recovery	%	[NT]	[NT]	[NT]	A15/5628-A-41	95%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	98%
alpha-BHC	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	102%
beta-BHC	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	97%
gamma-BHC (Lindane)	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	96%
delta-BHC	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	97%
cis-Chlordane	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	96%
trans-Chlordane	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	98%
p,p'-DDD	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	113%
p,p'-DDE	µg/kg	[NT]	A15/5628-A-31	2.0 || 2.0 || RPD: 0	A15/5628-A-41	92%
p,p'-DDT	µg/kg	[NT]	A15/5628-A-31	<5 || <5	A15/5628-A-41	102%
Dieldrin	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	95%
alpha-Endosulfan	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	99%
beta-Endosulfan	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	100%
Endosulfan Sulphate	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	99%
Endrin	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	126%
Endrin ketone	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	80%
Endrin aldehyde	µg/kg	[NT]	A15/5628-A-31	<5 || <5	A15/5628-A-41	90%
Heptachlor	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	91%
Heptachlor epoxide	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	54%
Hexachlorobenzene	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	101%
Methoxychlor	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	73%
Oxychlordane*	µg/kg	[NT]	A15/5628-A-31	<1.0 || <1.0	A15/5628-A-41	58%
Surrogate Recovery	%	[NT]	A15/5628-A-31	84 || 74 || RPD: 13	A15/5628-A-41	83%

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Batch Number: A15/5628-A [R00]
Project Reference: Port of Brisbane - Sediments

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Mono-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	106%
Di-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	104%
Tri-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	106%
Tetra-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	100%
Penta-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	95%
Hexa-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	89%
Hepta-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	91%
Octa-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	98%
Nona-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	95%
Deca-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	88%
Total PCB congeners	µg/kg	[NT]	[NT]	[NT]	A15/5628-A-41	97%
Surrogate 1 Recovery	%	[NT]	[NT]	[NT]	A15/5628-A-41	95%
Surrogate 2 Recovery	%	[NT]	[NT]	[NT]	A15/5628-A-41	98%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Monobutyl tin	µgSn/kg	[NT]	A15/5628-A-31	1.3 || 1.2 || RPD: 8
Dibutyl tin	µgSn/kg	[NT]	A15/5628-A-31	1.0 || 1.3 || RPD: 26
Tributyl tin	µgSn/kg	[NT]	A15/5628-A-31	0.70 || 0.90 || RPD: 25
Surrogate 1 Recovery	%	[NT]	A15/5628-A-31	108 || 101 || RPD: 7

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Total Organic Carbon	%	[NT]	A15/5628-A-40	1.6 || 1.6 || RPD: 0
Total Nitrogen	mg/kg	[NT]	A15/5628-A-40	1210 || 1260 || RPD: 4

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aluminium	mg/kg	[NT]	A15/5628-A-41	27000 || 27000 || RPD: 0
Arsenic	mg/kg	[NT]	A15/5628-A-41	8.0 || 7.8 || RPD: 3
Cadmium	mg/kg	[NT]	A15/5628-A-41	<0.1 || <0.1
Chromium	mg/kg	[NT]	A15/5628-A-41	45 || 46 || RPD: 2
Copper	mg/kg	[NT]	A15/5628-A-41	34 || 34 || RPD: 0
Iron	mg/kg	[NT]	A15/5628-A-41	46000 || 47000 || RPD: 2
Lead	mg/kg	[NT]	A15/5628-A-41	15 || 15 || RPD: 0
Mercury	mg/kg	[NT]	A15/5628-A-41	0.1 || 0.1 || RPD: 0
Nickel	mg/kg	[NT]	A15/5628-A-41	29 || 30 || RPD: 3
Phosphorus*	mg/kg	[NT]	A15/5628-A-41	820 || 820 || RPD: 0
Silver	mg/kg	[NT]	A15/5628-A-41	0.14 || 0.15 || RPD: 7
Zinc	mg/kg	[NT]	A15/5628-A-41	100 || 99 || RPD: 1

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Batch Number: A15/5628-A [R00]
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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
TPH C6-C9	mg/kg	[NT]	A15/5628-A-41	<20 || <20
TPH C10-14	mg/kg	[NT]	A15/5628-A-41	<20 || <20
TPH C15-28	mg/kg	[NT]	A15/5628-A-41	<100 || <100
TPH C29-36	mg/kg	[NT]	A15/5628-A-41	<100 || <100
Surrogate Recovery	%	[NT]	A15/5628-A-41	89 || 101 || RPD: 13

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Naphthalene	µg/kg	[NT]	A15/5628-A-41	<10 || <10
1-Methylnaphthalene	µg/kg	[NT]	A15/5628-A-41	<10 || <10
2-Methylnaphthalene	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Acenaphthylene	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Acenaphthene	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Fluorene	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Phenanthrene	µg/kg	[NT]	A15/5628-A-41	17 || 18 || RPD: 6
Anthracene	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Fluoranthene	µg/kg	[NT]	A15/5628-A-41	11 || <10
Pyrene	µg/kg	[NT]	A15/5628-A-41	54 || 50 || RPD: 8
Benz(a)anthracene	µg/kg	[NT]	A15/5628-A-41	24 || 29 || RPD: 19
Chrysene	µg/kg	[NT]	A15/5628-A-41	26 || 27 || RPD: 4
Benzo(b)&(k)fluoranthene	µg/kg	[NT]	A15/5628-A-41	59 || 70 || RPD: 17
Benzo(a)pyrene	µg/kg	[NT]	A15/5628-A-41	33 || 40 || RPD: 19
Indeno(1,2,3-cd)pyrene	µg/kg	[NT]	A15/5628-A-41	27 || 34 || RPD: 23
Dibenz(a,h)anthracene	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Benzo(g,h,i)perylene	µg/kg	[NT]	A15/5628-A-41	25 || 31 || RPD: 21
Coronene	µg/kg	[NT]	A15/5628-A-41	<20 || <20
Benzo(e)pyrene	µg/kg	[NT]	A15/5628-A-41	25 || 29 || RPD: 15
Perylene	µg/kg	[NT]	A15/5628-A-41	66 || 58 || RPD: 13
Total PAHs (as above)	µg/kg	[NT]	A15/5628-A-41	420 || 440 || RPD: 5
Surrogate 1 Recovery	%	[NT]	A15/5628-A-41	92 || 96 || RPD: 4
Surrogate 2 Recovery	%	[NT]	A15/5628-A-41	86 || 89 || RPD: 3
Surrogate 3 Recovery	%	[NT]	A15/5628-A-41	97 || 99 || RPD: 2

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Batch Number: A15/5628-A [R00]
Project Reference: Port of Brisbane - Sediments

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aldrin	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
alpha-BHC	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
beta-BHC	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
gamma-BHC (Lindane)	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
delta-BHC	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
cis-Chlordane	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
trans-Chlordane	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
p,p'-DDD	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
p,p'-DDE	µg/kg	[NT]	A15/5628-A-41	4.0 || 4.0 || RPD: 0
p,p'-DDT	µg/kg	[NT]	A15/5628-A-41	<5 || <5
Dieldrin	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
alpha-Endosulfan	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
beta-Endosulfan	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
Endosulfan Sulphate	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
Endrin	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
Endrin ketone	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
Endrin aldehyde	µg/kg	[NT]	A15/5628-A-41	<5 || <5
Heptachlor	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
Heptachlor epoxide	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
Hexachlorobenzene	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
Methoxychlor	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
Oxychlordane*	µg/kg	[NT]	A15/5628-A-41	<1.0 || <1.0
Surrogate Recovery	%	[NT]	A15/5628-A-41	85 || 85 || RPD: 0

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Batch Number: A15/5628-A [R00]
Project Reference: Port of Brisbane - Sediments

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mono-PCB congeners	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Di-PCB congeners	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Tri-PCB congeners	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Tetra-PCB congeners	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Penta-PCB congeners	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Hexa-PCB congeners	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Hepta-PCB congeners	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Octa-PCB congeners	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Nona-PCB congeners	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Deca-PCB congeners	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Total PCB congeners	µg/kg	[NT]	A15/5628-A-41	<10 || <10
Surrogate 1 Recovery	%	[NT]	A15/5628-A-41	93 || 96 || RPD: 3
Surrogate 2 Recovery	%	[NT]	A15/5628-A-41	96 || 100 || RPD: 4

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Monobutyl tin	µgSn/kg	[NT]	A15/5628-A-41	2.5 || 2.3 || RPD: 8
Dibutyl tin	µgSn/kg	[NT]	A15/5628-A-41	1.6 || 1.6 || RPD: 0
Tributyl tin	µgSn/kg	[NT]	A15/5628-A-41	1.5 || 1.5 || RPD: 0
Surrogate 1 Recovery	%	[NT]	A15/5628-A-41	114 || 119 || RPD: 4

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: 30%
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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Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS 136870

Client:

Advanced Analytical Aust. Pty Ltd
Unit 1, 482 Kingsford Smith Dr
Hamilton
QLD 4007

Attention: Trent Biggin

Sample log in details:

Your Reference:	**A15/5628A**		
No. of samples:	15 Sediments		
Date samples received / completed instructions received	04/11/15	/	04/11/15

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:	11/11/15	/	11/11/15
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

sPOCAS						
Our Reference:	UNITS	136870-1	136870-2	136870-3	136870-4	136870-5
Your Reference	----------	A15/5628A/55-0	A15/5628A/69-1	A15/5628A/75-1A	A15/5628A/85-1B	A15/5628A/95-1C
Sample ID	----------					
Date Sampled		29/10/2015	29/10/2015	29/10/2015	29/10/2015	29/10/2015
Type of sample		sediment	sediment	sediment	sediment	sediment
Date prepared	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
Date analysed	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
pH $_{kcl}$	pH units	8.2	8.1	8.5	8.5	8.2
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5

sPOCAS						
Our Reference:	UNITS	136870-6	136870-7	136870-8	136870-9	136870-10
Your Reference	----------	A15/5628A/10	A15/5628A/12	A15/5628A/23	A15/5628A/28	A15/5628A/29
Sample ID	----------	6-3	7-1	13-8	13-1	15-3
Date Sampled		29/10/2015	29/10/2015	30/10/2015	30/10/2015	02/11/2015
Type of sample		sediment	sediment	sediment	sediment	sediment
Date prepared	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
Date analysed	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
pH $_{kcl}$	pH units	8.2	8.2	8.6	8.9	9.1
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5

sPOCAS						
Our Reference:	UNITS	136870-11	136870-12	136870-13	136870-14	136870-15
Your Reference	----------	A15/5628A/30	A15/5628A/33	A15/5628A/35	A15/5628A/40	A15/5628A/41
Sample ID	----------	15-2	12-1	11-8	10-6A	10-6B
Date Sampled		02/11/2015	02/11/2015	02/11/2015	02/11/2015	02/11/2015
Type of sample		sediment	sediment	sediment	sediment	sediment
Date prepared	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
Date analysed	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
pH $_{kcl}$	pH units	9.1	8.9	8.7	8.2	8.4
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5

SCr						
Our Reference:	UNITS	136870-1	136870-2	136870-3	136870-4	136870-5
Your Reference	----------	A15/5628A/5	A15/5628A/6	A15/5628A/7	A15/5628A/8	A15/5628A/9
Sample ID	----------	5-0	9-1	5-1A	5-1B	5-1C
Date Sampled		29/10/2015	29/10/2015	29/10/2015	29/10/2015	29/10/2015
Type of sample		sediment	sediment	sediment	sediment	sediment
Date prepared	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
Date analysed	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
Chromium Reducible Sulfur	%w/w	0.24	0.17	0.56	0.44	0.35
a-Chromium Reducible Sulfur	moles H^+/t	150	110	350	270	220

SCr						
Our Reference:	UNITS	136870-6	136870-7	136870-8	136870-9	136870-10
Your Reference	----------	A15/5628A/10	A15/5628A/12	A15/5628A/23	A15/5628A/28	A15/5628A/29
Sample ID	----------	6-3	7-1	13-8	13-1	15-3
Date Sampled		29/10/2015	29/10/2015	30/10/2015	30/10/2015	02/11/2015
Type of sample		sediment	sediment	sediment	sediment	sediment
Date prepared	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
Date analysed	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
Chromium Reducible Sulfur	%w/w	0.24	0.21	0.15	0.12	0.14
a-Chromium Reducible Sulfur	moles H^+/t	150	130	94	74	89

SCr						
Our Reference:	UNITS	136870-11	136870-12	136870-13	136870-14	136870-15
Your Reference	----------	A15/5628A/30	A15/5628A/33	A15/5628A/35	A15/5628A/40	A15/5628A/41
Sample ID	----------	15-2	12-1	11-8	10-6A	10-6B
Date Sampled		02/11/2015	02/11/2015	02/11/2015	02/11/2015	02/11/2015
Type of sample		sediment	sediment	sediment	sediment	sediment
Date prepared	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
Date analysed	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
Chromium Reducible Sulfur	%w/w	0.05	0.18	0.21	0.23	0.21
a-Chromium Reducible Sulfur	moles H^+/t	34	120	130	140	130

Method ID	Methodology Summary
Inorg-064	sPOCAS determined using titrimetric and ICP-AES techniques. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.
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: A15/5628A

QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			11/11/2015	136870-9	11/11/2015 || 11/11/2015	LCS-1	11/11/2015
Date analysed	-			11/11/2015	136870-9	11/11/2015 || 11/11/2015	LCS-1	11/11/2015
pH kcl	pH units		Inorg-064	[NT]	136870-9	8.9 || 8.9 || RPD: 0	LCS-1	95%
TAA pH 6.5	moles H^+/t	5	Inorg-064	<5	136870-9	<5 || <5	LCS-1	95%

QUALITY CONTROL SCr	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			11/11/2015	136870-9	11/11/2015 || 11/11/2015	LCS-1	11/11/2015
Date analysed	-			11/11/2015	136870-9	11/11/2015 || 11/11/2015	LCS-1	11/11/2015
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	136870-9	0.12 || 0.12 || RPD: 0	LCS-1	102%
a-Chromium Reducible Sulfur	moles H^+/t	3	Inorg-068	<3	136870-9	74 || 75 || RPD: 1	[NR]	[NR]

QUALITY CONTROL sPOCAS	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	136870-12	11/11/2015 || 11/11/2015
Date analysed	-	136870-12	11/11/2015 || 11/11/2015
pH kcl	pH units	136870-12	8.9 || 8.9 || RPD: 0
TAA pH 6.5	moles H^+/t	136870-12	<5 || <5

QUALITY CONTROL SCr	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	136870-12	11/11/2015 || 11/11/2015
Date analysed	-	136870-12	11/11/2015 || 11/11/2015
Chromium Reducible Sulfur	%w/w	136870-12	0.18 || 0.19 || RPD: 5
a-Chromium Reducible Sulfur	moles H^+/t	136870-12	120 || 120 || RPD: 0

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
NR: 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 (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

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Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS 136870-A

Client:

Advanced Analytical Aust. Pty Ltd
Unit 1, 482 Kingsford Smith Dr
Hamilton
QLD 4007

Attention: Trent Biggin

Sample log in details:

Your Reference:	**A15/5628A**		
No. of samples:	15 Sediments		
Date samples received / completed instructions received	04/11/15	/	04/12/15

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:	9/12/15	/	9/12/15
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

sPOCAS Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	136870-A-1 A15/5628A/5 29/10/2015 sediment	136870-A-2 A15/5628A/6 29/10/2015 sediment	136870-A-3 A15/5628A/7 29/10/2015 sediment	136870-A-4 A15/5628A/8 29/10/2015 sediment	136870-A-5 A15/5628A/9 29/10/2015 sediment
Date prepared	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Date analysed	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
pH $_{kcl}$	pH units	8.2	8.1	8.5	8.5	8.2
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
pH $_{Ox}$	pH units	6.7	7.1	5.1	5.8	6.5
TPA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TPA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TSA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
ANC_E	% $CaCO_3$	0.66	0.59	<0.05	<0.05	<0.05
a-ANC_E	moles H^+/t	130	120	<5	<5	<5
s-ANC_E	%w/w S	0.21	0.19	<0.05	<0.05	<0.05
S_{KCl}	%w/w S	0.19	0.20	0.24	0.22	0.19
S_P	%w/w	0.40	0.28	0.83	0.72	0.49
S_{POS}	%w/w	0.20	0.08	0.60	0.50	0.30
a-S_{POS}	moles H^+/t	130	48	370	310	190
Ca_{KCl}	%w/w	0.25	0.26	0.27	0.27	0.27
Ca_P	%w/w	0.37	0.39	0.62	0.56	0.32
Ca_A	%w/w	0.12	0.13	0.35	0.28	0.051
Mg_{KCl}	%w/w	0.25	0.26	0.26	0.22	0.26
Mg_P	%w/w	0.32	0.29	0.33	0.29	0.32
Mg_A	%w/w	0.069	0.027	0.075	0.070	0.055
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5
a-Net Acidity	moles H^+/t	<10	<10	130	310	190
Liming rate	kg $CaCO_3$/t	<0.75	<0.75	9.4	24	14
a-Net Acidity without ANCE	moles H^+/t	130	48	NA	NA	NA
Liming rate without ANCE	kg $CaCO_3$/t	9.6	3.6	NA	NA	NA

sPOCAS Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	136870-A-6 A15/5628A/10 29/10/2015 sediment	136870-A-7 A15/5628A/12 29/10/2015 sediment	136870-A-8 A15/5628A/23 30/10/2015 sediment	136870-A-9 A15/5628A/28 30/10/2015 sediment	136870-A-10 A15/5628A/29 02/11/2015 sediment
Date prepared	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Date analysed	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
pH $_{kcl}$	pH units	8.2	8.2	8.6	8.9	9.1
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
pH $_{Ox}$	pH units	7.0	7.2	8.0	8.0	8.1
TPA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TPA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TSA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
ANC_E	% $CaCO_3$	0.65	0.67	1.5	0.66	0.72
a-ANC_E	moles H^+/t	130	130	310	130	140
s-ANC_E	%w/w S	0.21	0.21	0.49	0.21	0.23
S_{KCl}	%w/w S	0.14	0.35	0.16	0.06	0.15
S_P	%w/w	0.42	0.39	0.33	0.16	0.21
S_{POS}	%w/w	0.28	0.04	0.16	0.10	0.07
a-S_{POS}	moles H^+/t	180	25	100	63	41
Ca_{KCl}	%w/w	0.28	0.32	0.30	0.23	0.18
Ca_P	%w/w	0.45	0.48	0.76	0.52	0.46
Ca_A	%w/w	0.16	0.16	0.45	0.29	0.27
Mg_{KCl}	%w/w	0.24	0.34	0.24	0.11	0.12
Mg_P	%w/w	0.31	0.39	0.32	0.13	0.14
Mg_A	%w/w	0.064	0.049	0.078	0.018	0.016
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5
a-Net Acidity	moles H^+/t	<10	<10	<10	<10	<10
Liming rate	kg $CaCO_3$/t	<0.75	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+/t	180	25	100	63	41
Liming rate without ANCE	kg $CaCO_3$/t	13	1.9	7.7	4.7	3.1

sPOCAS Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	136870-A-11 A15/5628A/30 02/11/2015 sediment	136870-A-12 A15/5628A/33 02/11/2015 sediment	136870-A-13 A15/5628A/35 02/11/2015 sediment	136870-A-14 A15/5628A/40 02/11/2015 sediment	136870-A-15 A15/5628A/41 02/11/2015 sediment
Date prepared	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Date analysed	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
pH $_{kcl}$	pH units	9.1	8.9	8.7	8.2	8.4
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
pH $_{Ox}$	pH units	7.8	7.6	7.6	7.4	7.0
TPA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TPA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TSA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
ANC_E	%$CaCO_3$	0.58	0.56	0.70	0.75	0.91
a-ANC_E	moles H^+/t	120	110	140	150	180
s-ANC_E	%w/w S	0.19	0.18	0.22	0.24	0.29
S_{KCl}	%w/w S	0.1	0.13	0.17	0.24	0.21
S_P	%w/w	0.16	0.27	0.34	0.44	0.43
S_{POS}	%w/w	0.07	0.14	0.17	0.20	0.22
a-S_{POS}	moles H^+/t	41	85	110	130	140
Ca_{KCl}	%w/w	0.16	0.20	0.24	0.37	0.35
Ca_P	%w/w	0.43	0.48	0.55	0.50	0.57
Ca_A	%w/w	0.27	0.28	0.31	0.13	0.22
Mg_{KCl}	%w/w	0.097	0.13	0.18	0.29	0.28
Mg_P	%w/w	0.12	0.15	0.21	0.36	0.37
Mg_A	%w/w	0.025	0.022	0.031	0.071	0.090
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5
a-Net Acidity	moles H^+/t	<10	<10	<10	<10	<10
Liming rate	kg $CaCO_3$/t	<0.75	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+/t	41	85	110	130	140
Liming rate without ANCE	kg $CaCO_3$/t	3.1	6.4	8.0	9.4	10

Method ID	Methodology Summary
Inorg-064	sPOCAS determined using titrimetric and ICP-AES techniques. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			07/12/2015	[NT]	[NT]	LCS-1	07/12/2015
Date analysed	-			07/12/2015	[NT]	[NT]	LCS-1	07/12/2015
pH_{kcl}	pH units		Inorg-064	[NT]	[NT]	[NT]	LCS-1	99%
TAA pH 6.5	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	LCS-1	95%
s-TAA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
pH_{Ox}	pH units		Inorg-064	[NT]	[NT]	[NT]	LCS-1	97%
TPA pH 6.5	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	LCS-1	112%
s-TPA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
TSA pH 6.5	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NR]	[NR]
s-TSA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
ANC_E	% $CaCO_3$	0.05	Inorg-064	<0.05	[NT]	[NT]	[NR]	[NR]
a-ANC_E	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NR]	[NR]
s-ANC_E	%w/w S	0.05	Inorg-064	<0.05	[NT]	[NT]	[NR]	[NR]
S_{KCl}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
S_P	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
S_{POS}	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
a-S_{POS}	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NR]	[NR]
Ca_{KCl}	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
Ca_P	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
Ca_A	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
Mg_{KCl}	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
Mg_P	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
Mg_A	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
S_{HCl}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
S_{NAS}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
a-S_{NAS}	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NR]	[NR]
s-S_{NAS}	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
Fineness Factor	-	1.5	Inorg-064	<1.5	[NT]	[NT]	[NR]	[NR]
a-Net Acidity	moles H^+/t	10	Inorg-064	<10	[NT]	[NT]	[NR]	[NR]
Liming rate	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	[NT]	[NT]	[NR]	[NR]

Client Reference: A15/5628A

QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
a-Net Acidity without ANCE	moles H^+/t	10	Inorg-064	<10	[NT]	[NT]	[NR]	[NR]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL sPOCAS	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	136870-A-12	07/12/2015 || 07/12/2015
Date analysed	-	136870-A-12	07/12/2015 || 07/12/2015
pH $_{kcl}$	pH units	136870-A-12	8.9 || 8.9 || RPD: 0
TAA pH 6.5	moles H^+/t	136870-A-12	<5 || <5
s-TAA pH 6.5	%w/w S	136870-A-12	<0.01 || <0.01
pH $_{Ox}$	pH units	136870-A-12	7.6 || 7.5 || RPD: 1
TPA pH 6.5	moles H^+/t	136870-A-12	<5 || <5
s-TPA pH 6.5	%w/w S	136870-A-12	<0.01 || <0.01
TSA pH 6.5	moles H^+/t	136870-A-12	<5 || <5
s-TSA pH 6.5	%w/w S	136870-A-12	<0.01 || <0.01
ANCE	% $CaCO_3$	136870-A-12	0.56 || 0.61 || RPD: 9
a-ANCE	moles H^+/t	136870-A-12	110 || 120 || RPD: 9
s-ANCE	%w/w S	136870-A-12	0.18 || 0.20 || RPD: 11
S_{KCl}	%w/w S	136870-A-12	0.13 || 0.12 || RPD: 8
S_P	%w/w	136870-A-12	0.27 || 0.26 || RPD: 4
S_{POS}	%w/w	136870-A-12	0.14 || 0.14 || RPD: 0
a-S_{POS}	moles H^+/t	136870-A-12	85 || 89 || RPD: 5
Ca_{KCl}	%w/w	136870-A-12	0.20 || 0.20 || RPD: 0
Ca_P	%w/w	136870-A-12	0.48 || 0.51 || RPD: 6
Ca_A	%w/w	136870-A-12	0.28 || 0.31 || RPD: 10
Mg_{KCl}	%w/w	136870-A-12	0.13 || 0.13 || RPD: 0
Mg_P	%w/w	136870-A-12	0.15 || 0.15 || RPD: 0
Mg_A	%w/w	136870-A-12	0.022 || 0.026 || RPD: 17
S_{HCl}	%w/w S	[NT]	[NT]
S_{NAS}	%w/w S	[NT]	[NT]
a-S_{NAS}	moles H^+/t	[NT]	[NT]
s-S_{NAS}	%w/w S	[NT]	[NT]
Fineness Factor	-	136870-A-12	1.5 || 1.5 || RPD: 0
a-Net Acidity	moles H^+/t	136870-A-12	<10 || <10

QUALITY CONTROL sPOCAS	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Liming rate	kg $CaCO_3$ /t	136870-A-12	<0.75 || <0.75
a-Net Acidity without ANCE	moles H^+/t	136870-A-12	85 || 89 || RPD: 5
Liming rate without ANCE	kg $CaCO_3$ /t	136870-A-12	6.4 || 6.7 || RPD: 5

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
NR: 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 (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

REPORT OF ANALYSIS

Laboratory Reference: A15/5628-D [R00]

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

Contact: Brad Grant

Order No:
Project: Port of Brisbane - Sediments - DAE
Sample Type: Sediment
No. of Samples: 46
Date Received: 02/11/2015
Date Completed: 1/12/2015

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: A15/5628-D [R00]
Project Reference: Port of Brisbane - Sediments - DAE

Laboratory Reference:	-	-	/3	/4	/5	/7
Client Reference:	-	-	4-4	4-0	5-0	5-1A
Date Sampled:	-	-	29/10/2015	29/10/2015	29/10/2015	29/10/2015
Analysis Description	**Method**	**Units**				
Dilute Acid Extraction - Metal						
Mercury	04-002	mg/kg	0.01	<0.01	<0.01	<0.01
Nickel	04-001	mg/kg	6.3	12	6.0	5.2

Laboratory Reference:	-	-	/8	/11	/20	/25
Client Reference:	-	-	5-1B	6-2A	13-9	13-4A
Date Sampled:	-	-	29/10/2015	29/10/2015	30/10/2015	30/10/2015
Analysis Description	**Method**	**Units**				
Dilute Acid Extraction - Metal						
Mercury	04-002	mg/kg	<0.01	<0.01	<0.01	0.01
Nickel	04-001	mg/kg	5.4	7.7	6.4	4.6

Laboratory Reference:	-	-	/26	/28	/32	/34
Client Reference:	-	-	13-4B	13-1	12-2	11-5
Date Sampled:	-	-	30/10/2015	30/10/2015	02/11/2015	02/11/2015
Analysis Description	**Method**	**Units**				
Dilute Acid Extraction - Metal						
Mercury	04-002	mg/kg	<0.01	0.01	<0.01	<0.01
Nickel	04-001	mg/kg	2.2	3.5	8.0	4.6

Laboratory Reference:	-	-	/36	/37	/38	/39
Client Reference:	-	-	11-9A	11-9B	11-9C	10-8
Date Sampled:	-	-	02/11/2015	02/11/2015	02/11/2015	02/11/2015
Analysis Description	**Method**	**Units**				
Dilute Acid Extraction - Metal						
Mercury	04-002	mg/kg	0.01	0.01	0.01	0.01
Nickel	04-001	mg/kg	5.2	5.5	5.2	5.5

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Batch Number: A15/5628-D [R00]
Project Reference: Port of Brisbane - Sediments - DAE

Laboratory Reference:	**-**	**-**	**/40**	**/42**
Client Reference:	**-**	**-**	**10-6A**	**10-5**
Date Sampled:	**-**	**-**	**02/11/2015**	**02/11/2015**
Analysis Description	**Method**	**Units**		
Dilute Acid Extraction - Metal				
Mercury	04-002	mg/kg	0.01	<0.01
Nickel	04-001	mg/kg	6.0	6.4

Method	Method Description
04-002	Mercury by CVAAS, mg/kg
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.

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Batch Number: A15/5628-D [R00]
Project Reference: Port of Brisbane - Sediments - DAE

QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Mercury	mg/kg	<0.01	A15/5628-A-4	<0.01 || <0.01	A15/5628-A-4	104%
Nickel	mg/kg	<0.1	A15/5628-A-4	12 || 12 || RPD: 0	A15/5628-A-4	91%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mercury	mg/kg	[NT]	A15/5628-A-32	<0.01 || <0.01
Nickel	mg/kg	[NT]	A15/5628-A-32	8.0 || 7.8 || RPD: 3

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: 30%
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: A15/5628-E [R00]

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

Contact: Brad Grant

Order No:
Project: Port of Brisbane - Sediments - Elutriate
Sample Type: Sediment
No. of Samples: 47
Date Received: 02/11/2015
Date Completed: 3/12/2015

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: A15/5628-E [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

Laboratory Reference:	-	-	/3	/4	/5	/7
Client Reference:	-	-	4-4	4-0	5-0	5-1A
Date Sampled:	-	-	29/10/2015	29/10/2015	29/10/2015	29/10/2015
Analysis Description	**Method**	**Units**				
Elutriate - Metals						
Mercury	04-002	µg/L	<0.1	<0.1	<0.1	<0.1
Nickel	04-015	µg/L	<3	4.4	6.2	<3

Laboratory Reference:	-	-	/8	/11	/20	/25
Client Reference:	-	-	5-1B	6-2A	13-9	13-4A
Date Sampled:	-	-	29/10/2015	29/10/2015	30/10/2015	30/10/2015
Analysis Description	**Method**	**Units**				
Elutriate - Metals						
Mercury	04-002	µg/L	<0.1	<0.1	<0.1	<0.1
Nickel	04-015	µg/L	<3	3.8	<3	<3

Laboratory Reference:	-	-	/26	/28	/32	/34
Client Reference:	-	-	13-4B	13-1	12-2	11-5
Date Sampled:	-	-	30/10/2015	30/10/2015	02/11/2015	02/11/2015
Analysis Description	**Method**	**Units**				
Elutriate - Metals						
Mercury	04-002	µg/L	<0.1	<0.1	<0.1	<0.1
Nickel	04-015	µg/L	<3	<3	3.5	<3

Laboratory Reference:	-	-	/36	/37	/38	/39
Client Reference:	-	-	11-9A	11-9B	11-9C	10-8
Date Sampled:	-	-	02/11/2015	02/11/2015	02/11/2015	02/11/2015
Analysis Description	**Method**	**Units**				
Elutriate - Metals						
Mercury	04-002	µg/L	<0.1	<0.1	<0.1	<0.1
Nickel	04-015	µg/L	<3	<3	<3	<3

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Batch Number: A15/5628-E [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

Laboratory Reference:	**-**	**-**	**/40**	**/42**	**/47**
Client Reference:	**-**	**-**	**10-6A**	**10-5**	**Elutriate Blank**
Date Sampled:	**-**	**-**	**02/11/2015**	**02/11/2015**	**NA**
Analysis Description	**Method**	**Units**			
Elutriate - Metals					
Mercury	04-002	µg/L	<0.1	<0.1	<0.1
Nickel	04-015	µg/L	<3	<3	<3

Method	Method Description
04-002	Mercury by CVAAS, mg/kg
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.
Radionuclides (Gross Alpha/Beta Analysis) was subcontracted to
Western Radiation Services (NATA # 14174);
reference report number xxxx Western Radiation.pdf
Analysis was subcontracted to Sydney Analytical Laboratories (NATA Number 1884);
reference SAL report number SAL25718.
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 .

If the moisture factor was greater than 2.5 the LOR has been raised by a factor 2 for Organic Tests.

For TBT analysis, there is suspected sample matrix interference and heterogenity for sample 2.

For OC analysis, LORs have been raised for DDT and endrin aldehyde due to sample matrix interference.

- Spike recovery for Al and Fe could not be accurately determined due to a significant
background analyte concentration.

Trace elements RPD duplicate failed for sample one for Copper, Lead and Zinc. Sample eleven for Cadmium. This was due to sample heterogen

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Batch Number: A15/5628-E [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Mercury	µg/L	<0.1	A15/5628-E-3	<0.1 || <0.1	A15/5628-E-4	89%
Nickel	µg/L	<0.10	A15/5628-E-3	<3 || <3	A15/5628-E-4	122%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mercury	µg/L	[NT]	A15/5628-E-32	<0.1 || <0.1
Nickel	µg/L	[NT]	A15/5628-E-32	3.5 || <3

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mercury	µg/L	[NT]	[NT]	[NT]
Nickel	µg/L	[NT]	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mercury	µg/L	[NT]	[NT]	[NT]
Nickel	µg/L	[NT]	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mercury	µg/L	[NT]	[NT]	[NT]
Nickel	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: 30%
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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Appendix D Laboratory Results – Secondary Laboratory

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1533461**	Page	: 1 of 8
Client	: **BMT WBM GROUP LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR BRAD GRANT	Contact	:
Address	: PO BOX 203 SPRING HILL BRISBANE QLD 4004	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: brad.grant@bmtwbm.com.au	E-mail	:
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 B3 & ALS QC Standard
Order number	: ----	Date Samples Received	: 02-Nov-2015 15:00
C-O-C number	: ----	Date Analysis Commenced	: 03-Nov-2015
Sampler	: BRAD HILES, DANIEL MORAN, GRACE BURKE	Issue Date	: 26-Nov-2015 08:35
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.

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
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils Brisbane Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Ryan Story	Inorganic Coordinator	Brisbane External Subcontracting
Satishkumar Trivedi	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.

- **EP131A : Positive result for particular sample #6-2C (EB1533461_2) is confirmed by re-extraction re-analysis.**
- EP090: Sample '6-2C' shows poor matrix spike recovery for MBT due to matrix interference.
- EA150H: Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1 2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently NATA endorsement does not apply to hydrometer results.
- EP132B-SD : Poor duplicate precision due to sample heterogeneity. Confirmed by re-extraction and re-analysis.
- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- 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'.
- Radiological work undertaken by ALS Laboratory Group (Ceska Lipa) under CAI accreditation No. L1163. Report No. PR1576123. NATA and CAI accreditations' are both recognised under ILAC.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	10-6C	6-2C	----	----	----
			Client sampling date / time	[02-Nov-2015]	[29-Oct-2015]	----	----	----
Compound	CAS Number	LOR	Unit	EB1533461-001	EB1533461-002	--------	--------	--------
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**8.4**	----	----	----	----
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	**0.234**	----	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**146**	----	----	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**3.03**	----	----	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**606**	----	----	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**0.97**	----	----	----	----
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	----	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	**0.23**	----	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**146**	----	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	**11**	----	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	**62.4**	**58.6**	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	**9**	**9**	----	----	----
+150µm	----	1	%	**6**	**7**	----	----	----
+300µm	----	1	%	**3**	**4**	----	----	----
+425µm	----	1	%	**1**	**3**	----	----	----
+600µm	----	1	%	<1	**2**	----	----	----
+1180µm	----	1	%	<1	**2**	----	----	----
+2.36mm	----	1	%	<1	**1**	----	----	----
+4.75mm	----	1	%	<1	<1	----	----	----
+9.5mm	----	1	%	<1	<1	----	----	----
+19.0mm	----	1	%	<1	<1	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	10-6C	6-2C	----	----	----
				Client sampling date / time	[02-Nov-2015]	[29-Oct-2015]	----	----	----
Compound	CAS Number	LOR	Unit		EB1533461-001	EB1533461-002	--------	--------	--------
					Result	Result	Result	Result	Result
EA150: Particle Sizing - Continued									
+37.5mm	----	1	%		<1	<1	----	----	----
+75.0mm	----	1	%		<1	<1	----	----	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		46	46	----	----	----
Silt (2-60 µm)	----	1	%		36	36	----	----	----
Sand (0.06-2.00 mm)	----	1	%		17	16	----	----	----
Gravel (>2mm)	----	1	%		1	2	----	----	----
Cobbles (>6cm)	----	1	%		<1	<1	----	----	----
EG005-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		32400	29500	----	----	----
Iron	7439-89-6	50	mg/kg		51300	49100	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1	mg/kg		8.50	7.36	----	----	----
Cadmium	7440-43-9	0.1	mg/kg		<0.1	0.1	----	----	----
Chromium	7440-47-3	1	mg/kg		51.9	50.4	----	----	----
Copper	7440-50-8	1	mg/kg		30.0	38.1	----	----	----
Lead	7439-92-1	1	mg/kg		18.0	20.4	----	----	----
Nickel	7440-02-0	1	mg/kg		36.8	37.8	----	----	----
Silver	7440-22-4	0.1	mg/kg		0.2	0.1	----	----	----
Zinc	7440-66-6	1	mg/kg		119	132	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.09	0.08	----	----	----
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		1660	----	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		1660	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		1.16	1.14	----	----	----
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	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	10-6C	6-2C	----	----	----
			Client sampling date / time	[02-Nov-2015]	[29-Oct-2015]	----	----	----
Compound	CAS Number	LOR	Unit	EB1533461-001	EB1533461-002	--------	--------	--------
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued								
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	----	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	**0.5**	**1.1**	----	----	----
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	**1.39**	----	----	----
4.4`-DDE	72-55-9	0.5	µg/kg	<0.50	**2.32**	----	----	----
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	**3.71**	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	10-6C	6-2C	----	----	----
			Client sampling date / time	[02-Nov-2015]	[29-Oct-2015]	----	----	----
Compound	CAS Number	LOR	Unit	EB1533461-001	EB1533461-002	--------	--------	--------
				Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued								
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	6	----	----	----	----
Acenaphthene	83-32-9	4	µg/kg	<5	----	----	----	----
Fluorene	86-73-7	4	µg/kg	<5	----	----	----	----
Phenanthrene	85-01-8	4	µg/kg	10	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	10-6C	6-2C	----	----	----
			Client sampling date / time	[02-Nov-2015]	[29-Oct-2015]	----	----	----
Compound	CAS Number	LOR	Unit	EB1533461-001	EB1533461-002	--------	--------	--------
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Anthracene	120-12-7	4	µg/kg	6	----	----	----	----
Fluoranthene	206-44-0	4	µg/kg	31	----	----	----	----
Pyrene	129-00-0	4	µg/kg	57	----	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg	18	----	----	----	----
Chrysene	218-01-9	4	µg/kg	15	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	25	----	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg	12	----	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg	16	----	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg	24	----	----	----	----
Perylene	198-55-0	4	µg/kg	23	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	17	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	14	----	----	----	----
Coronene	191-07-1	5	µg/kg	5	----	----	----	----
^ Sum of PAHs	----	4	µg/kg	279	----	----	----	----
Radionucleides / Activity								
Gross alpha	----	500	Bq/kg DW	670	----	----	----	----
Gross beta	----	500	Bq/kg DW	<500	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	91.1	----	----	----	----
Toluene-D8	2037-26-5	0.2	%	92.7	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%	103	----	----	----	----
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	86.0	85.2	----	----	----
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.5	%	54.4	68.2	----	----	----
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.5	%	48.4	----	----	----	----
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	106	----	----	----	----
Anthracene-d10	1719-06-8	10	%	124	----	----	----	----
4-Terphenyl-d14	1718-51-0	10	%	118	----	----	----	----

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