BAE SYSTEMS

BAE Dredging Project Support and Consultancy Services

Sediment Quality Assessment Report

301012-01750

18/06/13

Level 7, QV1 Building
250 St Georges Terrace
Perth WA 6000 Australia
Tel: +61 8 9278 8111
Fax: +61 8 9278 8110
www.worleyparsons.com
WorleyParsons Services Pty Ltd
ABN 61 001 279 812

WorleyParsons
resources & energy

BAE SYSTEMS

BAE SYSTEMS
BAE DREDGING PROJECT SUPPORT AND CONSULTANCY SERVICES
SEDIMENT QUALITY ASSESSMENT REPORT

Disclaimer

This report has been prepared on behalf of and for the exclusive use of BAE Systems, and is subject to and issued in accordance with the agreement between BAE Systems and WorleyParsons. WorleyParsons accepts no liability or responsibility whatsoever for it in respect of any use of or reliance upon this report by any third party.

Copying this report without the permission of BAE Systems or WorleyParsons is not permitted.

PROJECT 301012-01750 - BAE DREDGING PROJECT SUPPORT AND CONSULTANCY SERVICES

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
0	Issued for Use	N Willson	H Houridis	A Blanksby	18/06/13	N/A	

CONTENTS

BAE Dredging Project Support and Consultancy Services i
1. EXECUTIVE SUMMARY 1
2. INTRODUCTION 2
  2.1 Objectives 2
3. DESCRIPTION OF PROPOSED DREDGING 3
4. REVIEW OF EXISTING INFORMATION 5
  4.1 Site condition 5
  4.2 Geotechnical conditions 5
  4.3 Previous relevant studies 5
  4.4 Benthic habitat 7
5. SAMPLING AND ANALYSIS 8
  5.1 Sampling design and rationale 8
  5.2 Contaminants list 8
  5.3 Sampling locations 9
  5.4 Sampling procedures 11
    5.4.1 Sample processing 11
    5.4.2 Laboratory analysis 12
  5.5 Quality control – field sampling 13
  5.6 Quality control – laboratory 14
  5.7 Data analysis 15
6. RESULTS 17
  6.1 Chemical 17
    6.1.1 Trace metals 17
    6.1.2 TBT 19
    6.1.3 TBT Leachability 19
    6.1.4 Particle Size 20

7. QUALITY ASSURANCE/ QUALITY CONTROL 21
  7.1 Field triplicates and split triplicates........ 21
    7.1.1 Split triplicates 21
    7.1.2 Field triplicates 21
  7.2 Holding times........ 23
  7.3 Laboratory quality control assurance 23
    7.3.1 Laboratory blanks........ 23
    7.3.2 Laboratory duplicates 23
    7.3.3 Matrix spikes........ 23
8. CONCLUSIONS 25
9. REFERENCES........ 26

Appendices

Appendix 1 - Sampling and Analysis Plan
Appendix 2 - Site Description Sheet and Sediment Log
Appendix 3 - Raw results
Appendix 4 - Sediment log and photos
Appendix 5 - Laboratory QA/QC results

1. EXECUTIVE SUMMARY

WorleyParsons was commissioned by BAE Systems to undertake a sediment quality assessment to assess the suitability of sediments for dredging and disposal to land. BAE Systems propose to expand the facilities on the site at Henderson Point and develop the waterfront infrastructure including a 75 metre wharf. The area around the wharf requires the dredging of approximately 22,500m^3 of sediment.

The preferred method of dredging is based on using a backhoe dredge (BHD), loading sediment onto barge(s) which will then be unloaded onshore. The dredge material will be unloaded from the barges using crane mounted grab equipment and stockpiled onshore.

Sediment quality of sediments were sampled and assessed in accordance with the requirements of the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia 2009). Their suitability for disposal to land was assessed against adopted EIL and HIL criteria for re-use on site (DEC 2010).

The assessment confirmed that metal concentrations were low and well below the relevant sediment quality criteria. The concentration of TBT was generally low but slightly higher than the recommended screening level at three of the sites tested. These were resubmitted for leachability assessment to assess the risk to groundwater quality and nearshore marine water within Cockburn Sound. All samples were below the 90 percent ecological protection level (0.02 µg/L Sn) (ANZECC/ARMCANZ 2000).

Based on these findings, there will be no impediment to using this material as fill on-site as all sediment concentrations were below relevant assessment criteria. Sediment is also likely to be suitable for disposal to landfill to a Class I landfill facility if offsite disposal is required.

2. INTRODUCTION

WorleyParsons was commissioned by BAE Systems to undertake a sediment quality assessment to assess the suitability of sediments for dredging and disposal to land.

BAE Systems operate a 14.5 hectare waterfront facility within the Australian Marine Complex shipyard at Henderson. The site is immediately adjacent to Cockburn Sound, approximately 22 km southwest of Perth, Western Australia. The shipyard is used for the construction, repair and maintenance of defence and commercial vessels.

BAE Systems propose to expand the facilities on the site at Henderson and develop the waterfront infrastructure including a 75 metre wharf. The area around the wharf requires the dredging of approximately 22,500m^3 of sediment. Further details of the dredging are outlined in Section 3.

Sediment quality of sediments were sampled and assessed in accordance with the requirements of the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia 2009). Their suitability for disposal to land was assessed against adopted EIL and HIL criteria for re-use on site.

2.1 Objectives

The principal aim of the study is to assess the quality of marine sediments and their suitability for dredging and disposal. More specifically, the objectives of this report are to:

- analyse sediments for a range of physical and chemical properties;
- provide comparison of chemical concentrations against the NAGD Screening Levels and other relevant guidelines;
- determine the suitability of dredged sediment for use as fill onsite; and to
- determine the suitability of dredged sediment for disposal offsite.

3. DESCRIPTION OF PROPOSED DREDGING

BAE require dredging and disposal of capital dredged material to be carried out as part of waterfront expansion at the Henderson site at Cockburn Sound. To allow access to the new wharf, dredging is required to create a navigable area with a draft of – 6.0m. The dredge footprint is 13,000 m^2 with a total dredge volume of approximately 22,500m^3 (see Figure 1). Dredging is proposed to take approximately 4 weeks and is currently scheduled for September 2013.

The preferred method of dredging is based on using a backhoe dredge (BHD), loading sediment onto barge(s) which will then be unloaded onshore. The dredge material will be unloaded from the barges using crane mounted grab equipment and stockpiled onshore.

It is proposed all material dredged will be disposed of onshore, with some of the material used as backfill for the land-backed wharf at the rear of the new berth. It is estimated that 13,500 m^3 of dredge spoil can be used for this purpose. The remainder of the dredge material is expected to be used for hardstand levelling and maintenance purposes on the project site, depending on volumes of backfill required and the suitability of dredged material.

.

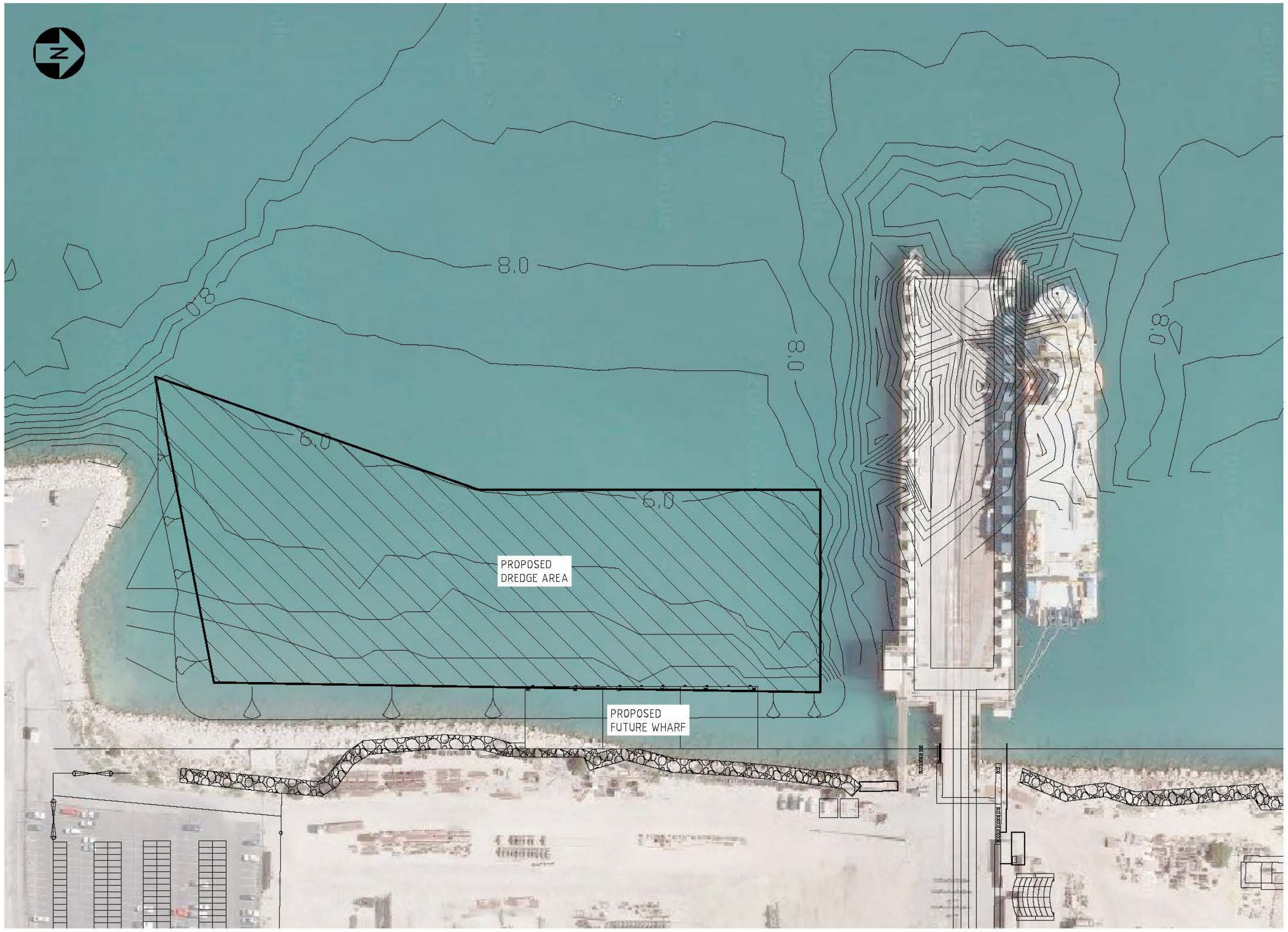


Figure 1: Proposed dredge footprint, BAE Systems Henderson shipyard, Cockburn Sound

4. REVIEW OF EXISTING INFORMATION

4.1 Site condition

The site has been a working shipyard since the 1960's. The infrastructure includes dry berths, administration buildings and bitumen car parks. The area surrounding the project site is for industrial use. The soil and sediment at the project site has been contaminated by waste from the removal and reapplication of antifouling treatments (AEC Environmental 2011b). Further details on the types of contaminants are outlined in Section 5.2.

4.2 Geotechnical conditions

The geology underlying the site is surficial sediments overlying limestone and calcrete of the Quaternary Age (AEC Environmental 2011b). A benthic mapping survey in 2004 also confirmed the presence of limestone bedrock (DALSE 2004).

4.3 Previous relevant studies

Sediment, soil and groundwater monitoring was undertaken quarterly between 2005 and 2010 under the Department of Conservation (DEC) licence conditions (Environmental Protection Act 1986 Licence No 5897/9) (AEC Environmental 2011b). The results for marine sediments were assessed against the Revised Environmental Quality Criteria (EQC) for Cockburn Sound (EPA 2005).

Sediment within and around the dredge footprint was monitored quarterly for metals, TBT and diuron at 14 locations during 2005 to 2010 (Figure 2) (AEC Environmental 2011a). All metals and contaminants were below the Cockburn sounds EQC guideline levels (EPA 2005) except:

- Copper at site T06 was consistently above the guideline;
- Nickel and zinc exceeded the guideline at site T07 in the April 2007 monitoring event;
- TBT in the majority of locations; and
- In March 2005, T09 had exceedences for all metals except for lead. This is thought to be an isolated contamination caused by a heavy ship being unloaded at the port.

Zinc, copper and TBT were also present in groundwater and soil samples recorded between 2005 and 2010 (AEC Environmental 2011a).

Figure 2: Sediment monitoring locations 2005 to 2010 (reproduced from (URS 2009))

An additional sediment study was carried out in 2010 as part of a baseline site investigation (AEC Environmental 2011a). Five sediment sample sites were analysed for metals and metalloids, pH and TBT. These sample sites were parallel to the shoreline at a distance of approximately 1 metre, in close proximity to sites T05, T07, T08 and T11 (Figure 2). The results were compared to the ANZECC low and high Interim Sediment Quality Guidelines (ISQG's) (ANZECC/ARMCANZ 2000). ISQG-low is a threshold level at which adverse environmental impacts are unlikely to occur. ISQG-high levels are threshold levels at which adverse environmental impacts are more likely to occur. Across the sites, copper exceeded the ISQG-low and TBT exceeded the ISQG-high trigger levels.

4.4 Benthic habitat

No benthic primary producer habitat or other significant habitat type is present within or adjacent to the dredge footprint. The seabed in the dredge footprint is bare sediment. Benthic habitats in the broader Cockburn Sound are shown in Figure 3.

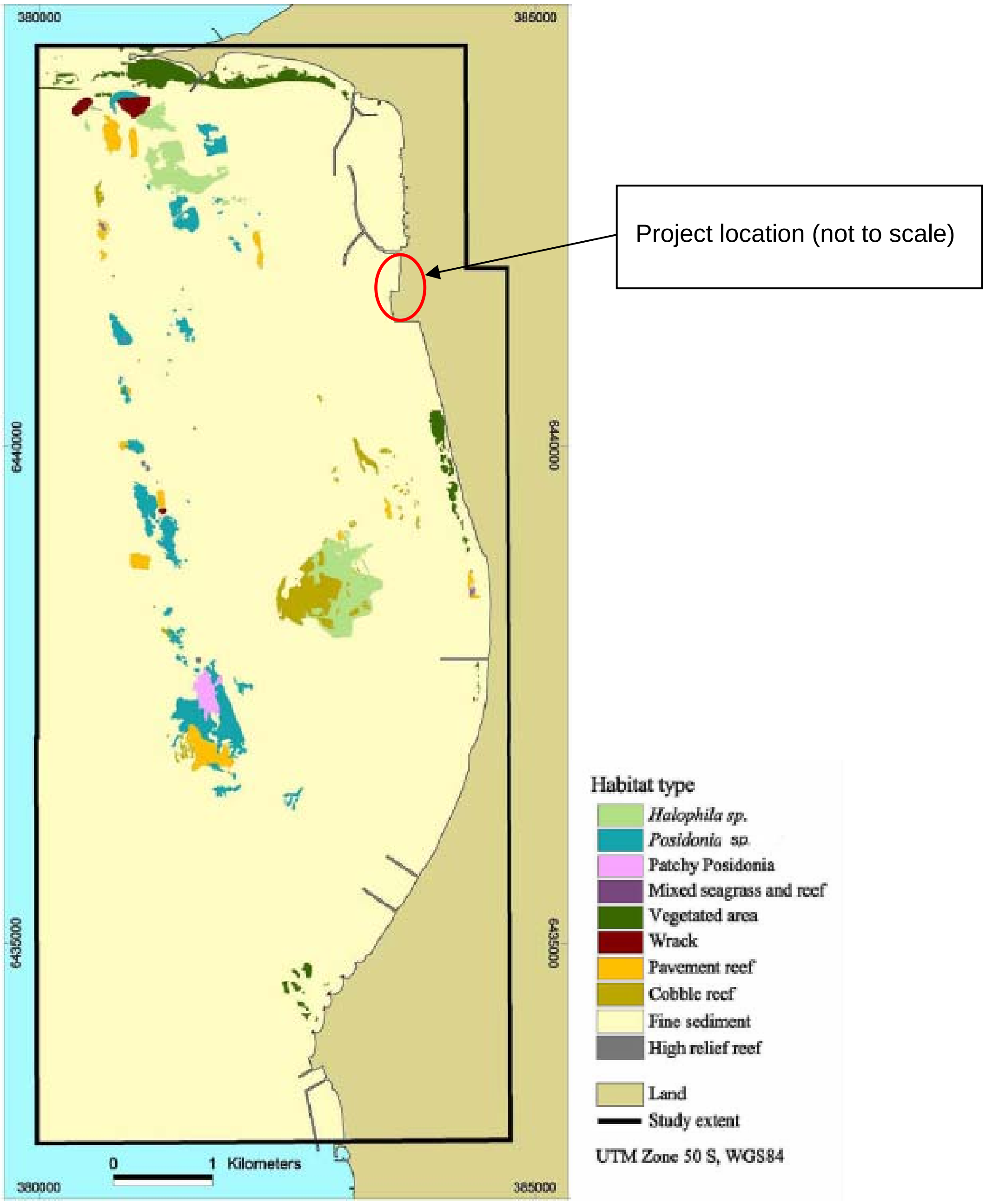


Figure 3: Benthic habitat

(reproduced from (DALSE 2004))

5. SAMPLING AND ANALYSIS

A sampling and analysis plan (SAP) for the project was prepared by WorleyParsons on behalf of BAE (Appendix 1 -) and executed on the 24th April 2013.

5.1 Sampling design and rationale

The dredge volume for safe access to the wharf is approximately 22,500 m^3 over an area of 13,000 m^2.

As the proposed dredging is capital in nature, the number of sample locations is based on the layer of recent sediments which could be contaminated and does not include the volume of underlying natural geological materials which are likely to be uncontaminated. Based on up to 1 m of soft surface sediments being potentially contaminated, the relevant volume for sample number determination is estimated at 13,000 m^3.

Sediments to be dredged were classified as ‘probably contaminated’ on the basis that the dredge area is located in an area that has previously been identified as containing sediment contaminated with some heavy metals and TBT.

Additional physical and chemical information for characterisation of sediments to full dredge depth has been collected as part of a geotechnical investigation separate to the proposed sediment quality investigation and is reported elsewhere (WorleyParsons, in prep).

5.2 Contaminants list

Appendix A (page 27) of the NAGD requires that a potential contaminants list be developed and 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 historical review, substances potentially present at such levels in the sediments to be dredged.

Previous investigations at the project site indicate that TBT, copper, nickel and zinc are the main contaminants of potential concern (AEC Environmental 2011b). While all other contaminants were below screening levels, a number of metals were recorded above their respective detection limits and were included in the potential contaminants list. Particle size distribution has also been included to provide physical characterisation of surface sediments within the dredge footprint.

For clarity, the following parameters comprise the list of physical and chemical analytes that were analysed.

Based on contaminants of concern found during previous investigations and NAGD guidelines (Commonwealth of Australia 2009, AEC Environmental 2011b,) the contaminants list proposed for analysis was:

- metals and metalloids:
  - arsenic (As)
  - chromium (Cr)
  - copper (Cu)
  - lead (Pb)
  - nickel (Ni)
  - zinc (Zn)
- organics:
  - organotins (TBT);
- total organic carbon; and
- particle size distribution (to 2 µm);

5.3 Sampling locations

The number of sample locations required was determined using Table 6 of the NAGD (Commonwealth of Australia 2009). A total number of 8 sampling locations have been calculated for the dredge footprint as shown in Figure 4 . Sampling locations were chosen at random within the dredge footprint. Table 1 provides a list of the GPS coordinates of the sampling locations. All samples were collected using a Van Veen grab.

Table 1: Sampling sites

Site	Latitude	Longitude
S1	- 32.15488	115.76550
S2	- 32.15499	115.76566
S3	- 32.15531	115.76564
S4	- 32.15470	115.76510
S5	- 32.15500	115.76500
S6	- 32.15580	115.76556
S7	- 32.15566	115.76551
S8	- 32.15580	115.76490

Figure 4: SAP sampling locations

5.4 Sampling procedures

Surface samples were retrieved using a Van Veen grab from a 6.4m commercial vessel. The sampling was led by a suitably qualified environmental scientist/ engineer with experience in the application of the NAGD and sediment quality assessments. The vessel was anchored at each sampling location prior to sampling. Each sampling location was recorded on a handheld GPS.

Any potential contaminants, e.g lead diving weights, antifoulants, fuels and oils and sunscreen) were removed from the sampling area prior to mobilisation to minimise the potential for cross contamination of samples. The sample processing area was cleaned with a decontamination solution (Decon 90) and rinsed with seawater prior to sampling.

5.4.1 Sample processing

Sediment samples were logged and processed onboard the sampling vessel. At each sample location a site description sheet was completed to document sample collection and sediment descriptions (Appendix 2). The following information was collected:

- Name of client;
- Sampling date;
- General location number and sample identifiers assigned;
- Name of the sample collector;
- Type of sampler used;
- Weather conditions at the time of sampling;
- Sea state at the time of sampling;
- General comments (eg level of shipping traffic etc);
- GPS location;
- Time of sampling;
- Water depth at each sampling location; and
- Photograph of each sediment sample.

A sediment log of each core was recorded on a field data sheet, providing a description of the composition of each sample which included the following information (Appendix 2):

- Colour;

- Field texture;
- Observed sand grain size;
- Plasticity;
- Moisture content of sample;
- Consistency;
- % stones;
- Presence of shell/shell grit; and
- Odour (eg marine, sulphurous).

Sample handling on-board the vessel included sediment description logging, sample homogenisation, and preparation for dispatch to analytical laboratories (ALS and Advanced Analytical Laboratories) under Chain-of-Custody (CoC) documentation. Samples were homogenised in Pyrex mixing bowls using powderless latex gloves. A table of containers used for samples is provided in Table 2. Sample containers were labelled using indelible ink to record the sample location number and date, stored in eskies with ice packs for until dispatched to the testing laboratories (Advanced Analytical Australia) for analysis.

Table 2: Sample containers

Analyte	Containers
Metals	1 x 500 ml solvent washed, glass jar with a Teflon lined lid
TBT	1 x 500 ml solvent washed, glass jar with a Teflon lined lid
Particle size	1 x 250 ml ziplock plastic bag to hold a minimum of 500 g sample

5.4.2 Laboratory analysis

Table 3 provides a summary of details regarding the laboratory method information for the suite of whole sediment analyses that were undertaken. All limit of reporting (LOR) concentrations met the practical quantitation limits in accordance with NAGD.

Table 3: Analytical method information for sediments

Activity/test	Method reference	Method summary	PQL
Moisture content	EA055: In house	Oven-dry overnight, measure weight before and after drying	1%
Particle size distribution	Sieve and hydrometer	Sieve and hydrometer	To 2um
Total organic carbon	Handbook of soil & water	Dilute acid treatment, high temperature dry combustion, infrared detection.	0.02%
Organotins (TBT)	EP090	Acidified solvent extraction, ethylation, derivitisation, GC/MS (EI mode)	0.5 ug Sn/kg
Trace metals	EG020SD	Nitric/hydrochloric acid digestion, ICPMS	1.0 mg/kg
TBT leachate test	EN60a EN60-DIa	AS4439.3 Preparation of Leachates	2ngSn/L
Soluble organotin (TBT) compounds	EP090	Sample extracts are analysed by GC/MS coupled with high volume injection and quantification is by comparison against an established 5 point calibration curve.	0.1%

5.5 Quality control – field sampling

Quality Control during sampling was ensured by:

- using suitably qualified environmental staff experienced in sediment sampling, field supervision and sediment logging;
- logs were completed for each sample collected including time, location, initials of sampler, duplicate type, chemical analyses to be performed and site observations;

- chain of custody forms identifying (for each sample) the sampler, nature of the sample, collection date and time, analyses to be performed, sample preservation method and time samples were relinquished;
- using a surveyed vessel which is thoroughly inspected and washed down;
- samples contained in appropriately cleaned, pre-treated and labelled sample containers;
- samples kept cool (4°C) using ice after sampling and transported to laboratories in eskies with pre-frozen ice bricks;
- transportation of samples under CoC documentation;
- additional QC samples to be generated in accordance with the NAGD (refer Section 5.6 below);
- all field QC duplicate/triplicate samples are to be 'blind' labelled in the field with QC field numbers which do not relate to sampling location names; and
- all sampling equipment, including mixing bowls etc. were decontaminated between sampling locations using a decontamination procedure involving a wash with ambient seawater and a laboratory grade detergent, and successive rinsing with deionised water; or by a similarly acceptable method.

5.6 Quality control – laboratory

ALS was used as the primary laboratory and are NATA-accredited for the methods used for analysis of marine sediments and for all chemicals analysed in this investigation. Consistent with NAGD requirements, the following quality control measures were implemented:

- Collection of field triplicates (3 separate samples taken at the same location) at 10% of sites, to determine the variability of the sediment physical and chemical characteristics; and
- Collection of split triplicates (1 sample split into 3 containers) at 5 percent of sites, to assess variation in results between laboratory analysis method and process and variation between laboratory associated with sub-sample handling.

One field triplicate (i.e. three separate samples collected in the field at the same sampling location) was collected to test for sediment homogeneity. Contaminant results were compared through calculation of the Relative Standard Deviation (RSD). The NAGD states that the RSD for field triplicates should be within 50 percent.

Split triplicates (intra laboratory) are samples that are split from the same original sample into three samples and one sample submitted to a secondary laboratory for analysis. Contaminant concentrations are compared between the two split samples through calculation of the

Relative Percent Difference (RPD). The RPD value provides an indication of the accuracy of laboratory analysis between samples. The NAGD states that the relative percent difference (RPD) for duplicate split samples should be within 35 percent.

Inter-batch duplicates to determine analytical variation between batches were not collected as the samples were collected in one batch.

A summary of samples and QA samples is presented in Table 4.

Table 4: QA samples

Site	Field triplicate	Split triplicate
S1		
S2		
S3		
S4		
S5	X	
S6		X
S7		
S8		

The analytical laboratory complied with the laboratory and quality assurance procedures specified in Appendix A and Appendix F of the NAGD (Commonwealth of Australia 2009).

5.7 Data analysis

Contaminant levels for sediments were compared against the following guidelines:

- the NAGD Screening Level concentrations listed in Appendix A, Table 2 of the NAGD (Commonwealth of Australia 2009) to assess marine sediment quality;
- Ecological Investigation Level (EIL) and Health Investigation Level for residential use (HIL_A) in the ‘Assessment Levels for Soil, Sediment and Water’ (DEC 2010) to assess the suitability of dredged material placed onshore. The use of the HIL-A is to provide a conservative approach to the assessment of sediments for onshore disposal. The project site is in an area designated for industrial use under HIL-F, which is a far less conservative HIL than HIL-A;

- Environmental quality criteria reference document for Cockburn Sound (2003-2004), (EPA 2005)
- ANZECC/ARMCANZ guidelines (ANZECC/ARMCANZ 2000) to identify potential toxic impacts from onshore disposal of sediments and discharges to the marine environment or groundwater. The ANZECC guidelines include the ISQG-low and ISQG-high assessment levels. The ISQG-low level is a threshold below which the frequency of adverse effects is expected to be very low. The ISQG-high level is a threshold above which adverse biological effects are expected to occur more frequently.

The comparison against guideline levels involves the comparison of mean contaminant concentrations at the 95 percent upper confidence level (UCL) of the mean. For the purposes of calculation of 95 percent UCLs, values below detection limits were set to half of the LOR in accordance with NAGD recommendations.

The methods used to calculate the 95 percent UCLs were based on those required in Appendix A of the NAGD. Normality of datasets was determined using Shapiro-Wilks test and quantile-quantile plots in ProUCL Version 4.1 (4.1.01). Datasets were determined as being normal, log-normal or neither in their distributions. Normal datasets were analysed using the 1-tailed Student’s ‘t’ UCL. Log-normal datasets were analysed using non-parametric jacknife analysis as recommended in the NAGD. Similarly, datasets that were neither normal nor log-normally distributed were analysed using non-parametric jacknife analysis.

Where results were recorded above the NAGD screening levels, EIL’s or HIL-A’s a further phase of testing will be initiated. As it is proposed sediment will be disposed of onshore, Australian Standard Leaching Procedure (ASLP) testing, as set out in the ‘Landfill Waste Classification and Waste Definitions (DEC 2006/ 2009) was undertaken on all results above the NAGD screening level, the most conservative of the guidelines listed above. This test is designed to measure analyte levels that could potentially leach into the aquatic environment.

6. RESULTS

All laboratory results are presented in full in Appendix 3. Photos and the sediment quality log are included in Appendix 4. All COC documentation and laboratory QA/QC reports are included in Appendix 5.

6.1 Chemical

6.1.1 Trace metals

Metal concentrations (arsenic, chromium, copper, lead, nickel and zinc) were all below the NAGD screening levels, DEC EIL levels and HIL-A levels at all sampling sites.

The 95 percent UCL of all metals were also below the NAGD screening levels, DEC EIL levels and HIL-A levels.

Results for arsenic, nickel and lead were similar to the levels found in the baseline investigation (AEC Environmental 2011a). Copper and zinc results were generally lower than levels found during the baseline investigation.

All metal results are presented in Table 5.

Table 5: Individual metal results and 95 percent UCLs

Analyte	Moisture Content	Arsenic	Chromium	Copper	Lead	Nickel	Zinc
Unit of measurement	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
PQL	0%	1	1	1	1	1	1
NAGD Screening Level	N/A	20	80	65	50	21	200
EIL Screening Level	N/A	20	N/A	100	600	60	200
HIL-A Screening Level	N/A	100	N/A	1,000	300	600	7,000
Sampling Site							
S1	27.3	2.22	8.9	5.8	2.4	0.5	10.6
S2	26.3	2.6	9.1	6.7	2.3	0.5	8.9
S3	27.3	1.56	7.6	7	2.8	0.5	17.1
S4	26.4	2.12	7.8	10.6	2.8	0.5	11.9
S5	32.8	2.49	11.4	8.4	3.8	0.5	18.6
S6	28.5	2.22	11.5	7.4	2.3	2.5	13.1
S7	29.2	2.2	10.5	7.7	2.8	2.5	14.7
S8	32.2	1.78	9.9	4.9	2.8	2.5	11.9
Mean	28.75	2.14875	9.5875	7.3125	2.75	1.25	13.35
Standard Deviation	2.52	0.34	1.50	1.72	0.48	1.04	3.28
95% UCL	**30.44**	**2.377**	**10.59**	**8.465**	**3.074**	**0.493**	**15.54**

6.1.2 TBT

Non-normalised TBT levels ranged between 3.1 and 16.9 µg Sn/kg. The 95 percent UCL (12.05 µg Sn/kg) was above the NAGD screening level (9 µg Sn/kg). The TBT results were closer to the ISQ- low level (5 µg Sn/kg), than the ISQG-high level (70 µg Sn/kg), indicating a low likelihood of adverse effects (to marine species). TBT results are presented in Table 6, with exceedences highlighted in yellow. All samples that exceeded the NAGD screening level were analysed for leachability. This was intended to assess the risk to groundwater if sediments were disposed onshore (see Section 5.7).

Table 6: TBT concentrations (non-normalised) individual site and 95% UCL results

Analyte	**TBT**	**TOC**
Unit of measurement	µg Sn/kg	%
PQL	0.5	0.02
NAGD Screening Level	9	N/A
ISQG-Low Level	5#	N/A
ISQG-High Level	70^	N/A
Sampling Site		
S1	7.8	0.18
S2	7.1	0.19
S3	13.1	0.28
S4	5.6	0.24
S5	5.2	0.50
S6	16.9	0.18
S7	12.3	0.24
S8	3.1	0.34
Mean	8.88	0.27
Standard Deviation	8.91	0.11
95% UCL	12.05	0.44

No EIL for TBT - ISQG low (ANZECC/ARMCANZ 2000)

^ No HIL for TBT - ISQG high (ANZECC/ARMCANZ 2000)

6.1.3 TBT Leachability

Sediment samples exceeding the NAGD screening level for TBT were analysed for leachability. Leachability was assessed using the ASLP leachate test and the DI (dionised) leachate test. Results for the DI test which are the most relevant are presented in Table 7. ASLP results have also been included in Appendix 3.

All leachability results were below the 90 percent ecological protection level (EPL) (Table 7). The 90 percent EPL is the recommended species protection guideline trigger level for toxicants in the industrial precinct of Cockburn Sound (EPA 2005).

Table 7: TBT leachability concentrations for three sites exceeding NAGD screening levels

Analyte	TBT
Unit of measurement	ng Sn/L
LOR	2
ANZECC/ARMCANZ (2000) 95% EPL	6
ANZECC/ARMCANZ (2000) 90% EPL	20
ANZECC/ARMCANZ (2000) 80% EPL	50
Sampling Site	
S3	13
S6	8
S7	10

6.1.4 Particle Size

All samples sites were dominated by sand (65 - 89%) with an overlying layer of fine silts and clay (11-23%). No sample was retrieved at S4 due to low sample volume.

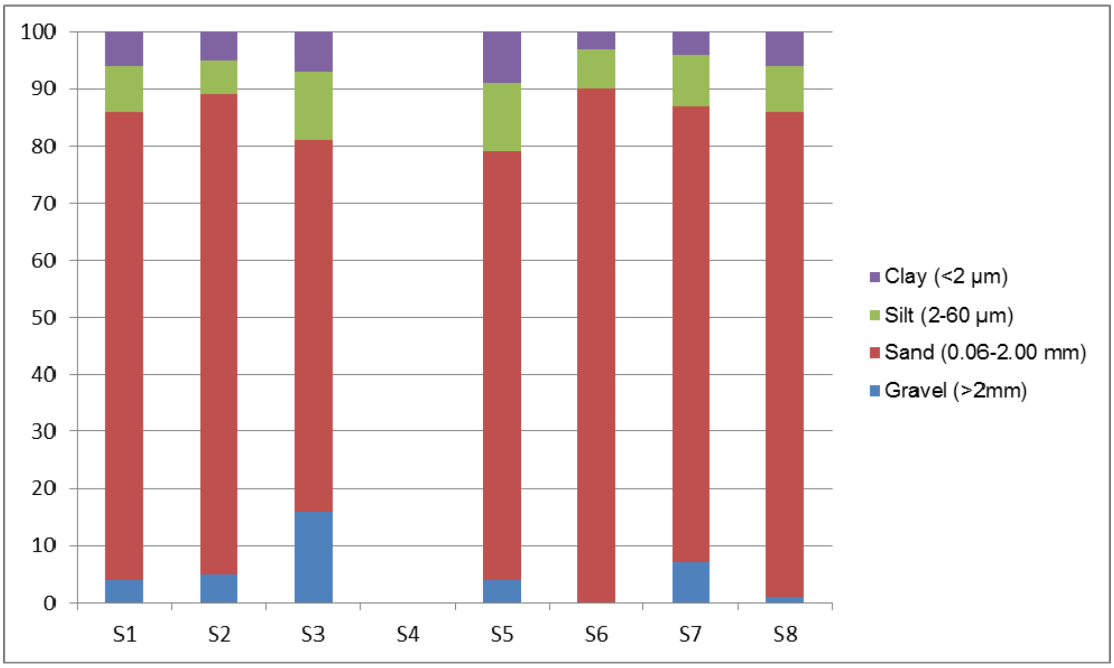


Figure 5: Particle Size Distribution

7. QUALITY ASSURANCE/ QUALITY CONTROL

Field based and laboratory QA/QC procedures were assessed by collecting triplicate samples. Further detail on quality control procedures are detailed in Sections 5.5 and 5.6.

7.1 Field triplicates and split triplicates

7.1.1 Split triplicates

The NAGD states that the RPD for split triplicates should be within 35 percent. Inter laboratory RPDs exceeded the 35 percent guideline level for arsenic, copper, nickel and TBT. The LOR was raised for nickel in the primary laboratory; this would have caused an increase in the RPD in nickel (Table 8). Also, low levels of contaminants, i.e arsenic and lead can exaggerate the RPD.

7.1.2 Field triplicates

The NAGD states that the RSD for field triplicates should be within 50 percent. The RSD for all metals and TBT were below 50 percent (Table 9). This shows that the chemical composition of sediments within the proposed dredge footprint can be considered relatively homogenous.

Table 8: Quality Control results for split triplicates

Sample Type	Site	Moisture Content	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	TBT
Original Sample	S6	28.5	2.22	11.5	7.4	2.3	2.5	13.1	16.9
Split Triplicate	ST1	25	2.03	10.7	7.1	2.4	2.5	14.4	9.6
Split Triplicate	ST2	21.8	3.5	11	13	2.3	0.86	12	7.4
	Inter Lab RPD (%)	**-23.5**	**57.7**	**-4.3**	**75.7**	**0.0**	**-65.6**	**-8.4**	**-56.2**
	Intra Lab RPD (%)	**-12.3**	**-8.6**	**-7.0**	**-4.1**	**4.3**	**0.0**	**9.9**	**-43.2**

Table 9: Quality Control results for field triplicates

Sample Type	Site	Moisture Content	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	TBT
Original Sample	S5	32.8	2.49	11.4	8.4	3.8	0.5	18.6	5.2
Field Triplicate	FT1	28	2.26	10.5	6.6	3.4	0.5	14.2	6.4
Field Triplicate	FT2	46	2.65	13.9	9.4	5.2	0.25	19.9	12.6
	RSD	**26.2%**	**7.9%**	**14.8%**	**17.4%**	**22.9%**	**34.6%**	**17.0%**	**49.2%**

7.2 Holding times

Samples were kept chilled whilst in the field, during storage and delivery, and stored under refrigeration on arrival at each of the laboratories. No holding time breaches were recorded as all sample analyses were undertaken within required holding times specified in the NAGD by the laboratory (Appendix 5).

7.3 Laboratory quality control assurance

The laboratories (AAA and ALS) incorporated a range of QA/QC methods to ensure accuracy of data. These are detailed further below. Analytical quality control data (blanks, duplicates and spiked samples) for the various sediment analyses are contained in the laboratory reports in Appendix 5, including the quality control data for the analytical data.

7.3.1 Laboratory blanks

Laboratory blanks are samples submitted by the laboratory during sample analysis to assist in identifying any cross contamination of samples during laboratory preparation, extraction or analysis. Analysis of laboratory blank samples should result in a concentration not exceeding the detection limit for a particular contaminant. An assessment of laboratory blank samples reported by AAA and ALS demonstrates concentrations below the detection limit for all parameters. Therefore cross contamination of samples does not appear to have occurred.

7.3.2 Laboratory duplicates

The precision of analysis performed by the laboratory is determined by the calculation of the relative percent difference (RPD). The RPD is calculated based on a comparison of an intra-laboratory split of the sample material with results representing the percent difference between the two sample concentrations for a specific contaminant.

Laboratory duplicates in accordance to NATA standards specify no RPD limit for results <10 times the LOR and 0-50 percent limit on results >10 times the LOR. All RPD results were within NATA accreditation criteria for both laboratories. NAGD states that the RPD should be within ±35 percent. All laboratory duplicate RPD results were within the 35 percent RPD guideline.

7.3.3 Matrix spikes

Matrix spikes are undertaken by the laboratory to identify the amount of interference from the sediment matrix on contaminant recovery. Samples collected from the field are split from the base sample and spiked with a known contaminant concentration. The percent recovery of the contaminant is then calculated.

The accuracy of the data is determined through analysis of spiked samples. NAGD recommends that “recovery rates (for matrix spiked samples) should be within the limits specified for the analysis method (typically 75-125 percent)”.

Primary and secondary laboratory matrix spike percent recovery values were within the specified spike recovery range for all metals. The test for the matrix spike for TBT was not determined as reported contaminant concentrations by the laboratory are potentially lower than actual contaminant concentrations found within sediment samples. Appendix 5 contains the laboratory quality control reports and results from both the primary and secondary laboratories.

8. CONCLUSIONS

Based on results of this investigation, the following conclusions are applicable:

- Metal concentrations were generally low and well below the relevant criteria;
- The concentrations of non-normalised TBT in sediment were less than the screening level in five of the eight samples tested. The 95th percentile UCL was also relatively low (12.05 µg Sn/kg) compared to previous findings but slightly higher than the NAGD screening level (9 µg Sn/kg);
- Samples from the three locations containing elevated TBT were resubmitted for leachability assessment to assess the risk to groundwater quality and nearshore marine water and sediment quality within Cockburn Sound. All samples were below the 90 percent ecological protection level (0.02 µg/L Sn) (ANZECC/ARMCANZ 2000);
- There will be no impediment to using this material as fill on-site as all sediment concentrations were below relevant assessment criteria;
- Particle size distribution of sample sediments showed that sand was the dominant fraction confirming that any turbidity generated by dredging is likely to be limited in spatial extent and duration; and
- Sediment is also likely to be suitable for disposal to landfill to a Class I landfill facility if offsite disposal is required.

9. REFERENCES

AEC Environmental (2011a) Baseline Site Investigation BAE Henderson Site Freehold Area.

AEC Environmental (2011b) Preliminary Site Investigation of Henderson Shipyard for BAE Systems.

ANZECC/ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

Commonwealth of Austr alia (2009) National Assessment Guidelines for Dredging. In: Department of the Environment W, Heritage and the Arts (ed), Canberra

DALSE (2004) Benthic Habitat Mapping of the Eastern Shelf of the Cockburn Sound 2004. Prepared for Cockburn Sound Management Council

DEC (2010) Assessment Levels for Soil, Sediment and Water In: Conservation DoEa (ed). Contaminated Sites Management Series

EPA (2005) Environmental Quality Criteria Reference Document for Cockburn Sound.

URS (2009) BAE Systems Henderson Shipyard Historical Trend Analysis. Prepared for BAE Systems

Appendix 1 - Sampling and Analysis Plan

BAE SYSTEMS

Henderson Point Shipyard Dredging

Sediment Sampling and Analysis Plan

301012-01750

20/04/13

Level 7, QV1 Building
250 St Georges Terrace
Perth WA 6000 Australia
Tel: +61 8 9278 8111
Fax: +61 8 9278 8110
www.worleyparsons.com
WorleyParsons Services Pty Ltd
ABN 61 001 279 812

BAE SYSTEMS
HENDERSON POINT SHIPYARD DREDGING
SEDIMENT SAMPLING AND ANALYSIS PLAN

Disclaimer

This report has been prepared on behalf of and for the exclusive use of BAE Systems, and is subject to and issued in accordance with the agreement between BAE Systems and WorleyParsons. WorleyParsons accepts no liability or responsibility whatsoever for it in respect of any use of or reliance upon this report by any third party.

Copying this report without the permission of BAE Systems or WorleyParsons is not permitted.

PROJECT 301012-01750 - HENDERSON POINT SHIPYARD DREDGING

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	HH N Willson	PM H Houridis	PM P Mellor	16/04/13	N/A	
B	Issued for implementation	N Wilson	H Houridis		20/04/13		

CONTENTS

Henderson Point Shipyard Dredging i
ACRONYMS....................1
1. INTRODUCTION 3
  1.1 Objectives 3
  1.2 Description of the Proposed Dredging....................4
2. REVIEW OF EXISTING INFORMATION....................6
  2.1 Site condition 6
  2.2 Geotechnical 6
  2.3 Previous relevant studies....................6
  2.4 Dredge areas, volumes and likely contaminants 8
  2.5 Contaminants list 8
3. SAMPLING AND ANALYSIS....................10
  3.1 Sampling rationale 10
  3.2 Sampling locations....................10
  3.3 Proposed sediment quality attributes for analysis 10
    3.3.1 Sediment characterisation 10
    3.3.2 Elutriate and bioavailability analyses 11
  3.4 Sampling procedures....................11
    3.4.1 Sample processing 12
  3.5 Contingency plan 13
  3.6 Laboratory analysis....................13
  3.7 Sampling and Analysis Quality Control....................14
    3.7.1 Quality Control – Field Sampling 14
    3.7.2 Quality control – analysis 15
  3.8 Analysis of results....................16
    3.8.1 Sediment Analysis for Total Sediment Concentrations....................16
  3.9 Reporting 17

4. REFERENCES 18

Appendices

ACRONYMS

Acronym	Definition
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
DBT	Dibutyltin
DCW	Dampier Cargo Wharf
DEC	Department of Environment and Conservation
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities.
DHLO	Dampier Heavy Load Out Area
DPA	Dampier Port Authority
DTACC	Dampier Technical Advisory and Consultative Committee
DWT	Dead Weight Tonnage
EPA	Environmental Protection Authority
DHLO	Dampier Heavy Load Out
LAT	Lowest Astronomical Tide
LOR	Limit of Reporting
MBT	Monobutyltin
NAGD	National Assessment Guidelines for Dredging
NATA	National Association of Testing Authorities
NODGDM	National Ocean Disposal Guidelines for Dredged Material
NWSV	North West Shelf Venture
PAH	Polycyclic Aromatic Hydrocarbons
PQL	Practical Quantitation Limits
SAP	Sampling and Analysis Plan
SRM	Standard Reference Material
TBT	Tributyltin
TOC	Total Organic Carbon

Acronym	Definition
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
UCL	Upper Confidence Limit

1. INTRODUCTION

BAE Systems operate a 14.5 hectare waterfront facility within the Australian Marine Complex shipyard at Henderson Point. The site is immediately adjacent to Cockburn Sound, approximately 22 km southwest of Perth, Western Australia. The shipyard is used for the construction, repair and maintenance of defence and commercial vessels.

During vessel maintenance activities antifouling treatments are removed and reapplied in one of the five vessel repair dry docks. Removal methods include the use of wet and dry pressure washing methods and sand blasting the hull in dry docks. These treatment removal methods produce waste containing toxic substances. Historically, antifouling treatments contained tributyltin (TBT) or heavy metals such as copper and zinc. Although the use of antifouling treatments containing TBT have been banned in Australia there are still vessels that are coated with antifouling treatments containing TBT that will be maintained and repaired at the site.

The primary environmental concern with the shipyard operations is that contaminants, particularly from antifouling treatments may be introduced to the marine environment. When contaminants are discharged into the marine environment they readily bind with sediment on the seafloor. If this sediment is disturbed, for example, through dredging, contaminants are released into the water column.

BAE want to expand the facilities on the site at Henderson Point and develop the water front infrastructure. The area around the wharf requires the dredging of approximately 20,000m^3 of sediment (Figure 1). Further details of the dredging are outlined in Section 1.2.

This document provides the plan for the sampling and analysis of sediments from the proposed dredging area. This sampling and analysis plan (SAP) is designed to comply with the sampling and analysis requirements of the *National Assessment Guidelines for Dredging* (NAGD), (Commonwealth of Australia 2009).

1.1 Objectives

This SAP aims to develop a set of procedures that will provide a statistically valid representation of the physico-chemical properties of sediments to be dredged, and an assessment of the likely impacts of sea disposal (if this disposal method is chosen) of the dredged sediment. Its specific objectives are to:

- provide a brief summary of the dredging operations relevant to the SAP;
- provide a summary of the land-use activities with the potential to impact on dredged material quality;
- identify a contaminants list for testing of sediments, based on potential contaminant sources and results of prior testing;

- identify the number of samples required to provide an adequate representation of the mean and upper 95 percent confidence interval for the contaminants list analytes;
- develop protocols for the collection and handling of sediment samples for analysis;
- identify the types of analyses to be performed on sediment samples;
- outline quality assurance and quality control (QA/QC) procedures for the collection, handling and laboratory analysis of samples;
- describe statistical techniques to determine the status of potential contaminants within dredged material; and
- prescribe a reporting framework for all data, results and discussion which will address the requirements of BAE Systems and the Determining Authority.

1.2 Description of the Proposed Dredging

BAE require dredging and disposal of capital dredged material to be carried out as part of waterfront expansion at the Henderson Point site at Cockburn Sound. To allow access to the new wharf dredging is required to create a navigable area with a draft of – 6.0m. The dredge footprint is 14,500 m^2 with a total dredge volume of approximately 20,000m^3 (Figure 1).

The preferred method of dredging is based on using a backhoe dredge (BHD) loading onto barge(s) which will be unloaded onshore. Loading and unloading of barges shall be carried out in order to minimise the environmental impact of these operations and meeting the applicable environmental conditions. All dredging must be undertaken to comply with the Project Environmental Management Plan (EMP).

It is proposed all material dredged will be disposed of onshore, with some of the material dredged as backfill for the land-backed wharf at the rear of the new berth and elsewhere on the BAE site, depending on volumes of backfill required and suitability of dredged material.

Figure 1: Proposed dredge footprint, BAE Systems, Cockburn Sound

2. REVIEW OF EXISTING INFORMATION

2.1 Site condition

The site has been a working shipyard since the 1960's. The infrastructure includes dry berths, administration buildings and bitumen car parks (AEC Environmental 2011b). The area surrounding the project site is for industrial use. There has been no previous dredging at the project site. The soil and sediment at the project site has been contaminated by waste from the removal and reapplication of antifouling treatments. Further details on the types of potential contaminants are outlined in Section 2.5.

2.2 Geotechnical

The geology underlying the site is surficial sediments overlying limestone and calcrete of the Quaternary Age (AEC Environmental 2011b). A benthic mapping survey in 2004 also confirmed the presence of limestone bedrock (DALSE 2004).

2.3 Previous relevant studies

Sediment, soil and groundwater monitoring was undertaken quarterly between 2005 and 2010 under the Department of Conservation (DEC) licence conditions (Environmental Protection Act 1986 Licence No 5897/9) (AEC Environmental 2011b). The results for marine sediments were assessed against the Revised Environmental Quality Criteria (EQC) for Cockburn Sound (EPA 2005).

Sediment within and around the dredge footprint was monitored quarterly for metals, TBT and diuron (contaminants associated with hull blasting) at 14 locations during 2005 to 2010 (**Error! Reference source not found.**) (AEC Environmental 2011a). All metals and contaminants were below the Cockburn sounds EQC guideline levels (EPA 2005) except:

- Copper at site T06 was consistently above the guideline;
- Nickel and zinc exceeded the guideline at site T07 in the April 2007 monitoring event;
- TBT in the majority of locations; and
- In March 2005 T09 had exceedences for all metals except for lead. This is thought to be an isolated contamination caused by a heavy ship being unloaded at the port.

Zinc, copper and TBT were also present in groundwater and soil results between 2005 and 2010 (AEC Environmental 2011a).

An additional sediment study was carried out in 2010 as part of a baseline site investigation (AEC Environmental 2011a). Five sediment sample sites were analysed for metals and metalloids, pH and TBT. These sample sites were parallel to the shoreline at a distance of approximately 1 metre, similar to sites T05, T06 and T07 & T11 (**Error! Reference source not found.**). The results were compared to the ANZECC low and high Interim Sediment Quality Guidelines (ISQG's) (ANZECC/ARMCANZ 2000). ISQG-low is a threshold level at which adverse environmental impacts are unlikely to occur. ISQG-high levels are threshold levels at which adverse environmental impacts are more likely to occur. Across the sites, copper exceeded the ISQG-low and TBT exceeded the ISQG-high.

Figure 2: Sediment monitoring locations 2005 to 2010 (reproduced from (URS 2009))

2.4 Dredge areas, volumes and likely contaminants

The dredge volume for safe access to the wharf is approximately 20,000m^3 over an area of 14,500 m^2.

As the proposed dredging is capital in nature, the number of sample locations is based on the layer of recent sediments which *could* be contaminated. Based on up to 1 m of soft surface sediments being potentially contaminated, the relevant volume for sample number determination is 14,500m^3. As the site is potentially contaminated and the dredge volume is low the entire dredge volume of 20,000 m^3 has been used to conservatively estimated the number of samples required (Section 3.2).

2.5 Contaminants list

Appendix A (page 27) of the NAGD requires that a potential contaminants list be developed and 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 historical review, substances potentially present at such levels in the sediments to be dredged.

Previous investigations at the project site indicate that TBT, copper, nickel and zinc are the main contaminants of potential concern (AEC Environmental 2011b, a). While all other contaminants were below screening levels, a number of metals were recorded above their respective detection limits and have been included in the potential contaminants list. Particle size distribution has also been included to provide physical characterisation of surface sediments within the dredge footprint.

For clarity, the following parameters comprise the list of physical and chemical analytes for sediment characterisation.

Based on contaminants of concern found during previous investigations and NAGD guidelines (Commonwealth of Australia 2009, AEC Environmental 2011b, a) the contaminants list proposed for analysis is:

- metals and metalloids:
  - arsenic (As)
  - chromium (Cr)
  - copper (Cu)
  - lead (Pb)
  - nickel (Ni)

  - zinc (Zn)
- organics:
  - organotins (TBT);
- total organic carbon; and
- particle size distribution (to 2 µm).

3. SAMPLING AND ANALYSIS

3.1 Sampling rationale

The sampling and analysis of sediments proposed below complies with the requirements for small sized capital dredging projects (less than 50,000 m^3) in Appendix D of the NAGD.

The number of samples and sample locations has been derived from the NAGD as shown in Table 6 (Appendix D of the NAGD).

3.2 Sampling locations

The number of sample locations is based on the volume of the layer of recent sediments which *could* be contaminated, but does not include the volume of underlying consolidated materials. Based on available current data (from the last past five years), the dredge site is initially classified as *probably contaminated*. As the site is potentially contaminated and the dredge volume is low the entire dredge volume of 20,000 m^3 has been used to conservatively estimated the number of samples required. This will require sampling at a total of eight sampling locations.

Sample locations will be selected at random across the proposed dredge footprint. Locations will be recorded using either an onboard GPS or hand-held GPS that is reliable and accurate to at least +/- 10 m.

3.3 Proposed sediment quality attributes for analysis

3.3.1 Sediment characterisation

For sediment characterisation, the suite of contaminants to be tested includes those identified in the contaminants list as well as the physical characteristics. Table 1 provides the appropriate list of physical and chemical parameters and their associated practical quantitation limits (PQL) for sediment characterisation.

Table 1: Contaminant list and their PQL's

Metals and metalloids:	PQL (mg\Kg)
arsenic (As)	1
chromium (Cr)	1
copper (Cu)	1
lead (Pb)	1

nickel (Ni)	1
zinc (Zn)	1
Organics:	
organotins (TBT)	0.5 µgSn/kg
total organic carbon	0.02%
moisture content	1%
Physical characteristics	
particle size distribution	NA

NA = no stipulated PQL so use lowest limit of reporting available from the chosen laboratory.

3.3.2 Elutriate and bioavailability analyses

Based on previous sampling, exceedence of screening levels at the 95per cent UCL of the may occur for TBT. To minimise the need to recollect material for Phase 3 elutriate and bioavailability testing (if required), enough sample will be collected at each sampling location, and stored in the event that further testing is required.

If elutriate and bioavailability (i.e. dilute acid extraction for metals) testing are required, samples from the locations exceeding the appropriate NAGD screening level will be analysed. According to Table 7 in Appendix D of the NAGD, samples from a minimum of three locations are required for Phase 3 testing (for the given volume of dredging).

.

3.4 Sampling procedures

Grab samples will be retrieved using a Van Veen grab sampler from a 6.4m commercial vessel. The sampling will be led by a suitably qualified environmental scientist with experience in the application of the NAGD and sediment quality assessments. The vessel will be anchored at each sampling location to allow for repeated grabs to be taken, if required. Each sampling location will be recorded on a handheld GPS.

Any potential contaminants, e.g lead diving weights, antifoulants, fuels and oils and sunscreen) will be removed from the sampling area prior to mobilisation to minimise the potential for cross contamination of samples.The sample processing area will be cleaned with a decontamination solution (Decon 90) and rinsed with seawater prior to sampling.

3.4.1 Sample processing

Sediment samples will be logged and processed onboard the sampling vessel. At each sample location a site description sheet will be completed to document sample collection and sediment descriptions (Appendix 1). The following information will be collected:

- Name of client;
- Sampling date;
- General location number and sample identifiers assigned;
- Name of the sample collector;
- Type of sampler used;
- Weather conditions at the time of sampling;
- Sea state at the time of sampling;
- General comments (eg level of shipping traffic etc);
- GPS location;
- Time of sampling;
- Water depth at each sampling location; and
- Photograph of each sediment sample.

A sediment log of each core will be recorded on a field data sheet, providing a description of the composition of each sample which includes the following information (Appendix 2):

- Colour;
- Field texture;
- Observed sand grain size;
- Plasticity;
- Moisture content of sample;
- Consistency;
- % stones;
- Presence of shell/shell grit; and
- Odour (eg marine, sulphurous).

Sample handling on-board the vessel will include sediment description logging, sample homogenisation, and preparation for dispatch to analytical laboratories (ALS and Advanced Analytical Laboratories) under Chain-of-Custody (CoC) documentation. Samples will be homogenised in pyrex mixing bowls using powderless latex gloves. A table of containers used for samples is provided in Table 2. Sample containers were labelled using indelible ink to record the sample location number and date, stored in eskies with ice packs for until dispatched to the testing laboratories (Advanced Analytical Australia) for analysis.

Table 2: Sample containers

Analyte	Containers
Metals	1 x 500 ml solvent washed, glass jar with a Teflon lined lid
TBT	1 x 500 ml solvent washed, glass jar with a Teflon lined lid
Particle size	1 x 250 ml ziplock plastic bag to hold a minimum of 500 g sample

3.5 Contingency plan

Sampling is proposed to be undertaken in April 2012 over one day.

The potential for disruption to sediment collection will be minimal as weather forecasts and shipping schedules will be reviewed before mobilisation to the field.

The potential for gear failure will be minimised through properly maintained equipment. If an equipment failure occurs, some parts may be repaired with spares taken to the site. If serious equipment failure occurs, then demobilisation and rescheduling following equipment repair would be required.

3.6 Laboratory analysis

Table 3 summarises the laboratory methods for the suite of analytes to be tested. All laboratories used for analyses will be National Association of Testing Authorities (NATA) accredited for the methods used and experienced in the analysis of marine sediments.

Table 3 Analytical method information for sediments

Activity/test	Method reference	Method summary	PQL
Moisture content	Gravimetric	Oven-dry overnight, measure weight	1%
Particle size	Sieve and	Sieve and hydrometer	To 2um

Activity/test	Method reference	Method summary	PQL
distribution	hydrometer		
Total organic carbon	Handbook of soil & water	Dilute acid treatment, high temperature dry combustion, infrared detection.	0.02%
Organotins	In-house	GC/MS	0.5 ug Sn/kg
Trace metals	USEPA 3050 / 200.7 ICP/AES	Nitric/hydrochloric acid digestion, ICP/AES	1 mg/kg

3.7 Sampling and Analysis Quality Control

3.7.1 Quality Control – Field Sampling

Quality control during sampling will be ensured by:

- using suitably qualified environmental staff experienced in sediment sampling, field supervision and sediment logging;
- using a survey vessel which is thoroughly inspected and washed down;
- containing samples in appropriately cleaned, pre-treated and labelled sample containers;
- keeping samples cool (4°c) after sampling and during transport where they would be stored in eskies with pre-frozen ice bricks;
- transportation of samples under chain of custody documentation;
- generating additional QC samples in accordance with the NAGD (refer Section 3.7.2 below);
- ‘blind labelling’ all field QC split triplicate samples in the field with QC field numbers that do not relate to sampling location names; and
- decontaminating all sampling equipment, including mixing bowls etc., between sampling locations via a decontamination procedure involving a wash with ambient sea water and a laboratory grade detergent, and successive rinsing with deionised water.

3.7.2 Quality control – analysis

Appendix F of NAGD specifies that field quality control samples should include (per batch of 20 or fewer):

- *In cases where volatile substances such as some chlorinated organics are being determined, one container (trip) blank filled with inert material, for example chromatographic sand;*
- *On 10 per cent of locations, a field triplicate (that is three separate samples taken at the same location)is collected at both depth intervals (if possible) to determine the spatial variability of the sediment physical and chemical characteristics. T ;*
- *On five per cent of locations, samples should be thoroughly mixed then split into three containers to assess laboratory variation, with one of the three samples sent to a second (reference) laboratory for analyses. This process will be repeated for the second depth interval (0.5-1.0m) if possible; and*
- *One sample that has been analysed in a previous batch (if more than one batch is sent) to determine the analytical variation between batches.*

In consideration of this, the following QA/QC protocol has been developed:

- no trip blanks will be taken and analysed as volatile organic carbon compounds, (e.g. chlorinated hydrocarbons and BTEX), are not being assessed.
- the field samples proposed to be taken for QC analysis will comply with the 10 percent and 5 percent criteria for separate (field) triplicate and split triplicate samples respectively; and
- all samples will be sent to the laboratories as a single batch.

The analytical laboratory will need to comply with the laboratory and QA procedures specified in Appendix F of the NAGD which require:

The laboratory quality assurance program should include the following quality control samples to be analysed in each batch (10-20 samples). This is in addition to its own internal procedures to ensure analytical procedures are conducted properly and produce reliable results:

- *One laboratory blank sample;*
- *For metals, one Standard Reference Material (SRM), that is, a sample of certified composition such as MESS-1 or BCSS-1, or BEST-1 (for mercury), or a suitable internal laboratory standard calibrated against an SRM. The laboratory standard should be a ground sediment sample, not a liquid sample, to test both the recovery of the extraction procedure and the analysis;*

- *For organics, one sample spiked with the parameters being determined (or a surrogate spike for certain organics) at a concentration within the linear range of the method being employed – this will determine whether the recovery rate of the analytical method is adequate or not (that is, that all the chemicals present in the sample are actually being found in the analysis); and*
- *One replicate sample to determine the precision of the analysis; the standard deviation and coefficient of variation should be documented.*

A validation of the analytical data obtained will be undertaken in accordance with Appendix F of the NAGD. This validation will include a consideration of results for blanks, standards and spikes, and replicate and duplicate samples. Relative percentage differences and relative standard deviations between QC duplicate and triplicate samples will be compared against relevant criteria.

3.8 Analysis of results

3.8.1 Sediment Analysis for Total Sediment Concentrations

Contaminant levels for sediments will be compared against the following guidelines:

- the NAGD Screening Level concentrations listed in Appendix A, Table 2 of the NAGD (Commonwealth of Australia 2009) to assess marine sediment quality;
- Ecological Investigation Level (EIL) and Health Investigation Level for residential use (HIL_A) in the ‘Assessment Levels for Soil, Sediment and Water’ (Draft DEC 2010 OR 1999 ref) to assess the suitability of dredged material placed onshore. The use of the HIL-A is to provide a conservative approach to the assessment of sediments for onshore disposal. The project site is in an area designated for industrial use under HIL-F, which is a far less conservative HIL than HIL-A;
- ANZECC/ARMCANZ guidelines (REF) to identify potential toxic impacts from onshore disposal of sediments and discharges to the marine environment or groundwater. The ANZECC guidelines include the ISQG-low and ISQG-high assessment levels. The ISQG-low level is a threshold below which the frequency of adverse effects is expected to be very low. The ISQG-high level is a threshold above which adverse biological effects are expected to occur more frequently.

The comparison against guideline levels involves the comparison of mean contaminant concentrations at the 95 percent upper confidence level (UCL) of the mean. For the purposes of calculation of 95 percent UCLs, values below detection limits will be set to half of the LOR in accordance with NAGD recommendations.

The methods used to calculate the 95 percent UCLs are based on those required in Appendix A of the NAGD. Normality of datasets are determined using Shapiro-Wilks test and quantile-

quantile plots in ProUCL Version 4.1 (4.1.01). Datasets are determined as being normal, log-normal or neither in their distributions. Normal datasets are analysed using the 1-tailed Student's 't' UCL. Log-normal datasets are analysed using non-parametric jacknife analysis as recommended in the NAGD. Similarly, datasets that are neither normal nor log-normally distributed are analysed using non-parametric jacknife analysis.

If any results are above the NAGD screening levels, EIL or HIL-A a further phase of testing will be initiated. As it is proposed sediment will be disposed of onshore, Australian Standard Leaching Procedure (ASLP) testing, as set out in the 'Landfill Waste Classification and Waste Definitions (DEC 2006/ 2009) will be undertaken on all results above the NAGD screening level, the most conservative of the guidelines. This test is designed to measure analyte levels that could potentially leach into the groundwater.

3.9 Reporting

A report containing the following information will be prepared at the conclusion of the sampling and analysis program:

- introduction and description of the study area;
- details of the sampling methodology including any deviations from the approved SAP;
- a figure showing the sampling locations;
- descriptions of any observations or anomalies during sampling and/or analysis;
- laboratories used and the analytical methods employed;
- QA procedures and results;
- summary table of results for each parameter analysed;
- comparison and interpretation of the results;
- discussion; and
- appendices containing all laboratory reports and QA/QC analyses.

4. REFERENCES

AEC Environmental (2011a) Baseline Site Investigation BAE Henderson Site Freehold Area.

AEC Environmental (2011b) Preliminary Site Investigation of Henderson Shipyard for BAE Systems.

ANZECC/ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

Commonwealth of Australia (2009) National Assessment Guidelines for Dredging. In: Department of the Environment W, Heritage and the Arts (ed), Canberra

DALSE (2004) Benthic Habitat Mapping of the Eastern Shelf of the Cockburn Sound 2004. Prepared for Cockburn Sound Management Council

EPA (2005) Environmental Quality Criteria Reference Document for Cockburn Sound.

URS (2009) BAE Systems Henderson Shipyard Historical Trend Analysis. Prepared for BAE Systems

Appendix 1 - Site description sheet

301012-01750: BAE Systems Dredging Support and Consultancy Services

---

CLIENT: BAE Systems

DATE OF CORING:__________

TIME OF CORING:___________

Collection Details

General location of core of sampling location	
Site/location number	
Sample Id.s assigned	
Easting/Longitude of core location (from onboard GPS)	
Northing/Latitude of core location (from onboard GPS)	
Water depth at core location	
Sample collector	
Type of core sampler	
Sea state at time of coring	
Conditions (e.g. weather, sea state, wind speed, level of shipping traffic)	
General comments	

Appendix 2 - Sediment core log

301012-01750: BAE Systems Dredging Support and Consultancy Services

Sediment Description

Sample Location	
Date / Sample Time	
Depth retained	

Strata Change (m)	**Colour* (refer AS1726)**	**Field texture****	**Moist.**	**Consist**	**Sand grain size**	**Plasticity**	**% stones**	**Shell/grit and/or biota**	**Odour**

* Colour: black, white, grey, red, brown, orange, yellow, green, blue. Pale, dark, mottled. *e.g. grey mottled red-brown clay*.
**Field Texture: clay, silt, sand, gravel, etc

Appendix 2 - Site Description Sheet and Sediment Log

S2 on last page

Garmin GPS map 62 use (GPS005)

WorleyParsons
resources & energy

301012-01750: BAE Systems Dredging Support and Consultancy Services

---

CLIENT: BAE Systems

DATE OF CORING: 24/4/13

TIME OF CORING: 12:30

Collection Details

General location of core of sampling location	
Site/location number	Mark39 on GPS
Sample Id.s assigned	S2
Easting/Longitude of core location (from onboard GPS)	[redacted]
Northing/Latitude of core location (from onboard GPS)	[redacted]
Water depth at core location	~ 3m
Sample collector	NW's
Type of core sampler	VV
Sea state at time of coring	
Conditions (e.g. weather, sea state, wind speed, level of shipping traffic)	
General comments 0-2 knots Fine, calm Nil	

301012-01750: BAE Systems Dredging Support and Consultancy Services

Sediment Description

Sample Location	S2
Date / Sample Time	24/4/13
Depth retained	~3m

Strata Change (m)	Colour* (refer AS1726)	Field texture**	Moist.	Consist	Sand grain size	Plasticity	% stones	Shell/grit and/or biota	Odour
	Light ~~yellow~~ brown w/ gray mottle	Sand	H	W	M	~~W~~ L	Trace up to 2cm	5% up to 4cm	Feint Anoxic -Marine

* Colour: black, white, grey, red, brown, orange, yellow, green, blue. Pale, dark, mottled. *e.g. grey mottled red-brown clay.*

**Field Texture: clay, silt, sand, gravel, etc

WorleyParsons
resources & energy

301012-01750: BAE Systems Dredging Support and Consultancy Services

---

CLIENT: BAE Systems

DATE OF CORING: 24/4

TIME OF CORING: 12:50

Collection Details

General location of core of sampling location	S3
Site/location number	mark 40 on GPS
Sample Id.s assigned	
Easting/Longitude of core location (from onboard GPS)	
Northing/Latitude of core location (from onboard GPS)	
Water depth at core location	~4.5m
Sample collector	
Type of core sampler	
Sea state at time of coring	
Conditions (e.g. weather, sea state, wind speed, level of shipping traffic)	
General comments As previous	

301012-01750: BAE Systems Dredging Support and Consultancy Services

Sediment Description

Sample Location		S3							
Date / Sample Time									
Depth retained									
Strata Change (m)	**Colour* (refer AS1726)**	**Field texture****	**Moist.**	**Consist**	**Sand grain size**	**Plasticity**	**% stones**	**Shell/grit and/or biota**	**Odour**
/	Grey	Silty sand w/ clay mottle	H	W	Fine	L	30% up to 5cm	Trace biota 10% up to 8cm	Marine

* Colour: black, white, grey, red, brown, orange, yellow, green, blue. Pale, dark, mottled. *e.g. grey mottled red-brown clay.*

**Field Texture: clay, silt, sand, gravel, etc

301012-01750: BAE Systems Dredging Support and Consultancy Services

CLIENT: BAE Systems

DATE OF CORING: 24/6/13

TIME OF CORING: 14:55

Collection Details

General location of core of sampling location	S4
Site/location number	Mark 4a on GPS
Sample Id.s assigned	
Easting/Longitude of core location (from onboard GPS)	
Northing/Latitude of core location (from onboard GPS)	
Water depth at core location	5.5m
Sample collector	
Type of core sampler	
Sea state at time of coring	
Conditions (e.g. weather, sea state, wind speed, level of shipping traffic)	
General comments As previous	

301012-01750: BAE Systems Dredging Support and Consultancy Services

Sediment Description

Sample Location	S4
Date / Sample Time	
Depth retained	

Strata Change (m)	Colour* (refer AS1726)	Field texture**	Moist.	Consist	Sand grain size	Plasticity	% stones	Shell/grit and/or biota	Odour
	Grey	Silty sand	H	W	M	Low	10% up to 10cm	5% up to 8cm	Marine

* Colour: black, white, grey, red, brown, orange, yellow, green, blue. Pale, dark, mottled. *e.g. grey mottled red-brown clay.*

**Field Texture: clay, silt, sand, gravel, etc

301012-01750: BAE Systems Dredging Support and Consultancy Services

---

CLIENT: BAE Systems

DATE OF CORING: 24/4

TIME OF CORING: 15:15

Collection Details

General location of core of sampling location	
Site/location number	S5 - mark 63 on ur. GPS
Sample Id.s assigned	
Easting/Longitude of core location (from onboard GPS)	FT1 & FT2
Northing/Latitude of core location (from onboard GPS)	
Water depth at core location	5.7m
Sample collector	
Type of core sampler	
Sea state at time of coring	
Conditions (e.g. weather, sea state, wind speed, level of shipping traffic)	
General comments As previous	

301012-01750: BAE Systems Dredging Support and Consultancy Services

Sediment Description

Sample Location	S5
Date / Sample Time	
Depth retained	

Strata Change (m)	Colour* (refer AS1726)	Field texture**	Moist.	Consist	Sand grain size	Plasticity	% stones	Shell/grit and/or biota	Odour
	D.Gray	Sandy silt	H	[illegible]	f-M	~~[illegible]~~ Nil	Trace up to 3cm	Trace up to 3cm	Anoxic
				V S					
				to					
				[illegible]					

* Colour: black, white, grey, red, brown, orange, yellow, green, blue. Pale, dark, mottled. *e.g. grey mottled red-brown clay.*
**Field Texture: clay, silt, sand, gravel, etc

WorleyParsons
resources & energy

301012-01750: BAE Systems Dredging Support and Consultancy Services

CLIENT: BAE Systems

DATE OF CORING: 24/4/13

TIME OF CORING: 15:45

Collection Details

General location of core of sampling location	S6 - Mark 44 yellow GPS
Site/location number	
Sample Id.s assigned	ST1 & ST2
Easting/Longitude of core location (from onboard GPS)	
Northing/Latitude of core location (from onboard GPS)	
Water depth at core location	4.8m
Sample collector	
Type of core sampler	
Sea state at time of coring	
Conditions (e.g. weather, sea state, wind speed, level of shipping traffic)	
General comments As previous.	

301012-01750: BAE Systems Dredging Support and Consultancy Services

Sediment Description

Sample Location 56

Date / Sample Time

Depth retained

Strata Change (m)	Colour* (refer AS1726)	Field texture**	Moist.	Consist	Sand grain size	Plasticity	% stones	Shell/grit and/or biota	Odour
	Grey w light brown mottle	Sand	H	VW	f	L	Trace up to 0.5cm	Trace shell up to 0.5 cm	Marine w weird chemical smell

* Colour: black, white, grey, red, brown, orange, yellow, green, blue. Pale, dark, mottled. *e.g. grey mottled red-brown clay.*

**Field Texture: clay, silt, sand, gravel, etc

WorleyParsons
resources & energy

301012-01750: BAE Systems Dredging Support and Consultancy Services

CLIENT: BAE Systems

DATE OF CORING: 24/4

TIME OF CORING: 16:05

Collection Details

General location of core of sampling location	
Site/location number	S7-Mark 45
Sample Id.s assigned	
Easting/Longitude of core location (from onboard GPS)	[illegible]
Northing/Latitude of core location (from onboard GPS)	
Water depth at core location	4.3m
Sample collector	
Type of core sampler	
Sea state at time of coring	
Conditions (e.g. weather, sea state, wind speed, level of shipping traffic)	
General comments As previous	

301012-01750: BAE Systems Dredging Support and Consultancy Services

Sediment Description

Sample Location	57
Date / Sample Time	
Depth retained	

Strata Change (m)	**Colour* (refer AS1726)**	**Field texture****	**Moist.**	**Consist**	**Sand grain size**	**Plasticity**	**% stones**	**Shell/grit and/or biota**	**Odour**
	Grey	Sand	H	VW	M	L	Trace up to 2cm	5% up to 5cm	Marine
								Trace	
								biota	

* Colour: black, white, grey, red, brown, orange, yellow, green, blue. Pale, dark, mottled. *e.g. grey mottled red-brown clay.*

**Field Texture: clay, silt, sand, gravel, etc

301012-01750: BAE Systems Dredging Support and Consultancy Services

---

CLIENT: BAE Systems

DATE OF CORING: 24/4

TIME OF CORING: 14 16:30

Collection Details

General location of core of sampling location	
Site/location number	S8 -made 46 in GPS
Sample Id.s assigned	
Easting/Longitude of core location (from onboard GPS)	
Northing/Latitude of core location (from onboard GPS)	
Water depth at core location	6.3m
Sample collector	
Type of core sampler	
Sea state at time of coring	
Conditions (e.g. weather, sea state, wind speed, level of shipping traffic)	
General comments As previous	

301012-01750: BAE Systems Dredging Support and Consultancy Services

Sediment Description

Sample Location	S8
Date / Sample Time	24/4
Depth retained	6.3m depth

Strata Change (m)	**Colour* (refer AS1726)**	**Field texture****	**Moist.**	**Consist**	**Sand grain size**	**Plasticity**	**% stones**	**Shell/grit and/or biota**	**Odour**
	Grey with light brown mottle	Sandy silt	H	VW	Fine	~~Weak/~~ ~~Not~~ L	Trace upto 0.5cm	Trace shell up to 0.5cm	Marine w ammonia type smell

* Colour: black, white, grey, red, brown, orange, yellow, green, blue. Pale, dark, mottled. *e.g. grey mottled red-brown clay.*

**Field Texture: clay, silt, sand, gravel, etc

301012-01750: BAE Systems Dredging Support and Consultancy Services

CLIENT: BAE Systems

DATE OF CORING: 24/4/13

TIME OF CORING: ~~12:30~~ 11:20

Collection Details

General location of core of sampling location	
Site/location number	
Sample Id.s assigned	S1 - Mark Simon GB (BAE1)
Easting/Longitude of core location (from onboard GPS)	
Northing/Latitude of core location (from onboard GPS)	
Water depth at core location	
Sample collector	
Type of core sampler	
Sea state at time of coring	
Conditions (e.g. weather, sea state, wind speed, level of shipping traffic)	
General comments	

301012-01750: BAE Systems Dredging Support and Consultancy Services

Sediment Description

Sample Location	S1
Date / Sample Time	24/4/13
Depth retained	~~Surface~~ Grab

Strata Change (m)	Colour* (refer AS1726)	Field texture**	Moist.	Consist	Sand grain size	Plasticity	% stones	Shell/grit and/or biota	Odour
	grey	sandy SILT ~~trace biota~~	high	very weak	~~weak~~ fine	~~weak~~	trace up to 3cm	trace	marine

* Colour: black, white, grey, red, brown, orange, yellow, green, blue. Pale, dark, mottled. *e.g. grey mottled red-brown clay.*

**Field Texture: clay, silt, sand, gravel, etc

Appendix 3 - Raw results

REPORT OF ANALYSIS

Laboratory Reference: A13/2073 [R00]

Client:	WorleyParsons Services Pty Ltd Bishop See Building, L1, 235 St Georges Tce Perth WA 6000	**Order No:**	301012-01750
		Project:	Sediment 301012-01750
		Sample Type:	sediment
		No. of Samples:	1
Contact:	Nicola Willson	**Date Received:**	24/024/2013
		Date Completed:	15/05/2013

Laboratory Contact Details:

Client Services Manager: Jane Struthers
Technical Enquiries: Andrew Bradbury
Telephone: +61 8 9325 9799
Fax: +61 8 9325 4299
Email: perth@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:

Ian Eckhard
Technical Director

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

ilac-MRA

NATA
Accreditation No.15109

Batch Number: A13/2073 [R00]
Project Reference: Sediment 301012-01750

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**1** **ST2** **24/04/2013**
Moisture Content			
Moisture Content	04-004	%	21.8
Trace Elements			
Arsenic	04-001	mg/kg	3.5
Chromium	04-001	mg/kg	11
Copper	04-001	mg/kg	13
Lead	04-001	mg/kg	2.3
Nickel	04-001	mg/kg	0.86
Zinc	04-001	mg/kg	12
Organotins			
Monobutyl tin	04-026	µgSn/kg	3.4
Dibutyl tin	04-026	µgSn/kg	4.2
Tributyl tin	04-026	µgSn/kg	7.4
Surrogate 1 Recovery	04-026	%	88
Date Extracted	04-026	-	14/05/2013
Date Analysed	04-026	-	14/05/2013
Subcontract Analysis			
Total Organic Carbon	SUB	%	0.25

Method	Method Description
04-004	Moisture by gravimetric, %
04-001	Metals by ICP-OES, mg/kg
04-026	Organotins by GCMS, µgSn/kg
SUB	Subcontracted Analyses

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order : **EP1303024**
Client : **WORLEY PARSONS - INFRASTRUCTURE MWE**
Contact : NICOLA WILLSON
Address : QV1 Building Lvl 7
250 St Georges Tce
PERTH WA, AUSTRALIA 6000
E-mail : nicola.willson@worleyparsons.com
Telephone : +61 08 9278 8111
Facsimile : ----
Project : 301012-01750
Order number : 301012-01750-PS-CNT-100513ALS
C-O-C number : ----
Sampler : NW
Site : BAE Dredging Project
Quote number : EP/386/13

Page : 1 of 6
Laboratory : Environmental Division Perth
Contact : Scott James
Address : 10 Hod Way Malaga WA Australia 6090
E-mail : perth.enviro.services@alsglobal.com
Telephone : +61-8-9209 7655
Facsimile : +61-8-9209 7600
QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Date Samples Received : 26-APR-2013
Issue Date : 10-MAY-2013
No. of samples received : 11
No. of samples analysed : 11

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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*
Hamish Murray	Laboratory Supervisor	Newcastle - Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics
SATISH.TRIVEDI	2 IC Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics

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

- **EG020-SD (Total Metals in Sediments): Ni LOR raised for samples EB1303024-006 (S6), --007 (S7), -008 (S8), -010 (FT2), -011 (ST1) due to matrix interference.**

Analytical Results

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

			Client sample ID	**S1**	**S2**	**S3**	**S4**	**S5**
			Client sampling date / time	24-APR-2013 11:20	24-APR-2013 12:30	24-APR-2013 12:50	24-APR-2013 14:55	24-APR-2013 15:15
Compound	*CAS Number*	*LOR*	*Unit*	**EP1303024-001**	**EP1303024-002**	**EP1303024-003**	**EP1303024-004**	**EP1303024-005**
EA150: Particle Sizing								
+75µm	----	1	%	**86**	**88**	**81**	----	**77**
+150µm	----	1	%	**76**	**83**	**73**	----	**64**
+300µm	----	1	%	**44**	**55**	**63**	----	**54**
+425µm	----	1	%	**30**	**36**	**55**	----	**48**
+600µm	----	1	%	**21**	**24**	**45**	----	**40**
+1180µm	----	1	%	**8**	**10**	**26**	----	**14**
+2.36mm	----	1	%	**4**	**5**	**16**	----	**4**
+4.75mm	----	1	%	**2**	**3**	**10**	----	<1
+9.5mm	----	1	%	<1	<1	**2**	----	<1
+19.0mm	----	1	%	<1	<1	<1	----	<1
+37.5mm	----	1	%	<1	<1	<1	----	<1
+75.0mm	----	1	%	<1	<1	<1	----	<1
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**27.3**	**26.3**	**27.3**	**26.4**	**32.8**
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	**6**	**5**	**7**	----	**9**
Silt (2-60 µm)	----	1	%	**8**	**6**	**12**	----	**12**
Sand (0.06-2.00 mm)	----	1	%	**82**	**84**	**65**	----	**75**
Gravel (>2mm)	----	1	%	**4**	**5**	**16**	----	**4**
Cobbles (>6cm)	----	1	%	<1	<1	<1	----	<1
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	**2.22**	**2.60**	**1.56**	**2.12**	**2.49**
Chromium	7440-47-3	1.0	mg/kg	**8.9**	**9.1**	**7.6**	**7.8**	**11.4**
Copper	7440-50-8	1.0	mg/kg	**5.8**	**6.7**	**7.0**	**10.6**	**8.4**
Lead	7439-92-1	1.0	mg/kg	**2.4**	**2.3**	**2.8**	**2.8**	**3.8**
Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	7440-66-6	1.0	mg/kg	**10.6**	**8.9**	**17.1**	**11.9**	**18.6**
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.18**	**0.19**	**0.28**	**0.24**	**0.50**
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	**7.8**	**7.1**	**13.1**	**5.6**	**5.2**
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	**72.1**	**73.0**	**70.7**	**79.0**	**93.2**

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**S6**	**S7**	**S8**	**FT1**	**FT2**
			Client sampling date / time	24-APR-2013 15:45	24-APR-2013 16:05	24-APR-2013 16:30	24-APR-2013 11:20	24-APR-2013 11:20
Compound	*CAS Number*	*LOR*	*Unit*	**EP1303024-006**	**EP1303024-007**	**EP1303024-008**	**EP1303024-009**	**EP1303024-010**
EA150: Particle Sizing								
+75µm	----	1	%	**89**	**86**	**85**	----	----
+150µm	----	1	%	**73**	**62**	**67**	----	----
+300µm	----	1	%	**29**	**40**	**54**	----	----
+425µm	----	1	%	**14**	**34**	**45**	----	----
+600µm	----	1	%	**7**	**26**	**33**	----	----
+1180µm	----	1	%	**1**	**12**	**8**	----	----
+2.36mm	----	1	%	<1	**7**	**1**	----	----
+4.75mm	----	1	%	<1	**3**	<1	----	----
+9.5mm	----	1	%	<1	**2**	<1	----	----
+19.0mm	----	1	%	<1	<1	<1	----	----
+37.5mm	----	1	%	<1	<1	<1	----	----
+75.0mm	----	1	%	<1	<1	<1	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**28.5**	**29.2**	**32.2**	**28.0**	**46.0**
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	**3**	**4**	**6**	----	----
Silt (2-60 µm)	----	1	%	**7**	**9**	**8**	----	----
Sand (0.06-2.00 mm)	----	1	%	**90**	**80**	**85**	----	----
Gravel (>2mm)	----	1	%	<1	**7**	**1**	----	----
Cobbles (>6cm)	----	1	%	<1	<1	<1	----	----
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	**2.22**	**2.20**	**1.78**	**2.26**	**2.65**
Chromium	7440-47-3	1.0	mg/kg	**11.5**	**10.5**	**9.9**	**10.5**	**13.9**
Copper	7440-50-8	1.0	mg/kg	**7.4**	**7.7**	**4.9**	**6.6**	**9.4**
Lead	7439-92-1	1.0	mg/kg	**2.3**	**2.8**	**2.8**	**3.4**	**5.2**
Nickel	7440-02-0	1.0	mg/kg	<5.0	<5.0	<5.0	<1.0	<5.0
Zinc	7440-66-6	1.0	mg/kg	**13.1**	**14.7**	**11.9**	**14.2**	**19.9**
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.18**	**0.24**	**0.34**	**0.45**	**0.50**
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	**16.9**	**12.3**	**3.1**	**6.4**	**12.6**
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	**94.5**	**90.3**	**79.6**	**86.2**	**88.5**

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Client sample ID	**ST1**	----	----	----	----
			Client sampling date / time	24-APR-2013 11:20	----	----	----	----
Compound	CAS Number	LOR	Unit	**EP1303024-011**	----	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**25.0**	----	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	**2.03**	----	----	----	----
Chromium	7440-47-3	1.0	mg/kg	**10.7**	----	----	----	----
Copper	7440-50-8	1.0	mg/kg	**7.1**	----	----	----	----
Lead	7439-92-1	1.0	mg/kg	**2.4**	----	----	----	----
Nickel	7440-02-0	1.0	mg/kg	<5.0	----	----	----	----
Zinc	7440-66-6	1.0	mg/kg	**14.4**	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.23**	----	----	----	----
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	**9.6**	----	----	----	----
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	**80.1**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	*CAS Number*	***Recovery Limits (%)***	
		Low	***High***
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130

Certificate of Analysis

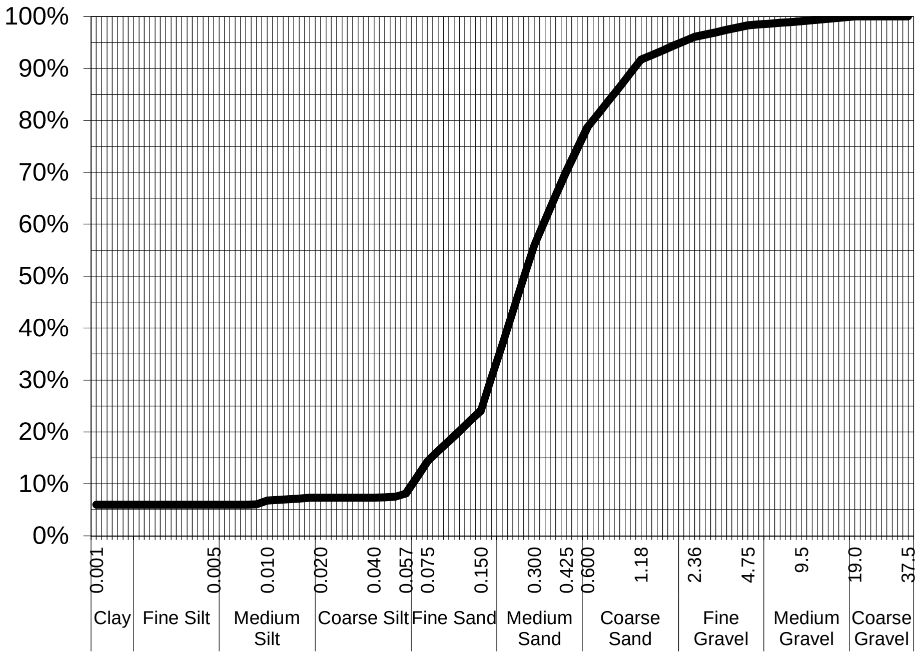
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT:	Nicola Willson	**DATE REPORTED:**	10-May-2013
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	26-Apr-2013
ADDRESS:	QV1 Building Lvl 7 250 St Georges Tce Perth, WA 6000	**REPORT NO:**	EP1303024-001 / PSD
PROJECT:	301012-01750	**SAMPLE ID:**	S1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	99%
4.75	98%
2.36	96%
1.18	92%
0.600	79%
0.425	70%
0.300	56%
0.150	24%
0.075	14%
Particle Size (microns)	
57	8%
40	7%
20	7%
10	7%
5	6%
4	6%
1	6%

Median Particle Size (mm)	0.225

Samples analysed as received.

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

Sample Comments:

Analysed: 10-May-13

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Sand and shell

Dispersion Method Shaker

Test Method: AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm^3

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

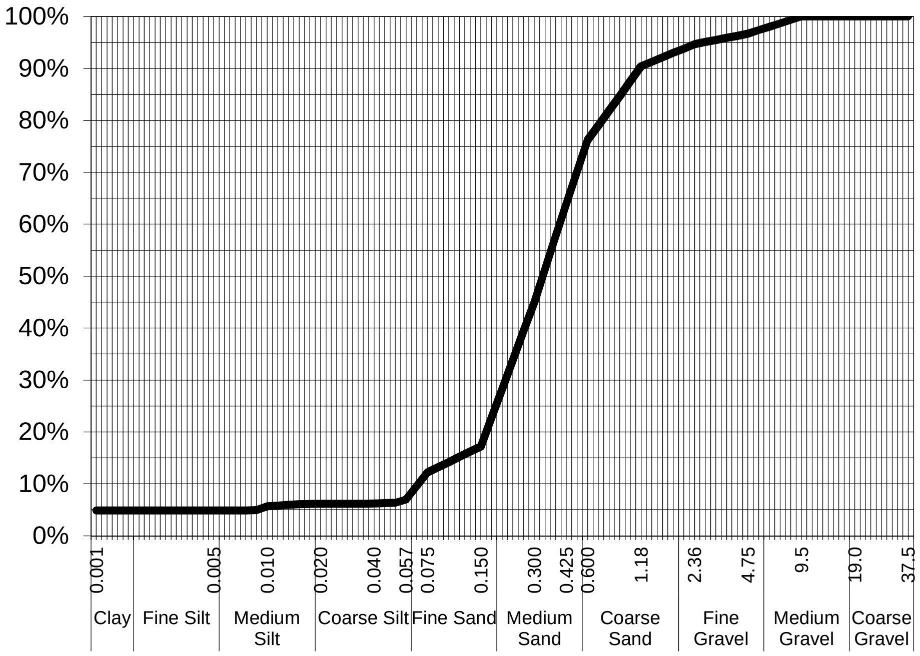
Certificate of Analysis

ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW

CLIENT:	Nicola Willson	**DATE REPORTED:**	10-May-2013
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	26-Apr-2013
ADDRESS:	QV1 Building Lvl 7 250 St Georges Tce Perth, WA 6000	**REPORT NO:**	EP1303024-002 / PSD
PROJECT:	301012-01750	**SAMPLE ID:**	S2

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	97%
2.36	95%
1.18	90%
0.600	76%
0.425	64%
0.300	45%
0.150	17%
0.075	12%
Particle Size (microns)	
57	7%
40	6%
20	6%
10	6%
5	5%
4	5%
1	5%

Median Particle Size (mm)	0.300

Samples analysed as received.

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

Sample Comments:		**Analysed:**	10-May-13
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	Sand and shell	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm^3

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

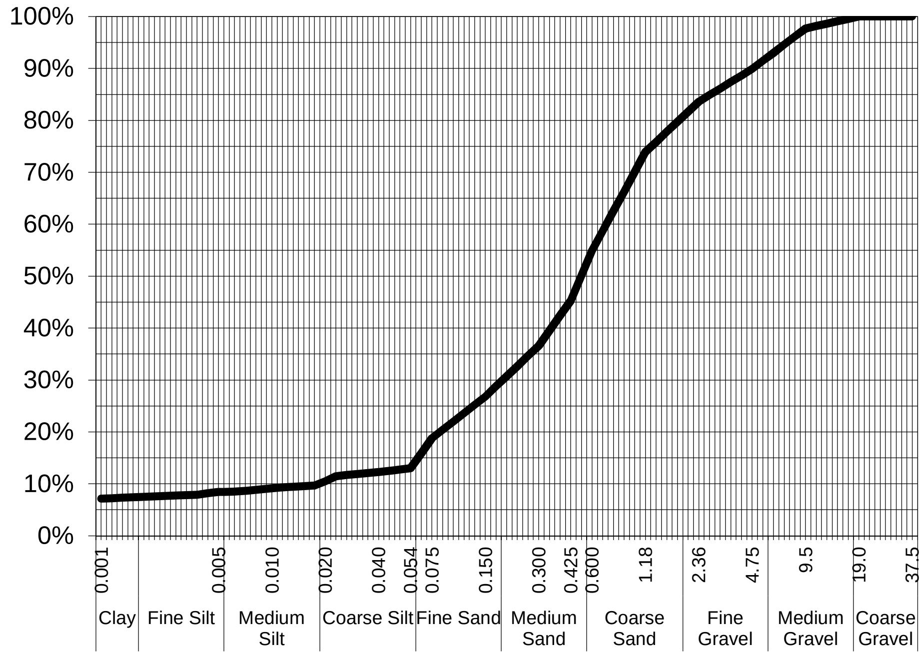
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT:	Nicola Willson	**DATE REPORTED:**	10-May-2013
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	26-Apr-2013
ADDRESS:	QV1 Building Lvl 7 250 St Georges Tce Perth, WA 6000	**REPORT NO:**	EP1303024-003 / PSD
PROJECT:	301012-01750	**SAMPLE ID:**	S3

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	98%
4.75	90%
2.36	84%
1.18	74%
0.600	55%
0.425	45%
0.300	37%
0.150	27%
0.075	19%
Particle Size (microns)	
54	13%
40	12%
20	10%
10	9%
5	8%
4	8%
1	7%

Median Particle Size (mm)	0.425

Samples analysed as received.

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

Sample Comments:		**Analysed:**	10-May-13
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	Sand, silty clay and shell	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm^3

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

NATA
WORLD RECOGNISED ACCREDITATION

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

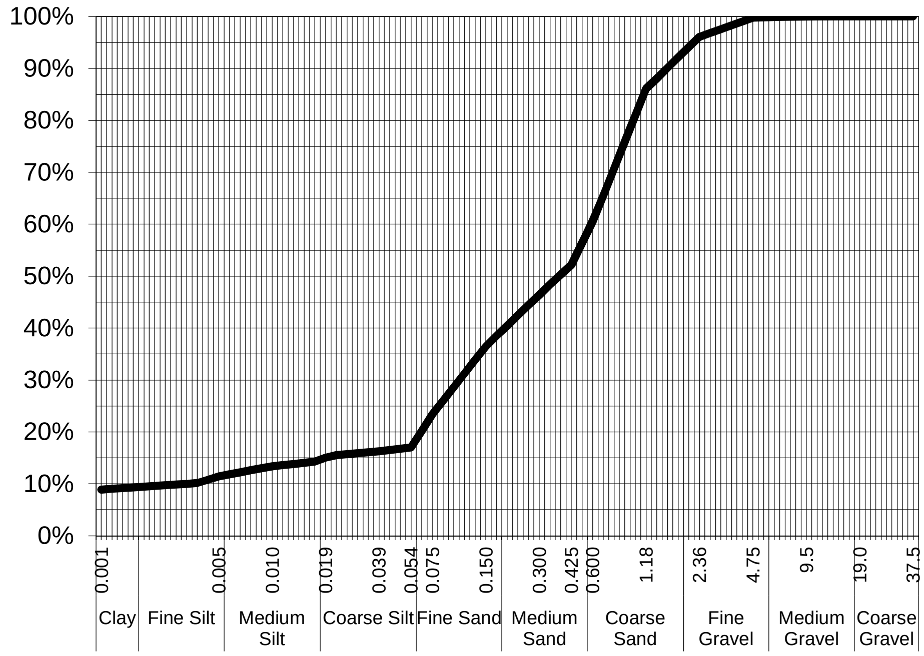
Certificate of Analysis

ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW

CLIENT:	Nicola Willson	**DATE REPORTED:**	10-May-2013
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	26-Apr-2013
ADDRESS:	QV1 Building Lvl 7 250 St Georges Tce Perth, WA 6000	**REPORT NO:**	EP1303024-005 / PSD
PROJECT:	301012-01750	**SAMPLE ID:**	S5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	96%
1.18	86%
0.600	61%
0.425	52%
0.300	46%
0.150	37%
0.075	23%
Particle Size (microns)	
54	17%
39	16%
19	15%
10	13%
5	11%
4	10%
1	9%

Median Particle Size (mm)	0.300

Samples analysed as received.

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

Sample Comments:		**Analysed:**	10-May-13
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	Sand, silty clay and shell	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm^3

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

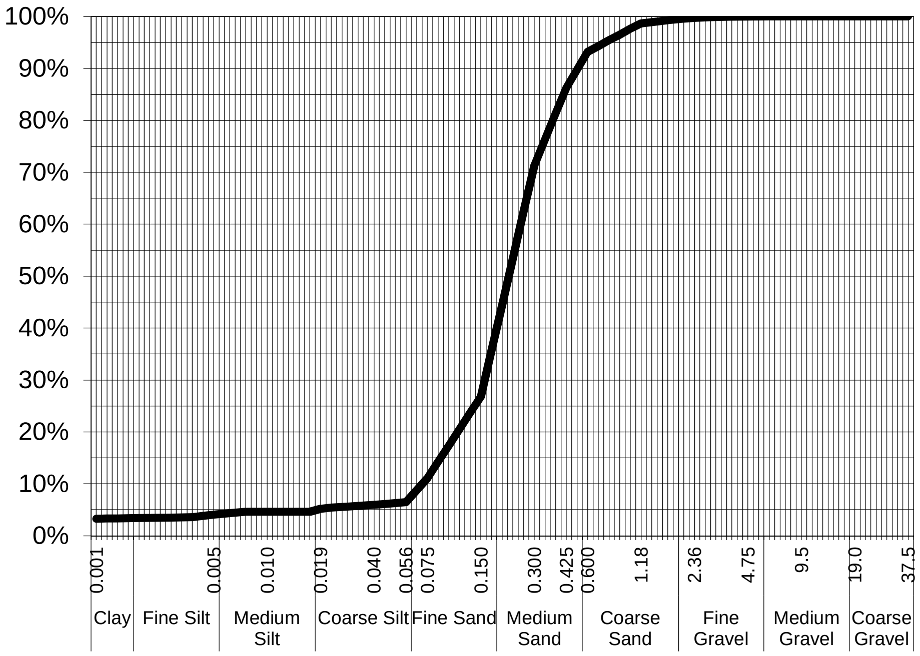
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT:	Nicola Willson	**DATE REPORTED:**	10-May-2013
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	26-Apr-2013
ADDRESS:	QV1 Building Lvl 7 250 St Georges Tce Perth, WA 6000	**REPORT NO:**	EP1303024-006 / PSD
PROJECT:	301012-01750	**SAMPLE ID:**	S6

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	93%
0.425	86%
0.300	71%
0.150	27%
0.075	11%
Particle Size (microns)	
56	6%
40	6%
19	5%
10	5%
5	4%
4	4%
1	3%

Median Particle Size (mm)	0.150

Samples analysed as received.

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

Sample Comments:		**Analysed:**	10-May-13
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	Sand and shell	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm^3

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

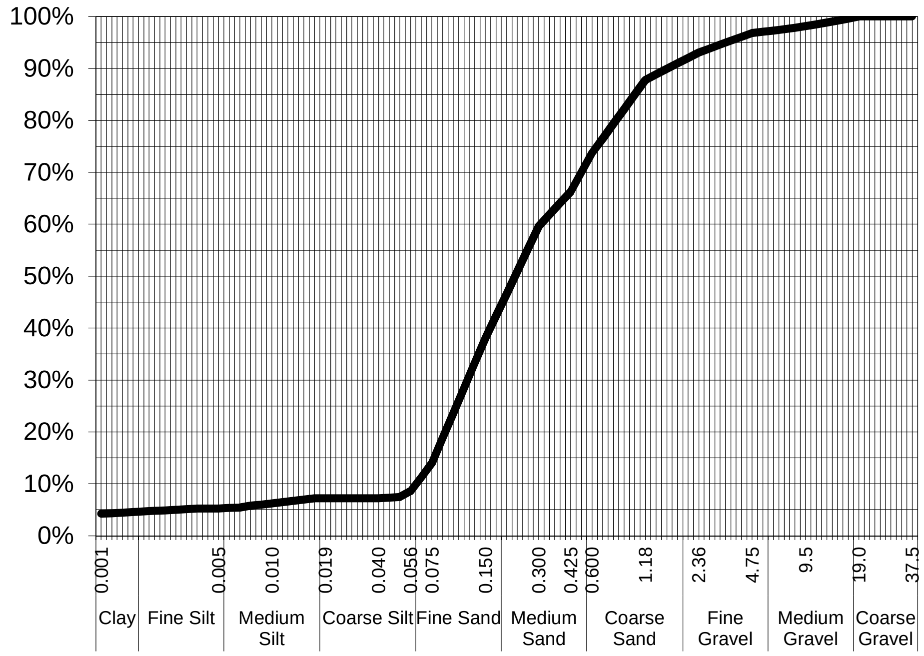
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT:	Nicola Willson	**DATE REPORTED:**	10-May-2013
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	26-Apr-2013
ADDRESS:	QV1 Building Lvl 7 250 St Georges Tce Perth, WA 6000	**REPORT NO:**	EP1303024-007 / PSD
PROJECT:	301012-01750	**SAMPLE ID:**	S7

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	98%
4.75	97%
2.36	93%
1.18	88%
0.600	74%
0.425	66%
0.300	60%
0.150	38%
0.075	14%
Particle Size (microns)	
56	9%
40	7%
19	7%
10	6%
5	5%
4	5%
1	4%

Median Particle Size (mm)	0.150

Samples analysed as received.

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

Sample Comments:		**Analysed:**	10-May-13
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	Sand and shell	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm^3

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT: Nicola Willson

DATE REPORTED: 10-May-2013

COMPANY: Worley Parsons - Infrastructure MWE

DATE RECEIVED: 26-Apr-2013

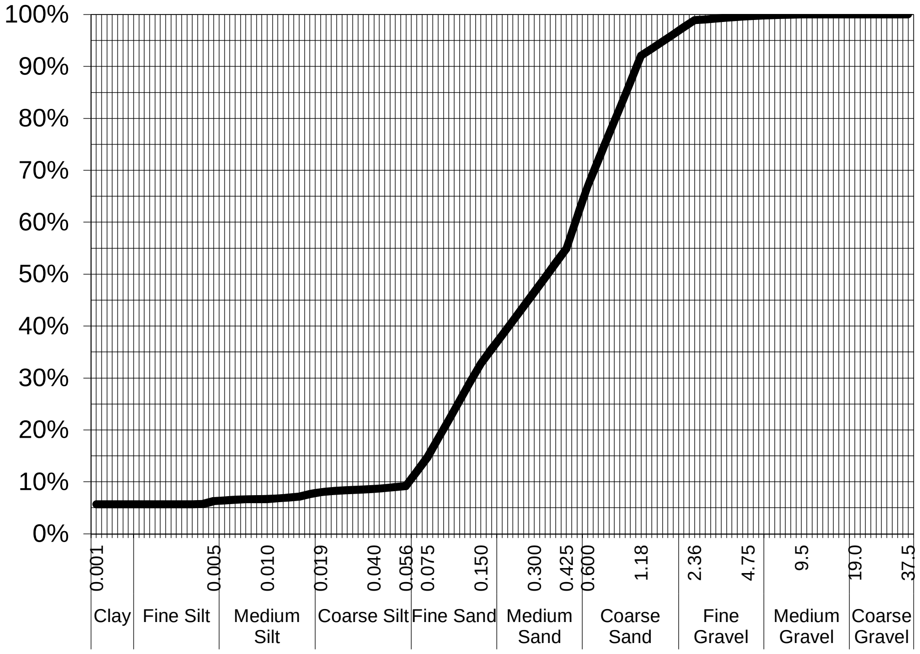
ADDRESS: QV1 Building Lvl 7
250 St Georges Tce
Perth, WA 6000

REPORT NO: EP1303024-008 / PSD

PROJECT: 301012-01750

SAMPLE ID: S8

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	99%
1.18	92%
0.600	67%
0.425	55%
0.300	47%
0.150	33%
0.075	15%
Particle Size (microns)	
56	9%
40	9%
19	8%
10	7%
5	6%
4	6%
1	6%

Median Particle Size (mm)	0.300

Samples analysed as received.

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

Sample Comments:

Analysed: 10-May-13

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Sand and shell

Dispersion Method Shaker

Test Method: AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm^3

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

ALS Group

Environmental Division

Food & Environmental Pharmaceutical
ALS Life Sciences

CERTIFICATE OF ANALYSIS

Work Order : **EB1311906**

Client : **WORLEY PARSONS - INFRASTRUCTURE MWE**

Contact : NICOLA WILLSON

Address : QV1 Building Lvl 7
250 St Georges Tce
PERTH WA, AUSTRALIA 6000

E-mail : nicola.willson@worleyparsons.com

Telephone : +61 08 9278 8111

Facsimile : ----

Project : 301012-01750

Order number : 301012-01750-PS-CNT-100513ALS

C-O-C number : ----

Sampler : Nicola Willson

Site : BAE Dredging Site

Quote number : EN/034/12

Page : 1 of 7

Laboratory : Environmental Division Brisbane

Contact : Customer Services

Address : 2 Byth Street Stafford QLD Australia 4053

E-mail : Brisbane.Enviro.Services@alsglobal.com

Telephone : +61 7 3243 7222

Facsimile : +61 7 3243 7218

QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Date Samples Received : 17-MAY-2013

Issue Date : 28-MAY-2013

No. of samples received : 6

No. of samples analysed : 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA
WORLD RECOGNISED
ACCREDITATION

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*
Matt Frost	Senior Organic Chemist	Brisbane Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics

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

Analytical Results

Sub-Matrix: **ASLP LEACHATE (**Matrix: **WATER)**

			Client sample ID	**S3 ASLP LEACH**	**S6 ASLP LEACH**	**S7 ASLP LEACH**	**S3 DI LEACH**	**S6 DI LEACH**
			Client sampling date / time	20-MAY-2013 15:00	20-MAY-2013 15:00	20-MAY-2013 15:00	22-MAY-2013 14:00	22-MAY-2013 14:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1311906-001**	**EB1311906-002**	**EB1311906-003**	**EB1311906-004**	**EB1311906-005**
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	**7**	**8**	**5**	**13**	**8**
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	**61.5**	**61.2**	**65.2**	**76.2**	**90.8**

Analytical Results

Sub-Matrix: **ASLP LEACHATE** (Matrix: **WATER**)			*Client sample ID*	**S7 DI LEACH**	----	----	----	----
			Client sampling date / time	22-MAY-2013 14:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1311906-006**	**----**	**----**	**----**	**----**
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	**10**	----	----	----	----
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	**80.0**	----	----	----	----

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**S3 ASLP LEACH**	**S6 ASLP LEACH**	**S7 ASLP LEACH**	**S3 DI LEACH**	**S6 DI LEACH**
			Client sampling date / time	24-APR-2013 12:50	24-APR-2013 15:45	24-APR-2013 16:05	24-APR-2013 12:50	24-APR-2013 15:45
Compound	*CAS Number*	*LOR*	*Unit*	**EB1311906-001**	**EB1311906-002**	**EB1311906-003**	**EB1311906-004**	**EB1311906-005**
EN60: ASLP Leaching Procedure								
Initial pH	----	0.1	pH Unit	**9.0**	**9.2**	**9.1**	----	----
After HCl pH	----	0.1	pH Unit	**2.5**	**2.4**	**2.4**	----	----
Extraction Fluid pH	----	0.1	pH Unit	**5.0**	**5.0**	**5.0**	----	----
Final pH	----	0.1	pH Unit	**7.0**	**6.9**	**6.9**	----	----
EN60: Bottle Leaching Procedure								
Final pH	----	0.1	pH Unit	----	----	----	**8.8**	**8.9**

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Client sample ID	**S7 DI LEACH**	----	----	----	----
			Client sampling date / time	24-APR-2013 16:05	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1311906-006**	**----**	**----**	**----**	**----**
EN60: Bottle Leaching Procedure								
Final pH	----	0.1	pH Unit	**8.9**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **ASLP LEACHATE**

Compound	CAS Number	Recovery Limits (%) Low	Recovery Limits (%) High
EP090S: Organotin Surrogate			
Tripropyltin	----	24	116

Appendix 4 - Sediment log and photos

Site number	Date sampled	Time Sampled	Water Depth (m)	Depth Retained (m)	Colour (refer AS1726)	Field texture	Moisture	Consistency	Sand grain size	Plasticity	% stones	% Shell/grit	% biota	Odour
1	24/04/2013	11.20	3	Grab	Grey	Sandy silt	H	Very weak	Fine	Low	Trace up to 3 cm	Trace		Marine
2	24/04/2013	12:30	3	Grab	Light brown with grey mottle	Sand	H	Weak	Medium	Low	Trace up to 2 cm	5% up to 4 cm		Feint anoxic
3	24/04/2013	12:50	4.5	Grab	Grey	Sandy silt with grey mottle	H	Weak	Fine	Low	20% up to 5 cm	10% up to 5 cm	Trace	Marine
4	24/04/2013	14:55	5.5	Grab	Grey	Silty sand	H	Very weak	Medium	Low	10% up to 10 cm	5% up to 8 cm		Marine
5	24/04/2013	15:15	5.7	Grab	Dark grey	Sandy silt	H	Very weak	Fine to medium	Nil	Trace up to 3 cm	Trace up to 3 cm		Anoxic
6	24/04/2013	15:45	4.8	Grab	Grey with light brown mottle	Sand	H	Very weak	Fine	Low	Trace up to 0.5 cm	Trace up to 0.5 cm		Marine with ammonia
7	24/04/2013	16:05	4.3	Grab	Grey	Sand	H	Very weak	Medium	Low	Trace up to 2 cm	5% up to 5 cm	Trace	Marine
8	24/04/2013	16:30	6.3	Grab	Grey with light brown mottle	Sandy silt	H	Very weak	Fine	Low	Trace up to 0.5 cm	Trace up to 0.5 cm		Marine with ammonia


PROJECT: 301012-01750 BAE SYSTEMS DREDGING SUPPORT AND CONSULTANCY SERVICES

LOCATION: S1

DATE: 24/4/13 SAMPLE TIME: 11:22

SITE:


PROJECT: 301012-01750 BAE SYSTEMS DREDGING SUPPORT AND CONSULTANCY SERVICES

LOCATION: S2

DATE: 24/4/13 SAMPLE TIME: 12:31

SITE:


PROJECT: 301012-01750 BAE SYSTEMS DREDGING SUPPORT AND CONSULTANCY SERVICES

LOCATION: S3

DATE: 24/4/13 SAMPLE TIME: 12:50

SITE:


PROJECT: 301012-01750 BAE SYSTEMS DREDGING SUPPORT AND CONSULTANCY SERVICES

LOCATION: S4

DATE: 24/4/13 SAMPLE TIME: 14:55

SITE:

LOCATION: S5

DATE: 24/4/13 SAMPLE TIME: 15-15

SITE:

PROJECT: 301012-01750 BAE SYSTEMS DREDGING SUPPORT AND CONSULTANCY SERVICES

LOCATION: S6

DATE: 24/4/13 SAMPLE TIME: 15:45

SITE:

No image for sample 7

OJECT: 301012-01750 BA STEMS DREDGING SUPPORT AND CONSULTANC ERVICES

LOCATION: S8

DATE: 24/4/13 SAMPLE TIME: 16.30

SITE:

Appendix 5 - Laboratory QA/QC results

REPORT OF ANALYSIS

Laboratory Reference: A13/2073 [R00]

Client: WorleyParsons Services Pty Ltd
Bishop See Building, L1, 235 St Georges Tce
Perth WA 6000

Contact: Nicola Willson

Order No: 301012-01750
Project: Sediment 301012-01750
Sample Type: sediment
No. of Samples: 1
Date Received: 24/024/2013
Date Completed: 15/05/2013

Laboratory Contact Details:

Client Services Manager: Jane Struthers
Technical Enquiries: Andrew Bradbury
Telephone: +61 8 9325 9799
Fax: +61 8 9325 4299
Email: perth@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:

Ian Eckhard
Technical Director

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

Accreditation No.15109

Batch Number: A13/2073 [R00]
Project Reference: Sediment 301012-01750

QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Arsenic	mg/kg	<0.4	A13/2073-1	3.5||3.5||RPD:0	A13/2069-A/01	103%
Chromium	mg/kg	<0.1	A13/2073-1	11||11||RPD:0	A13/2069-A/01	101%
Copper	mg/kg	<0.1	A13/2073-1	13||12||RPD:8	A13/2069-A/01	98%
Lead	mg/kg	<0.5	A13/2073-1	2.3||2.5||RPD:8	A13/2069-A/01	92%
Nickel	mg/kg	<0.1	A13/2073-1	0.86||0.92||RPD:7	A13/2069-A/01	96%
Zinc	mg/kg	<0.5	A13/2073-1	12||12||RPD:0	A13/2069-A/01	98%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	<0.50	[NT]	[NT]	A13/2154-1	76%
Dibutyl tin	µgSn/kg	<0.50	[NT]	[NT]	A13/2154-1	89%
Tributyl tin	µgSn/kg	<0.50	[NT]	[NT]	A13/2154-1	84%
Surrogate 1 Recovery	%	101	[NT]	[NT]	A13/2154-1	92%

TEST	UNITS	Blank
Total Organic Carbon	%	<0.01

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

Acceptable replicate reproducibility limit or RPD:	Results < 10 times LOR: no limits.
	Results >10 times LOR: 0% - 50%.
Acceptable matrix spike & LCS recovery limits:	Trace elements 70-130%
	Organic analyses 50-150%
	SVOC & speciated phenols 10-140%
	Surrogates 10-140%

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

Environmental Division

QUALITY CONTROL REPORT

Work Order : **EP1303024**

Client : **WORLEY PARSONS - INFRASTRUCTURE MWE**
Contact : NICOLA WILLSON
Address : QV1 Building Lvl 7
250 St Georges Tce
PERTH WA, AUSTRALIA 6000

E-mail : nicola.willson@worleyparsons.com
Telephone : +61 08 9278 8111
Facsimile : ----

Project : 301012-01750
Site : BAE Dredging Project
C-O-C number : ----
Sampler : NW
Order number : 301012-01750-PS-CNT-100513ALS

Quote number : EP/386/13

Page : 1 of 5

Laboratory : Environmental Division Perth
Contact : Scott James
Address : 10 Hod Way Malaga WA Australia 6090

E-mail : perth.enviro.services@alsglobal.com
Telephone : +61-8-9209 7655
Facsimile : +61-8-9209 7600

QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Date Samples Received : 26-APR-2013
Issue Date : 10-MAY-2013

No. of samples received : 11
No. of samples analysed : 11

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

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

NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

WORLD RECOGNISED
ACCREDITATION

Signatories

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

Signatories	*Position*	*Accreditation Category*
Hamish Murray	Laboratory Supervisor	Newcastle - Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics
SATISH.TRIVEDI	2 IC Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics

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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix**: SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	***Client sample ID***	***Method: Compound***	***CAS Number***	***LOR***	***Unit***	***Original Result***	***Duplicate Result***	***RPD (%)***	***Recovery Limits (%)***
EA055: Moisture Content (QC Lot: 2844816)									
EB1310009-022	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	1.8	1.9	10.0	No Limit
EB1310009-029	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	2.6	2.4	5.4	No Limit
EA055: Moisture Content (QC Lot: 2844817)									
EP1303024-007	S7	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	29.2	29.9	2.4	0% - 20%
ES1309459-003	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	<1.0	<1.0	0.0	No Limit
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 2848366)									
EP1303024-001	S1	EG020-SD: Chromium	7440-47-3	1.0	mg/kg	8.9	8.3	7.6	0% - 20%
		EG020-SD: Copper	7440-50-8	1.0	mg/kg	5.8	5.5	5.1	No Limit
		EG020-SD: Lead	7439-92-1	1.0	mg/kg	2.4	2.0	18.0	0% - 20%
		EG020-SD: Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	0.0	No Limit
		EG020-SD: Zinc	7440-66-6	1.0	mg/kg	10.6	10.2	3.8	0% - 20%
		EG020-SD: Arsenic	7440-38-2	1.00	mg/kg	2.22	1.85	17.9	0% - 20%
EP1303024-011	ST1	EG020-SD: Chromium	7440-47-3	1.0	mg/kg	10.7	12.3	13.3	0% - 50%
		EG020-SD: Copper	7440-50-8	1.0	mg/kg	7.1	7.3	2.9	No Limit
		EG020-SD: Lead	7439-92-1	1.0	mg/kg	2.4	2.5	0.0	No Limit
		EG020-SD: Nickel	7440-02-0	1.0	mg/kg	<5.0	<5.0	0.0	No Limit
		EG020-SD: Zinc	7440-66-6	1.0	mg/kg	14.4	13.7	5.2	0% - 20%
		EG020-SD: Arsenic	7440-38-2	1.00	mg/kg	2.03	1.91	6.1	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2846012)									
EB1309937-015	Anonymous	EP003: Total Organic Carbon	----	0.02	%	0.06	0.05	0.0	No Limit
EP1303024-007	S7	EP003: Total Organic Carbon	----	0.02	%	0.24	0.27	12.7	0% - 50%
EP090: Organotin Compounds (QC Lot: 2844815)									
EP1303024-001	S1	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	7.8	6.8	13.8	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 2848366)								
EG020-SD: Arsenic	7440-38-2	1.0	mg/kg	<1.00	21.7 mg/kg	106	74	126
EG020-SD: Chromium	7440-47-3	1.0	mg/kg	<1.0	43.9 mg/kg	95.0	79	129
EG020-SD: Copper	7440-50-8	1.0	mg/kg	<1.0	32.0 mg/kg	112	80	125
EG020-SD: Lead	7439-92-1	1.0	mg/kg	<1.0	40.0 mg/kg	108	72	122
EG020-SD: Nickel	7440-02-0	1.0	mg/kg	<1.0	55.1 mg/kg	98.8	77	123
EG020-SD: Zinc	7440-66-6	1.0	mg/kg	<1.0	60.8 mg/kg	121	71	127
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 2846012)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.11 %	104	70	130
EP090: Organotin Compounds (QCLot: 2844815)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	66.7	45	134

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 2848366)							
EP1303024-002	S2	EG020-SD: Arsenic	7440-38-2	50 mg/kg	114	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	114	70	130
		EG020-SD: Copper	7440-50-8	50 mg/kg	101	70	130
		EG020-SD: Lead	7439-92-1	50 mg/kg	108	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	97.1	70	130
		EG020-SD: Zinc	7440-66-6	50 mg/kg	98.5	70	130
EP090: Organotin Compounds (QCLot: 2844815)							
EP1303024-002	S2	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	# Not Determined	20	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

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

Sub-Matrix: **SOIL**

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report Spike Concentration	Spike Recovery (%) MS	Spike Recovery (%) MSD	Recovery Limits (%) Low	Recovery Limits (%) High	RPDs (%) Value	RPDs (%) Control Limit
EP090: Organotin Compounds (QCLot: 2844815)										
EP1303024-002	S2	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	# Not Determined	----	20	130	----	----
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 2848366)										
EP1303024-002	S2	EG020-SD: Arsenic	7440-38-2	50 mg/kg	114	----	70	130	----	----
		EG020-SD: Chromium	7440-47-3	50 mg/kg	114	----	70	130	----	----
		EG020-SD: Copper	7440-50-8	50 mg/kg	101	----	70	130	----	----
		EG020-SD: Lead	7439-92-1	50 mg/kg	108	----	70	130	----	----
		EG020-SD: Nickel	7440-02-0	50 mg/kg	97.1	----	70	130	----	----
		EG020-SD: Zinc	7440-66-6	50 mg/kg	98.5	----	70	130	----	----

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EP1303024**	Page	: 1 of 6
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Perth
Contact	: NICOLA WILLSON	Contact	: Scott James
Address	: QV1 Building Lvl 7 250 St Georges Tce PERTH WA, AUSTRALIA 6000	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: nicola.willson@worleyparsons.com	E-mail	: perth.enviro.services@alsglobal.com
Telephone	: +61 08 9278 8111	Telephone	: +61-8-9209 7655
Facsimile	: ----	Facsimile	: +61-8-9209 7600
Project	: 301012-01750	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: BAE Dredging Project		
C-O-C number	: ----	Date Samples Received	: 26-APR-2013
Sampler	: NW	Issue Date	: 10-MAY-2013
Order number	: 301012-01750-PS-CNT-100513ALS		
		No. of samples received	: 11
Quote number	: EP/386/13	No. of samples analysed	: 11

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non -volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method ***Container** / Client Sample ID(s)*	***Sample Date***	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055-103) S1, S2, S3, S4, S5, S6, S7, S8, FT1, FT2, ST1	**24-APR-2013**	**----**	----	----	**30-APR-2013**	08-MAY-2013	✓
EA150: Particle Sizing							
Snap Lock Bag (EA150H) S1, S2, S3, S5, S6, S7, S8	**24-APR-2013**	**---**	21-OCT-2013	----	**09-MAY-2013**	21-OCT-2013	✓
EA150: Soil Classification based on Particle Size							
Snap Lock Bag (EA150H) S1, S2, S3, S5, S6, S7, S8	**24-APR-2013**	**---**	21-OCT-2013	----	**09-MAY-2013**	21-OCT-2013	✓
EG020-SD: Total Metals in Sediments by ICPMS							
Soil Glass Jar - Unpreserved (EG020-SD) S1, S2, S3, S4, S5, S6, S7, S8, FT1, FT2, ST1	**24-APR-2013**	**02-MAY-2013**	21-OCT-2013	✓	**03-MAY-2013**	21-OCT-2013	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP003: Total Organic Carbon (TOC) in Soil								
Pulp Bag (EP003)								
S1,	S2,	**24-APR-2013**	**01-MAY-2013**	22-MAY-2013	✓	**02-MAY-2013**	22-MAY-2013	✓
S3,	S4,							
S5,	S6,							
S7,	S8,							
FT1,	FT2,							
ST1								
EP090: Organotin Compounds								
Soil Glass Jar - Unpreserved (EP090)								
S1,	S2,	**24-APR-2013**	**30-APR-2013**	08-MAY-2013	✓	**02-MAY-2013**	09-JUN-2013	✓
S3,	S4,							
S5,	S6,							
S7,	S8,							
FT1,	FT2,							
ST1								

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	4	31	**12.9**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organotin Analysis	EP090	1	9	**11.1**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	2	11	**18.2**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	2	15	**13.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Organotin Analysis	EP090	1	9	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	11	**9.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	1	15	**6.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organotin Analysis	EP090	1	9	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	11	**9.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	1	15	**6.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Organotin Analysis	EP090	1	9	**11.1**	**5.0**	✓	ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	11	**9.1**	**5.0**	✓	ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2010 Draft) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Total Metals in Sediments by ICPMS	EG020-SD	SOIL	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. Analyte list and LORs per NODG.
Total Organic Carbon	EP003	SOIL	In-house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automaticaly measured by infra-red detector.
Organotin Analysis	EP090	SOIL	(USEPA SW 846 - 8270D) Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quanitified against an established calibration curve.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	USEPA 200.2 Mod. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (1999) Schedule B(3) (Method 202)
Organotin Sample Preparation	ORG35	SOIL	In house. 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	**Analyte**	CAS Number	Data	Limits	**Comment**
Matrix Spike (MS) Recoveries							
EP090: Organotin Compounds	EP1303024-002	S2	**Tributyltin**	56573-85-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- **No Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

A13/2073

Due: 10/5/13

CHAIN OF CUSTODY **QUOTE NO:** EN13_057 Page 1 of 1

FROM
Client: **WORLEY PARSONS**
Address: Level 1, Bishop See, 235 St Georges Tce
Tel: 63116340 *Fax:* 92788110
Project Manager: Amanda Blanksby
Project Ref: 301012- 01750
Results expected due date:
Report results to: Nicola Willson

TO
ADVANCED ANALYTICAL AUSTRALIA
7 Forrest Ave, East Perth WA 6004
Tel: 08 9325 9799 (0423 917 339) *Fax: 08 9325 4299*
Contact: Jane Struthers
Email: perth@advancedanalytical.com.au
www.advancedanalytical.com.au

ANALYSES

Laboratory ID		*Client ID*	*Sample Date*	*Time*	*Matrix*								
					Marine Sediment	Bottles	Other	(Arsenic, Chromium, Copper, Lead, Nickel and Zinc)	TBT	Moisture content	TOCs	
A13/20	73-1	ST2	24/04/2013		✓	2 jars		✓	✓	✓	✓		

RELINQUISHED BY **Nicola Willson** **Date:** 26/04/2013 **RECEIVED BY:**

2 6 APR 2013

psd=100g bag, metals,tbt,tph,pah,pcb,OC,OP= 250mL jar, TOC nutrients =125mL jar, remaining+elutr+dae = 250mL or 125mL jar

CHAIN OF CUSTODY DOCUMENTATION

Australian Laboratory Services Pty Ltd

CLIENT: WorleyParsons
ADDRESS / OFFICE: Bishop See Building, Level 1, 235 St Georges Tce, Perth, 6000
PROJECT MANAGER (PM): Amanda Blanksby (Contact: Nicola Willson)
PROJECT ID: 301012- 01750
SITE: BAE Dredging Project
P.O. NO.:
RESULTS REQUIRED (**Date**):
QUOTE NO.: EP/386/13

SAMPLER: Nicola Willson
MOBILE: 0432972436
PHONE
EMAIL REPORT TO: Nicola.Willson@worleyparsons.com
EMAIL INVOICE TO: nicola.willson@worleyparsons.com

ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)

FOR LABORATORY USE ONLY
COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DIPOSAL:
Marine sediments

Notes: e.g. Highly contaminated samples,

Extra volume for QC or trace LORs etc.

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION						
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Jars	Bags	Ultra trace Metals (Arsenic, Chromium, Copper, Lead, Nickel, Zinc)	PSD	Moisture content	TBT	TOCs
	S1	SED	24/4/13	11:20	2 jars	2 bags	✓	✓	✓	✓	✓
	S2	SED	24/4/13	12:30	2 jars	1 bag	✓	✓	✓	✓	✓
	S3	SED	24/4/13	12:50	2 jars	1 bag	✓	✓	✓	✓	✓
	S4	SED	24/4/13	14:55	2 jars	1 bag	✓		✓	✓	✓
	S5	SED	24/4/13	15:15	2 jars	2 bags	✓	✓		✓	✓
	S6	SED	24/4/13	15:45	2 jars	1 bag	✓	✓		✓	✓
	S7	SED	24/4/13	16:05	2 jars	1 bag	✓	✓		✓	✓
	S8	SED	24/4/13	16:30	2 jars	1 bag	✓	✓		✓	✓
	FT1	SED	24/4/13		2 jars		✓			✓	✓
	FT2	SED	24/4/13		2 jars		✓			✓	✓
	ST1	SED	24/4/13		2 jars		✓			✓	✓

RELINQUISHED BY:		RECEIVED BY		METHOD OF SHIPMENT
Name: Nicola Willson	Date: 26/4/2013	Name:	Date:	Con' Note No:
Of: WorleyParsons	Time: 10:00	Of:	Time:	
Name:	Date:	Name:	Date:	Transport Co:
Of:	Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserveed Plastic; AG = Amber Glass Unpreserved;
V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bad for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

ALS Group

Food& Environmental Pharmaceutical

ALS Life Sciences

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **EB1311906**	Page	: 1 of 4
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Brisbane
Contact	: NICOLA WILLSON	Contact	: Customer Services
Address	: QV1 Building Lvl 7 250 St Georges Tce PERTH WA, AUSTRALIA 6000	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: nicola.willson@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 08 9278 8111	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: 301012-01750	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: BAE Dredging Site		
C-O-C number	: ----	Date Samples Received	: 17-MAY-2013
Sampler	: Nicola Willson	Issue Date	: 28-MAY-2013
Order number	: 301012-01750-PS-CNT-100513ALS		
		No. of samples received	: 6
Quote number	: EN/034/12	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

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

NATA

WORLD RECOGNISED ACCREDITATION

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*
Matt Frost	Senior Organic Chemist	Brisbane Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics

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.

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

Laboratory Duplicate (DUP) Report

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

- **No Laboratory Duplicate (DUP) Results are required to be reported.**

Method Blank (MB) and Laboratory Control Spike (LCS) Report

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP090: Organotin Compounds (Soluble) (QCLot: 2880949)								
EP090S: Tributyltin	56573-85-4	2	ngSn/L	<2	147 ngSn/L	109	24.1	115
EP090: Organotin Compounds (Soluble) (QCLot: 2889274)								
EP090S: Tributyltin	56573-85-4	2	ngSn/L	<2	147 ngSn/L	81.2	24.1	115

Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

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

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order : **EB1311906**

Client : WORLEY PARSONS - INFRASTRUCTURE MWE
Contact : NICOLA WILLSON
Address : QV1 Building Lvl 7
250 St Georges Tce
PERTH WA, AUSTRALIA 6000

E-mail : nicola.willson@worleyparsons.com
Telephone : +61 08 9278 8111
Facsimile : ----

Project : 301012-01750
Site : BAE Dredging Site
C-O-C number : ----
Sampler : Nicola Willson
Order number : 301012-01750-PS-CNT-100513ALS

Quote number : EN/034/12

Page : 1 of 5

Laboratory : Environmental Division Brisbane
Contact : Customer Services
Address : 2 Byth Street Stafford QLD Australia 4053

E-mail : Brisbane.Enviro.Services@alsglobal.com
Telephone : +61 7 3243 7222
Facsimile : +61 7 3243 7218

QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Date Samples Received : 17-MAY-2013
Issue Date : 28-MAY-2013

No. of samples received : 6
No. of samples analysed : 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

Evaluation: ✘ = Holding time breach ; ✓ = Within holding time.

Method	*Sample Date*	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		*Date extracted*	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EN60: ASLP Leaching Procedure							
LabSplit: Leach for organics and other tests (EN60a) S3 - ASLP LEACH	**24-APR-2013**	---	08-MAY-2013	----	**21-MAY-2013**	08-MAY-2013	✘
LabSplit: Leach for organics and other tests (EN60a) S6 - ASLP LEACH, S7 - ASLP LEACH	**24-APR-2013**	---	08-MAY-2013	----	**22-MAY-2013**	08-MAY-2013	✘
EN60: Bottle Leaching Procedure							
LabSplit: Leach for organics and other tests (EN60-DIa) S3 - DI LEACH	**24-APR-2013**	---	08-MAY-2013	----	**21-MAY-2013**	08-MAY-2013	✘
LabSplit: Leach for organics and other tests (EN60-DIa) S6 - DI LEACH, S7 - DI LEACH	**24-APR-2013**	---	08-MAY-2013	----	**22-MAY-2013**	08-MAY-2013	✘
EP090: Organotin Compounds (Soluble)							
Amber Glass Bottle - Unpreserved (EP090S) S3 - ASLP LEACH, S6 - ASLP LEACH, S7 - ASLP LEACH	**20-MAY-2013**	**28-MAY-2013**	27-MAY-2013	✘	**28-MAY-2013**	07-JUL-2013	✓
Amber Glass Bottle - Unpreserved (EP090S) S3 - DI LEACH, S6 - DI LEACH, S7 - DI LEACH	**22-MAY-2013**	**23-MAY-2013**	29-MAY-2013	✓	**24-MAY-2013**	02-JUL-2013	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS)							
Organotin Compounds (Soluble)	EP090S	2	6	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organotin Compounds (Soluble)	EP090S	2	6	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Organotin Compounds (Soluble)	EP090S	SOIL	USEPA SW 846 - 8270D Sample extracts are analysed by GC/MS coupled with high volume injection and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
ASLP for Non & Semivolatile Analytes	EN60a	SOIL	AS4439.3 Preparation of Leachates
Deionised Water Leach	EN60-DIa	SOIL	AS4439.3 Preparation of Leachates
Organotin Sample Preparation	ORG34	SOIL	In-house. A specified volume of sample is spiked with surrogate, acidified and vacuum filtered. Reagents and solvent are added and the mixture tumbled. The butyltin compounds is derivitisated, extracted and the subtitution reaction completed. The extract is transferred to a separatory funnel and further extracted two times with petroleum ether. The resultant extracts are combined and concentrated for analysis.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **SOIL**

Method		*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EN60: ASLP Leaching Procedure							
LabSplit: Leach for organics and other tests S3 - ASLP LEACH		----	----	----	21-MAY-2013	08-MAY-2013	**13**
LabSplit: Leach for organics and other tests S6 - ASLP LEACH,	S7 - ASLP LEACH	----	----	----	22-MAY-2013	08-MAY-2013	**14**
EN60: Bottle Leaching Procedure							
LabSplit: Leach for organics and other tests S3 - DI LEACH		----	----	----	21-MAY-2013	08-MAY-2013	**13**
LabSplit: Leach for organics and other tests S6 - DI LEACH,	S7 - DI LEACH	----	----	----	22-MAY-2013	08-MAY-2013	**14**
EP090: Organotin Compounds (Soluble)							
Amber Glass Bottle - Unpreserved S3 - ASLP LEACH, S7 - ASLP LEACH	S6 - ASLP LEACH,	28-MAY-2013	27-MAY-2013	**1**	----	----	----

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**