



**BAE SYSTEMS**

**HENDERSON POINT SHIPYARD DREDGING  
SEDIMENT SAMPLING AND ANALYSIS PLAN**

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## **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:

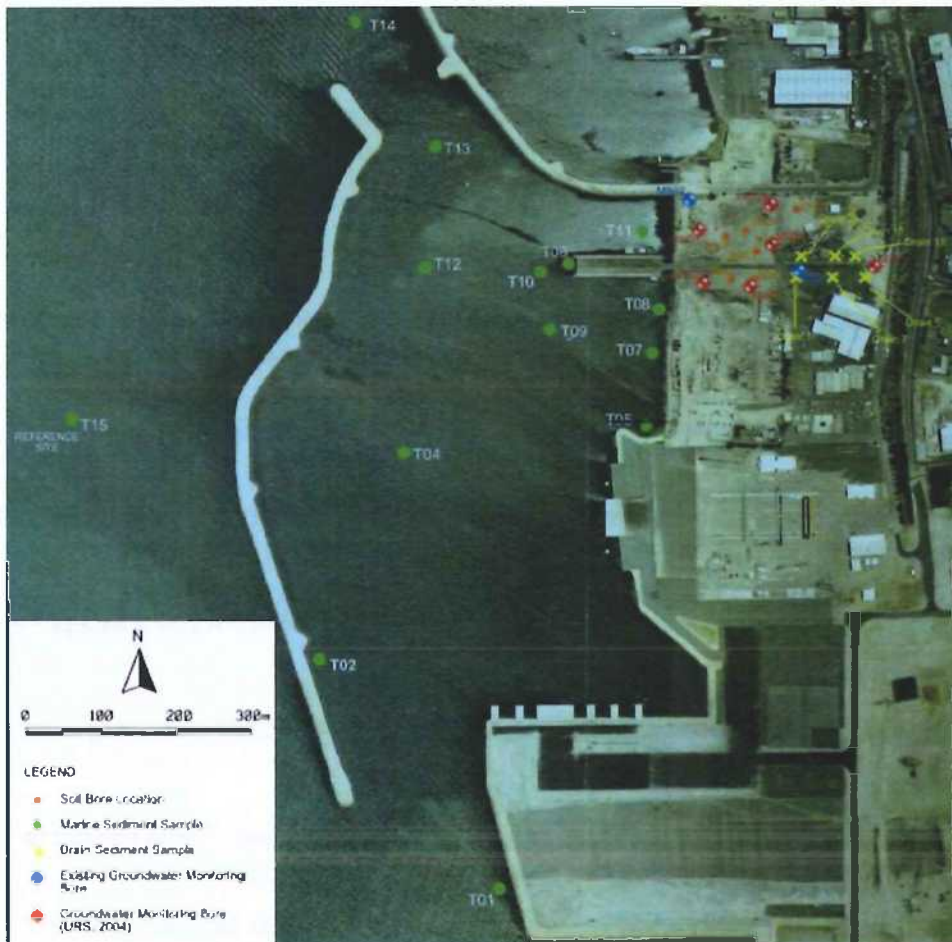
- Copper at site T06 was consistently above the guideline;
- Nickel and zinc exceeded the guideline at site T07 in the April 2007 monitoring event;
- TBT in the majority of locations; and
- In March 2005 T09 had exceedences for all metals except for lead. This is thought to be an isolated contamination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



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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))



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## **2.4 Dredge areas, volumes and likely contaminants**

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

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<sup>3</sup>. As the site is potentially contaminated and the dredge volume is low the entire dredge volume of 20,000 m<sup>3</sup> 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)



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- zinc (Zn)
- organics:
  - organotins (TBT);
- total organic carbon; and
- particle size distribution (to 2  $\mu\text{m}$ ).





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**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<sup>3</sup>) 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<sup>3</sup> 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**

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



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nickel (Ni)	1
zinc (Zn)	1
<b>Organics:</b>	
organotins (TBT)	0.5 µgSn/kg
total organic carbon	0.02%
moisture content	1%
<b>Physical characteristics</b>	
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.



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**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).



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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





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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.



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**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;*



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- *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-



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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 jackknife analysis as recommended in the NAGD. Similarly, datasets that are neither normal nor log-normally distributed are analysed using non-parametric jackknife 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.





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#### **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



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**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	





**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



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**BAE DREDGING PROJECT SUPPORT AND CONSULTANCY SERVICES**

**SEDIMENT QUALITY ASSESSMENT REPORT**

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## **Appendix 2 - Site Description Sheet and Sediment Log**

SZ on last page

### 301012-01750: BAE Systems Dredging Support and Consultancy Services

**CLIENT: BAE Systems**

**DATE OF CORING:** 27/10/13

**TIME OF CORING:** 12.30

#### Collection Details

General location of core or sampling location	
Site/location number	M0439 on GPS
Sample Id.s assigned	SZ
Easting/Longitude of core location (from onboard GPS)	<del>115116550</del>
Northing/Latitude of core location (from onboard GPS)	<del>321151033</del>
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 lumps fine, calm nil

**301012-01750: BAE Systems Dredging Support and Consultancy Services**  
**Sediment Description**

<b>Sample Location</b>		S2							
<b>Date / Sample Time</b>		24/4/13							
<b>Depth retained</b>		~3m							
<b>Strata Change (m)</b>	<b>Colour* (refer AS1726)</b>	<b>Field texture**</b>	<b>Moist.</b>	<b>Consist</b>	<b>Sand grain size</b>	<b>Plasticity</b>	<b>% stones</b>	<b>Shell/grit and/or blota</b>	<b>Odour</b>
	Light <del>yellow</del> <sup>tan</sup> gray mottled	Sand	H	W	M	XL	Trace up to 2cm	5% up to 4cm	Faint 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





## 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	made 4D 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 3cm	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	SE
Site/location number	mark 14 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		SL4							
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	M	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	SS - mark U3 on wa. 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		SS							
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	<del>W</del> F-M		Nil	Trace up to 3cm	Trace up to 3cm	Anoxic
				↓					
				to base					

\* 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:** 15:45

### Collection Details

General location of core of sampling location	<u>56 - Mark 46 yellow</u>
Site/location number	<u>GPS</u>
Sample Id.s assigned	<u>ST1 &amp; ST2</u>
Easting/Longitude of core location (from onboard GPS)	
Northing/Latitude of core location (from onboard GPS)	
Water depth at core location	<u>4.8m</u>
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	<u>As previous.</u>

**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 mottled	sand	H	V	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



## 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 <del>4</del> 45
Sample Id.s assigned	
Easting/Longitude of core location (from onboard GPS)	GA
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
	<del>Grey</del> Grey	Sand	H	V W	M	<del>Trace</del> L	Trace up to 2cm	2" 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:** 16:30

### Collection Details

General location of core of sampling location	
Site/location number	<u>58 - made 46 m GPS</u>
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	<u>6.3m</u>
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	<u>As previous</u>



**301012-01750: BAE Systems Dredging Support and Consultancy Services**  
**Sediment Description**

Sample Location		S8							
Date / Sample Time		# 24/6							
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 mottled	Sandy silt	H	W	Fine	Weakly plastic	Trace up to 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	(BAE1) S1 - made from G/B
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**

<b>Sample Location</b>		S1							
<b>Date / Sample Time</b>		24/4/13							
<b>Depth retained</b>		<del>0.4m</del> Grab							
<b>Strata Change (m)</b>	<b>Colour* (refer AS1726)</b>	<b>Field texture**</b>	<b>Moist</b>	<b>Consist</b>	<b>Sand grain size</b>	<b>Plasticity</b>	<b>% stones</b>	<b>Shell/grit and/or biota</b>	<b>Odour</b>
	grey	sandy SILT <del>fine silt</del>	high	veg 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



**WorleyParsons**

resources & energy

**BAE SYSTEMS**

**BAE DREDGING PROJECT SUPPORT AND CONSULTANCY SERVICES**

**SEDIMENT QUALITY ASSESSMENT REPORT**

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## 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:** Sediment301012-01750  
**Sample Type:** sediment  
**No. of Samples:** 1  
**Date Received:** 24/024/2013  
**Date Completed:** 15/05/2013

**Contact:** Nicola Willson

---

### Laboratory Contact Details:

**Client Services Manager:** Jane Struthers  
**Technical Enquiries:** Andrew Bradbury  
**Telephone:** +61 89325 9799  
**Fax:** +61 89325 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.



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Issue Date: 15 May 2013

Page 1 of 4

**Advanced Analytical Australia Pty Ltd**  
ABN 20 105 644 979  
11 Julius Avenue  
North Ryde NSW 2113 Australia

Ph: +61 2 9888 9077  
Fax: +61 2 9888 9577  
contact@advancedanalytical.com.au  
www.advancedanalytical.com.au





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

<b>Laboratory Reference:</b>	-	-	<b>1</b>
<b>Client Reference:</b>	-	-	<b>ST2</b>
<b>Date Sampled:</b>	-	-	<b>24/04/2013</b>
<b>Analysis Description</b>	<b>Method</b>	<b>Units</b>	
<b>Moisture Content</b>			
Moisture Content	04-004	%	21.8
<b>Trace Elements</b>			
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
<b>Organotins</b>			
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
<b>Subcontract Analysis</b>			
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

## CERTIFICATE OF ANALYSIS

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

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

Page : 2 of 6  
Work Order : EP1303024  
Client : WORLEY PARSONS - INFRASTRUCTURE MWE  
Project : 301012-01750



### 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
				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
<b>EA150: Particle Sizing</b>								
+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
<b>EA055: Moisture Content</b>								
Moisture Content (dried @ 103°C)	---	1.0	%	27.3	26.3	27.3	26.4	32.8
<b>EA150: Soil Classification based on Particle Size</b>								
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
<b>EG020-SD: Total Metals in Sediments by ICPMS</b>								
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
<b>EP003: Total Organic Carbon (TOC) in Soil</b>								
Total Organic Carbon	---	0.02	%	0.18	0.19	0.28	0.24	0.50
<b>EP090: Organotin Compounds</b>								
Tributyltin	56573-85-4	0.5	µgSn/kg	7.8	7.1	13.1	5.6	5.2
<b>EP090S: Organotin Surrogate</b>								
Tripopyltin	---	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
				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
Client sampling date / time				EP1303024-006	EP1303024-007	EP1303024-008	EP1303024-009	EP1303024-010
Compound	CAS Number	LOR	Unit					
<b>EA150: Particle Sizing</b>								
+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	---	---
<b>EA055: Moisture Content</b>								
Moisture Content (dried @ 103°C)	---	1.0	%	28.5	29.2	32.2	28.0	46.0
<b>EA150: Soil Classification based on Particle Size</b>								
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	---	---
<b>EG020-SD: Total Metals in Sediments by ICPMS</b>								
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
<b>EP003: Total Organic Carbon (TOC) in Soil</b>								
Total Organic Carbon	---	0.02	%	0.18	0.24	0.34	0.45	0.50
<b>EP090: Organotin Compounds</b>								
Tributyltin	56573-85-4	0.5	µgSn/kg	16.9	12.3	3.1	6.4	12.6
<b>EP090S: Organotin Surrogate</b>								
Tripopyltin	---	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	---	---	---	---
<b>EA055: Moisture Content</b>								
Moisture Content (dried @ 103°C)	---	1.0	%	25.0	---	---	---	---
<b>EG020-SD: Total Metals in Sediments by ICPMS</b>								
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	---	---	---	---
<b>EP003: Total Organic Carbon (TOC) in Soil</b>								
Total Organic Carbon	---	0.02	%	0.23	---	---	---	---
<b>EP090: Organotin Compounds</b>								
Tributyltin	56573-85-4	0.5	µgSn/kg	9.6	---	---	---	---
<b>EP000: Organotin Surrogate</b>								
Tripopyltin	---	0.1	%	80.1	---	---	---	---



### Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%)	
		Low	High
<b>EP090S: Organotin Surrogate</b>			
<b>Tripropyltin</b>	---	35	130

# Certificate of Analysis

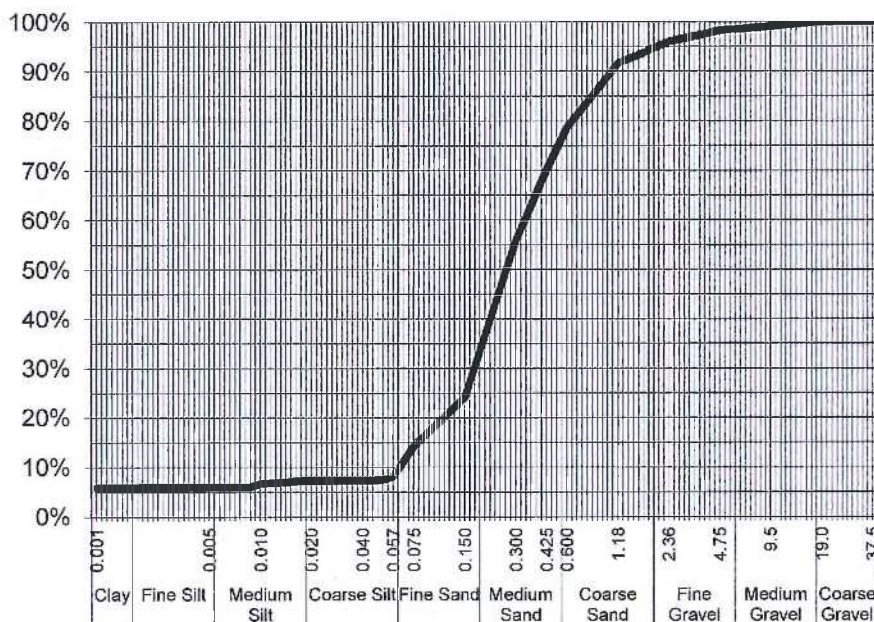
ALS Laboratory Group Pty Ltd  
5 Rosegum Road  
Warabrook, NSW 2304  
pH 02 4968 9433  
fax 02 4968 0349  
samples.newcastle@alsenviro.com

**ALS Environmental**  
**Newcastle, NSW**



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

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:

**Loss on Pretreatment** NA

**Sample Description:** Sand and shell

**Test Method:** AS1289.3.6.3

**Soil Particle Density (<2.36mm)** 2.65 g/cm<sup>3</sup>

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**Median Particle Size (mm)** 0.225

**Analysed:** 10-May-13

**Limit of Reporting:** 1%

**Dispersion Method** Shaker

**Hydrometer Type** ASTM E100

**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**



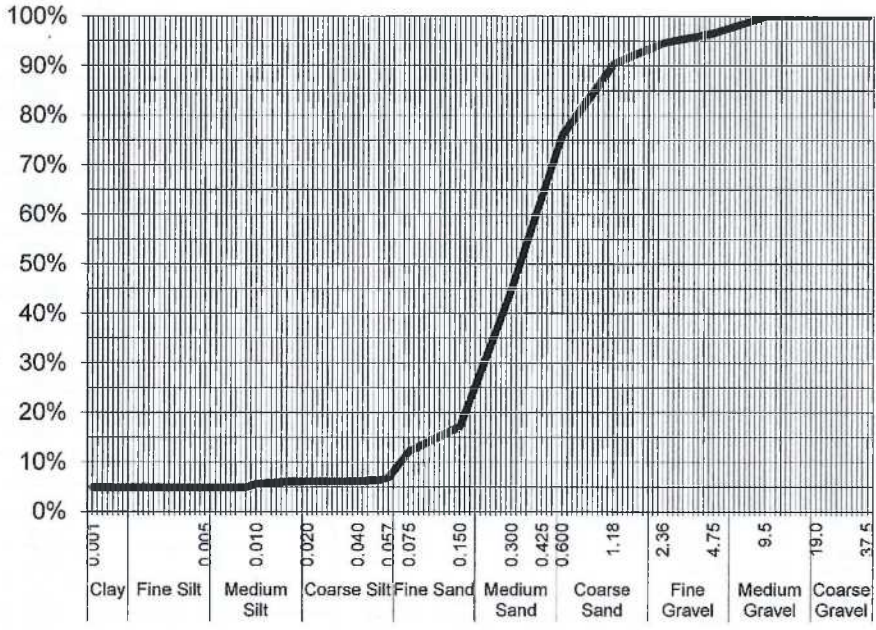
**CLIENT:** Nicola Willson                      **DATE REPORTED:** 10-May-2013

**COMPANY:** Worley Parsons - Infrastructure                      **DATE RECEIVED:** 26-Apr-2013  
 MWE

**ADDRESS:** QV1 Building Lvl 7                      **REPORT NO:** EP1303024-002 / PSD  
 250 St Georges Tce  
 Perth, WA 6000

**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:**

**Loss on Pretreatment:** NA

**Sample Description:** Sand and shell

**Test Method:** AS1289.3.6.3

**Analysed:** 10-May-13

**Limit of Reporting:** 1%

**Dispersion Method:** Shaker

**Hydrometer Type:** ASTM E100

**Soil Particle Density (<2.36mm):** 2.65 g/cm<sup>3</sup>

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**Hamish Murray**  
 Laboratory Supervisor, Newcastle  
 Authorised Signatory



# Certificate of Analysis

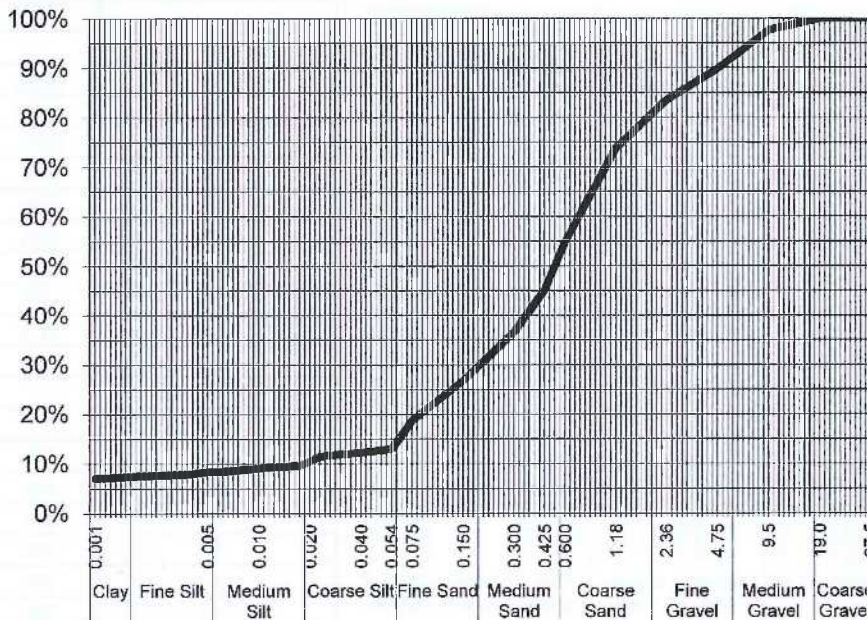
ALS Laboratory Group Pty Ltd  
 5 Rosegum Road  
 Warabrook, NSW 2304  
 pH 02 4968 9433  
 fax 02 4968 0349  
 samples.newcastle@alsenviro.com

**ALS Environmental**  
**Newcastle, NSW**



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

**Loss on Pretreatment** NA

**Sample Description:** Sand, silty clay and shell

**Test Method:** AS1289.3.6.3

**Soil Particle Density (<2.36mm)** 2.65 g/cm<sup>3</sup>

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**Analysed:** 10-May-13

**Limit of Reporting:** 1%

**Dispersion Method** Shaker

**Hydrometer Type** ASTM E100

**Hamish Murray**  
 Laboratory Supervisor, Newcastle  
**Authorised Signatory**



# Certificate of Analysis

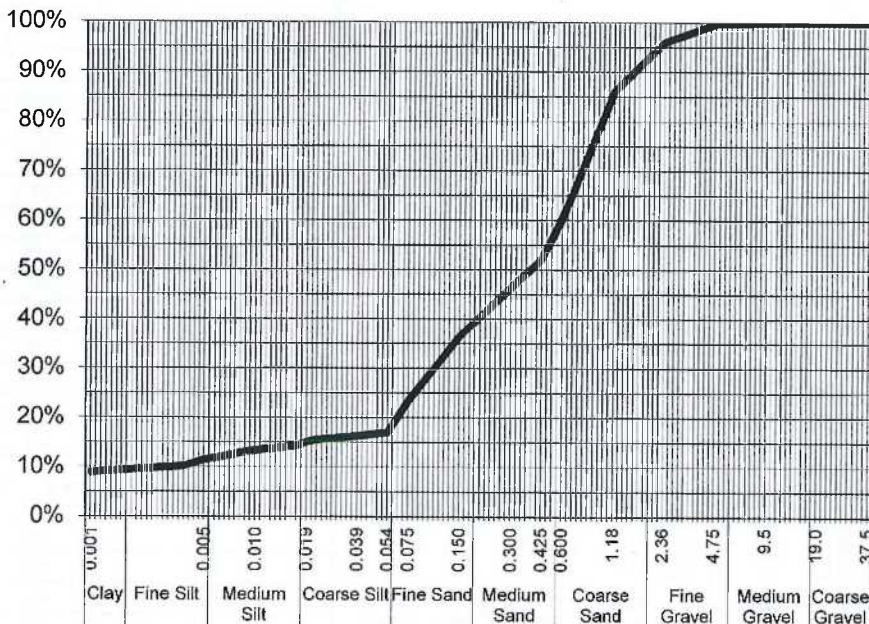
ALS Laboratory Group Pty Ltd  
 5 Rosegum Road  
 Warabrook, NSW 2304  
 pH 02 4968 9433  
 fax 02 4968 0349  
 samples.newcastle@alsenviro.com

**ALS Environmental**  
**Newcastle, NSW**



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

**Loss on Pretreatment** NA

**Sample Description:** Sand, silty clay and shell

**Test Method:** AS1289.3.6.3

**Soil Particle Density (<2.36mm)** 2.65 g/cm<sup>3</sup>

NATA Accreditation: 825 Site: Newcastle  
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**Analysed:** 10-May-13

**Limit of Reporting:** 1%

**Dispersion Method** Shaker

**Hydrometer Type** ASTM E100

**Hamish Murray**  
 Laboratory Supervisor, Newcastle  
**Authorised Signatory**





# Certificate of Analysis

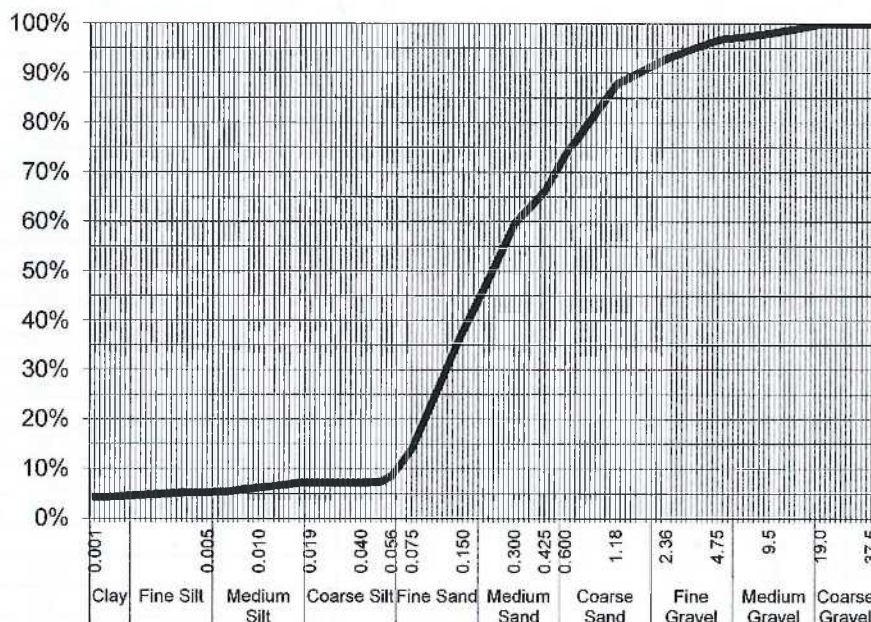
ALS Laboratory Group Pty Ltd  
 5 Rosegum Road  
 Warabrook, NSW 2304  
 pH 02 4968 9433  
 fax 02 4968 0349  
 samples.newcastle@alsenviro.com

**ALS Environmental**  
**Newcastle, NSW**



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

**Loss on Pretreatment** NA

**Sample Description:** Sand and shell

**Test Method:** AS1289.3.6.3

**Soil Particle Density (<2.36mm)** 2.65 g/cm<sup>3</sup>

NATA Accreditation: 825 Site: Newcastle  
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**Analysed:** 10-May-13

**Limit of Reporting:** 1%

**Dispersion Method** Shaker

**Hydrometer Type** ASTM E100

**Hamish Murray**  
 Laboratory Supervisor, Newcastle  
 Authorised Signatory

# Certificate of Analysis

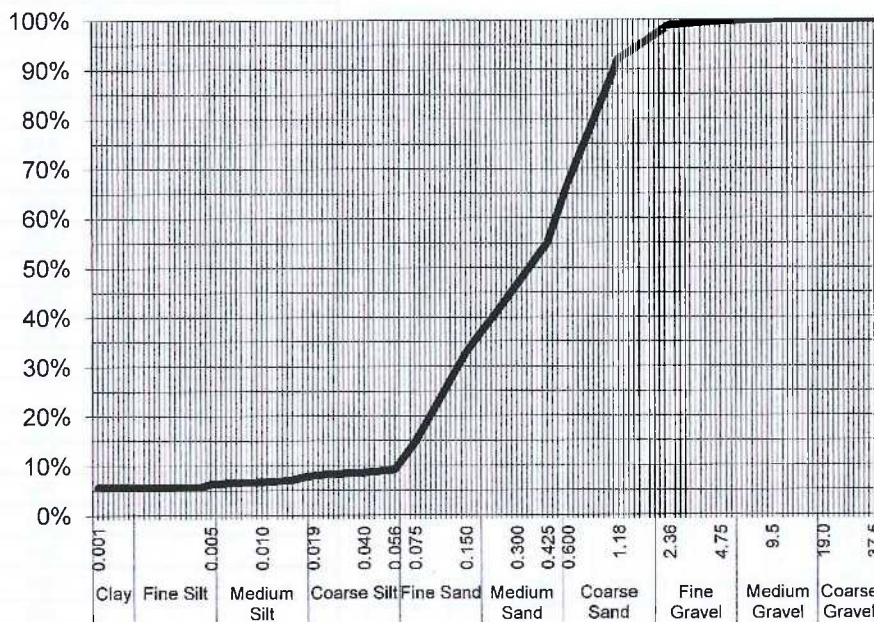
ALS Laboratory Group Pty Ltd  
 5 Rosegum Road  
 Warabrook, NSW 2304  
 pH 02 4968 9433  
 fax 02 4968 0349  
 samples.newcastle@alsenviro.com

**ALS Environmental**  
**Newcastle, NSW**



**CLIENT:** Nicola Willson **DATE REPORTED:** 10-May-2013  
**COMPANY:** Worley Parsons - Infrastructure **DATE RECEIVED:** 26-Apr-2013  
 MWE  
**ADDRESS:** QV1 Building Lvl 7 **REPORT NO:** EP1303024-008 / PSD  
 250 St Georges Tce  
 Perth, WA 6000  
**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:**

**Loss on Pretreatment** NA

**Sample Description:** Sand and shell

**Test Method:** AS1289.3.6.3

**Soil Particle Density (<2.36mm)** 2.65 g/cm<sup>3</sup>

**NATA Accreditation: 825 Site: Newcastle**  
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**Analysed:** 10-May-13

**Limit of Reporting:** 1%

**Dispersion Method** Shaker

**Hydrometer Type** ASTM E100

**Hamish Murray**  
 Laboratory Supervisor, Newcastle  
**Authorised Signatory**

Environmental Division

## CERTIFICATE OF ANALYSIS

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

Compound	CAS Number	LOR	Unit	S3	S6	S7	S3	S6
				ASLP LEACH	ASLP LEACH	ASLP LEACH	DI LEACH	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
				EB1311906-001	EB1311906-002	EB1311906-003	EB1311906-004	EB1311906-005
<b>EP090: Organotin Compounds (Soluble)</b>								
Tributyltin	56573-85-4	2	ngSn/L	7	8	5	13	8
<b>EP090S: Organotin Surrogate</b>								
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	---	---	---	---
<b>EP090: Organotin Compounds (Soluble)</b>								
Tributyltin	56573-85-4	2	ngSn/L	10	---	---	---	---
<b>EP090B: Organotin Surrogates</b>								
Tripropyltin	---	0.1	%	80.0	---	---	---	---



**Analytical Results**

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	S3	S6	S7	S3	S6
				ASLP LEACH	ASLP LEACH	ASLP LEACH	DI LEACH	DI LEACH
				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
				EB1311906-001	EB1311906-002	EB1311906-003	EB1311906-004	EB1311906-005
<b>EN60: ASLP Leaching Procedure</b>								
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	---	---
<b>EN60: Bottle Leaching Procedure</b>								
Final pH	---	0.1	pH Unit	---	---	---	8.8	8.9



**Analytical Results**

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

Client sample ID

				<b>S7</b>	---	---	---	---
				<b>DI LEACH</b>	---	---	---	---
				Client sampling date / time	24-APR-2013 16:05	---	---	---
				Compound	EB1311906-006	---	---	---
				CAS Number		---	---	---
				LOR	0.1	---	---	---
				Unit	pH Unit	---	---	---
				<b>Final pH</b>	<b>8.9</b>	---	---	---

**EN60: Bottle Leaching Procedure**

Final pH

8.9



Page : 7 of 7  
Work Order : EB1311906  
Client : WORLEY PARSONS - INFRASTRUCTURE MWE  
Project : 301012-01750



### Surrogate Control Limits

Sub-Matrix: **ASLP LEACHATE**

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



# WorleyParsons

resources & energy

BAE SYSTEMS

BAE DREDGING PROJECT SUPPORT AND CONSULTANCY SERVICES

SEDIMENT QUALITY ASSESSMENT REPORT

---

## 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		Faint 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







No image for sample 7







**WorleyParsons**

resources & energy

**BAE SYSTEMS**

**BAE DREDGING PROJECT SUPPORT AND CONSULTANCY SERVICES**

**SEDIMENT QUALITY ASSESSMENT REPORT**

---

## 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

**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

**Contact:** Nicola Willson

---

### 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.



Issue Date: 15 May 2013

Page 1 of 4

**Advanced Analytical Australia Pty Ltd**  
ABN20 105 644 979  
11 Julius Avenue  
North Ryde NSW 2113 Australia

Ph: +61 2 9888 9077  
Fax: +61 2 9888 9577  
contact@advancedanalytical.com.au  
www.advancedanalytical.com.au



**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	Page	: 1 of 5
Client	: <b>WORLEY PARSONS - INFRASTRUCTURE MWE</b>	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	Date Samples Received	: 26-APR-2013
C-O-C number	: ----	Issue Date	: 10-MAY-2013
Sampler	: NW	No. of samples received	: 11
Order number	: 301012-01750-PS-CNT-100513ALS	No. of samples analysed	: 11
Quote number	: EP/386/13		

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.

### 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

Page : 2 of 5  
Work Order : EP1303024  
Client : WORLEY PARSONS - INFRASTRUCTURE MWE  
Project : 301012-01750



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### **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 (%)
<b>EA055: Moisture Content (QC Lot: 2844816)</b>									
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
<b>EA055: Moisture Content (QC Lot: 2844817)</b>									
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
<b>EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 2848366)</b>									
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%
EP1303024-011	ST1	EG020-SD: Arsenic	7440-38-2	1.00	mg/kg	2.22	1.85	17.9	0% - 20%
		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%
<b>EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2846012)</b>									
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%
<b>EP090: Organotin Compounds (QC Lot: 2844815)</b>									
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: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
				Result	Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%)	
EP020-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

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%)	
EP020-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**

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

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
					MS	MSD	Low	High	Value	Control Limit
<b>EP090: Organotin Compounds (QCLot: 2844815)</b>										
EP1303024-002	S2	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	# Not Determined	---	20	130	---	---
<b>EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 2848366)</b>										
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	---	---



## INTERPRETIVE QUALITY CONTROL REPORT

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

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	
<b>EA055: Moisture Content</b>								
<b>Soil Glass Jar - Unpreserved (EA055-103)</b>								
S1, S3, S5, S7, FT1, ST1	S2, S4, S6, S8, FT2,	24-APR-2013	---	---	---	30-APR-2013	08-MAY-2013	✓
<b>EA150: Particle Sizing</b>								
<b>Snap Lock Bag (EA150H)</b>								
S1, S3, S6, S8	S2, S5, S7,	24-APR-2013	---	21-OCT-2013	---	09-MAY-2013	21-OCT-2013	✓
<b>EA150: Soil Classification based on Particle Size</b>								
<b>Snap Lock Bag (EA150H)</b>								
S1, S3, S6, S8	S2, S5, S7,	24-APR-2013	---	21-OCT-2013	---	09-MAY-2013	21-OCT-2013	✓
<b>EG020-SD: Total Metals in Sediments by ICPMS</b>								
<b>Soil Glass Jar - Unpreserved (EG020-SD)</b>								
S1, S3, S5, S7, FT1, ST1	S2, S4, S6, S8, FT2,	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
<b>EP003: Total Organic Carbon (TOC) in Soil</b>							
<b>Pulp Bag (EP003)</b>							
S1, S2, S3, S4, S5, S6, S7, S8, FT1, FT2, ST1	24-APR-2013	01-MAY-2013	22-MAY-2013	✓	02-MAY-2013	22-MAY-2013	✓
<b>EP090: Organic Compounds</b>							
<b>Soil Glass Jar - Unpreserved (EP090)</b>							
S1, S2, S3, S4, S5, S6, S7, S8, FT1, FT2, ST1	24-APR-2013	30-APR-2013	08-MAY-2013	✓	02-MAY-2013	09-JUN-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: **SOIL**

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

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Regular	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Laboratory Duplicates (DUP)</b>							
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
<b>Laboratory Control Samples (LCS)</b>							
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
<b>Method Blanks (MB)</b>							
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
<b>Matrix Spikes (MS)</b>							
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 automatically 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 quantified 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-QW/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
<b>Matrix Spike (MS) Recoveries</b>							
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

Laboratory ID	Client ID	Sample Date	Time	ANALYSES						
				Matrix						
				Marine Sediment	Bottles	Other	(Arsenic, Chromium, Copper, Lead, Nickel and Zinc)	TBT	Moisture content	TOCs
A13/2073-1	ST2	24/04/2013		✓	2 jars		✓	✓	✓	✓

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

psd=100g bag, metals,db,ph,pah,pch,OC,OP=250ml jar, TOC nutrients=125ml jar, remaining+elutri=250ml or 125ml jar







## QUALITY CONTROL REPORT

<b>Work Order</b>	: <b>EB1311906</b>	<b>Page</b>	: 1 of 4
<b>Client</b>	: <b>WORLEY PARSONS - INFRASTRUCTURE MWE</b>	<b>Laboratory</b>	: Environmental Division Brisbane
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<b>Telephone</b>	: +61 08 9278 8111	<b>Telephone</b>	: +61 7 3243 7222
<b>Facsimile</b>	: —	<b>Facsimile</b>	: +61 7 3243 7218
<b>Project</b>	: 301012-01750	<b>QC Level</b>	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
<b>Site</b>	: BAE Dredging Site	<b>Date Samples Received</b>	: 17-MAY-2013
<b>C-O-C number</b>	: —	<b>Issue Date</b>	: 28-MAY-2013
<b>Sampler</b>	: Nicola Willson	<b>No. of samples received</b>	: 6
<b>Order number</b>	: 301012-01750-PS-CNT-100513ALS	<b>No. of samples analysed</b>	: 6
<b>Quote number</b>	: EN/034/12		

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.

### 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

Page : 2 of 4  
Work Order : EB1311906  
Client : WORLEY PARSONS - INFRASTRUCTURE MWE  
Project : 301012-01750



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

## INTERPRETIVE QUALITY CONTROL REPORT

<b>Work Order</b>	<b>EB1311906</b>	<b>Page</b>	: 1 of 5
<b>Client</b>	WORLEY PARSONS - INFRASTRUCTURE MWE	<b>Laboratory</b>	: Environmental Division Brisbane
<b>Contact</b>	NICOLA WILLSON	<b>Contact</b>	: Customer Services
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<b>Telephone</b>	+61 08 9278 8111	<b>Telephone</b>	: +61 7 3243 7222
<b>Facsimile</b>	---	<b>Facsimile</b>	: +61 7 3243 7218
<b>Project</b>	301012-01750	<b>QC Level</b>	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
<b>Site</b>	BAE Dredging Site	<b>Date Samples Received</b>	: 17-MAY-2013
<b>C-O-C number</b>	---	<b>Issue Date</b>	: 28-MAY-2013
<b>Sampler</b>	Nicola Willson	<b>No. of samples received</b>	: 6
<b>Order number</b>	301012-01750-PS-CNT-100513ALS	<b>No. of samples analysed</b>	: 6
<b>Quote number</b>	EN/034/12		

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
<b>EN60: ASLP Leaching Procedure</b>							
<b>LabSplit: Leach for organics and other tests (EN60a)</b> S3 - ASLP LEACH	24-APR-2013	---	08-MAY-2013	---	21-MAY-2013	08-MAY-2013	*
<b>LabSplit: Leach for organics and other tests (EN60a)</b> S6 - ASLP LEACH, S7 - ASLP LEACH	24-APR-2013	---	08-MAY-2013	---	22-MAY-2013	08-MAY-2013	*
<b>EN60: Bottle Leaching Procedure</b>							
<b>LabSplit: Leach for organics and other tests (EN60-D1a)</b> S3 - DI LEACH	24-APR-2013	---	08-MAY-2013	---	21-MAY-2013	08-MAY-2013	*
<b>LabSplit: Leach for organics and other tests (EN60-D1a)</b> S6 - DI LEACH, S7 - DI LEACH	24-APR-2013	---	08-MAY-2013	---	22-MAY-2013	08-MAY-2013	*
<b>EP090: Organotin Compounds (Soluble)</b>							
<b>Amber Glass Bottle - Unpreserved (EP090S)</b> S3 - ASLP LEACH, S7 - ASLP LEACH	20-MAY-2013	28-MAY-2013	27-MAY-2013	*	28-MAY-2013	07-JUL-2013	✓
<b>Amber Glass Bottle - Unpreserved (EP090S)</b> S3 - 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	Method	Count		Rate (%)			Quality Control Specification
		QC	Regular	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Laboratory Control Samples (LCS)</b>							
Organotin Compounds (Soluble)	EP090S	2	6	33.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
<b>Method Blanks (MB)</b>							
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.

<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
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)
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
ASLP for Non & Semivolatile Analytes	EN60a	SOIL	AS4439.3 Preparation of Leachates
Deionised Water Leach	EN60-D1a	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 derivatisated, extracted and the substitution 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-QW/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 Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
<b>EN60: ASLP Leaching Procedure</b>						
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
<b>EN60: Bottle Leaching Procedure</b>						
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
<b>EP090: Organotin Compounds (Soluble)</b>						
Amber Glass Bottle - Unpreserved S3 - ASLP LEACH, S6 - ASLP LEACH, S7 - 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.