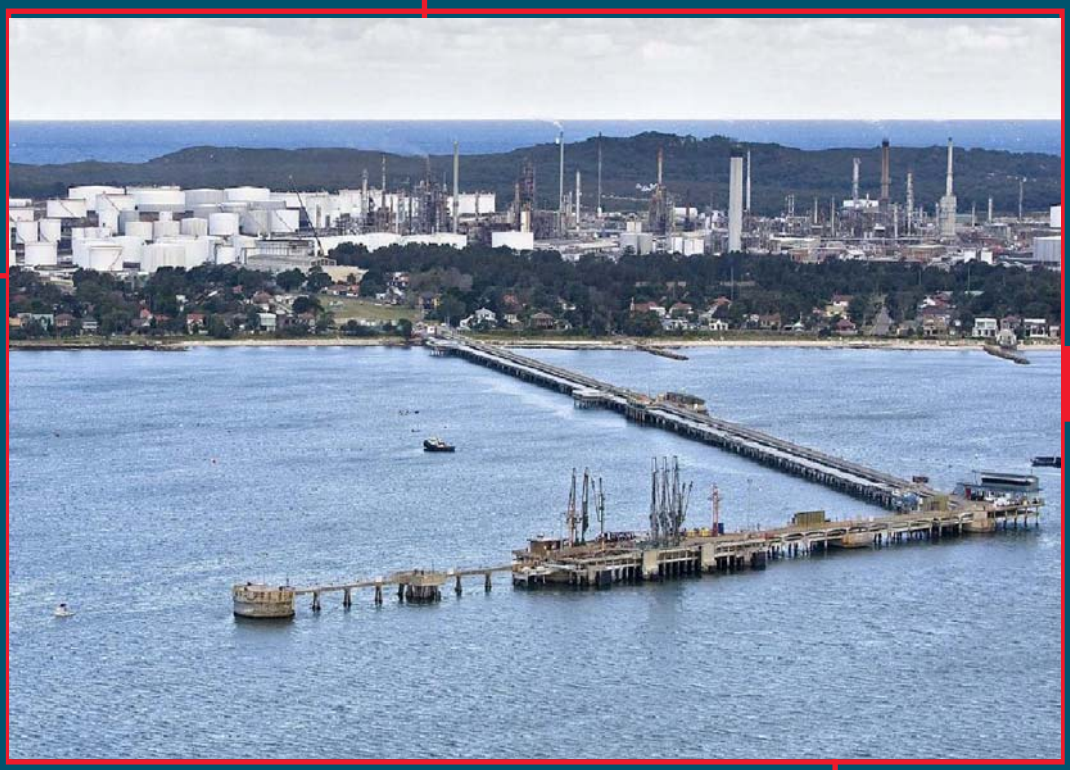
ENVIRONMENTAL IMPACT STATEMENT



VOLUME 2

Appendix D1

February 2013

Kurnell Ports and Berthing Facility

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CALTEX REFINERIES NSW

Caltex Dredging

Sediment Sampling and Analysis Plan Implementation Report – Final Report

301015-02448/07 – rp301015-02248oam010512_Final SAP Implementation Report_Rev1.docm

12 June 2012

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Disclaimer

This document has been prepared for the sole purpose of documenting our Sediment Sampling and Analysis Plan Implementation Report

It is expected that this document and its contents will be treated in strict confidence by Caltex Refineries NSW.

PROJECT 301015-02448/07 - CALTEX DREDGING

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	OAM	CM	LN	27 Apr 2012	N/A	N/A
0	Issued for client review	OAM	CM	LN	30 April 2012	CH	1 May 2012
1	Final issued to client (revised)	OAM	CM	LN	12 June 2012		

CONTENTS

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ACRONYMS

AA	Advanced Analytical Australia
ANC	Acid Neutralising Capacity
ANZECC/ARMCANZ	Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand
ASSMP	Acid Sulfate Soil Management Plan
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CCO	Chemical Control Order
CD	Chart Datum
CECR	Centre for Environmental Contaminants Research
COPC	Contaminant of Potential Concern
CRS	Chromium Reducible Sulfur
CSIRO	Commonwealth Scientific and Industrial Research Organization
DECC	Department of Environment and Climate Change
DEWHA	Department of Environment, Water, Heritage and the Arts
DSEWPaC	Department of Sustainability, Environment, Water, Populations and Communities
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
ESA	Ecotox Services Australasia
ESL	Ecological Screening Level
HIL	Health based Investigation Level
HSL	Health Screening Level
ISQG	Interim Sediment Quality Guidelines
LOR	Limit of Reporting
MGA	Map Grid of Australia
NAGD	National Assessment Guidelines for Dredging
NODG	National Ocean Disposal Guidelines (superseded by the NAGD)
NATA	National Association of Testing Authorities
NEPM	National Environmental Protection Measure

OCPs	Organochlorine Pesticides
OPPs	Organophosphorus Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PSD	Particle Size Distribution
QA/QC	Quality Assurance/ Quality Control
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedures
SPC	Sydney Ports Corporation
SVOCs	Semi-volatile Organic Compounds
TAA	Titratable Actual Acidity
TBT	Tributyltin
TOC	Total Organic Carbon
TPHs	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
VOCs	Volatile Organic Compounds
WGS	World Geodetic System

1 INTRODUCTION

1.1 Synopsis

Caltex Refineries (NSW) Pty Ltd (Caltex) maintains a refinery at Kurnell, on the southern side of Botany Bay, Sydney, as well as port facilities within the bay (**Figure 1**). The facilities comprise the Caltex Wharf located to the west of Sutherland Point, and associated berths and approaches.

Caltex proposes to undertake maintenance dredging of the approaches and Swing Basin (Dredge Area 1) and sub-berth (Dredge Area 2), and capital dredging of the fixed berths (Dredge Area 3) adjacent to the refinery wharf (**Figure 2**).

This Final Sampling and Analysis Plan Implementation Report presents the findings of three separate sediment investigations undertaken by WorleyParsons between November 2009 and November 2011, the combination of which result in the overall geochemical assessment of sediments in three Dredge Areas within the dredge footprint.

This report supersedes any previously reported sediment investigations undertaken by WorleyParsons for the dredging of the Caltex berths and approaches in Botany Bay.

1.2 Background

Caltex formerly proposed to undertake maintenance dredging of the berths and approaches to remove sediment that had accumulated since the last maintenance dredging campaign undertaken in 1969. Maintenance dredging of the seabed was proposed in the following areas to the specified depths:

- Dredge Area 1 – Approaches: -12.8 m relative to Chart Datum (CD);
- Dredge Area 1 – Swing Basin -12.0 m CD;
- Dredge Area 2 – Sub-berth: -14.0 m CD; and
- Dredge Area 3 – Fixed Berths 1 and 2: -11.2 and -11.6 m CD respectively.

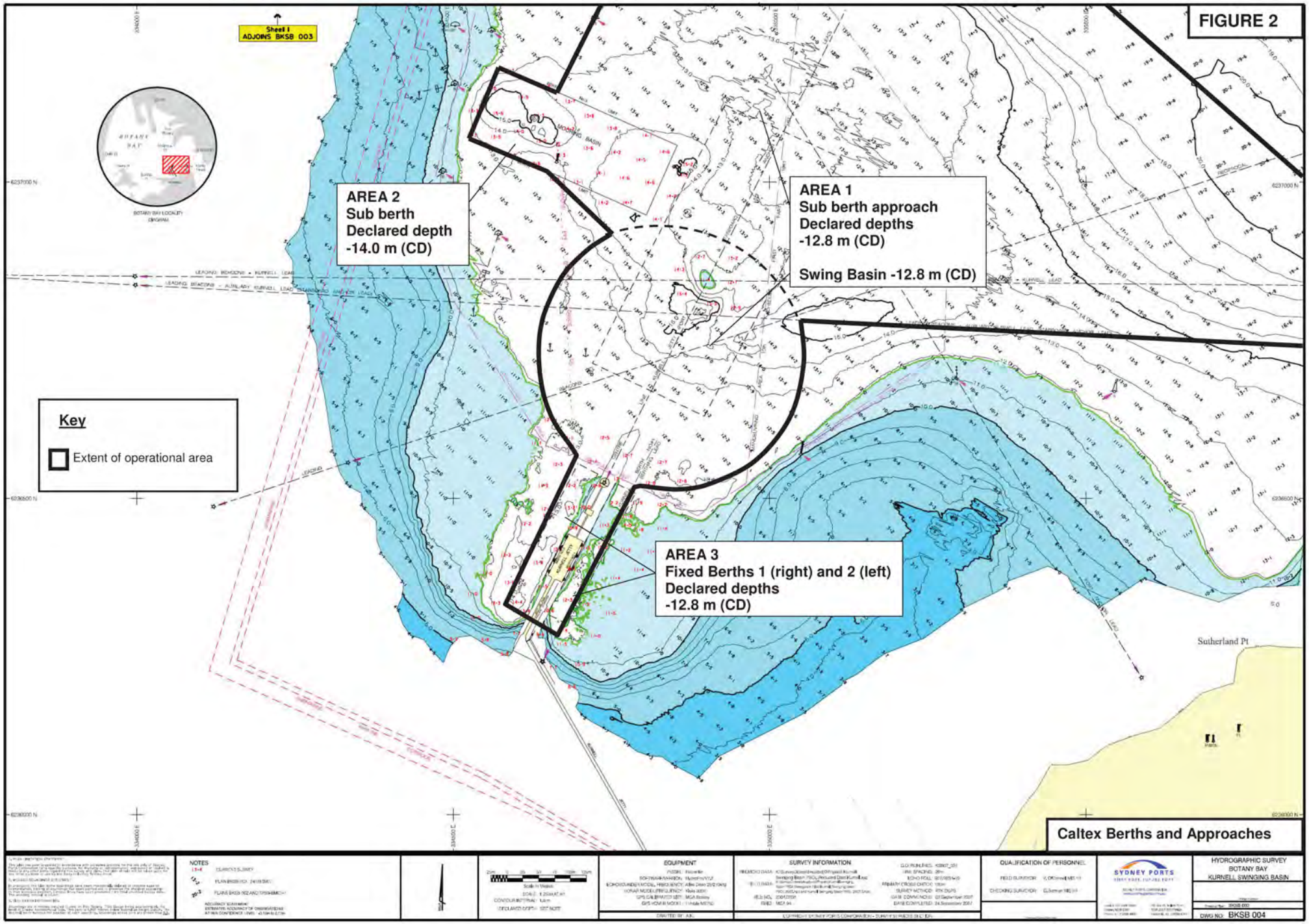
Two sediment investigations were undertaken by WorleyParsons in November 2009 and in March 2010 in association with former maintenance dredging proposals to determine the suitability of the material for unconfined sea disposal. Following these investigations, further sampling and testing requirements were identified in association with:

- Caltex's amended dredging proposal to include capital dredging of the No. 1 and No. 2 Fixed Berths (Dredge Area 3) adjacent to the Caltex jetty and in the Swing Basin to -12.8 m CD;
- identified accumulation of sediment in the approaches and Swing Basin following review of a recent hydrographic survey (SPC, 2011); and
- an oily water discharge from the Caltex Refinery in March 2011 which may have impacted on the proposed dredge footprint.

FIGURE 1

LOCATION PLAN

FIGURE 2



NOTES

EQUIPMENT

SURVEY INFORMATION

QUALIFICATION OF PERSONNEL

SYDNEY PORTS

HYDROGRAPHIC SURVEY
BOTANY BAY
KURNELL SWINGING BASIN

DWG NO: BKSB 004

Based on a review of the recent 2011 Sydney Ports Corporation (SPC) hydrographic survey data, the total volume of proposed maintenance and capital dredge material, including an allowance for dredging tolerance of 0.3 m, is approximately 90,300 m^3. A third sediment sampling and analysis investigation was therefore completed in November 2011.

To determine the most appropriate methods of dredging and disposal and to provide sufficient information for any government approvals that may be required, the compiled results of the three recent sediment quality investigations of 2009, 2010 and 2011 are discussed herein.

1.3 Sediment Sampling and Analysis Plans

A preliminary investigation was undertaken in November 2009 to characterise the physical properties and the types, concentrations and bioavailability of contaminants present in the proposed dredge material. The dredging requirements were determined from the SPC (2007) hydrographic survey, i.e. the most recent hydrographic survey available at the time of sampling.

A Sampling and Analysis Plan (SAP) was prepared for the preliminary investigation in accordance with the National Assessment Guidelines for Dredging (Commonwealth of Australia, 2009). However, due to the need to fit in with Caltex shipping movements at short notice, the SAP was not submitted to the Department of Environmental, Water, Heritage and the Arts (DEWHA) (now the Department of Sustainability, Environment, Water, Populations and Communities - DSEWPaC) for review.

The results of the preliminary investigation indicated that there were elevated concentrations of tributyltin (TBT) in the sediments. In addition, subsequent discussions with the SPC pilots and review of the SPC (2009) hydrographic survey determined that the required dredge footprint was larger than the footprint investigated in the preliminary investigation.

Therefore, further investigations were undertaken to:

- characterise the chemical properties of sediment from within the expanded areas of the dredge footprint; and
- assess the bioavailability and toxicity of the observed TBT with depth across the dredge footprint (including elutriate analyses and toxicity testing where required).

A Sampling and Analysis Plan (SAP) (WP, 2010) was prepared for the additional investigation undertaken in March 2010. The SAP was submitted to DEWHA (now DSEWPaC) for review in February 2010, and, following minor requested amendments, was approved on 5 March 2010.

Sampling was undertaken in March 2010. The analytical results indicated that, while elevated concentrations of TBT were observed in elutriates, dilution modelling using the numerical method for material from the combined Dredge Areas 1, 2 and 3 determined that the concentrations of TBT in the dredge material would not be of concern to water quality during disposal at the Sydney Offshore Spoil Ground (**Figure 3**). In addition, toxicity was not observed by whole sediment or elutriate toxicity testing. Following the second sediment sampling program in March 2010, it was identified that

additional sampling and testing was required in association with Caltex's proposal to undertake capital dredging in a portion of the dredge footprint to:

- meet the required minimum number of samples specified in the NAGD for the increase in dredge volume since the previous sampling and testing;
- provide a better spatial and vertical coverage of the proposed three Dredge Areas; and
- identify whether any hydrocarbon contamination was present in the surface sediments within the proposed Dredge Areas following an oily water discharge from the Caltex Refinery in March 2011.

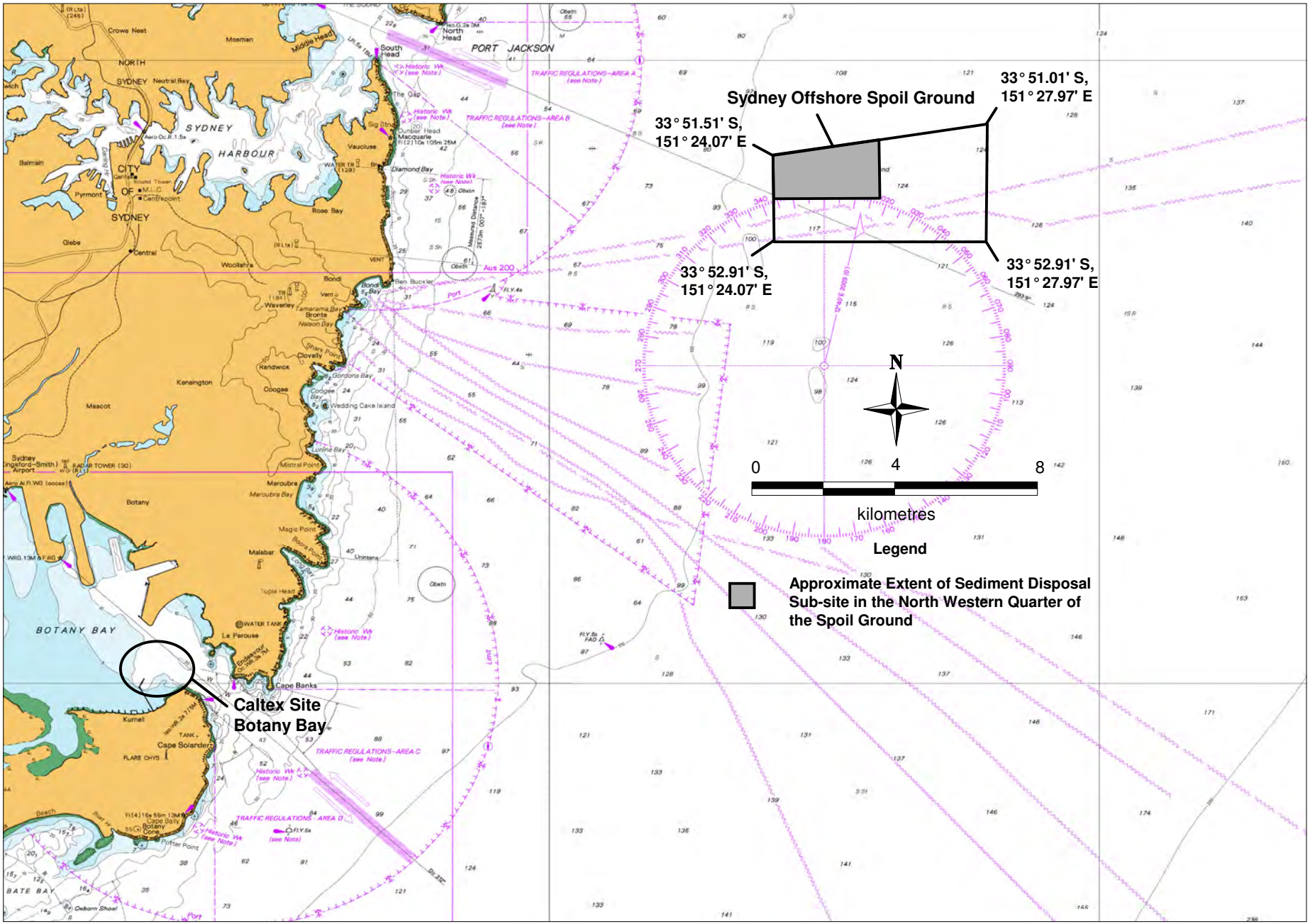
A Supplementary SAP (WP, 2011) was prepared for the additional sediment investigation. The Supplementary SAP specified the program of sampling and testing that would be undertaken in accordance with the NAGD (Commonwealth of Australia, 2009). The Supplementary SAP also provided details on the methodology and results from the two previous investigations (**Appendix 1**). The Supplementary SAP was submitted to DSEWPaC for review on 20 September 2011. Comments on the Supplementary SAP were received from DSEWPaC on 27 October 2011 (**Appendix 1**) and the Supplementary SAP was amended in accordance with the review comments.

The third sediment sampling and analysis investigation was completed in November 2011 in accordance with the Supplementary SAP (WP, 2011) and the review comments that were provided by DSEWPaC.

1.4 Project Objectives

The objectives of the sediment investigations that have been completed to date are as follows:

- Undertake sediment sampling and analysis programs in accordance with the SAPs;
- Ensure an adequate spatial and vertical coverage of the three proposed Dredge Areas to meet the NAGD minimum sampling requirements for the proposed dredge footprint and the estimated dredge volume;
- Testing and analysis of the dredge material situated within the dredge footprint for a range of physical and chemical properties;
- Comparison of contaminant concentrations against the NAGD;
- Testing of whole sediment and elutriate toxicity; and
- Determining suitability of maintenance and capital dredge material from the Caltex Berths and Approaches in Dredge Areas 1, 2 and 3 for sea disposal.



CALTEX MAINTENANCE DREDGING
PROPOSED SPOIL GROUND
FIGURE 3

2 METHODOLOGY

The proposed dredge footprint for each investigation was determined through review of the most recent hydrographic survey at the time of sampling. During each investigation, the required depth of dredging was identified to be about 0.5 m across much of the dredge footprint. A combination of surface grab sampling and surface sediment cores collected by divers was used to recover samples within the three Dredge Areas. Areas of greater sediment accretion that were identified require a removal of up to 2.5 m of material, predominantly from within the Fixed Berths (Dredge Area 3). Therefore vibrocoring was used to collect sediment samples from areas where sediment accumulation exceeded more than 1 m above the design dredge levels.

As the dredge design changed, following the preliminary 2009 investigation, a judgemental sampling pattern was used to locate samples in the two subsequent investigations in 2010 and 2011 in areas:

- with the greatest sediment accretion within the proposed dredge footprint;
- that had shown to contain elevated concentrations of TBT in sediments, based on the findings of the preliminary investigation in November 2009, and resulting in repeat sampling at five locations to undertake further elutriate TBT and toxicity testing; and
- not covered in previous investigations due to the broadening of the dredge footprint, recent accumulation of sediment, or inclusion of capital dredging.

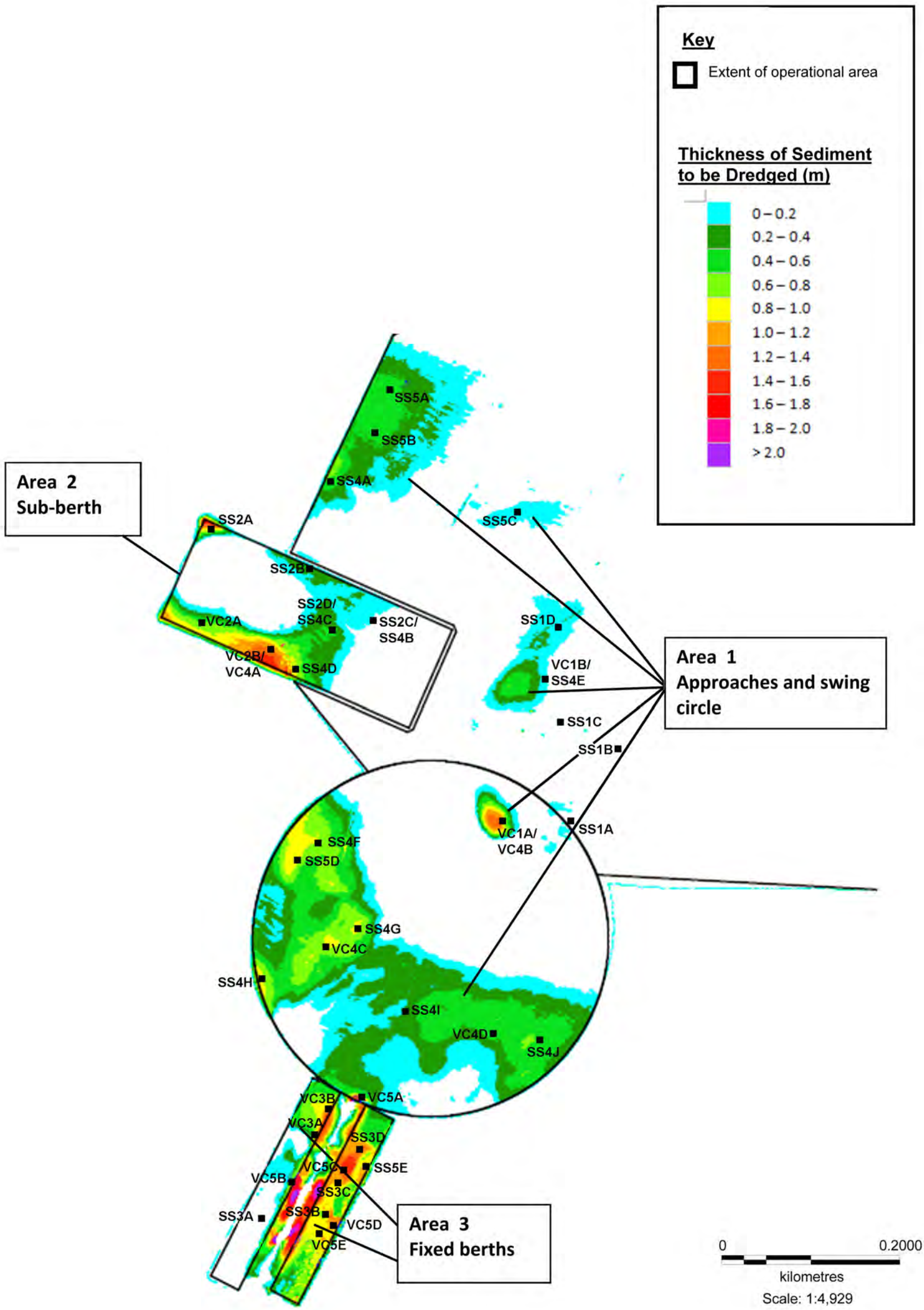
The three field sampling programs were carried out between:

- 16-17 November 2009;
- 3-5 March 2010; and
- 16-17 November 2011.

In total, sediment samples were collected to the depth of proposed dredging at 37 discrete sample locations over the three sampling programs in 2009, 2010 and 2011 (**Table 2.1)**. Repeat sampling was undertaken at five of these sample locations (VC2B/VC4A, SS2D/SS4C and SS2C/SS4B in Dredge Area 2 and VC1B/SS4E and VC1A/VC4B in Dredge Area 1). The number of sample locations is adequate to satisfy the minimum sampling requirements stipulated in the NAGD even if the entire dredge footprint containing 90,300 m^3 of dredge sediment) is considered as three individuals Dredge Areas (Dredge Areas 1, 2 and 3).

The sample locations from all three investigations are shown in **Figure 4**. Coordinates (MGA94 – Zone 56) for all sample locations are shown in **Appendix 2**.

FIGURE 4



SEDIMENT SAMPLING LOCATIONS

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Table 2.1 Number of Actual and Required Sample Locations for Dredge Areas 1, 2 and 3

Dredge Area	Total Estimated Dredge Volume (including overdredging) (m^3)	Number of Sample Locations	
		Total Number of Sample Locations	Minimum Required Sample Locations (according to Table 7 of NAGD)
Combined Dredge Areas, 1, 2 and 3	90,300	37 (+5 repeat locations)	17 (i.e. one Dredge Area)
Approaches and Swing Basin (Dredge Area 1)	58,450	19 (+2 repeat locations)	14
Sub-berth (Dredge Area 2)	12,050	7 (+3 repeat locations)	7
Fixed Berths No. 1 and No.2 (Dredge Area 3)	19,800	11	8

2.1 Sample Collection

Vibrocores in all three investigations were collected by McLennan's Diving Service (MDS) aboard the crane barges "Alkira" or "Polaris" (**Photo 1**). An onboard GPS was used to position the vessel to within 5m of each sample location to record adjusted sample locations where necessary.

Vibrocores were taken to a depth of up to 2.5m, depending on the depth of dredging required, or until refusal. The equipment used in the sampling of sediments was a Rossfelder™ P3 model vibrocorer with 100mm steel core tubes (**Photo 2**). Divers were used to verify the vertical penetration of each vibrocore into the sediments and to assist in sample retention and minimizing core loss, in particular at the sandy sediment locations predominating in Dredge Areas 1 and 2. Vibrocores were capped at each end following core retrieval. During vibrocoring in Fixed Berth1, where sampling was undertaken during the November 2011 investigation, a vibrocore frame (**Photo 3)** was used to ensure that the vibrocore tube remained vertical whilst penetrating the hard peat layers that were present at that locality.

Surface samples were either collected by MDS divers to a depth of 0.5m or by Petite Ponar grab sampler.

Where necessary, two or more cores were taken at vibrocore and surface core locations to ensure that sufficient volume of sediment was retrieved for the required geochemical analyses.

Ambient seawater for use in elutriate analysis and elutriate toxicity testing was collected in a triple-rinsed plastic bucket.

Photo 1. McLennan's Diving Service crane barge "Alkira".

Photo 2. Vibrocoring from the crane barge "Alkira".

Photo 3. Use of the vibrocore frame.

2.2 Sample Processing

Sediment cores were transported onshore for sample processing by an experienced WorleyParsons scientist. Cores were split longitudinally, photographed and logged. A core log was kept during the preliminary investigation to record sediment characteristics at each sample location. A detailed field log was also kept during the March 2010 and November 2011 investigations to record details of the sediment characteristics in each sample, such as colour, texture, odour, the time of sampling, etc. Surface samples collected by grab sampler were logged, photographed and subsampled onboard the sampling vessel by a WorleyParsons scientist. Field logs are provided in **Appendix 3**.

Standard Operating Procedures (SOP) for the coring, surface sampling and sub-sampling are included in **Appendix 4**. New powder-free nitrile gloves were worn by the sampler for the processing of each sample from each location. Subsampling was undertaken using stainless steel implements that were decontaminated between each sample using Decon90, followed by a freshwater rinse.

One subsample was collected from each surface core and subsamples were collected from each 0.5m depth interval from each vibrocore or at other depth intervals below 0.5 m to ensure that sub-sampling was not undertaken across stratigraphic boundaries (e.g. across mud and sand layers).

Samples for chemical analysis[1] and possible elutriate testing were homogenised and placed in appropriate sampling containers that were provided by the laboratory[2] and with zero headspace. Samples for physical testing and acid sulfate soil (ASS) testing were placed in plastic ziplock bags. Excess air was expelled from the ASS ziplock sample bags. Bulk samples for toxicity testing were transferred to plastic ziplock bags and double-bagged to minimise sample oxidation.

Each sample container was tightly sealed and labelled with a unique identification number. Samples were stored immediately on ice to maintain sample temperatures below 4°C before being shipped under Chain-of-Custody (CoC) protocols to the following analytical and scientific laboratories:

- ALS Laboratory Group[3] (ALS) for physical and chemical testing;
- Advanced Analytical Australia (AA)[3] for chemical testing of split triplicates; and
- CSIRO Centre for Environmental Contaminants Research (CECR) for whole sediment toxicity testing. On receipt of whole sediment samples at CECR, samples were stored under nitrogen until receipt and chemical analysis. Additional sediment was sent to CECR for storage under nitrogen in the event that elutriate toxicity testing was required. Following receipt of samples, CECR was responsible for sample handling and liaison with Ecotox Services Australia (ESA) regarding elutriate toxicity testing.

2.2.1 Number of Samples

In total, 78 samples and 13 QA/QC samples were collected during the three investigations in 2009, 2010 and 2011 (**Table 2.2**).

Table 2.2 Number of Analysed Subsamples

	Number of Subsamples			
Sample type	**Nov 2009**	**March 2010**	**Nov 2011**	**Total**
Surface cores	12	10	5	**27**
Vibrocores	21	16	14	**51**
Field Triplicate	-	2 additional samples	2 additional samples	**4**
Split Triplicate	-	2 additional samples	2 additional samples	**4**
Split Duplicates	3 additional samples	-	-	**3**
Blank	0	1	1	**2**
Total	**36**	**31**	**24**	**91**

[1] Excluding subsamples to be tested for acid sulfate soils and volatile organics.
[2] Laboratory provided containers comprised solvent rinsed glass jars with Teflon-lined lids.

Field QA/QC samples included:

- Field triplicates comprising three sediment samples taken at the same location to give an indication of the small-scale spatial variability of the concentrations of analytes in sediments at a sample location;
- Split duplicates and split triplicates (i.e., a single homogenised sample split into two or more containers) to assess variability associated with subsample handling. The third sample of the split triplicate was sent to a second laboratory; and
- Field blanks to assess handling and variability in the concentrations of volatile organic compounds (VOCs) associated with sample transportation.

2.3 Analysis Protocol

2.3.1 Laboratory Analysis

CHEMICAL TESTING

Geochemical analysis of sediment samples was undertaken by two NATA-accredited laboratories. The majority of analyses were carried out by ALS Laboratory Group (ALS) whilst Advanced Analytical Australia (AA) provided secondary laboratory services for the analysis of one sample of each split triplicate.

Chemical testing during the preliminary investigation in November 2009 comprised a suite of heavy metals (Ag, As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Se, V, and Zn), polycyclic aromatic hydrocarbons (PAHs) and total organic carbon (TOC) on all samples. In addition, to confirm that the following contaminants were not of concern, testing was also undertaken on:

- About 20% of samples for Benzene, Toluene, Ethylbenzene and Xylene (BTEX), total petroleum hydrocarbons (TPHs) (C_6-C_{36}), organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs); and
- 50% of samples for TBT.

Results of the preliminary investigation indicated that elevated TBT concentrations were found in samples from each of the proposed dredge areas, including in samples taken at depth. The elevated concentrations of TBT and the need to sample and test sediment from the broadened dredge footprint triggered the need for further investigations. Chemical testing undertaken in March 2010 comprised testing for:

- TBT and TOC in all sediment samples;
- a suite of heavy metals and PAHs in all samples in the expanded area of the dredge footprint; and

[3] Accredited by the National Association of Testing Authorities (NATA).

- BTEX, TPHs, OCPs and PCBs in about 20% of samples in the expanded area of the dredge footprint to confirm that these contaminants are not of concern.

Chemical testing in the November 2011 investigation comprised:

- TBT and TOC analyses of all sediment samples;
- a suite of heavy metals analysed in at least 20% of samples from areas within the dredge footprint that were not previously tested;
- testing of about 20% of samples for BTEX, OCPs, OPPs and PCBs as a precautionary measure[4]; and
- testing of five surface samples for PAHs and TPHs in Dredge Area 3 and the Swing Basin in Dredge Area 1 to address the potential for hydrocarbon contamination as a result of oily water from the Caltex Refinery[4].

In summary, the increase in the dredge footprint and resulting dredge volume between the preliminary investigation in November 2009 and the final investigation in November 2011, resulted in an increase in the overall sampling and analysis requirements to maintain compliance with the NAGD (Commonwealth of Australia, 2009). The hierarchical assessment strategy that was used allowed an elimination of some chemicals to be considered further, such as PAHs, BTEX, OCPs and PCBs. In particular the concentrations of BTEX, OCPs and PCBs were below the analytical limits of reporting (LOR) in all sediment samples analysed. This outcome, together with the absence of identified local sources of these chemicals in the vicinity of the dredge footprint in Dredge Areas 1, 2 and 3 resulted in omitting these chemicals from further sampling, analysis and assessment. This conforms to the NAGD provisions for a pilot study, for which analysis of approximately 20% of the total number of samples required for the overall assessment of a dredge area is considered to be sufficient to characterize sediments within the dredge footprint, as long as these chemicals are not found to be present at significant concentrations (NAGD, Commonwealth of Australia, 2009; p. 28). While a total of 20% of sediment samples were not analysed for each of the above groups of chemicals (PAHs, BTEX, OCPs and PCBs) in each of the three Dredge Areas (i.e. 10% of samples were analysed for BTEX in Dredge Area 1), the sampling undertaken during the three sampling periods is adequate to demonstrate that BTEX as well as PAHs, OCPs and PCBs are unlikely to represent contaminants of potential concern in sediments of the three Dredge Areas.

The chemical analytes, analytical methodologies and analytical limits of reporting (LOR) are listed in the Contaminants List in **Table 2.3.**

During subsampling of cores VC5D and VC5E from Fixed Berth 1 (eastern berth in Dredge Area 3) in the November 2011 investigation, a hard, black material and black viscous fluid was observed on splitting of the cores. Due to the location of the samples adjacent to the Caltex Wharf facilities and the unknown physical and chemical characteristics of the material, it was tested for a range of volatile

[4] In accordance with DSEWPaC's comments on the SAP (**Appendix 1**).

organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), together with the physical and chemical parameters outlined in the Supplementary SAP.

Table 2.3 Analytical Requirements for Chemical Analyses of Sediment Samples From Dredge Areas 1, 2 and 3.

Analyte	PQL	Unit	Laboratory Method	NAGD Screening Level
Silver (Ag)	0.1	mg/kg	USEPA 6020	1
Cadmium (Cd)	0.1	mg/kg	USEPA 6020	1.5
Selenium (Se)	0.1	mg/kg	USEPA 6020	--
Cobalt (Co)	0.5	mg/kg	USEPA 6020	--
Antimony (Sb)	0.5	mg/kg	USEPA 6020	2
Copper (Cu)	1	mg/kg	USEPA 6020	65
Lead (Pb)	1	mg/kg	USEPA 6020	50
Zinc (Zn)	1	mg/kg	USEPA 6020	200
Chromium (Cr)	1	mg/kg	USEPA 6020	80
Nickel (Ni)	1	mg/kg	USEPA 6020	21
Arsenic (As)	1	mg/kg	USEPA 6020	20
Vanadium (V)	2	mg/kg	USEPA 6020	--
Manganese (Mn)	10	mg/kg	USEPA 6020	--
Mercury (Hg)	0.01	mg/kg	APHA 3112 Hg-B	0.15
PAHs (each individual species)	4-5[1]	µg/kg	USEPA 3640/8270	10,000
TPH (C6-C9)	0.2	mg/kg	USEPA 5030/8260	550
TPH (C10-C36)	3-5	mg/kg	USEPA 3510/8015	550
Total PCBs	5[1]	µg/kg	USEPA 3640/3620 USEPA 8081/8082	23
TBT	0.5	µg/kg	In-House GC/MS	9
TOC	0.02	%	In house/Leco	--

PQL: Practical Quantitation Limit

ACID SULFATE SOIL TESTING

Acid sulfate soil (ASS) testing was undertaken on all samples during the preliminary investigation in 2009. Following the results of the field screen testing, 10% of samples were selected for the Chromium Reducible Sulfur (CRS) suite to confirm the risk of acid-generating material being present in the proposed dredge material. Based on the results of the preliminary investigation, it was considered that there was limited risk of disturbing acid sulfate soils within the dredge footprint and no further testing was undertaken during the 2010 investigation.

During subsampling of cores from the November 2011 investigation, sediment indicators of potential acid sulfate soils were identified in several cores (i.e. grey to black sediments, presence of shell, sulphurous odour). Acid sulfate soil screen testing and chromium-reducible sulfur testing were carried out on samples from these cores.

PHYSICAL TESTING

Quantitative particle size distribution (PSD) testing was carried out on 30% of samples from the preliminary 2009 investigation and on selected samples from the November 2011 investigation[5] to characterise the physical properties of the proposed dredge material. A total of 19 out of 78 samples from the three Dredge Areas (i.e. 24% of samples) were analysed for PSD, including 8 out of 36 samples (22% of samples) from Dredge Area 1 (Samples VC1A(0-0.6), VC1A(0.6-1.2), VC1A(1.2-1.6), SS5A, SS5C, SS5D, VC5A(0-0.5) and VC5A(1.5-2.)), 4 out of 20 samples (20% of samples) from Dredge Area 2 (Samples VC2A(1.4-2.0), VC2A(2.3-2.6), VC2B(0-0.5), and VC2B(0.5-0.9)) and 7 out of 22 samples (32% of samples) from Dredge Area 3 (Samples VC3A(0-0.6), VC3B(0-0.5), SS5E, VC5C(0.5-1.0), VC5D(2.1-3.3), VC5E(0-0.6), and VC5E(1-1.6)). The PSD analyses of sediments undertaken, together with field observations and visual estimates of sediment fine fraction content are adequate to characterize the textural characteristics of the sediments in the three Dredge Areas.

ELUTRIATE TESTING

During the preliminary investigation in November 2009 elutriate TBT testing was undertaken on three selected samples, one from each of the three Dredge Areas. The samples selected included two samples with normalised TBT concentrations as close as possible to, or slightly higher than, the 95% upper confidence limit (UCL) of the mean TBT concentration obtained from the TBT data of the 2009 investigation (**Section 3.2**), as well as the sample with the highest TBT concentration.

Elevated elutriate concentrations of TBT were identified in two of the three samples tested in the November 2009 investigation (**Section 3.2.5.2**), triggering the need for further testing in accordance with the testing framework provided in the NAGD. Advice was subsequently sought from Dr Stuart Simpson (CSIRO) on the most appropriate method of testing for bioavailability and toxicity of TBT. Dr Simpson is an expert in aquatic geochemistry and sediment toxicology and was a key technical expert in the development of the NAGD (Commonwealth of Australia, 2009). The testing undertaken in March 2010 was based on the recommendations provided by Dr Simpson (**Appendix 5**).

In March 2010, elutriate TBT testing was carried out on ten additional samples. Samples with varying TBT concentrations (normalised to 1% TOC) were selected for testing, including samples with TBT concentrations:

- above the NAGD maximum level (i.e. the ANZECC/ARMCANZ Interim Sediment Quality Guidelines High value (ISQG-High)) of 70 µgSn/kg; and
- representative of, or higher than, the 95% UCL of the mean total TBT concentration from the combined 2009 and 2010 data (i.e. 363 µgSn/kg - subsequently reduced to 255 µg Sn/kg, following the inclusion of TBT data from sediment analyses of the November 2011 investigation).

The elutriate analysis of sample SS4B from Dredge Area 2, which contained a normalized (to 1% TOC) TBT concentration of 64 µgSn/kg (i.e., about 90% of the NAGD Maximum Level of 70 µgSn/kg)

[5] In accordance with DSEWPaC's comments on the SAP (refer **Appendix 1**).

was adequately compensated for by elutriate analyses of samples SS2D and SS4D, both of which contained whole sediment TBT concentrations that substantially exceeded the ISQG-High value for TBT (i.e. 259 µgSn/kg and 1,040 µgSn/kg, respectively). Similarly, elutriate TBT analyses of samples SS4G and SS4H from Dredge Area 1, obtained in March 2010 also exhibited whole sediment TBT concentrations below the ISQG-High value, although the TBT concentrations in these two samples exceeded the NAGD Screening Level. However, elutriate TBT analyses of samples from Dredge Area 1 that contained elevated TBT concentrations above the ISQG-High value were adequately undertaken through elutriate analysis of samples SS4F and VC4C (0.5-1), which contained whole sediment TBT concentrations of 129 µgSn/kg and 231 µgSn/kg, respectively, as well as elutriate analysis of samples VC1A (0.0-0.6), VC4B(0.5-1), VC4B(1.0-1.5), VC4B(1.5-2.0) and SS4E, which contained TBT concentrations of 115, 840, 690, 505 and 3740 µgSn/kg, respectively (**Table 3.3**).

In addition, the logistics of TBT analyses of sediments often require to assign samples for elutriate analysis before the actual whole sediment analytical TBT data are available, thereby ensuring that elutriate analysis is undertaken within the required analytical holding time. Therefore it is not always possible to choose samples with exceptionally high "target concentrations" to obtain a worst case scenario for the elutriate assessment.

In addition, one replicate and one seawater sample was submitted for TBT analysis for QA/QC purposes.

In accordance with the DSEWPaC comments on the SAP for the November 2011 investigation (**Appendix 1**) additional elutriate testing was undertaken. Testing for elutriate TBT was carried out on three samples with TBT concentrations close to the 95%UCL of the mean TBT concentration for the combined data for all three investigations. The three elutriate samples tested were collected in Dredge Area 1 and Dredge Area 3. No samples were obtained from Dredge Area 2 as part of the November 2011 investigation for reasons outlined below.

The selection of sample locations for further elutriate testing in November 2011 was based on an assessment of the available elutriate data from the previous two sampling periods in 2009 and 2010, which showed that the variability of the elutriate TBT concentrations was low in Dredge Area 2. The three TBT elutriate concentrations in sediments from Dredge Area 2 varied from 7-31 ng/L (i.e. a less than 4-fold ratio of highest to lowest concentration) (**Table 3.3**). In contrast, the elutriate TBT concentrations in Dredge Area 1 varied from <2 ng/L to 4518 ng/L (i.e., >2000-fold ratio of highest to lowest concentration). Including the data from the two elutriate sample analyses from November 2011, the variability of TBT concentrations in elutriates in Dredge Area 3 has shown to be low and similar to sediment elutriate concentrations in Dredge Area 2 (i.e. <2-43ng/L).

Therefore it was considered to be of substantially greater benefit to obtain additional elutriate data from Dredge Areas 1 and 3 due to the substantially greater variability of TBT elutriate data in Dredge Area 1 compared with Dredge Area 2 and to ensure that a minimum of three elutriate sample analyses were undertaken in Dredge Area 3. Therefore collection of more samples in areas of greater data variability (i.e., Dredge Area 1) was undertaken in accordance with guidance in the NAGD.

The overall dredge volumes for Dredge Areas 1, 2 and 3 are 58,450 m^3, 12,050 m^3 and 19,800 m^3, respectively. TBT elutriate analysis of three samples from each Dredge Areas 2 and 3 represent

about 19% of the total number of elutriate samples analysed (i.e., 3 out of 16 samples), which is in proportion to the dredge volumes for Dredge Areas 2 and 3. Similarly, about 63% of the total number of elutriate samples (i.e. 10 out of 16 samples), were analysed from within Dredge Area 1, which comprises 66% of the overall dredge volume.

Subsequently the elutriate data were used in dilution calculations to determine the potential bioavailability of dissolved TBT concentrations in the water column during disposal, as discussed in **Section 3.2.5.2**.

TOXICITY TESTING

Whole Sediment Toxicity Testing

Whole sediment toxicity testing was undertaken during the March 2010 investigation to determine the *in situ* effects of TBT contamination at the Sydney Offshore Spoil Ground after the disposal of dredged material from the three Dredge Areas. Typically this would be undertaken through porewater testing. However, extraction of pore-water from sandy sediments that typically are present in the three Dredge Areas (**Section 3.1**) is not practical and may result in an underestimation of the porewater TBT concentrations.

The methodology for the toxicity testing was provided by Dr Stuart Simpson of CSIRO and the testing was carried out by the CSIRO Centre for Environmental Contaminants Research (CECR). The testing comprised 10 day whole sediment toxicity testing to test for chronic effects (reproduction) to the epibenthic amphipod, *Melita plumulosa*[6].

Toxicity testing was undertaken on three samples[7] with total TBT concentrations above the ISQG-High value of 70 µgSn/kg and close to or above the 95% UCL of the mean TBT concentration for all areas from the combined 2009 and 2010 dataset (i.e. 363 µgSn/kg, which was reduced subsequently to 255 µgSn/kg, following inclusion of TBT data from the November 2011 investigation) (Samples VC4B(1.5-2.0), VC4C(0.5-1.0) and SS4D). One 'blind control' sediment sample with a TBT concentration below the ISQG-High value (Sample VC4C(1.0-1.5), containing a normalized (to 1% TOC) TBT concentration of 53 µgSn/kg), and an additional in-house laboratory control using a silty sediment sample were also tested.

[6] *M. plumulosa* may not inhabit ocean disposal sites, however the species is native to NSW waters, is exposed to contaminants via both dissolved and dietary exposure routes, and is relatively sensitive to contaminants in comparison to other native species. Toxicity tests using *M. plumulosa* are more robust than tests using other species present in NSW sediments such as the harpacticoid copepod, *Nitocra spinipes* (refer **Appendix 5**).

[7] A minimum of three samples are required for dredge volumes up to 50,000m^3, as indicated in Table 7 of the NAGD (Commonwealth of Australia, 2009).

Toxicity Testing of Elutriates

Toxicity testing of elutriates was undertaken during the March 2010 investigation. Elutriate toxicity testing was undertaken by the NATA accredited laboratory Ecotox Services Australasia (ESA). Testing was undertaken in polycarbonate containers that were used to minimise adsorption of TBT to the container walls.

Toxicity testing of elutriate waters was undertaken on three samples[8] (i.e. VC4B(0.5-1.0), VC4B(1.5-2.0), VC4C(0.5-1.0)) with total TBT concentrations above the ISQG-High value of 70 µgSn/kg and close to or above the 95% UCL of the mean TBT concentration for all Dredge Areas from the combined 2009 and 2010 dataset (i.e. 363 µgSn/kg, which was subsequently reduced to 255 µgSn/kg, following inclusion of TBT data from the November 2011 investigation).One 'blind control' sediment sample with a TBT concentration below the ISQG-High value was also tested (Sample SS4G, containing a normalized (to 1% TOC) TBT concentration of 16 µgSn/kg).

Testing of each sample involved the preparation of 1:4 elutriate, which was serially diluted with seawater to achieve test concentrations of 100%, 50%, 25%, 12.5% and 6.3%. Toxicity testing commenced immediately following elutriation and dilution. Testing comprised a 48-hour oyster larval development test using the rock oyster *Saccostrea commercialis* to determine the presence or absence of toxicity[9]. Elutriate samples were also tested for ammonia and sulphide and the seawater sample used to dilute samples was tested concurrently with the samples.

SUMMARY OF TESTING

A summary of the physical, chemical and toxicity testing and the frequency of testing carried out in both investigations is summarised in **Table 2.4**.

[8] A minimum of three samples are required for dredge volumes up to 50,000m^3, as indicated in Table 7 of the NAGD (Commonwealth of Australia, 2009).

[9] The absence of toxicity would not ensure that other toxic effects from dissolved TBT (e.g. imposex in snails and immune-suppression in bivalves) could not occur. There are no TBT sensitive tests using bivalves or snails however, it is considered that the water quality guidelines would need to be exceeded continuously for such chronic effects to occur (S. Simpson, pers. comm., 2009).

Table 2.4 Frequency of Testing of Analytes

Analyte	Frequency of Testing		
	November 2009	March 2010 I	November 2011
Moisture content	All samples	All samples	All samples
Heavy metals (Ag, Cd, Se, Co, Sb, Cu, Pb, Zn, Cr, Ni, As, V, Mn and Hg)	All samples	All samples from additional dredge footprint	All samples from additional dredge footprint
PAHs	All samples	All samples	Surface samples from Swing Basin and Dredge Area 3
TBT	50% of samples	All samples at all depths	All samples at all depths
TOC	All samples	All samples at all depths	All samples at all depths
OC pesticides	20% of samples	20% of samples from additional dredge footprint	20% of samples from additional dredge footprint
BTEX	20% of samples	20% of samples from additional dredge footprint	20% of samples from additional dredge footprint
TPHs (C_6-C_{36})	20% of samples	20% of samples from additional dredge footprint	Surface samples from Swing Basin and Dredge Area 3
PCBs	20% of samples	20% of samples from additional dredge footprint	20% of samples from additional dredge footprint
ASS field screen test	All samples	-	6 samples with sediment indicators of AASS/PASS
VOCs/SVOCs	-	-	Selected samples from VC5D and VC5E
Chromium Reducible Sulfur (CRS) suite	10% of samples (selected follow field screen test)	-	6 samples with sediment indicators of AASS/PASS
Particle size distribution (PSD)	30% of samples	-	50% of samples
Elutriate TBT testing	3 samples	10 samples	3 samples
Whole sediment toxicity testing	-	4 samples (3 samples with TBT >NAGD maximum TBT* level of 70 µgSn/kg and one blind control)	-
Elutriate toxicity testing	-	4 samples (3 samples with TBT >NAGD maximum TBT* level of 70 µgSn/kg and one blind control)	-

*normalised to 1% TOC

QUALITY CONTROL – FIELD SAMPLING

Quality control during sampling included:

- use of suitably qualified environmental staff and support personnel experienced in sediment sampling via vibrocoring and diving, field supervision, sediment sampling and sediment logging;
- following of the Standard Operating Procedures (SOP) provided in **Appendix 4**;

- decontamination/covering of all potentially contaminated surfaces prior to sampling and subsampling;
- documentation in a field log during sampling and subsampling noting sample locations and any changes, time, date, and sediment characteristics;
- use of appropriate PPE (i.e. nitrile gloves), appropriate sampling utensils, and decontamination of all sampling equipment between samples using a laboratory-grade detergent (Decon90);
- storage of samples in appropriately pre-treated and labelled sample containers provided by the analytical laboratory (where relevant);
- following sampling, an immediate storage of samples in eskies containing bags of ice to maintain sample temperatures below 4^0C until delivery to the analytical laboratories within 24 hours of sampling;
- storage of samples held for potential toxicity testing under nitrogen to ensure toxicity testing is undertaken within holding times, following receipt of chemical and/or elutriate TBT results;
- transportation of samples under chain-of-custody (CoC) procedures to the appropriate analytical or scientific laboratory; and
- submission of:
    - field triplicates, split duplicates and triplicates, and field blanks for geochemical analyses;
    - a split duplicate for elutriate TBT testing; and
    - validation of field data comprised calculation of relative standard deviation (RSD)/ relative percent difference (RPD) for triplicate and duplicate samples. Results were compared to NAGD criteria.

QUALITY CONTROL – LABORATORY ANALYSIS

The primary analytical laboratory used for the chemical and physicochemical analyses of sediments, ALS Environmental, is NATA-registered for the analytical methods used. ALS is experienced in the analysis of marine sediments, with specific analytical suites available where assessment is required in accordance with the NAGD (Commonwealth of Australia, 2009).

Quality control procedures relevant to the assessment of sediment geochemistry include:

- chain-of-custody (CoC) protocols;
- laboratory QC protocols; and
- inter-laboratory analysis.

Laboratory QC procedures were undertaken in accordance with Appendix A of the NAGD (Commonwealth of Australia, 2009) to confirm that the analytical data quality was suitable for undertaking an assessment to characterise material proposed for dredging and disposal.

Laboratory data validation included assessment of results for laboratory blanks, standards, surrogate spike samples and matrix spikes and duplicate samples. Results were compared to laboratory criteria.

3 FINDINGS OF THE INVESTIGATION

3.1 Sediment Physical Characteristics

3.1.1 Dredge Areas 1-3

Physical characteristics for samples selected for testing are provided **Table 3.1**. Field core logs are provided in **Appendix 3**. Results for the laboratory particle size distribution (PSD) are shown in **Appendix 6**.

Table 3.1 Summary of Sediment Particle Size Analyses

		Clay (<2 µm) (%)	Silt (2-60 µm) (%)	Fines (<75/60 µm) (%)	Sand (75/60µm-2 mm) (%)	Gravel (>2mm) (%)	Cobbles (>6cm) (%)
All Dredge Areas	**No of Samples**	9	9	19	19	19	19
	Mean	4.3	1.4	11.1	82.4	6.8	<1
	SD	2.4	0.8	11.0	22.2	14.6	N/A
	Max	9	3	36	99	61	<1
	Minimum	2	<1	1	21	<1	<1
Dredge Area 1	**No of Samples**	3	3	8	8	8	8
	Mean	2.0	0.8	7.5	89.3	3.6	<1
	SD	0.0	0.3	12.0	17.9	6.1	N/A
	Max	2	1	36	99	18	<1
	Minimum	2	<1	1	46	2	<1
Dredge Area 2	**No of Samples**	4	4	4	4	4	4
	Mean	6	2	8	93	<1	<1
	SD	2.4	0.8	3.5	3.5	N/A	N/A
	Max	9	3	11	96	<1	<1
	Minimum	4	1	4	89	<1	<1
Dredge Area 3	**No of Samples**	2	2	7	7	7	7
	Mean	4.5	1.3	17.1	68.9	14.1	<1
	SD	0.7	1.1	11.0	27.5	23.3	N/A
	Max	5	2	33	95	61	<1
	Minimum	4	1	5	21	1	<1

SD: Standard Deviation

Sediments within Dredge Areas 1 and 2 are dominated by sands, with mean sand contents in sediments in these two areas of 89% and 93%, respectively. The mean fines content (<75 μm grain size) in sediments in Dredge Areas 1 and 2 is about 8%. Sediments within Dredge Area 3 comprise a mean sand and gravel content of 69% and 16%, respectively, with a greater proportion of fines compared to Dredge Areas 1 and 2 (17% average silt and clay).

During sampling and subsampling of sediment cores VC5D and VC5E located in the southern end of Fixed Berth 1 in Dredge Area 3 the sediments were found to contain a hard, low density, black material with a chalky texture and a pitted surface. This material was identified at or near the surface to depths of 1.5m and 0.6m for each core, respectively which equates to approximately -12.5m below Chart Datum (CD). The material was subjected to testing for VOCs/SVOCs for consideration of potential hydrocarbon contamination. Subsequently, the results of visual inspections and geochemical analysis identified that the materials consisted of decomposing organic matter, or peat-like material. A review of historic borehole logs that were provided by Caltex (Australian Oil Refinery Limited (1953) Boring Plan AS6201-7 and Plan AA.6653-1), and made available since the preparation of the Supplementary SAP and the completion of the November 2011 investigation, indicated that peat layers had previously been observed in the vicinity of the Caltex berths and approaches. The plans identified peat layers at depths of approximately -10 to -13m CD in four boreholes located to the west of the Fixed Berths in Dredge Area 3 and outside of the proposed dredge footprint. The peat layers identified in the most recent investigation were present within this depth range.

Photos 4 and **5** are typical examples of the material observed in samples from Dredge Areas 1 and 2, whereas **Photos 6** and **7** exhibit the textural variability in material of Dredge Area 3.

Photo 4. Vibrocore VC4B(0.5-1.0m) from Dredge Area 1 (Swing Basin) showing silty sand.

Photo 5. Surface core SS4A (0.5 m to 1.0 m depth) from Dredge Area 1 showing sand.

Photo 6. Vibrocore VC5E(0.0-1.65m) from Dredge Area 3 showing broken up peat/mud overlying clay.

Photo 7. Vibrocore VC5C(0.0-0.5m) from Dredge Area 3 showing silty sand overlying clay.

3.2 Sediment Chemical Characteristics

All chemical laboratory reports are provided in **Appendix 6**. Results from all three investigations were compiled and the results analysed statistically.

A summary of results for Dredge Areas 1, 2 and 3, including a comparison of the results to the relevant guidelines for reuse and disposal is provided in **Appendix 7** and summarised in **Table 3.2** below.

3.2.1 Results of Testing Peat Materials from Dredge Area 3 (Fixed Berths)

As noted in **Section 2.3.1**, during subsampling of cores VC5D and VC5E from Fixed Berth 1 (eastern berth in Dredge Area 3) in the November 2011 investigation, a hard, black material and black viscous fluid was observed on splitting of the cores. Due to the location of the samples adjacent to the Caltex Wharf facilities and the unknown physical and chemical characteristics of the material, samples from cores VC5D and VC5E (**Figure 4**) were tested for VOCs and SVOCs. The laboratory data indicated that concentrations of VOCs/ SVOCs for these samples were typically below laboratory limits of reporting (Appendix 6). However, sediments from one or more subsample from each sediment core from Dredge Area 3 (fixed berths) and from sample location VC5A from the southern end of the Swing Basin (Dredge Area 1) at the end of the Caltex Wharf contained elevated total organic carbon contents of up to 4.76%.

Review of the geochemical and the historical borehole data provided by Caltex as well as further visual inspection of the material, determined that the hard black material in the sediment core from sample locations VC5D and VC5E from Dredge Area 3 likely comprised decomposing organic matter and peat-like material.

3.2.2 Results of Testing Surface Sediments Associated with the Oily Water Discharge in March 2011

Surface samples from the November 2011 investigation reported concentrations of total TPHs and total PAHs within limits previously reported across the dredge footprint for the November 2009 and March 2010 investigations. Concentrations of total petroleum hydrocarbons and total PAHs were below the NAGD screening levels for all surface samples tested in the November 2011 investigation. The data indicate that contamination of surface sediments within the dredge footprint resulting from the oily water discharge from the Caltex Refinery in March 2011 was not discernible.

Table 3.2 Summary of Geochemical Results and Disposal Criteria

Analyte		Total Organic Carbon	Metals														BTEX	Sum TPHs Normalised	TRHs	Pesticides		PCBs						TBT normalised	VOCs/ SVOCs
			Antimony	Arsenic	Cadmium	Chromium	Copper	Cobalt	Lead	Manganese	Nickel	Selenium	Silver	Vanadium	Zinc	Mercury			C6-C10 Fraction	OC Pesticides	OP Pesticides	Total PCBs normalised	Benzo(a)pyrene	Sum of carcinogenic PAHs TEF	Sum of PAHs	Sum of PAH normalised		
Units		%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µgSn/kg	mg/kg
LOR		0.02	0.5	1	0.1	1	1	0.5	1	10	1	0.1	0.1	2	1	0.01	0.2	3-5	3	0.5-10	0.5	5	4		4		0.5	0.2-0.5
Waste Classification Criteria	CT1 - General solid waste	-	-	100	20	100	-	-	100	-	40	20	100	-	-	4	10-1000		-	NA	NA	-	800	-	NA	-	-	-
	CT2 - Restricted solid waste	-	-	400	80	400	-	-	400	-	160	80	400	-	-	16	40-4000		-	NA	NA	-	3,200	-	NA	-	-	-
Site Contamination Criteria	NEPM HIL/HSL C - developed open space or recreational areas	-	-	300	100	240	20,000	300	600	9,000	800	700	-	-	30,000	400	38,420	-	5,100	9,000 - 500,000	300,000 - 750,000	2,000	-	4,000	400,000	-	-	
Aquatic Ecology	NAGD / ANZECC ISQG low	-	2	20	1.5	80	65	-	50	-	21	-	1	-	200	0.15	-	550	-	0.32-280		23			-	10000	9	
	NAGD / ANZECC ISQG high	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	-	-		-			-	-	70*	
ALL Dredge Areas	Mean	2.0	<LOR	2.1	0.07	3.9	3.5	0.43	4.8	8.8	0.64	0.20	0.07	7	20	0.05	<LOR	122	<LOR	<LOR	<LOR	<LOR	16	31	170	312	151	<LOR
	Standard Deviation	6.9	NA	3.5	0.06	5.2	5.5	0.52	9.1	10.2	1.3	0.35	0.15	15	64	0.12	NA	170	NA	NA	NA	NA	32	43	334	594	504	N/A
	95% UCL of the mean	3.3	<LOR	2.9	0.08	5.1	4.7	0.55	6.9	11.1	0.93	0.28	0.11	10	35	0.08	<LOR	193	<LOR	<LOR	<LOR	<LOR	23	41	246	446	255	<LOR
Dredge Area 1 - Approach and Swing Basin	Mean	0.13	<LOR	0.88	0.06	1.9	2.4	0.26	2.5	6.8	0.17	0.08	0.09	8.6	7.1	0.04	<LOR	202	<LOR	<LOR	<LOR	<LOR	8.1	20	87	296	226	<LOR
	Standard Deviation	0.18	NA	0.87	0.07	1.6	1.8	0.07	2.4	6.1	0.46	0.06	0.20	20	9.6	0.14	NA	229	NA	NA	NA	NA	11	13	136	456	695	N/A
	95% UCL of the mean	0.18	<LOR	1.2	0.09	2.3	3.0	0.29	3.2	8.8	0.32	0.10	0.16	15	10	0.08	<LOR	333	<LOR	<LOR	<LOR	<LOR	12	24	130	441	408	<LOR
Dredge Area 2 - Sub-berth	Mean	0.21	<LOR	2.4	0.06	5.5	2.0	0.55	3.3	6.5	0.65	0.29	<.01	4.9	10.7	0.06	<LOR	53	<LOR	<LOR	<LOR	<LOR	13	30	159	350	175	<LOR
	Standard Deviation	0.28	NA	4.3	0.02	7.0	1.8	0.79	3.3	4.0	1.2	0.51	NA	6.0	13	0.15	NA	14	NA	NA	NA	NA	25	34	377	874	307	N/A
	95% UCL of the mean	0.31	<LOR	4.3	<0.1	8.6	2.8	0.95	4.7	8.5	1.2	0.51	<0.1	7.5	17	0.13	<LOR	106	<LOR	<LOR	<LOR	<LOR	24	44	323	732	315	<LOR
Dredge Area 3 - Fixed Berths	Mean	6.2	<LOR	4.4	0.08	6.5	7.2	0.65	11.3	15.1	1.6	0.36	0.07	5.9	57	0.05	<LOR	51	<LOR	<LOR	<LOR	<LOR	33	56	350	306	23	<LOR
	Standard Deviation	11.6	NA	4.9	0.06	6.7	10.0	0.63	16.5	17.1	2.0	0.43	0.04	5.8	124	0.06	NA	27	NA	NA	NA	NA	55	73	492	546	69	N/A
	95% UCL of the mean	10.8	<LOR	6.5	0.11	9.5	11.7	0.96	18.8	22.5	2.5	0.55	0.09	8.4	114	0.08	<LOR	73	<LOR	<LOR	<LOR	<LOR	57	87	564	546	54	<LOR

Notes:

All organics are normalised to 1% TOC (w ith 0.2 to 10% TOC)

Where results are below LOR, half the LOR has been used in the statistical analyses

NEPC - National Environmental Protection Council (NEPC) (1999) National Environmental Protection (Assessment of Site Contamination) Measure

ANZECC ISQG-low - ANZECC/ARMCANZ (2000) Guidelines for Fresh and Marine Water Quality as updated (in draft) by Simpson et al. (2008)

* NAGD maximum level = 70 µgSn/kg w hereas ANZECC ISQG-high = 80 µgSn/kg

Total PAHs HILs relevant to the sum of all PAHs reported w here carcinogenic PAHs meet the BaP TEF HILs and naphthalenemeets the relevant HSL.

BTEX HSLs and ESL of obtained by summing the individual constituents (coarse grained soils w here applicable) in Tables 1A(6) and 1B(5) for NEPM ScheduleB1

3.2.3 Comparison of Results to DECC (2009) Waste Classification Guidelines

Individual results were compared to the NSW DECC (2009) Waste Classification Guidelines: Part 1 – Classifying Waste for the purpose of assessing the proposed dredge material for onshore disposal.

Individual results for all contaminants were below the CT1 levels, indicating that the material from all three Dredge Areas is suitable for disposal as general solid waste.

However, due to the elevated TBT concentrations in these sediments, there may be restrictions applied to the offsite disposal of the sediments at a licensed landfill. If dewatering of material is required prior to any onshore disposal, consideration would also need to be given to the quality of the return water and any specific treatment or disposal requirements. These matters would be addressed in the environmental assessment for the proposed works.

3.2.4 Comparison of Results to Contamination Criteria for Reuse

The draft variation to the National Environment Protection (Assessment of Site Contamination) Measure (the NEPM) was released in September 2010. The NEPM comprises an overarching framework for the assessment of site contamination and its relationship to the management of site contamination.

Changes to the NEPM made in the draft variation incorporate new scientific information and technological improvements. The changes allow for the setting of protection levels for the environment and levels of site management on a site specific basis. The changes are expected to reduce the level of costly and sometimes unnecessary site remediation undertaken based on the use of generic criteria.

The NEPM are relevant should the dredge material be considered for reuse onshore such as on playing fields or as beach nourishment material. The relevant NEPM criteria that apply to the Caltex project include:

- Health Investigation Levels (HIL's[10]) and Health Screening Levels (HSL's[11]) Category C developed open space or recreational areas; and
- Ecological Investigation Levels (EIL's[12]) and Ecological Screening Levels (ESL's[13]) for urban residential and open public spaces.

[10] HILs - Health investigation levels are generic and apply across Australia to all soil types generally to a depth of 3 m below surface.

[11] HSLs - Health screening levels for petroleum hydrocarbons depend on physicochemical properties of soil as it affects hydrocarbon vapour movement in soil and the characteristics of building structures. They apply to different soil types, land uses and depths below surface to >4 m and have a range of limitations.

Individual results and the mean concentration of each contaminant for each Dredge Area (**Table 3.2**) were found to be below the HILs and HSLs Category C. However, no reuse criteria are available for TBT. In discussions with State regulatory agencies including the NSW Office of Environment and Heritage (OEH), formerly DECCW and the NSW Department of Primary Industries (Fisheries) held in September 2011, it was considered that the elevated concentrations of TBT in the dredge material made it unsuitable for further consideration of reuse onshore (see Minutes of Meeting in Appendix 9). As such, no comparison of the results to the more conservative ecological investigation and screening levels (EILs and ESLs) has been undertaken, as the relevant EILs and ESLs are site specific and dependent of the "physicochemical properties of soil and the capacity of the soil to accommodate increases in contaminant levels above natural background while maintaining ecosystem protection for identified land uses."

3.2.5 Comparison of Results to NAGD/ANZECC Sediment Quality Guidelines for Sea Disposal

3.2.5.1 Sediment Contaminant Concentrations

Results for organic analytes, including TBT, were normalised to 1% TOC (within limits of 0.2% to 10% TOC) and results for each contaminant were statistically analysed to calculate the mean, standard deviation (SD) and the 95% UCL of the mean concentration for each Dredge Area (i.e. Dredge Areas 1, 2 and 3).

Where concentrations were below the analytical laboratory limit of reporting (<LOR), a value of half the LOR was used in the statistical analysis of the results. In accordance with the NAGD, the 95% UCL of the mean concentration of each contaminant was determined using either:

- the Standard Bootstrap Method where the Shapiro-Wilk test with a 5% significance level indicated that the data were not normally distributed; or
- the Student-t test Method where the Shapiro-Wilk test with a 5% significance level indicated that data was normally distributed or the data set contained insufficient discrete values to use the Standard Bootstrap Method.

The individual results and the 95% UCL of the mean concentration of each contaminant for each Dredge Area were compared to the screening levels provided in Appendix A, Table 2 of the NAGD and ANZECC ISQG.

Concentrations of antimony, BTEX, light fraction hydrocarbons (C_6-C_9 and C_6-C_{10}), OC and OP Pesticides and PCB's were below analytical limits of reporting in all samples analysed.

[12] EILs - Ecological investigation levels depend on specific soil physicochemical properties and land use scenarios and generally apply to the top 2m of soil.
[13] ESLs - Ecological screening levels for petroleum hydrocarbon materials broadly apply to coarse and fine grained soils and various land uses. They are applicable to the top 3m of soil.

The 95% UCL of the mean concentration of all trace metals, total TPH's and total PAH were below NAGD screening levels when calculated for each Dredge Area and for all Dredge Areas combined (**Table 3.2**).

Concentrations of TBT exceeded NAGD screening levels and the ANZECC ISQG-high levels in multiple sediment samples from all three Dredge Areas. The 95% UCL of the mean TBT concentration in sediments from Dredge Areas 1 and 2 and for all Dredge Areas combined exceeded the NAGD maximum level of 70 µgSn/kg (**Table 3.2**).

The majority of individual TBT concentrations in sediment samples from Dredge Area 3 were below NAGD screening levels, however the 95%UCL of the mean TBT concentration for Dredge Area 3 exceeded the NAGD screening level.

Several samples from the Fixed Berths contained elevated TOC contents of more than 7% to approximately 40%.

3.2.5.2 ELUTRIATE TESTING AND DILUTION CALCULATIONS

ELUTRIATE TBT TESTING

Elutriate TBT testing was undertaken to assess the possible impact of dissolved TBT in the water column at the disposal site(s). Laboratory results for elutriate TBT testing are provided in **Appendix 6** and have been summarized in **Table 3.3**.Two of the three elutriate TBT results from the preliminary investigation in November 2009 were elevated above the ANZECC/ARMCANZ (2000) water quality trigger value for the protection of 95% of marine species (i.e. 6 ng/L). These elevated elutriate TBT results were the primary reason for initiating further investigations across the three Dredge Areas.

In the March 2010 investigation, samples with a whole sediment TBT concentration that exceeded the NAGD maximum level of 70 µgSn/kg were selected for elutriate TBT testing and the results combined with the November 2009 investigation. Elutriate TBT concentrations were found to exceed the ANZECC/ARMCANZ water quality guideline value in several samples. The expected dilution at the disposal site(s) was calculated as recommended in the NAGD (Commonwealth of Australia, 2009) using the analytical and numerical methods to determine the likely dissolved TBT concentration in waters at the disposal site(s).

The results of the elutriate TBT testing and dilution calculations from the November 2009 and March 2010 investigations were assessed by DSEWPaC during the review of the SAP for the November 2011 investigation. DSEWPaC's comments (**Appendix 1**) indicated that:

- further elutriate TBT testing should be undertaken at a minimum of one additional sample from each Dredge Area;
- dilution modelling should be undertaken for each Dredge Area,or by appropriately using the "worst-case" 95% UCL value as a precautionary approach; and
- dilution modelling should incorporate appropriate particle size parameters of the sediments in the sediment type input (see **Table A4** in **Appendix 8**).

The November 2011 investigation therefore incorporated the testing of three additional samples for elutriate TBT. This included two samples with the highest sediment TBT concentrations from Dredge Area 3 and one sample with the highest TBT concentration from Dredge Area 1 (based on the TBT data obtained in the November 2011 investigation). The results of the combined data for the three investigations are provided in **Table 3.3.** The results indicated that the 95% UCL of the mean concentration of elutriate TBT was 1884 ng/L (Dredge Area 1), 38 ng/L (Dredge Area 2), and 56 ng/L (Dredge Area 3), all of which exceed the ANZECC/ARMCANZ (2000) water quality guideline value of 6 ng/L.

Table 3.3 Elutriate TBT Results

Dredge Area			Sediment TBT(1) (µg/kg)	Elutriate TBT (2) (ng/L)
	NAGD / ANZECC ISQG low		9	6
	NAGD / ANZECC ISQG high		80	-
Dredge Area 1	VC1A (0.0-0.6)	Stage 1 (Nov 09)	115	70
	VC4B(0.5-1.0)	Stage 2 (Mar 10)	840	3338
	VC4B(1.0-1.5)	Stage 2 (Mar 10)	690	4518
	VC4B(1.5-2.0)	Stage 2 (Mar 10)	505	1028
	SS4E	Stage 2 (Mar 10)	3740	246
	SS5D	Stage 3 (Nov 11)	17.4	*1.0*
	VC4C(0.5-1.0)	Stage 2 (Mar 10)	231	161
	SS4F	Stage 2 (Mar 10)	129	8
	SS4G	Stage 2 (Mar 10)	16	14
	SS4H	Stage 2 (Mar 10)	16	23
Dredge Area 2	SS2D	Stage 1 (Nov 09)	259	8.0
	SS4B	Stage 2 (Mar 10)	64	31
	SS4D	Stage 2 (Mar 10)	1040	7
Dredge Area 3	SS3B	Stage 1 (Nov 09)	46	*1.0*
	VC5B (0.0-0.8)	Stage 3 (Nov 11)	312	43
	VC5E (0.6-0.8)	Stage 3 (Nov 11)	42	*1.0*
All Dredge Areas (1, 2 and 3)		Mean	151	594
		95% UCL	255	1133
Dredge Area 1 - Approaches and Swing Basin		Mean	226	941
		95% UCL	408	1884
Dredge Area 2 - Sub-Berths		Mean	175	15.3
		95% UCL	315	38*
Dredge Area 3 - Fixed Berths		Mean	23	15
		95% UCL	54	56*

Notes:

(1) normalised to 1% TOC

(2) corrected for TBT concentration in seawater

(3) 95% Sediment UCL based on TBT data from all sediment samples from all three Dredge Areas

Where results are below LOR, half the LOR has been used in the statistical analyses (*italicised*)

*95% UCL (Assuming Normal Distribution) Student's-t UCL

TBT DILUTION CALCULATIONS

A full report on the dilution modelling is included in **Appendix 8**.

Initial dilution of disposed dredged material in the ocean depends on a number of factors, such as water depth, stratification in the water column, and current velocities and directions. As described in the NAGD, initial dilution can be determined using either of two methods, namely:

- the liquid and suspended particulate phases of the dredged material may be assumed to be evenly distributed after four hours over a column of water bounded on the surface by the release zone and extending to the ocean floor, thermocline or halocline, if one exists, or to a depth of 20m, whichever is shallower (analytical method); or
- it can be calculated using the US Army Engineers Waterways Research Station STFATE model (numerical method).

During the early stages of the project proposal, it was expected that backhoe dredging with overflowing was likely to be the preferred dredging method with disposal from a split hopper. Disposal was considered at two possible sites, i.e. the Sydney Offshore Spoil Ground and a spoil ground located within Botany Bay. Preliminary analytical modelling undertaken for the above dredging and disposal methods indicated that the concentrations of TBT in the water column after initial mixing of sediment from all Dredge Areas (based on combined results from the November 2009 and March 2010 investigations) would exceed the ANZECC/ARMCANZ (2000) TBT high reliability trigger value for protection of 95% of species. Following review of the results of the analytical modelling, it was considered that disposal within Botany Bay would not be pursued.

The more accurate numerical method (STFATE modelling) was adopted in the modelling to predict the initial dilution of TBT for disposal operations at the Sydney Offshore Spoil Ground. The analytical method is overly conservative for application in this case, given that the mixing zone is specified to only extend to a water depth of 20m in the methodology, when actual water depths at the Sydney Offshore Spoil Ground are about 100m, where an increased dilution is expected to occur.

The dilution modelling was undertaken using the physical, geochemical and elutriate properties of material from Dredge Area 1 as a worst-case scenario, given that the 95% UCL of the mean of the elutriate concentration of TBT in Dredge Area 1 is 1884 ng/L, which exceeds the 95% UCL of the elutriate TBT concentration in Dredge Areas 2 and 3 about 50-fold and 34-fold, respectively. Similarly, the 95% UCL of the mean of concentrations of TBT in sediments in Dredge Areas 2 and 3 (315 and 54 μgSn/g, respectively) are lower also than in Dredge Area 1 (409 μgSn/g), supporting the conservative choice of Dredge Area 1 for the dilution modelling. The dilution modelling also incorporated DSEWPaC's requirements with regards to the representation of the physical properties of the dredge material (refer **Appendix 1**).

Since the early stages of the project proposal, the preferred dredging method has been amended to include hydraulic dredging with backhoe dredging in the fixed berths. As such, numerical modelling using STFATE was carried out for four different scenarios for sediments in Dredge Area 1 as follows:

1. Backhoe loading a split hopper barge (with overflowing);
2. Backhoe loading a split hopper barge (no overflowing);
3. Trailer suction hopper dredging (with overflowing); and,
4. Trailer suction hopper dredging (no overflowing).

The results of the numerical modelling for the 'worst-case' Dredge Area 1 were compared to the ANZECC/ARMCANZ (2000) trigger values for TBT at the 95% and 99% levels of species protection, i.e. 6 ng/L and 0.4 ng/L, respectively. The results of the numerical modelling indicate that after initial mixing over a four hour period, the maximum concentration of TBT at the Sydney Offshore Spoil Ground for all four dredging scenarios for the 'worst-case' Dredge Area 1 sediments would be ≤0.089ng/L, which is substantially below the ANZECC/ARMCANZ (2000) trigger values at the 95% and 99% species protection levels.

The dilution modelling for Dredge Area 1 used a 95% UCL elutriate TBT concentration of 3119 ng/L, which represents the value that is calculated when elutriate TBT data from samples VC4C(0.5-1.0), SS4F, SS4G and SS4H are excluded from Dredge Area 1 (these sample locations were included previously in Dredge Area 3, but actually they are located in the Swing Basin that is located within Dredge Area 1). However, the actual 95% UCL elutriate TBT concentration for Dredge Area 1 (when including TBT elutriate concentrations for samples VC4C(0.5-1.0), SS4F, SS4G and SS4H) is 1884 ng/L, which is lower than the value of 3119 ng/L that was used in the dilution modelling. Therefore the dilution modelling undertaken for Dredge Area 1 (see Appendix 8) is more conservative. Given that the outcome of the conservative dilution modelling that was undertaken has resulted in a predicted TBT concentration below the ANZECC/ARMCANZ (2000) trigger values at the 95% and 99% species protection levels no further dilution modelling is required.

Based on the outcomes of the dilution modelling the concentrations of TBT in dredged sediments from the proposed Dredge Areas are unlikely to adversely affect water quality during the proposed disposal at the Sydney Offshore Spoil Ground.

3.2.5.3 TOXICITY TESTING

Whole Sediment Toxicity Testing

Whole-sediment toxicity testing was undertaken to determine if there is potential for *in situ* toxicity to benthic organisms following disposal of the dredged material. The toxicity testing of whole sediments that was undertaken assesses chronic effects (reproduction) to the epibenthic amphipod *Melita plumulosa*[14].

[14] *M. plumulosa* may not inhabit the designated ocean disposal site at the Sydney Offshore spoil Ground, however the species is native to NSW waters, is exposed to contaminants via both dissolved and dietary exposure routes, and is relatively sensitive to contaminants compared to other native species. Toxicity tests using *M. plumulosa* are more robust than tests using other species present in NSW sediments such as the harpacticoid copepod, *Nitocra spinipes* (S. Simpson, pers.comm., 2009).

Sediment samples for whole sediment toxicity testing were stored under nitrogen for a period of up to 22 days prior to the commencement of toxicity testing by CECR. Samples selected for whole sediment testing included:

- Three samples with total normalised TBT concentrations above the NAGD maximum level of 70 µgSn/kg) (i.e. samples VC4B (1.5-2.0), SS4D, VC4C (0.5-1.0)) and close to or above the 95% UCL of the mean normalised TBT concentration for all three Dredge Areas from the combined dataset (i.e. 255 µgSn/kg);
- One blind control with a total normalised TBT concentrations below the NAGD maximum level of 70µgSn/kg (i.e. sample VC4C (1-1.5); and
- One silty laboratory control.

Laboratory results of the whole sediment toxicity tests are provided in **Appendix 6.** The report provides survival rates and the number of embryos per female for the amphipod *Melita plumulosa.* The results indicated that all test sediments were considered to be non-toxic to the reproduction and survival of the amphipod *Melita plumulosa*.

Elutriate Toxicity Testing

Elutriate toxicity testing comprised a 48 hour larval development test using the rock oyster *Saccostrea commercialis*. The test involves exposure of developing bivalve embryos to a range of elutriate concentrations (diluted with seawater) from each sample and determination of the number of normally developed and abnormal larvae after 48 hours.

Sediments for use in elutriate toxicity testing were stored by CECR under nitrogen and provided to ESA for testing within 7 weeks of sampling. As for the whole sediment toxicity testing, samples selected for whole sediment testing included:

- three samples with total normalised TBT concentrations above the NAGD maximum level of 70 µgSn/kg) (i.e. samples VC4B (1.5-2.0), SS4D, VC4C (0.5-1.0)) and close to or above the 95%UCL of the mean normalised TBT concentration for all areas from the combined dataset (i.e. 255 µgSn/kg);
- one blind control with a total normalised TBT concentration below the NAGD maximum level of 70 µgSn/kg (i.e. sample VC4C (1.0-1.5); and
- one silty laboratory control.

Laboratory results of the elutriate toxicity tests are provided in **Appendix 6**. The results indicated that there was no detectable toxicity to the bivalve embryos from the elutriate samples tested.

The NAGD criteria require an assessment of four sample locations for elutriate toxicity testing for a dredge volume of 50,000 to 100,000 m^3 (NAGD, Table 7; Commonwealth of Australia, 2009). The testing was undertaken on three samples from locations VC4B (2 samples) and VC4C and one 'blind control' sample from location SS4G, reflecting the smaller sediment volume that was considered to be dredged when the earlier investigation was undertaken in 2010. However, the four toxicity tests,

including the analysis of the blind control sample, that were undertaken have passed the toxicity criteria, suggesting that the available toxicity data are adequate without further testing being required.

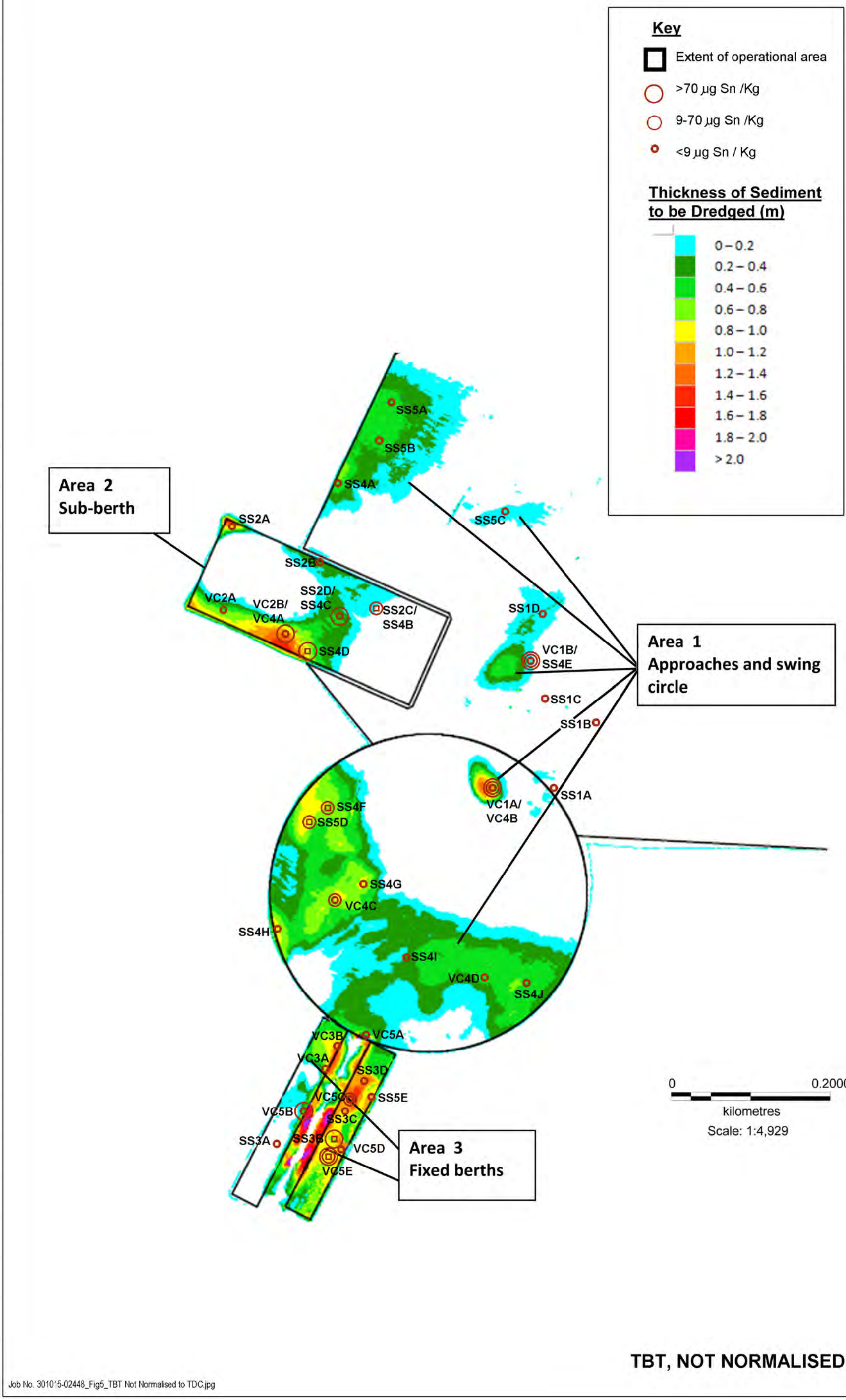
3.2.6 Spatial and Vertical Distribution of TBT and TOC in Dredge Areas

The concentrations of TBT in whole sediments generally are elevated in sediments throughout the three Dredge Areas, although TBT concentrations >9 μgSn/kg are mostly limited to areas in the southern parts of the fixed berths (Dredge Area 3), the south central portion of Dredge Area 2 and the western side of the Swing Basin and the central parts of Dredge Area 1 **(Figure 5).** However, sediments in the fixed berths in Dredge Area 3 and in the southern part of Dredge Area 2 generally have elevated TOC contents of >1% (**Figure 6**), resulting in a lowering of TBT concentrations when normalizing to 1% TOC. Elevated concentrations of normalized TBT of >9 μgSn/kg therefore are present predominantly in sediments in Dredge Areas 1 and 2, although sediments from four sample locations in the fixed berths in Dredge Area 3 exceed the NAGD screening level of 9 μgSn/kg (**Figure 7**).

Normalized concentrations of TBT in sediments generally are below the NAGD screening level in the northern part of Dredge Area 1 near sample locations SS5A and SS5B and in the central southern area of the Swing Basin near sample location VC4D (**Figure 7**).

TBT concentrations generally have shown to be more elevated in the upper 1 m of sediments near the surface compared to sediments below 1 m. The majority of sediment samples that exceeded the NAGD maximum level concentration of 70 μgSn/kg in Dredge Areas 1-3 are present in the upper one metre of sediment, which appears to reflect a more recent deposition of TBT-rich material (**Figure 8** and **Figure 9**).

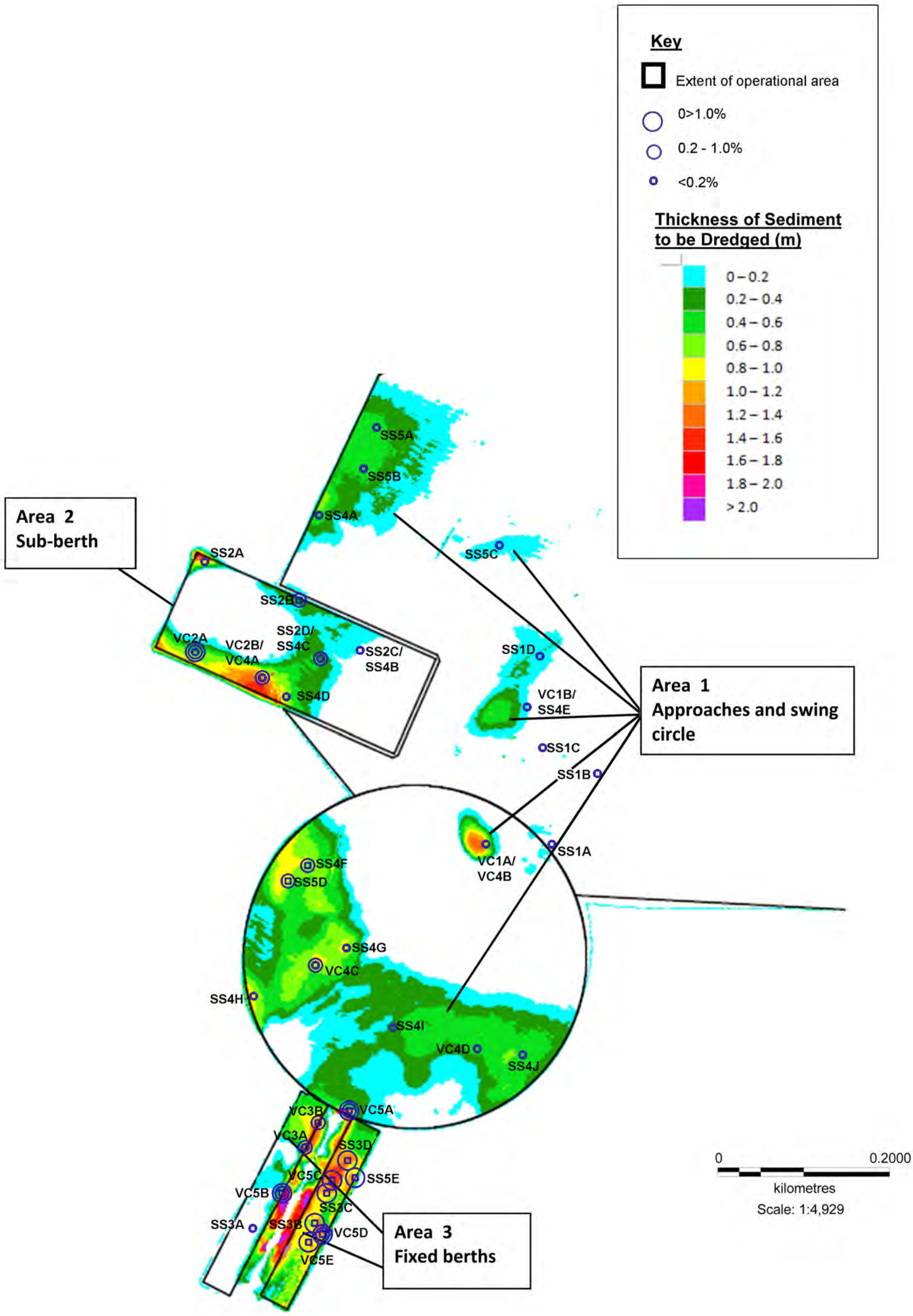
FIGURE 5



TBT, NOT NORMALISED TO TOC

Job No. 301015-02448_Fig5_TBT Not Normalised to TDC.jpg

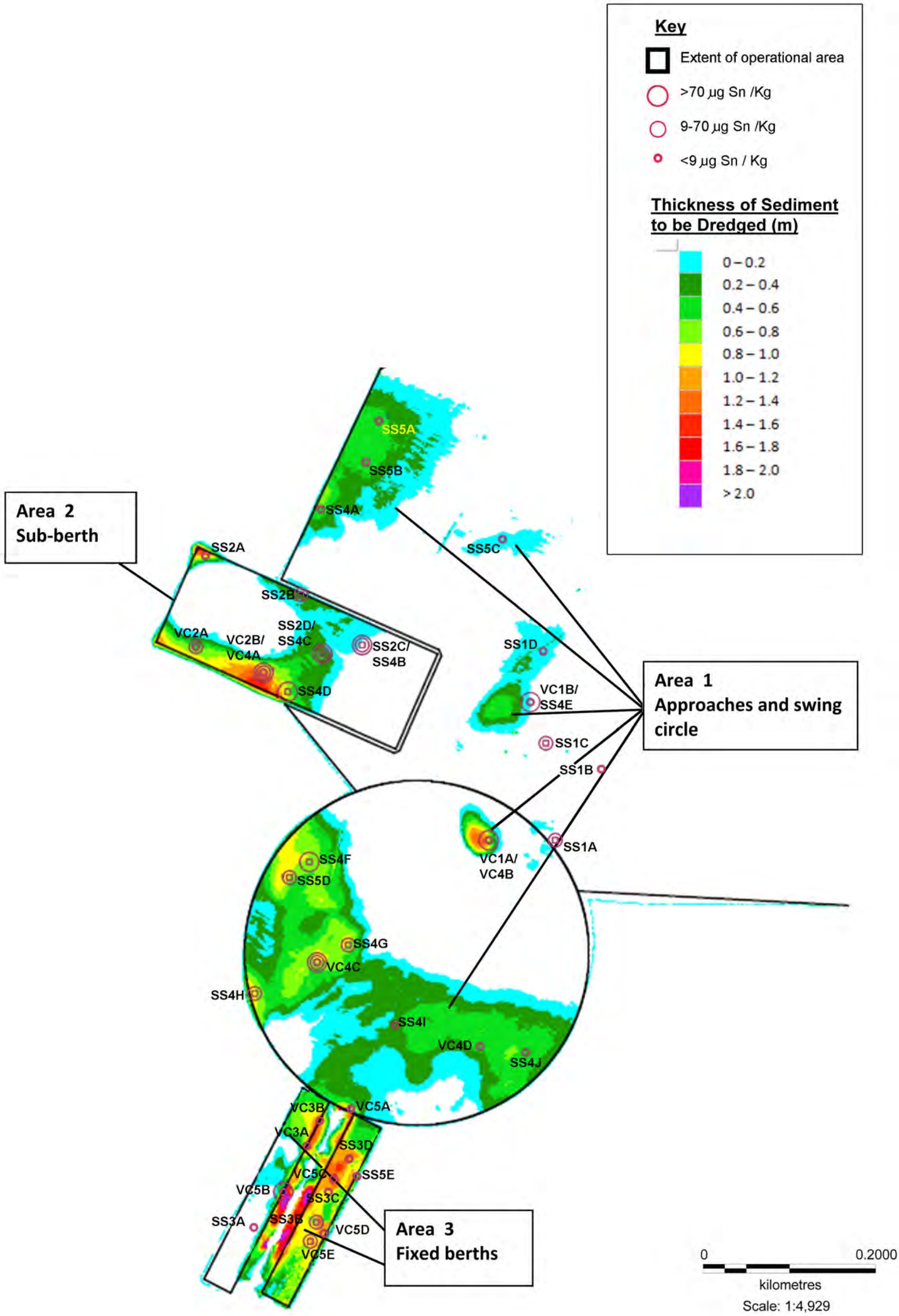
FIGURE 6



TOC

Job No. 301015-02448_Fig6_TOC.jpg

FIGURE 7



TBT, NORMALISED TO 1% TOC

Job No. 301015-02448_Fig7 TBT Normalised To 1%_TOC.jpg

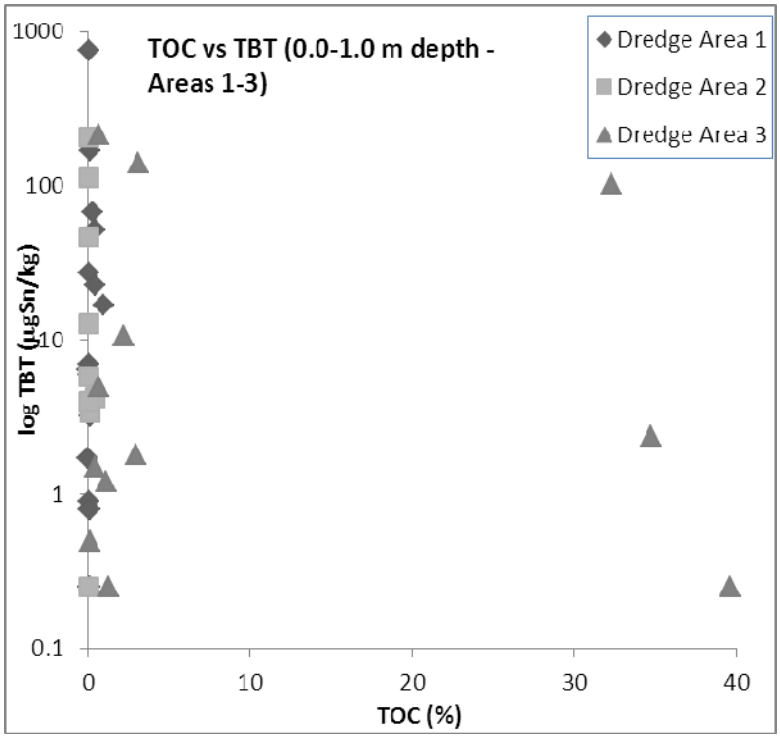


Figure 8: TOC vs log TBT in the Upper 1 m of Sediments in Dredge Areas 1-3.

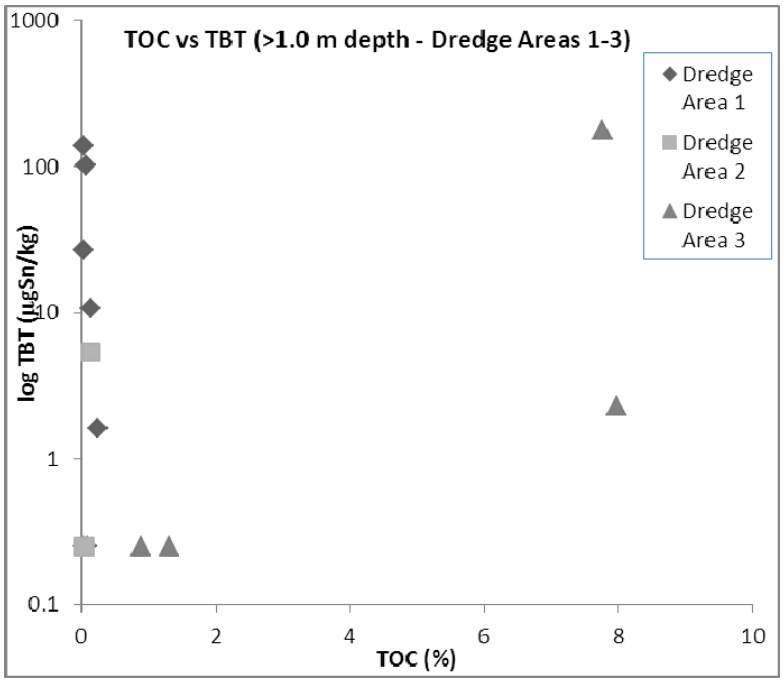


Figure 9: TOC vs log TBT below 1 m Depth in Sediments in Dredge Areas 1-3.

3.2.6.1 SUITABILITY OF MAINTENANCE DREDGE MATERIAL FOR SEA DISPOSAL

Based on the results of the geochemical analysis of sediments, elutriate testing, dilution modelling, whole sediment toxicity testing and elutriate toxicity testing, the following recommendations are made regarding the suitability of the sediments to be dredged from Dredge Areas 1, 2 and 3 for sea disposal.

Sediments from all three Dredge Areas contained elevated concentrations of TBT. The 95%UCL of the mean TBT concentration exceeded the NAGD screening level of 9 µgSn/kg in Dredge Area 3 and substantially exceeded the ISQG High value of 70 µgSn/kg in Dredge Areas 1 and 2 (**Table 3.3**). Elutriate concentrations of TBT from sediments in Dredge Area 1 exceeded the water quality guideline value of 6 ng/L more than 300 times. Using numerical dilution modelling for the 'worst-case' 95% UCL (Dredge Area 1) (i.e. trailer suction hopper dredging without overflowing), it was calculated that the maximum concentration of TBT in the water at the Sydney Offshore Spoil Ground, following initial mixing, would be 0.089 ng/L, a concentration that is well below the water quality guideline (WQG) value for 95% species protection. Continuous exceedance of the WQG for TBT in marine waters near the Sydney Offshore Spoil Ground is therefore unlikely following the offshore disposal of the dredged material from Dredge Areas 1, 2 and 3.

Although the sediments in Dredge Areas 1, 2 and 3 have elevated concentrations of TBT and elutriate TBT, both elutriate and whole-sediment toxicity tests indicate that TBT is unlikely to cause chronic toxic effects to benthic organisms. The tests used are considered to be the most sensitive tests that are currently available and it is not recommended that further ecotoxicological tests be undertaken.

Uncertainty exists regarding the potential for bioaccumulation of TBT by aquatic organisms that colonise and inhabit the sediments at the disposal site. The bioaccumulation of TBT has the potential to lead to imposex in organisms such as gastropods and immuno-supression in some bivalve species. For such effects to be considered likely to occur a significant abundance of these organism types would need to be present at the disposal site and TBT concentrations within the sedimentary porewaters would need to continuously exceed the WQG value of TBT at the disposal site. The likelihood and significance of such effects should be considered in relation to the nature and desired properties of the disposal site.

Based on the chemical and ecotoxicological tests, the sediments in Dredge Areas 1-3 are considered to be suitable for unconfined ocean disposal at the designated Sydney Offshore Spoil Ground. The above recommendation is supported by advice sought from Dr Stuart Simpson (CSIRO) in May 2011, prior to the November 2011 investigation, who advised that "Based on the chemical and ecotoxicological tests, the sediments are generally considered to be suitable for ocean disposal at the designated Sydney Offshore Spoil Ground." (Appendix 5).

For any dredging and spoil disposal program, careful consideration should be given to the design and execution of the operations. While it would be desirable for materials of perceived lower quality (physical and chemical) to be deposited beneath materials of higher quality at the disposal site, the practicalities of the dredging operations, during which sediments from the three Dredge Areas may be

dredged and disposed of simultaneously, thereby mixing and homogenizing the sediments in the dredge barge before disposal, may make a sequential dredging operation impractical. Further, a sequential dredging operation would not be necessary when the results of the above geochemical and toxicity assessments are considered.

However, sediments in the northern part of Dredge Area 1 and in the central and southern parts of the Swing Basin contain comparatively low TBT concentrations relative to sediments at other sample locations within the three Dredge Areas and it may be possible for sediments from these areas to be considered for disposal within Botany Bay. This dredging option may be discussed in a separate Dredge Management Plan to be submitted as part of the Sea Dumping Permit Application (SDPA), which is not included in the current scope of work for this report.

3.3 Acid Sulfate Soils

An assessment of acid generating risk was undertaken during the November 2009 and November 2011 investigations. Results of the acid sulfate soil investigation are provided in **Appendix 6**.

The acid sulfate soil assessments involved two stages. The first stage of testing involved laboratory screen testing of 39 samples collected over the two investigations to identify the presence and severity of actual acid sulfate soils and the likely presence of potential acid sulfate soil (PASS). The laboratory screening test reported that pH_f prior to oxidation ranged from 4.9 to 9 indicating that no actual acid sulfate soils (AASS) (i.e. $pH_f \leq 4$) are likely to be present though this should be confirmed through further testing (refer TAA testing). From the laboratory testing undertaken, the presence of PASS can be indicated (though not confirmed) through one or more of the following:

- Release of hydrogen sulfide (H_2S) during oxidation;
- Effervescence and release of heat during oxidation;
- A pH following oxidation (pH_{fox}) <3.5; and
- A drop in pH following oxidation of 1 or more (i.e. pHf – $pH_{fox} \geq 1$).

Analysis of the results of the field screen indicated that PASS may be present in all samples, particularly for sediments from Dredge Areas 2 and 3.

Detailed laboratory analysis was carried out using the more rigid Chromium Reducible Sulfur (CRS) suite on 16 selected samples, including those with the highest drop in pH following oxidation or those with the greatest reaction rate. A summary of results for the selected samples is provided in **Table 3.4**.

The Titratable Actual Acidity (TAA) results indicate that AASS is present in two of the sixteen selected samples prior to disturbance of the sediments. Both samples were obtained from Dredge Area 3 (fixed berths).

The potential sulfidic acidity of each sample was determined using the Chromium Reducible Sulfur (S_{Cr}) test which is a direct measure of reduced inorganic sulfur and therefore allows distinction between inorganic sulfur such as pyrite and sulfur from organic sources. Thirteen of the 16 selected

samples reported a potential sulfidic acidity greater than the “action criteria” specified in the Acid Sulfate Soils Manual guidelines (Stone et. al, 1998). These results indicate a high potential for acid generating conditions to develop in the dredge material, following disturbance and oxidation.

Generally, where action criteria are exceeded, an acid sulfate soil management plan (ASSMP) is required for the disturbance of these sediments, unless mitigating factors such as sufficient ANC are established. Such factors are accounted for by determining the net acidity of each sample using the acid base accounting equation:

Net acidity = potential sulfidic acidity + existing acidity – acid neutralising capacity

The acid neutralising capacity (ANC) of a soil is the ability of the soil to neutralise any acid that may be produced on oxidation and maintain the pH above 5.5. Organic matter, calcium carbonates (i.e. shell) and magnesium carbonates are common naturally occurring neutralising agents. The effectiveness of these agents varies depending on particle size, coatings on the agent and kinetic factors which affect the rate at which they dissolve and become available. To account for these limitations, the acid neutralising capacity is divided by a minimum fineness factor of 1.5.

As shown in **Table 3.4**, the net acidity was found to exceed the action criteria provided in the Acid Sulfate Soils Manual (Stone et. al, 1998) in five of the 16 selected samples (i.e. samples at depth from sample locations VC2A and VC2B from Dredge Area 2 and sample locations VC5C and VC5B from Dredge Area 3. Preliminary liming rates for the neutralisation of the samples with net acidity above the action criteria are also provided in **Table 3.4** and vary from 7 to 76 kg $CaCO_3$/t of sediment. The mean liming rate for Dredge Areas 1, 2 and 3 are <1, 4.2 and 21 kg $CaCO_3$/t of sediment, respectively.

An ASSMP will be required if the proposed works are expected to result in the oxidation of the dredged material during removal, transportation, reuse or disposal. Average liming rates for the neutralisation of the material from each Dredge Area are provided in **Table 3.4.**

Table 3.4 Summary of Acid Sulfate Soil Testing

					ASS Screen Test				Laboratory Result of Chromium Suite Testing															
									Actual Acidity			Potential Acidity		Acid Neutralising Capacity			Retained Acidity				Acid Base Accounting		Liming Rate	
					pH_F	pH_{FOX}	Drop in pH	Reaction Rate	pH_{KCl}	TAA	s-TAA	S_{CR}		ANC	a - ANC_{BT}	s - ANC_{BT}	a-S_{NAS}	s-S_{NAS}	S_{KCL}	S_{HCL}	Net Acidity		Liming Rate*	Mean Liming Rate
Area	Date	Core	Depth	Sediment Type	pH Unit	pH Unit			pH Unit	mole H+/t	% S	% S	mole H+/t	% $CaCO_3$	mole H+/t	% S	mole H+/t	% S	% S	% S	% S sulfur trail	mole H+/t acid trail	kg $CaCO_3$/t	kg $CaCO_3$/t
1	Nov-09	VC1A	0-0.5	Brown/grey silty sand	8.9	6	2.9	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1	Nov-09	VC1A	0.5-1.2	Grey silty sand	9	6.3	2.7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1	Nov-09	VC1A	1.2-1.6	Grey silty sand	9	6.2	2.8	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1	Nov-09	VC1B	0-0.6	Brown Sand	9	6.1	2.9	1	9.6	<2	<0.02	0.03	17	2.9	580	0.93	-	-	-	-	<0.02	<10	<1	
1	Nov-09	VC1B	0.6-1.2	Brown Sand	9	6.2	2.8	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1	Nov-09	VC1B	1.2-1.7	Brown Sand	8.9	4.2	4.7	2	9.6	<2	<0.02	0.06	40	2.3	449	0.72	-	-	-	-	<0.02	<10	<1	<1
1	Nov-09	SS1A	0-0.25	Brown sand	8.6	6.1	2.5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1	Nov-09	SS1B	0-0.25	Grey sand	8.6	5.9	2.7	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1	Nov-09	SS1C	0-0.25	Yellow sand	8.5	5.7	2.8	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1	Nov-09	SS1D	0-0.25	Yellow/ brown sand	8.9	5.8	3.1	1	9.6	<2	<0.02	<0.02	<10	0.61	121	0.19	-	-	-	-	<0.02	<10	<1	
1	Nov-11	VC5A	0-0.5	Fine to medium grained sand with coarse shell	7.9	6.2	1.7	1	9.6	<2	<0.02	0.02	13	9.1	1820	2.91	-	-	-	-	<0.02	<10	<1	
2	Nov-09	VC2A	0-1.0	Grey sand	7.1	2	5.1	2													-	-	-	
2	Nov-09	VC2A	1.0-1.4	Dark brown sand	7.4	1.9	5.5	4	7.2	<2	<0.02	0.22	137	0.35	71	0.11	-	-	-	-	0.15	90	7	
2	Nov-09	VC2A	1.4-2.0	Dark grey sand interbedded with silt	8.8	6.5	2.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	Nov-09	VC2A	2.0-2.3	Light grey sand	8.9	6.5	2.4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	Nov-09	VC2A	2.3-2.6	Grey sand	8.8	6.5	2.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	Nov-09	VC2B	0-0.5	Grey sand	8.9	6.3	2.6	2	9.6	<2	<0.02	0.07	45	3.6	726	1.16	-	-	-	-	<0.02	<10	<1	
2	Nov-09	VC2B	0.5-0.9	Dark grey silty sand	8.8	6.5	2.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.2
2	Nov-09	VC2B	0.9-1.5	Grey sand	7.7	2.1	5.6	4	5.7	8	<0.02	0.16	102				-	-	-	-	0.18	110	8.6	
2	Nov-09	VC2B	1.5-2.2	Grey sand	7.8	2	5.8	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	Nov-09	SS2A	0-0.25	Brown sand	9.7	6.1	2.6	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	Nov-09	SS2B	0-0.25	Brown silty sand	9.6	6.3	2.3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	Nov-09	SS2C	0-0.25	Grey sand	8.8	6.3	2.5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	Nov-09	SS2D	0-0.25	Brown sand	8.8	6.1	2.7	2	9.7	<2	<0.02	<0.02	<10	2.4	479	0.77	-	-	-	-	<0.02	<10	<1	
3	Nov-09	VC3A	0-0.6	Dark grey sand	8.8	6.5	2.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	Nov-09	VC3A	0.6-1.3	Grey gritty sand	8.9	6.5	2.4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	Nov-09	VC3A	1.3-1.9	Grey gritty sand	8.9	6.6	2.3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	Nov-09	VC3A	1.9-2.4	Grey coarse sand and shell	8.9	6.6	2.3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	Nov-09	VC3B	0-0.5	Grey sand	8.7	6.3	2.4	2	9.4	<2	<0.02	0.1	60	3.5	691	1.11	-	-	-	-	<0.02	<10	<1	
3	Nov-09	VC3B	0.5-0.9	Grey sand	8.7	6.3	2.4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	Nov-09	SS3A	0-0.25	Grey gritty sand	8.8	6.4	2.4	2	9.6	<2	<0.02	0.06	37	9.1	1830	2.9	-	-	-	-	<0.02	<10	<1	
3	Nov-09	SS3B	0-0.25	Dark brown silty sand	8.4	6.5	1.9	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
3	Nov-09	SS3C	0-0.25	Dark brown silty sand	8.4	6.4	2	3	9	<2	<0.02	0.27	167	16.3	3260	5.2	-	-	-	-	<0.02	<10	<1	
3	Nov-09	SS3D	0-0.25	Light grey sand	8.7	6.4	2.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	Nov-11	VC5B	0-0.8	Dark grey/ black muddy sand and coarse shell. Stro	8.2	6.1	2.1	2	9.3	<2	<0.02	0.122	76	24.8	4960	7.96	-	-	-	-	<0.02	<10	<1	
3	Nov-11	VC5B	0.8-1.3	Dark grey/ black clay. Strong H2S odour	7	1.5	5.5	4	6.5	<2	<0.02	1.86	1160	1.28	256	0.41					1.59	993	75.8	
3	Nov-11	VC5B	1.3-1.6	Grey to dark grey sandy clay/ clayey sand	4.9	1.5	3.4	4	4.1	38	0.06	1.25	779				52	0.09	0.2	0.31	1.39	869	66.6	
3	Nov-11	VC5C	0-0.5	Dark grey muddy sand interbedded with mud	8.4	6	2.4	3	8.7	<2	<0.02	0.3	187	5.99	1200	1.92	-	-	-	-	<0.02	<10	<1	
3	Nov-11	VC5C	0.5-1	Black clay (shale like). Brittle, dry and flaking	7.3	4.9	2.4	3	5.7	50	0.08	0.33	203								0.4	253	19.4	

Notes:
Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Vigorous; 4 - Very Vigorous
BOLD - pHfox (<3.5), drop in pH (≥1) or reaction rate (≥2) indicates PASS
Retained acidity not required where pH_{KCL} > 4.5
Acid neutralising capcity not effective where pH_{KCL} <6.5
TAA exceeds ASSMAC "action criteria" ie. AASS
Value exceeds ASSMAC "action criteria", ie PASS
* Liming rate calculated on the highest net acidity results (i.e. either the acid or sulfur trail)
* Liming rate using Ag Lime (ENV = 98%), Safety Factor = 1.5

3.4 Data Validation

Tabulated results for field triplicates, split triplicates and duplicates, and field blanks are provided in **Appendix 7**.

3.4.1 Field QA/QC samples

SEDIMENT DUPLICATES AND TRIPLICATES

A field triplicate sample was collected from a nominated location during the March 2010 investigation to identify any variability of the sediments chemical characteristics at a particular site. The relative standard deviation (RSD) was calculated for each contaminant (**Appendix 7**). The NAGD recommends that field replicates should agree within an RSD of +/-50% although the guidelines note "they may not always do so where the sediments are very heterogeneous or greatly differing in grain size". The RSD analysis of the chemical properties of the sample shows that the RSD was outside of the recommended +/-50% for Cu, Zn, and total PAHs. The remaining results for all subsamples of the triplicate were LOR or within the RSD tolerance. The concentrations of Cu and Zn were low and close to the LOR, which is likely to have resulted in a greater analytical variability for these two analytes.

Split duplicates were collected at three locations in November 2009 and a split triplicate was collected at one location during the March 2010 investigation. The third triplicate sample was sent to a secondary laboratory for analysis.

The recommended RPD/RSD limits were exceeded in three of the four split samples for total PAHs. Two of the split samples also exceeded the RPD/RSD limits for either Cr or TBT. The analysis of field replicate and duplicate results indicate that the presence of PAH's and TBT within the sediments is inhomogeneous and possibly due to variations in sediment particle size.

A field triplicate and split triplicate were also submitted to ALS Environmental for analysis during the November 2011 investigation. ALS Environmental submitted one of the split triplicate samples to Advanced Analytical for analysis. Based on a review of the results of the QA/QC samples, it is suspected that a human error in label writing in the field or in label identification in the laboratory may have occurred which has resulted in a mix up of the field and split triplicate samples. RSD and RPD analysis of the triplicate samples could therefore not be calculated and relied upon, but the raw data are shown in Appendix 7 (QA/QC data analysis).As the remaining samples were labelled with distinguishable identifiers, it is not expected that any error associated with the field and split triplicate data has affected the quality of the remaining data.

SEDIMENT FIELD BLANKS

Field blanks were submitted as part of the QA/QC procedures during the March 2010 and November 2011 investigations to detect cross contamination from volatile substances such as BTEX and light fraction TPHs during sample handling and transportation. The results showed that all analytes were below LOR, suggesting that cross-contamination from secondary sources is unlikely in the applied sampling methodology

ELUTRIATES

A split duplicate sample was also submitted for elutriate TBT testing. The RPD for the elutriate TBT results (as calculated from TBT concentrations prior to applying the TBT correction from the seawater blank sample) were within the +/-35% criteria.

The seawater used in the elutriate tests was tested for background concentrations of TBT. If background concentrations of TBT were detected in the seawater samples, the results of the elutriate testing were corrected for these background concentrations.

3.4.2 Geochemical Laboratory QA/QC

Laboratory quality assurance consisted of the analysis of laboratory duplicates, method blanks, laboratory controls samples and matrix spikes. The results of this quality assurance are shown within the laboratory reports (**Appendix 6**).

An assessment of laboratory blank samples reported by ALS and AAA demonstrates concentrations below the LOR for all parameters, indicating an absence of cross-contamination.

The precision of analyses performed by the analytical laboratory is determined from the relative percent difference (RPD) of the analytical data from duplicate analyses. The NAGD recommend that laboratory duplicates do not exceed an RPD of +/-35%. This range was exceeded for Cr in sample VC2A (1.4-2.0), for total PAHs in two ALS laboratory duplicates (VC4C(0.0-0.5) and SS4F) and, as such, the PAH results for samples VC4C(0.0-0.5) and SS4F are reported as estimates only. The remaining laboratory duplicates conform to the required RPD criteria, indicating that the analytical laboratories (ALS Environmental and Advanced Analytical) have provided an acceptable level of precision for the geochemical data.

Analyses of surrogate spike samples were undertaken by the analytical laboratory to identify the percent recovery of spiked organic compounds relative to the concentration of recovery. Surrogate spike samples were within NAGD criteria, with the exception of TBT surrogates for several samples, which were not reported due to the requirement for primary dilution due to high analyte concentrations within the sample or from matrix interference.

Recovery of matrix spikes determines the interference on contaminant recovery from the sediment matrix. The percent recovery for TBT was not reported due to primary dilution requirements due to high analyte concentrations in the samples. Recovery of OCPs and OPPs, individual Aroclors, and individual PAHs were non-compliant with the NAGD criteria, likely due to sample heterogeneity.

Laboratory control spikes were within recovery limits for all analytes with the exception of mercury in one sample obtained during the November 2011 investigation. The recovery limit was only slightly below the recommended limits and was considered to be within range of the laboratory's data quality objectives.

As noted in **Appendix 6**, elutriation was undertaken three days outside of recommended holding times during the March 2010 investigation. This was due to analysis difficulties encountered by the laboratory due to the high sediment TBT concentrations observed. A weekend then falling immediately after the results were available precluded the commencing of elutriate testing until the

following Monday. However, the laboratory and CSIRO have advised that this is not expected to adversely impact the analytical results.

3.4.3 Toxicity Laboratory QA/QC

Laboratory QA/QC for toxicity testing included percentage survival of organisms in laboratory control samples, reference toxicants and measurement of water quality criteria for pH, salinity, dissolved oxygen and temperature.

All QA/QC parameters for the whole sediment and elutriate TBT toxicity testing were met.

3.4.4 Summary

Overall, field and laboratory QA/QC was considered acceptable for the use of the analytical data in the interpretation and in the environmental assessment outlined in this report.

4 KEY FINDINGS

The sediment sampling and testing program detailed herein was undertaken to characterise the physical and chemical properties of sediment from the dredge footprint within Dredge Areas 1, 2 and 3, including an assessment of the bioavailability and toxicity of the TBT contamination to the depth of dredging across the dredge footprint. The three stages of the investigation in 2009, 2010 and 2011 were carried out in accordance with the NAGD (Commonwealth of Australia, 2009) and the relevant SAP's (WP, 2009; WP, 2010, WP, 2011). Results were compared to relevant guideline values for land disposal, reuse and sea disposal of the maintenance dredge material.

The key findings of the investigation are as follows:

- Sediments within Dredge Areas 1 and 2 of the dredge footprint are dominated by sands (about 90%), with minor amounts of silts and clays (~8%). Sediments within Dredge Area 3 comprise less sand (mean 69%) and a higher proportion of fines (mean 17%) and gravel (mean 14%) compared to Dredge Areas 1 and 2;
- Comparison of the results to the NSW DECC (2009) Waste Classification Guidelines: Part 1 – Classifying Waste indicated that the dredge material in Dredge Areas 1, 2 and 3 is suitable for disposal as a general solid waste. Due to the elevated TBT concentrations in the sediment, special conditions may apply to the disposal of the dredge material to a controlled landfill. Management of return water from any dewatering of dredge material may be required should the material be transported onshore. These matters would be addressed in the environmental assessment for the proposed works;
- Comparison of the results to available site contamination guidelines indicated that the material has contaminant concentrations below the Health Investigation Levels (HIL's) and Health Screening Levels (HSL's) Category C – developed open space or recreational areas. However, there are no reuse criteria for TBT. Preliminary discussions with OEH indicated that the dredge material would not be suitable for reuse onshore due to elevated concentrations of TBT that are present in the material;
- Acid sulfate soils testing indicated that the net acidity of some samples exceeded the action criteria provided in the Acid Sulfate Soils Manual (Stone et. al, 1998), triggering a need for the preparation of an Acid Sulfate Soil Management Plan (ASSMP) if the proposed works are expected to result in the oxidation of this dredged material during removal, transportation, reuse or disposal. The results of the acid sulfate soil testing should be considered in the environmental assessment for the preferred reuse or disposal option;
- Comparison of the results to the guidelines for sea disposal, i.e. the screening levels provided in Appendix A, Table 2 of the NAGD and the ANZECC ISQG low and high indicated:
    - concentrations of antimony, BTEX, light fraction hydrocarbons (C_6-C_9 and C_6-C_{10}), OCPs and OPPs and PCB's were below analytical limits of reporting in all sediment samples tested;

  - the 95% UCL of the mean concentration of metals, total TPH's and total PAH's were below NAGD screening levels when calculated for each Dredge Area as well as for all three Dredge Areas combined; and
  - elevated concentrations of TBT above the NAGD maximum level in sediments in the three Dredge Areas triggered further testing, including elutriate and toxicity testing.

- Analytical results for TPHs and PAHs indicate that there appears to be no significant contamination of surface sediments as a result of the oily water discharge in March 2011;
- Chemical testing of the peat-like material show that all analytes tested are below NAGD screening levels, indicating that the material is suitable for sea disposal. However, it is recommended that the behaviour of the material following dredging and prior to disposal be considered further as part of the environmental assessment due to its different physical properties compared with the sediments in other parts of the three Dredge Areas (i.e. lower density and higher fine fraction content);
- Elutriate testing indicated that elutriate TBT concentrations (excluding calculated dilutions) exceeded the ANZECC/ARMCANZ (2000) water quality guideline value;
- Dilution modelling for disposal of dredged sediments from the three Dredge Areas at the Sydney Offshore Spoil Ground using the numerical method and results of the elutriate testing for the 'worst-case' 95% UCL (i.e. Dredge Area 1) indicated that the maximum concentration of TBT in the water following initial mixing for four modelled possible scenarios would be ≤0.089 ng/L, which is substantially below both the 95% protection level (6 ng/L) and the 99% protection level (0.4 ng/L). Therefore the concentrations of TBT in sediments in the three Dredge Areas are unlikely to affect water quality adversely during disposal at the Sydney Offshore Spoil Ground;
- Whole sediment toxicity testing indicated that all test sediments were considered to be non-toxic to the reproduction and survival of the amphipod *Melita plumulosa;*
- Elutriate toxicity testing indicated that there was no detectable toxicity to bivalve embryos from the elutriate samples tested;
- Toxicity tests used in the current assessment are considered to be the most sensitive tests that are currently available and it is not recommended that further ecotoxicological tests be undertaken;
- Normalized concentrations of TBT in sediments are below the NAGD screening level in the northern part of Dredge Area 1 and in the central southern area of the Swing Basin and these sediments may be suitable for disposal within Botany Bay, which would be addressed in the environmental assessment for the proposed works; and
- Field and laboratory QA/QC methodology was acceptable.

Based on the chemical and ecotoxicological tests, the sediments in Dredge Areas 1, 2 and 3 are considered to be suitable for unconfined ocean disposal at the designated Sydney Offshore Spoil Ground.

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Appendix 1 Supplementary SAP (November 2011 investigation) and DSEWPaC Comments on Supplementary SAP

WorleyParsons

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Caltex Dredging

Supplementary Sampling and Analysis Plan

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SUPPLEMENTARY SAMPLING AND ANALYSIS PLAN

Confidentiality

This document has been prepared for the sole purpose of documenting our Supplementary Sampling and Analysis Plan.

It is expected that this document and its contents will be treated in strict confidence by Caltex Refineries NSW Pty Ltd.

PROJECT 301015-02448 - CALTEX DREDGING

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	OAM	AW	N/A	13-09-11	N/A	
0	Issued for SEWPaC review	OAM	AW	AW	19-09-11	N/A	

CONTENTS

ACRONYMS and ABBREVIATIONS

AAA	Advanced Analytical Australia
ANZECC/ARMCANZ	Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CD	Chart Datum
CSIRO	Australian Commonwealth Scientific and Research Organization
DEWHA	Department of Environment, Water, Heritage and the Arts
EILs	Ecological Investigation Levels
EPA	Environment Protection Authority
HILs	Health based Investigation Levels
ISQC	Interim Sediment Quality Guidelines
LOR	Limit of Reporting
NAGD	National Assessment Guidelines for Dredging
NATA	National Association of Testing Authorities
NEHF	National Environmental Health Forum
NEPM	National Environmental Protection Measure
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls

QA/QC	Quality Assurance/ Quality Control
SAP	Sampling and Analysis Plan
SEWPaC	Department of Sustainability, Environment, Water, Populations and Communities
SOP	Standard Operating Procedures
TBT	Tributyltin
TOC	Total organic carbon
TPHs	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
WGS	World Geodetic System

1 INTRODUCTION

Caltex Refineries (NSW) Pty Ltd (Caltex) is responsible for the maintenance of their port facilities in Botany Bay in association with their refinery at Kurnell.

Caltex has formerly proposed to undertake maintenance dredging of the berths and approaches to remove sediment that has accumulation since the last maintenance dredging campaign undertaken in the 1969. Two recent sediment investigations were undertaken by WorleyParsons in November 2009 and March 2010 in association with the formerly proposed maintenance dredging to determine the suitability of the material for unconfined sea disposal. The testing was undertaken in accordance with the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009) and indicated that the materials were considered to be suitable for ocean disposal at the designated Sydney Offshore Spoil Ground.

Since the completion of the previous investigations, Caltex has modified the project proposal to include capital dredging of the No. 1 and No. 2 Fixed Berths adjacent to the Caltex jetty. In addition, recent hydrographic survey indicates that sediment has accumulated in the approaches and swing circle.

During preparation of this document, it was also identified that a discharge of oily water occurred in Botany Bay from the Caltex Refinery in March 2011 which may have impacted on the proposed dredge footprint.

As such, additional sampling and testing is required to

- meet the required number of samples specified in the NAGD for the change in dredge volume since the previous sampling and testing;
- provide a better spatial and vertical coverage of the proposed dredge areas; and
- identify whether any hydrocarbon contamination is present in the surface sediments of the proposed dredge area following the oily water discharge from the Caltex Refinery.

This report outlines the proposed Supplementary Sampling and Analysis Plan (SAP) and should be considered in conjunction with the most recent SAP prepared for the March 2010 sediment investigation (refer **Appendix 1**) and the Implementation Report prepared for that investigation (refer **Appendix 2**).

The Supplementary SAP has been prepared in accordance with recommendations outlined in the National Assessment Guidelines for Dredging (DEWHA, 2009) and includes the following elements:

- evaluation of the site history and available data
- objectives of the SAP
- map showing the proposed sampling locations

- estimates of the number of samples including replicates and triplicates
- methods and procedures for sampling
- details of methods for sample handling, preservation, storage and quality control and quality assurance (QC/QA)
- list of analyses required, detection limits and laboratory QC/QA procedures.

2 COMPILATION & REVIEW OF EXISTING DATA

2.1 Site Location

The Caltex refinery is located at Kurnell on the southern shore of Botany Bay, just south of the Sydney CBD (refer **Figure 1**).

The Caltex jetty extends approximately 800m into Botany Bay to the west of Sutherland Point, terminating in a wharf approximately 300m long. Fixed Berths No. 1 and No. 2 are located either side of the wharf, beyond which lies the approaches (including a swing circle) and the Sub-berth as shown on **Figure 2**.

2.2 Existing Sediment Data

Recent sediment investigations have been undertaken which are relevant to the proposed dredge areas including:

- sediment investigations by GHD in 2007 and 2008 at locations in the vicinity of the proposed dredging areas (0.5 to 1 km from the dredge areas);
- sediment quality investigation by WorleyParsons in November 2009 within the proposed dredge areas; and
- sediment quality investigation by WorleyParsons in March 2010 within the proposed dredge areas.

Preliminary sediment investigations undertaken by WorleyParsons in November 2009 indicated that there were elevated concentrations of tributyltin (TBT) in the sediment. In addition, subsequent discussions with the SPC pilots and review of the SPC (2009) hydrographic survey determined that the required dredge footprint was larger than the footprint investigated in the preliminary investigation.

An SAP (refer **Appendix 1**) was prepared for further investigations carried out in March 2010 to:

- characterise the chemical properties of sediment from within the expanded areas of the dredge footprint; and
- assess the bioavailability and toxicity of the observed TBT with depth across the dredge footprint (including elutriate analyses and toxicity testing where required).

The SAP was approved by the Department of Sustainability, Environment, Water, Populations and Communities (then DEWHA) prior to implementation.

The main findings of the SAP Implementation Report (refer **Appendix 2**), which provides results from both the 2009 and 2010 investigation, are described below. The SAP Implementation Report has not yet been reviewed by SEWPaC.

FIGURE 1

Source: Google Earth Pro (2011)

LOCATION PLAN

FIGURE 2

Source: Google Earth Pro (2011)

LOCATION OF BERTHS AND APPROACHES

It is envisaged that **Appendix 2** would be updated following the implementation of this SAP and would be submitted with the Sea Dumping Permit application should Caltex pursue sea disposal of the dredged material.

Sampling Methodology

Samples comprising both vibrocores and surface samples were collected from the sub-berth and approaches during the investigations undertaken on 3rd and 5th March, 2010. A judgmental sampling pattern was used to position sample locations in areas:

- with the greatest sediment accretion within the proposed dredge footprint (based on review of the hydrographic survey);
- which had high TBT concentrations observed in the preliminary November 2009 investigation (i.e. in order to ensure retrieval of sufficient sample with TBT concentrations representative of the dredge material for use in elutriate and toxicity testing); and
- not covered in the preliminary investigation (i.e. those additional areas of the broadened dredge footprint).

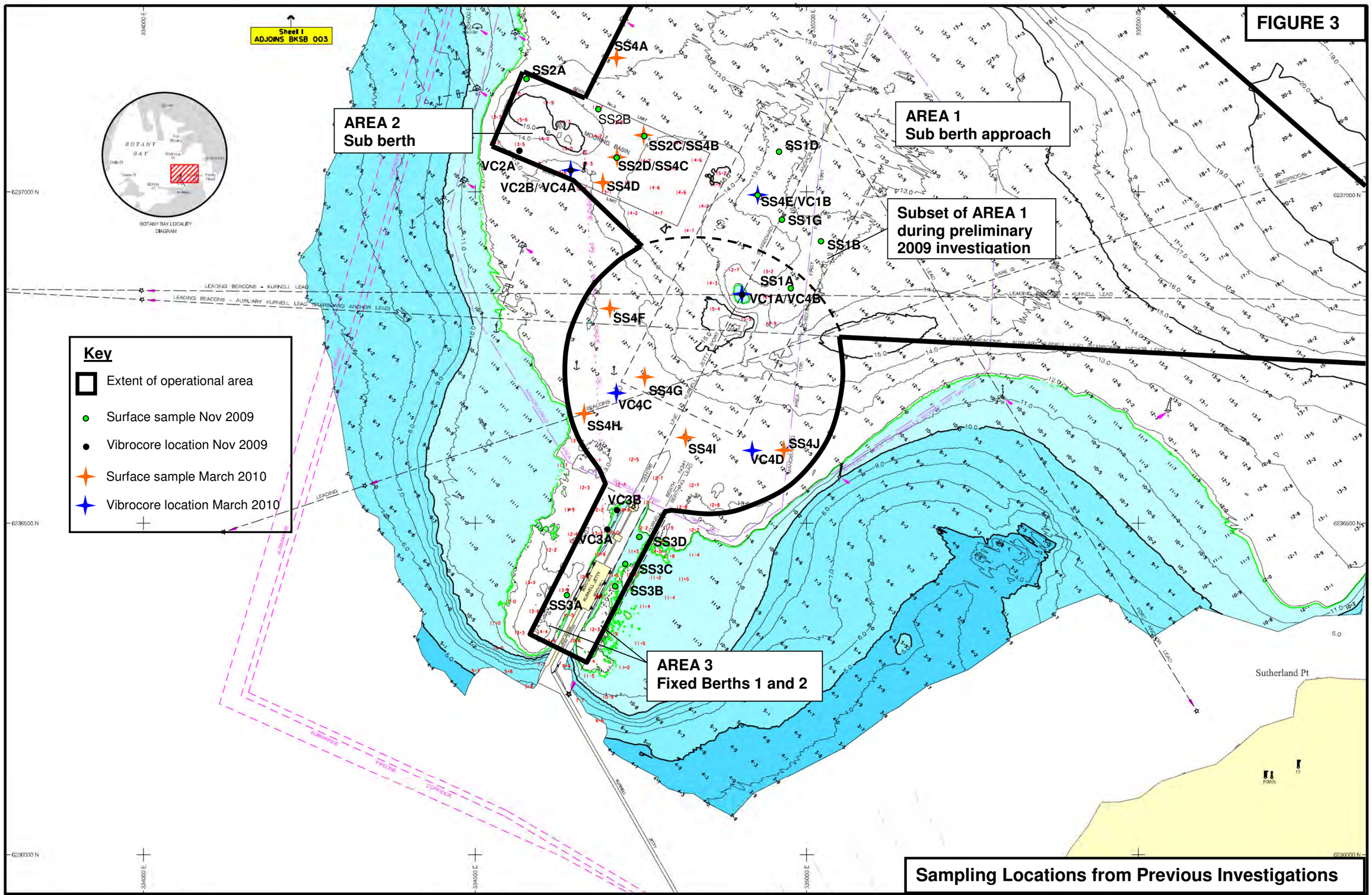
In total, samples were collected from 26 discrete locations for the November 2009 and March 2010 investigations as well as six locations from the 2009 investigation which were resampled during the 2010 investigation to obtain sediment with high TBT concentrations to undertake elutriate and toxicity testing.

Sufficient sediment was collected to allow a range of tests on each sample. Seawater was also collected for elutriate testing purposes.

Standard Operating Procedures (SOP) were used for the coring, surface sampling and sub sampling (refer **Appendix 3**). Samples were recovered approximately every 0.5 m from each vibrocore to the proposed dredge depth. One sample was recovered from each surface core.

Figure 3 shows the selected sample locations.

FIGURE 3



NOTES

13-4 CURRENT SURVEY

13-2 PLAN BKSB 003 , 24/09/2007

20-2 PLANS BKSB 002 AND SP59-BMC1-1

ACCURACY STATEMENT:
ESTIMATED ACCURACY OF OBSERVATIONS AT 95% CONFIDENCE LEVEL: -0.15m to 0.12m

Scale in Metres
SCALE 1:2500 AT A1
CONTOUR INTERVAL: 1.0 m
DECLARED DEPTH: SEE NOTE

EQUIPMENT
VESSEL: Recorder
SOFTWARE/VERSION: HydroPro/V9.2
ECHOSOUNDER MODEL/FREQUENCY: Atlas Deso 25/210kHz
SONAR MODEL/FREQUENCY: Klein 3000
GPS CALIBRATED SITE: MGA Botany
GPS ROVER MODEL: Trimble MS750
DRAFTED BY: AJC

SURVEY INFORMATION
REDUCED DATA: K:\Survey\Jobs\bksb\007\hydro\ Kurnell Swinging Basin 1SCU\Reduced Data\Kurnell.xyz
FIELD DATA: K:\Survey\Data\bksb\007\ydro\Kurnell Swinging Basin 1SCU\Navigation Files\Kurnell Swinging Basin 1SCU_2007.dps and Kurnell Swinging Basin 1SCU_2007.bksb
FILE NO.: 2004/2838
GRID: MGA 94
G.O./RUNLINES: KSB07_001
LINE SPACING: 20m
ECHO FOLL: 90°/315°/180°
PRIMARY CROSS CHECK: 100m
SURVEY METHOD: RTK DGPS
DATE COMMENCED: 03 September 2007
DATE COMPLETED: 24 September 2007
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QUALIFICATION OF PERSONNEL
FIELD SURVEYOR: V. O'Connell MIS H1
CHECKING SURVEYOR: G.Bettman MIS H1

SYDNEY PORTS
FIRST PORT, FUTURE PORT

HYDROGRAPHIC SURVEY
BOTANY BAY
KURNELL SWINGING BASIN

Previous Plan: BKSB 002

DWG NO: BKSB 004

Testing

Chemical testing undertaken in March 2010 comprised testing by ALS Environmental for:

- TBT and Total Organic Carbon (TOC) in all samples;
- a suite of heavy metals and Polycyclic Aromatic Hydrocarbons (PAHs) of all samples in the expanded area of the dredge footprint; and
- Benzene, Toluene, Ethyl Benzene and Xylene (BTEX),Total Petroleum Hydrocarbons (TPHs), Organochlorin (OC) Pesticides and Polychlorinated Biphenyls (PCBs) of 20% of samples in the expanded area of the dredge footprint to confirm that these contaminants are not of concern.

Particle size analysis and acid sulfate testing undertaken during the November 2009 investigation was considered sufficient for the expanded dredge footprint.

Advice was sought from Dr Stuart Simpson of CSIRO on the most appropriate method of testing for bioavailability and toxicity of TBT. Dr Simpson is an expert in aquatic geochemistry and sediment toxicology and was a key technical expert in the development of the NAGD. The toxicity tests selected by Dr Simpson are considered to be the most sensitive available currently and it was not recommended that further ecotoxicological tests be undertaken.

Following the statistical analysis of results to determine the 95% Upper Confidence Level (UCL) of the mean concentration of TBT, samples were selected for elutriate and toxicity testing. Dr Simpson recommended that samples be selected based on a TBT concentration (normalised to 1% TOC) greater than the NAGD maximum level of 70µg Sn/kg and as close as possible to, or slightly higher than the 95% UCL of the mean TBT concentration (i.e. 363µg Sn/kg). For toxicity tests, a "blind control" sample was also selected with a TBT concentration below the NAGD maximum level.

Elutriate testing comprised testing of twelve selected samples including one replicate and one seawater blank.

Dilution calculations were undertaken using the results for total sediment TBT concentrations and the elutriate TBT results to determine the potential bioavailability of dissolved TBT concentrations in the water column during sea disposal. Analytical dilution modeling was undertaken assuming dredging would be undertaken using a backhoe dredger with overflowing. Following analysis of the result from the analytical method, numerical modeling using STFATE was undertaken for four scenarios including backhoe dredging and trailer suction hopper dredging, both with and without overflowing.

Whole sediment toxicity testing was undertaken by CSIRO and comprised the 10 day toxicity testing for chronic effects (reproduction) to the epibenthic amphipod *Melita plumulosa* on three selected samples, a blind control and an in-house silty sediment sample.

Toxicity testing of elutriates was undertaken by Ecotox Services Australasia on three selected samples, a one blind control and a seawater blank. The elutriate water and serial dilutions (50%,

25%, 12.5%, 6.3%) were tested using the 48 hour oyster larval development test using the rock oyster *Saccostrea commercialis* to determine the presence or absence of toxicity.

Main Findings

The results of the sediment testing from both the November 2009 and March 2010 investigations were compiled. A statistical analysis of the pooled data was undertaken and the results compared to the NAGD, relevant reuse and disposal guidelines, and the ANZECC/ ARMCANZ (2000) Marine Water Quality Guidelines (refer **Table 2.1** and **Table 2.2**).

The full report on the findings is provided in **Appendix 2**. A summary of the results relevant to the proposed unconfined sea disposal of the material is provided below:

- the maintenance dredge material comprises grey/brown sands (mean 93%) with minimal amounts of clay (2-9%) and silt (<1-3%).
    - Concentrations of BTEX, OC Pesticides and PCB's were below laboratory detection levels in all samples tested.
    - the 95% UCL of the mean concentration of metals, TPH's and total PAH were below NAGD screening levels when calculated for each area and for all areas combined.
    - elevated concentrations of TBT were observed above the NAGD maximum level triggering the need for further testing including elutriate and toxicity testing.
- the results of the elutriate testing indicated that elutriate TBT concentrations (excluding calculated dilutions) exceeded the ANZECC/ARMCANZ (2000) water quality guideline value.
- dilution modelling for the Sydney Offshore Spoil Ground using the numerical method indicated that for all modelled scenarios, the concentration of TBT in the water following initial mixing would be a maximum of ≤ 0.000035µg/L, i.e. well below both the 95% protection level (0.006 µg/L) and the 99% level of protection (0.0004 µg/L). Therefore, the concentrations of TBT in material from the proposed Caltex maintenance dredge areas are not of concern to water quality during disposal at the Sydney Offshore Spoil Ground.
- results of the whole sediment toxicity testing indicated that all test sediments were considered to be non-toxic to the reproduction and survival of the amphipod *Melita plumulosa.*
- based on the chemical and ecotoxicological tests, the sediments are considered to be suitable for ocean disposal at the designated Sydney Offshore Spoil Ground.
- due to the uncertainty regarding the potential for bioaccumulation of TBT by aquatic organisms that colonise and inhabit the sediments, it would be desirable that the more highly
- TBT contaminated material from Area 1 material (approaches) should be deposited beneath materials of higher quality at the disposal site.

Table 2.1 Summary of Geochemical Results from the WP November 2009 and March 2010 Sediment Investigation in Comparison to Reuse and Disposal Criteria

		Metals														Organics					
		Antimony	Arsenic	Cadmium	Chromium	Copper	Cobalt	Lead	Manganese	Nickel	Selenium	Silver	Vanadium	Zinc	Mercury	BTEX	Sum TPHs	OC Pesticides	Total PCBs	Sum PAHs	TBT
Units		mg/kg														mg/kg		µg/kg			µg Sn/kg
LOR		0.5	1	0.1	1	1	0.5	1	10	1	0.1	0.1	2	1	0.01	0.2	3-5	0.5	5		0.5
Waste Classification Criteria	CT1 - General solid waste	-	100	20	100	-		100		40		-		-	4	10-1000		-	-	-	-
	CT2 - Restricted solid waste	-	400	80	400	-		400		160		-		-	16	40-4000		-	-	-	-
Site Contamination Criteria	NEPC E - Health based Investigation Level (HILS) parks, recreational open space, playing fields	-	200	40	24%	2000		600		600		-		14000	30	-		20000	20000	40000	-
	NEPC - Ecological Investigation Level (EILS) Interim Urban	-	20	3	400	100		600		60		-		200	1	-		-	-	-	-
Aquatic Ecology	NAGD / ANZECC ISQG low	2	20	1.5	80	65		50		21		1		200	0.15	-	550	0.32-280	23	10000	9
	NAGD / ANZECC ISQG max	-	-	-	-	-		-		-		-		-	-	-		-	-	-	70*
ALL AREAS	Mean	<0.5	1.78	<0.1	3.89	3.52	0.42	4.82	7.87	0.52	0.16	0.08	7.50	21	0.05	<0.2	165	<0.5	<5.0	283	206
	Standard Deviation	NA	2.93	0.20	5.49	5.78	0.53	9.52	7.88	1.22	0.31	0.15	15.6	68	0.13	NA	211	NA	NA	579	595
	95% UCL of the mean	<0.5	2.48	<0.1	5.18	4.89	0.55	7.08	9.72	0.81	0.24	0.11	11.2	37	0.08	<LOR	296	<LOR	<LOR	440	353
AREA 1 - SUB BERTH APPROACH	Mean	<0.5	0.76	<0.1	1.61	2.23	<0.5	1.89	6.50	<.01	0.06	0.09	9.43	4.85	0.04	<LOR	254	<0.5	<LOR	295	281
	Standard Deviation	NA	0.49	NA	1.15	1.55	NA	1.10	6.03	NA	0.03	0.21	21	3.76	0.14	<LOR	257	NA	<LOR	472	770
	95% UCL of the mean	<0.5	0.92	<0.1	1.99	2.73	<0.5	2.28	8.61	<0.1	0.07	0.17	16.4	6.07	0.09	<LOR	499	<LOR	<LOR	450	516
AREA 2 - SUB BERTH	Mean	<0.5	2.41	<0.1	5.49	1.96	0.55	3.26	6.54	0.65	0.28	<.01	4.89	10.7	0.06	<LOR	53	<LOR	<LOR	350	174
	Standard Deviation	NA	4.27	NA	6.99	1.80	0.79	3.25	3.95	1.15	0.51	NA	5.99	13.5	0.15	<LOR	14.1	<LOR	<LOR	874	307
	95% UCL of the mean	<0.5	4.27	<0.1	8.57	2.75	0.95	4.69	8.49	1.22	0.51	<0.1	7.53	16.6	0.13	<LOR	116	<LOR	<LOR	732	309
AREA 3 - FIXED BERTHS	Mean	<0.5	3.38	0.09	7.25	8.66	0.65	13.9	12.9	1.49	0.26	0.07	6.26	71	0.06	<LOR	56	<LOR	<LOR	166	10.1
	Standard Deviation	NA	3.58	0.06	7.44	11.09	0.64	18.1	13.0	2.06	0.29	0.05	5.99	140	0.07	<LOR	42	<LOR	<LOR	326	17.7
	95% UCL of the mean	<0.5	5.18	0.12	10.90	14.18	1.02	23	19.3	2.50	0.40	0.10	9.22	140	0.09	<LOR	245	<LOR	<LOR	326	25

Notes:

All organics are normalised to 1% TOC (with 0.2 to 10% TOC)

Where results are below LOR, half the LOR has been used in the statistical analyses (*italicised*)

NEPC - National Environmental Protection Council (NEPC) (1999) National Environmental Protection (Assessment of Site Contamination) Measure

ANZECC ISQG-low - ANZECC/ARMCANZ (2000) Guidelines for Fresh and Marine Water Quality as updated (in draft) by Simpson et al. (2008)

* NAGD maximum level = 70 µg Sn/kg whereas ANZECC ISQG-high = 80 µg Sn/kg

Table 2.2 Total Sediment and Elutriate TBT results from WP November 2009 and March 2010 Investigations

			Analyte	TBT Normalised	Elutriate TBT [(2)]
			Units	µgSn/kg	ng/L
			LOR	0.5	2
Aquatic Ecology			NAGD / ANZECC ISQG low	9	6
			NAGD / ANZECC ISQG high	70*	
Area 1	Nov-09	16/11/2009	VC1A 1.2-1.6	134	
Area 1	Nov-09	18/11/2009	VC1B 0-0.6	115	70
Area 1	Nov-09	18/11/209	SS1A	30	
Area 1	Nov-09	18/11/209	SS1B	3.5	
Area 1	Nov-09	17/11/2009	SS1C	32	
Area 1	Nov-09	17/11/2009	SS1D	8.5	
Area 1	Mar-10	5/05/2010	SS4A	4	
Area 1	Mar-10	5/05/2010	SS4E	3740	246
Area 1	Mar-10	5/05/2010	SS4F	129	8
Area 1	Mar-10	5/05/2010	SS4G	16	14
Area 1	Mar-10	3/05/2010	SS4H	16	23
Area 1	Mar-10	3/05/2010	SS4I	4.5	
Area 1	Mar-10	3/05/2010	SS4J	4	
Area 1	Mar-10	5/05/2010	VC4B 0-0.5	136	
Area 1	Mar-10	5/05/2010	VC4B 0.5-1	840	3338
Area 1	Mar-10	5/05/2010	VC4B 1-1.5	690	4518
Area 1	Mar-10	5/05/2010	VC4B 1.5-2	505	1028
Area 1	Mar-10	3/05/2010	VC4C 0-0.5	49	
Area 1	Mar-10	3/05/2010	VC4C 0.5-1	231	161
Area 1	Mar-10	3/05/2010	VC4C 1-1.5	53	
Area 1	Mar-10	3/05/2010	VC4C 1.5-2	6.4	
Area 1	Mar-10	3/05/2010	VC4D 0-0.5	1.3	
Area 1	Mar-10	3/05/2010	VC4D 0.5-1	1.3	
Area 1	Mar-10	3/05/2010	VC4D 1-1.5	1.3	
Area 1	Mar-10	3/05/2010	VC4D 1.5-2	1.3	
Area 2	Nov-09	16/11/2009	VC2A 2.3-2.6	27	
Area 2	Nov-09	17/11/2009	VC2B 0-0.5	17	
Area 2	Nov-09	17/11/2009	SS2A	1.25	
Area 2	Nov-09	17/11/2009	SS2B	10	
Area 2	Nov-09	17/11/2009	SS2C	234	
Area 2	Nov-09	17/11/2009	SS2D	259	8
Area 2	Mar-10	5/05/2010	SS4B	64	31
Area 2	Mar-10	5/05/2010	SS4C	20	
Area 2	Mar-10	5/05/2010	SS4D	1040	7
Area 2	Mar-10	5/05/2010	VC4A 0-0.5	565	
Area 2	Mar-10	5/05/2010	VC4A 0.5-1	29	
Area 2	Mar-10	5/05/2010	VC4A 1-1.5	1.3	
Area 2	Mar-10	5/05/2010	VC4A 1.5-2	1.3	
Area 3	Nov-09	16/11/2009	VC3A 0-0.6	7.2	
Area 3	Nov-09	16/11/2009	VC3B 0-0.5	3.7	
Area 3	Nov-09	16/11/2009	SS3A	2.5	
Area 3	Nov-09	16/11/2009	SS3B	46	<2
Area 3	Nov-09	16/11/2009	SS3C	0.2	
Area 3	Nov-09	16/11/2009	SS3D	1.0	
ALL AREAS			Mean	206	727
			Standard Deviation	595	1691
			n	44	13
			95% UCL of the mean	353	1369
AREA 1 - APPROACHES			Mean	281	1045
			Standard Deviation	770	1691
			n	25	9
			95% UCL of the mean	516	2093
AREA 2 - SUB BERTH			Mean	174	15.3
			Standard Deviation	307	13.6
			n	13	3
			95% UCL of the mean	309	38
AREA 3 - FIXED BERTHS			Mean	10.1	<2
			Standard Deviation	17.7	-
			n	6	1
			95% UCL of the mean	25	<2

Notes:

All organics are normalised to 1% TOC (with 0.2 to 10% TOC)

Where results are below LOR, half the LOR has been used in the statistical analyses (*italicised*)

ANZECC ISQG-low - ANZECC/ARMCANZ (2000) Guidelines for Fresh and Marine Water Quality as updated (in draft) by Simpson et al. (2008)

* NAGD maximum level = 70 µgSn/kg whereas ANZECC ISQG-high = 80 µgSn/kg

Student t-test used to calculate 95%UCL of the mean where insufficient data is available to use the Standard Bootstrap Method

2.3 Potential Impact from Recent Oil Slick

A sheen of hydrocarbons was identified in Botany Bay on 20th March, 2011. The oily water discharge resulted from heavy localised flooding which caused the failure of the Caltex Refinery's onsite stormwater management system which separates oil from water prior to release.

Caltex immediately contacted the New South Wales Department of Environment, Climate Change & Water (DECCW, now OEH) and Sydney Ports Corporation. The containment strategy used booms to entrain the oil and boats were used to break up the sheen to aid in evaporation of the sheen. Inspectors from the NSW Office of Environment and Heritage inspected the beaches and wetlands around Botany Bay on the day of the release and again the following day. No traces of the hydrocarbons were evident along the shoreline. Whilst it is not expected that the dredge footprint would have been impacted by this discharge, as a precautionary measure, testing of all surface samples (refer **Section 4**) for PAHs and TPHs is recommended.

2.4 Contaminants of Concern for the Further Testing

Based on a review of recent geochemical data for the dredge area and surrounding areas (refer **Section 2.2**), TBT has been identified as a contaminant of concern within the dredge footprint. TBT testing is required in those areas that have recently accumulated sediment within the swing circle and approaches, and at depth within the fixed berths proposed for capital dredging. **Section 4** of this SAP sets out in detail the proposed further TBT testing.

In addition to TBT testing, 20% of samples proposed for collection from the additional dredge areas within the fixed berths, swing circle and approaches would also be tested for a suite of heavy metals.

To address the potential for hydrocarbon contamination as a result of the oily water release from the refinery in March 2011, all surface samples for collection from the additional dredge areas within the fixed berths, swing circle and approaches would be tested for PAHs, TPHs and TOC.

As concentrations of BTEX, OC Pesticides and PCBs from recent samples collected across the dredge footprint were below the laboratory limits of reporting, testing for these analytes is not proposed.

3 DESCRIPTION OF DREDGING PROPOSAL

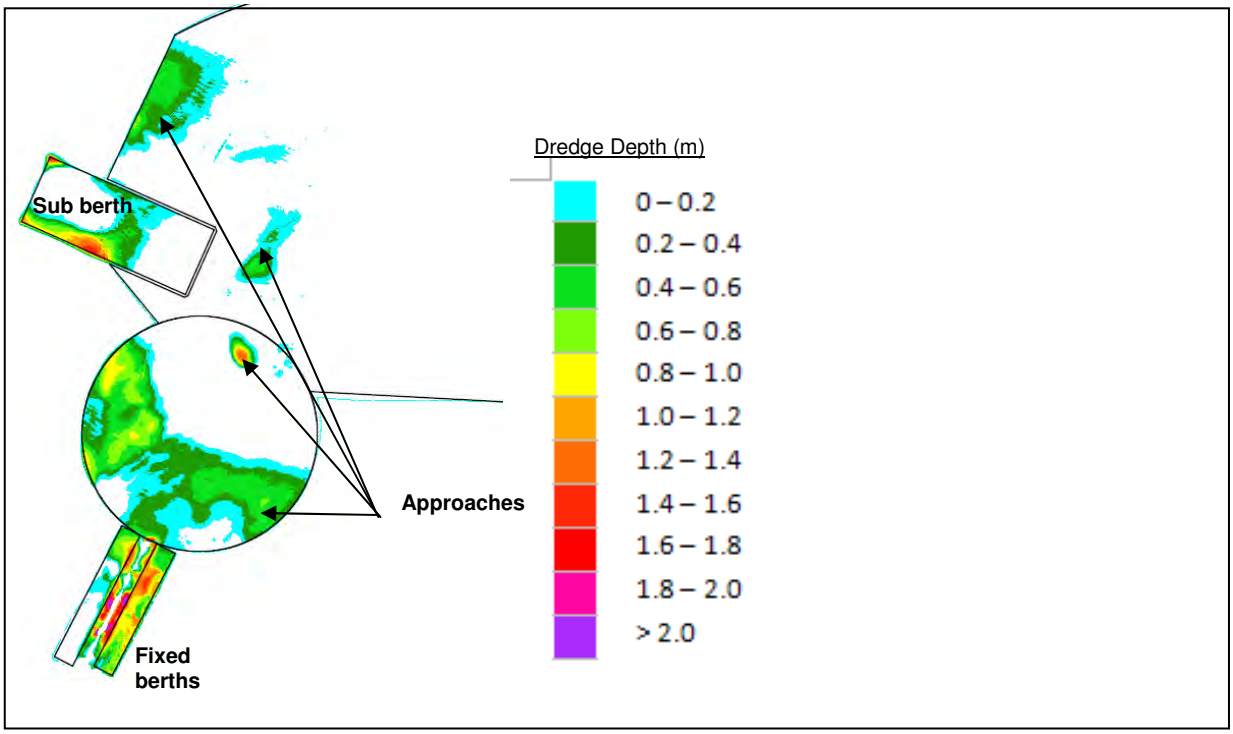
The project proposal comprises maintenance dredging activities of all areas to their declared depths as specified below:

- approaches to the sub berth -12.8 m CD;
- swing circle -12.8m CD;
- sub berth -14.0 m CD; and
- fixed berths 1 & 2 -11.2 and 11.6 m CD respectively.

In addition, capital dredging will be undertaken in the fixed berths, below the declared depths, to a depth of -12.8m CD.

The most recent hydrographic survey (SPC, 2011) made available since the previous sediment investigations, was used to identify the areas, thickness and volume of dredge material. The depth dredging required and the areas of greatest sediment accumulation are shown in **Figure 4**.

Figure 4 Areas and depths of proposed dredging



The total volume of proposed maintenance dredge material, including an allowance for dredging tolerance, is approximately 90,300 m^3.

It is envisaged that dredging would be undertaken using a trailer suction hopper dredge (TSHD) with overflowing through a green valve. However, other options have been considered for the purposes of assessing water quality impacts including backhoe dredging, and dredging without overflowing from the barge.

4 PROPOSED SEDIMENT SAMPLING AND ANALYSIS

4.1 Objective

The sampling and testing is to be undertaken to provide better spatial and vertical coverage of the dredge areas and to meet the NAGD sampling requirements for the change in dredge volume. The investigations are required to support applications for approvals for dredging and disposal from the relevant government agencies.

4.2 Sample Locations

Samples will be collected from ten locations including one vibrocore and four surface samples collected from the swing circle and approaches, and four vibrocores and one surface sample collected from the fixed berths. A judgmental sampling pattern has been used to locate samples:

- in areas of the of the swing circle and approaches which were not sampled in the previous investigations but are now part of the dredge footprint due to recent sediment accumulation; and
- in the fixed berths, in areas with the greatest sediment depth to dredge design level.

Vibrocore sample locations have been chosen to target areas with sediment accumulation more than 1 m above the design dredge levels. The proposed sampling locations are shown in **Figure 5**. The coordinates for each proposed sampling location are included in **Appendix 4**.

An onboard GPS will be used to position the sampling vessel at the nominated sampling locations. The GPS has an accuracy of +/-0.1m. However, following maneuvering of the vessel into position and recovery of the sample from the sea bed, the positioning of vibrocores is likely to have an accuracy of +/-5m.

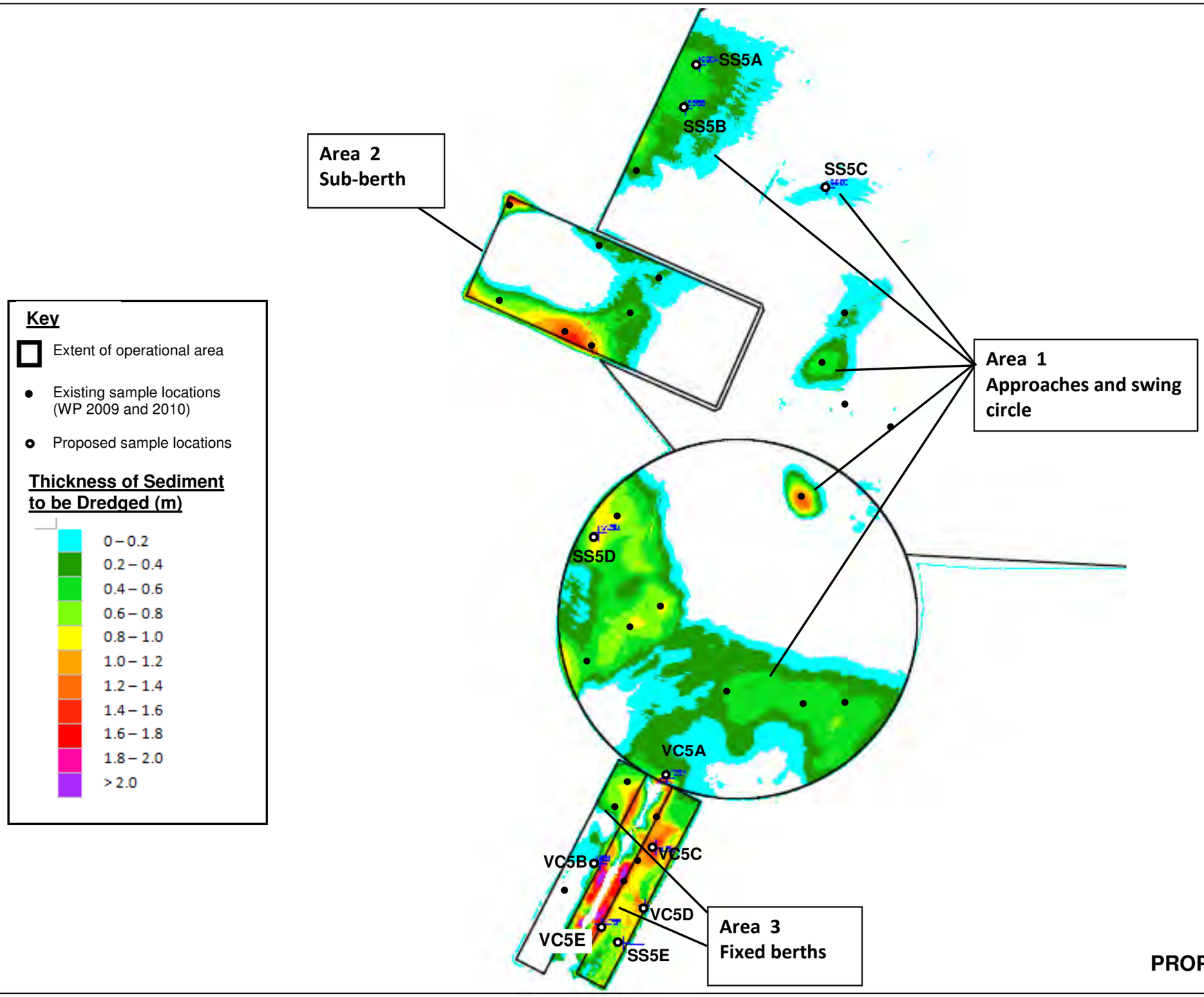
4.3 Sample Collection

Prior to sampling, each vessel proposed for use will be thoroughly inspected and washed down. Any evident sources of contamination will be cleaned and covered in plastic to avoid accidental contamination of any samples.

Collection of the vibrocores will be undertaken by McLennans Diving Service (MDS) using a Rossfelder P3 Vibrocore with 100mm diameter aluminium core tubes and if necessary, core catchers to retain sediment within each core. Vibrocores will be driven to a depth of 2.5m or refusal. Surface samples would be collected by a WorleyParsons environmental scientist using a Ponar grab sampler.

Sampling dates, time, water depth and depth of core penetration will be recorded. Vibrocores will be capped and transported onshore for subsampling. Surface samples will be sub-sampled onboard.

FIGURE 5



PROPOSED SAMPLING LOCATIONS

All surfaces used for sample handling will be covered in plastic sheeting prior to subsampling. Subsampling will be undertaken using nitrile gloves and decontaminated stainless steel equipment.

Cores will be split longitudinally, logged, photographed and subsampled for each half metre depth increment. The following volumes will be retained from each subsample, where relevant, for the different analyses potentially required:

- 150ml for analysis of TBT and TOC;
- 250ml for analysis of metals, PAHs and TPHs; and
- 250g for particle size analysis.

Samples for chemical analysis will be homogenised and transferred to glass jars with Teflon lined lids. Samples for particle size analysis will be transferred to a plastic ziplock bag. Each jar/bag will be filled with zero headspace and tightly sealed to avoid loss of sample. Each container will be labelled with a unique identification number and each sample will be recorded on a log sheet.

Sediment will typically adhere to the outside of the sample containers. To avoid cross contamination, after each container is sealed, the outside of each sample container will be washed with seawater.

Standard Operating Procedures (SOP) for the coring, surface sampling and sub sampling are included in **Appendix 3**.

4.4 Estimated Number of Samples

For a total estimated dredge volume (including overdredging) of 90,300m^3, the number of sampling locations required as specified in the NAGD, is 17.

The combined dataset from the recent November 2009 and March 2010 investigations comprised sampling from 26 locations, six of which were sampled during both investigations. In order to allow sufficient coverage of the additional proposed dredge areas since these investigations, sampling is proposed at an additional ten locations. This will bring the total number of sampling locations to 36 discrete locations (refer **Table 4.1**) which is considered more than sufficient to satisfy the requirements of the NAGD should the entire dredge footprint be considered as one area, or as individuals areas.

For geochemical analyses, one subsample will be collected from each of the surface cores. From each vibrocore, a sample from the surface 0-0.5m, and one to two samples at depth (in 0.5m increments) would be collected.

In addition, a field triplicate will be collected, that is, three samples taken at the same location (i.e. two addition samples). The triplicate samples will be used to give an indication of the variability in the chemical properties of the sediment at a sample location. As part of QA/QC procedures, it is proposed to submit one split triplicate, i.e. a single homogenised sample split into three containers with the third sample being sent to a second laboratory to assess variation associated with subsample handling (i.e. two additional samples).

As sediments are not being analysed for volatiles, it is not proposed to a submit field blank.

Particle size analysis will be carried out on an additional four samples at depth within the fixed berths to provide an indication of the physical characteristics of the proposed capital dredge material.

Table 4.1 Proposed Number of Sample Locations for the Dredge Footprint

Area	Total Estimated Volume Including Overdreding (m^3)	Number of Sample Locations			
		Nov 2009 and March 2010 Investigation	Proposed this SAP	Total	Table 7 of the NAGD
All proposed dredge areas (i.e. entire dredge footprint treated as one area)	90,300	26 (+ 6 repeated locations)	10	36 (+6 repeated locations)	17 (i.e. one dredge area)
Fixed Berths No. 1 and No.2	19,800	6	5	11	8
Approaches and Swing Circle	58,450	13 (+ 3 repeated locations)	5	18 (+3 repeated locations)	14
Sub-berth	12,050	7 (+3 repeated locations)	0	7 (+ 3 repeated locations)	7

Notes
1. Some sampling locations from the 2010 investigation were chosen based on locations from the preliminary investigation in 2009 that reported high concentrations of TBT in order to carry out elutriate and toxicity testing.

An estimated 23 subsamples will be collected in total including field QA/QC samples. The sub-sample breakdown is shown in **Table 4.2**.

Table 4.2 Proposed Number of Sub-samples

Sample type	Number of Subsamples
Surface cores	5
Vibrocores	14
Triplicate	2 additional samples
Split Triplicate	2 additional samples
Blank	0
Total	23

4.5 Sample Preservation

Samples for geochemical analysis will be packed in ice in an esky immediately after sampling to maintain the temperature below 4°C. Samples for physical analysis will be stored at ambient temperatures. Samples will then be submitted to the analytical laboratory on the same day or the following morning.

4.6 Equipment Decontamination Procedure

All sampling equipment will be decontaminated between each sampling event. Decontamination procedures will include rinsing equipment in seawater to remove visible sediment, followed by a Decon 90 rinse.

4.7 Sample Shipment

All sample containers will be clearly labelled with unique sample identification numbers. Samples will be transported in an esky in ice to the relevant analytical laboratory nominated for each analyses required. WorleyParsons will coordinate the analysis of the samples.

All samples will be transported under WorleyParsons chain of custody procedures.

4.8 Analysis Schedule

4.8.1 Chemical Analysis

The primary laboratory selected to undertake the chemical testing is the NATA registered ALS Laboratory Group. The third spilt triplicate sample will be submitted to a secondary laboratory, NATA registered Advanced Analytical Australia (AAA) laboratory group.

Chemical testing will comprise testing for TBT and TOC in all samples.

In addition, four samples at depth within the fixed berths will be tested for PAHs and TPHS, and twenty percent of samples will also be tested for a suite of metals as specified in the NAGD to confirm that they are not of concern.

The contaminants and the detection limit of the proposed analytical methods are listed in **Table 4.3**.

4.8.2 Physical Analysis

Physical testing will comprise determination of the particle size distribution (PSD) by sieve (to 75µm) and reporting of % gravel, sand and fines. Analysis will be undertaken by ALS Laboratory Group.

Table 4.3 Proposed Chemical Analyses of Sediment Samples

Test Parameter	PQL	units	Lab Method	Screening Level
Silver (Ag)	0.1	mg/kg	USEPA 6020	1
Cadmium (Cd)	0.1	mg/kg	USEPA 6020	1.5
Selenium (Se)	0.1	mg/kg	USEPA 6020	--
Cobalt (Co)	0.5	mg/kg	USEPA 6020	--
Antimony (Sb)	0.5	mg/kg	USEPA 6020	2
Copper (Cu)	1	mg/kg	USEPA 6020	65
Lead (Pb)	1	mg/kg	USEPA 6020	50
Zinc (Zn)	1	mg/kg	USEPA 6020	200
Chromium (Cr)	1	mg/kg	USEPA 6020	80
Nickel (Ni)	1	mg/kg	USEPA 6020	21
Arsenic (As)	1	mg/kg	USEPA 6020	20
Vanadium (V)	2	mg/kg	USEPA 6020	--
Manganese (Mn)	10	mg/kg	USEPA 6020	--
Mercury (Hg)	0.01	mg/kg	APHA 3112 Hg-B	0.15
PAHs (each individual species)	4-5[1]	µg/kg	USEPA 3640/8270	10,000
TPH (C6-C9)	0.2	mg/kg	USEPA 5030/8260	550
TPH (C10-C36)	3-5	mg/kg	USEPA 3510/8015	550
Total PCBs	5[1]	µg/kg	USEPA 3640/3620	23
TBT	0.5	µg/kg	USEPA 8081/8082 In-House GC/MS	9
TOC	0.02%		In house/Leco	--

Notes
2. The laboratory will strive to reach this PQL but previous sampling and testing indicates that matrix interference may prevent the laboratory reaching this very low detection limit.

The results of the chemical analysis will be pooled with data obtained from the November 2009 and March 2010 investigations. The 95% UCL of the mean concentration of each contaminant will be calculated and compared to the NAGD screening levels.

4.8.3 Requirements for Additional Testing

Provided that the 95%UCL of the mean normalised TBT concentration, once updated with the results of the proposed TBT testing, is consistent with the results from the previous investigations, it is not expected that further elutriate or toxicity testing would be required.

Elutriate and toxicity testing has previously been undertaken in accordance with the NAGD decision-tree approach for assessing potential contaminants. Results from these investigations are documented in **Appendix 2** and summarised in **Section 2.2**.

Should the 95%UCL of the mean normalised PAH and TPH concentrations be consistent with the results from the previous investigations, once updated with the additional proposed testing of surface samples, it would be considered that there has been no impact to the proposed dredge footprint following the recent oily water discharge from the refinery.

4.8.4 Data Management Procedure

Statistical analysis and tabulation of data will be undertaken following data validation. Data management of the analysis results will be in accordance with the requirements of NAGD. Validation of data will include evaluating the results from laboratory blanks, standard samples, field triplicate samples and split triplicate samples.

4.9 Equipment

The equipment required for the sampling program is summarised as follows:

- The crane barge the “Alkira” with onboard GPS (provided by MDS)
- The catamaran vessel the “Stewie Griffin” with onboard GPS (provided by WorleyParsons)
- Rossfelder P3 vibrocorer (provided by MDS)
- Commercial dive team (provided by MDS)
- 3m aluminium vibrocore pipes
- core catchers and core caps
- Ponar grab sampler
- trestles and table for use in subsampling;
- tarpaulin/ plastic sheeting;
- measuring tape;
- stainless steel bowl and spoons;
- nitrile gloves and PPE;
- Decon90 (diluted to 5% with deionised water) ;
- sample containers and zip-lock bags;
- permanent markers and other stationary;
- core log photo board;
- eskies and ice;
- camera;

- data forms for recording field measurements and logging samples; and
- chain of custody forms.

An experienced environmental scientist/environmental engineer from WorleyParsons will coordinate the sampling program and carry out the surface sampling. MDS personnel will operate the crane/barge and vibrocorer and undertake all diving operations.

4.10 Health and Safety Precautions

The sampling program will adhere to HSE systems of WorleyParsons, Caltex and McLennans Diving Service.

4.11 Contingency Plan

The sampling program is unlikely to be affected by weather or equipment failure. Sampling may be delayed due to operational requirements of the Caltex berths. In the event of delay, the sampling would be recommenced following the provision of access to the berths and access channel, improvement in the weather or fixing of the equipment.

5 QA/QC PROCEDURES

5.1 Field QA/QC Procedures

Field QA/QC procedures will include the following:

- Sample Location: The "Alkira's" onboard position fixing system will be used to locate the sampling locations.
- Decontamination of Sampling Equipment: Prior to use, the survey vessel will be thoroughly inspected and washed down. Any evident sources of contamination would be cleaned and covered in plastic to avoid accidental contamination of any samples. All surfaces used for sample handling will also be covered in plastic sheeting prior to subsampling. All sampling equipment that comes into contact with the sediment samples will be decontaminated (using Decon 90) prior to each sampling event.
- Field triplicates: Triplicate samples (comprising three samples taken from one location) will be analysed and used to give an indication of the variability in the chemical properties of the sediment at a sample location.
- Field Documentation: Each sample location will be numbered on a sampling plan in the field logbook. All other observations including weather, time, date of sampling, water depth, and depth of core penetration will be noted in the field logbook. Time, date, core compaction and appearance of the sediments, e.g. texture, colour, odour and the like will also be reported in the field logbook during sub-sampling.
- Cross Contamination: Following sampling, to avoid cross contamination, each sample jar will be washed with water to remove sediment adhering to the outside of the sample containers.
- Split triplicates: At one location, a split triplicate sample will be taken with two of the samples submitted to the primary laboratory and the third sample submitted to the secondary laboratory for geochemical analysis. The split triplicate results will be analysed to assess variability in sub-sampling.
- Sample Control: Each sample will have a unique identification number, which will be recorded in the field log book and chain of custody form. A chain of custody form will accompany the sediment samples at all times and will include the analysis method required of each laboratory.

5.2 Laboratory QA/QC Procedures

Laboratory QA/QC procedures for the geochemical analyses will include the following:

- Analysis Blanks: One per analytical run or one in every 20 samples, whichever is the smaller.

- Laboratory Duplicate: One in every 10 samples or client batch, whichever is the smaller.
- Laboratory Control Standard: One per analytical run or one in every 20 samples, whichever is the smaller.
- Laboratory Matrix Spike: One in every 20 samples or client batch, whichever is the smaller.
- Matrix Spike: One in every 20 samples or client batch, whichever is the smaller.
- Surrogate Spike: For determinations that are appropriate, surrogate spikes will be added to all samples for analysis.
- Calibration Blank and Mid Range Calibration Verification: One per analytical run or one in every 20 samples, whichever is the smaller.

6 REPORTING

The main findings of the proposed sampling and testing investigation will be documented in a factual report along. The report will include:

- a description of the sampling program
- tabulation of all laboratory results and a copy of the original laboratory sheets
- results for organic analytes normalised to 1% total organic carbon
- statistical analysis of the results to calculate the mean, and standard deviation and the 95% upper confidence limit of the mean (95% UCL).
- where values are less than the detection limit, a nominal value of one half of the detection limit will be used in the statistical analysis of the results
- reporting of all QA/QC.

7 REFERENCES

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000) *Australian and New Zealand guidelines for fresh and marine water quality* (i.e. the ANZECC Guidelines).

Commonwealth of Australia (2009) National Assessment Guidelines for Dredging.

GHD (2009) *Caltex Port Facilities, Botany Bay Geotechnical & Geochemical Investigations Desk Study*.

Simpson, SL, Batley, GE and Chariton, AA. (2008) *Revision of the ANZECC/ARMCANZ sediment quality guidelines. Draft, CSIRO Land and Water.* Technical report No. 8/07, August 2008. Prepared for the Commonwealth Department of the Environment, Heritage, Water and the Arts.

Appendix 1 WP (2010) Caltex Maintenance Dredging: Sampling and Analysis Plan

Supplied Under Separate Cover (Attached CD)

Appendix 2 WP (2010) Caltex Maintenance Dredging: Sampling and Analysis Plan Implementation Report

Supplied Under Separate Cover (Attached CD)

Appendix 3 Standard Operating Procedures for Sediment Sampling & Subsampling

STANDARD OPERATING PROCEDURES FOR SEDIMENT SAMPLING AND SUBSAMPLING

1. location of sampling to be confirmed by on-board GPS.
2. the coordinates of the sample location, date, time, weather conditions and water depth should be recorded in the field log book.
3. for coring:
    a. core deployed and lowered to sea bed
    b. depth of penetration of the core recorded
    c. core recovered, capped, and placed on vessel deck
    d. two cores taken from each location to obtain sufficient volume of sample.
4. for surface grab samples:
    a. Ponar grab (decontaminated with Decon90) to be deployed and lowered to sea bed
    b. Jaws of Ponar grab to close upon contact with the sea bed
    c. Ponar grab recovered and placed on vessel deck for inspection
    d. Integrity of grab sample assessed for loss of fines
    e. If grab not considered satisfactory, sample should be discarded and steps a to d repeated
5. steps 1 to 4 repeated at each core/surface core location.
6. surfaces to be covered in plastic sheeting prior to subsampling.
7. cores from each location split, logged and photographed.
8. for cores:
    a. core compaction calculation and each core subsampled.
    b. If more than one core was recovered from each location to obtain sufficient sediment for all analyses, the sediment from each core for 0.5m depth increment is to be homogenised into one sample
9. for each surface core/0.5m vibrocore depth increment, collect sufficient sediment for the analyses required, i.e.:
    a. one sub-sample for TBT and TOC (1x150 ml glass jar)
    b. one sub-sample for metals, PAHs and TPHs (1x250ml glass jars)
    c. one sub-sample for PSD (1 x 250g ziplock bag)

10. samples homogenised and transferred to the appropriate containers using stainless steel implements.
11. sample containers filled with zero headspace.
12. each container tightly sealed to avoid loss of sample and labelled with a unique identification number.
13. outside of each sample container washed with sea water to avoid cross contamination.
14. samples to be packed in ice in an esky immediately after sampling to maintain the temperature below 4°C. If overnight storage is required, freeze samples for chemical testing.
15. all sampling equipment should be decontaminated before the next sampling event by rinsing equipment in water to remove visible sediment, followed by a Decon 90 rinse.

Appendix 4 Coordinates of Proposed Sample Locations

Site	Easting	Northing
SS5A	334786	6237329
SS5B	334771	6237281
SS5C	334929	6237192
SS5D	334675	6236807
SS5E	334702	6236351
VC5A	334751	6236535
VC5B	334676	6236439
VC5C	334738	6236457
VC5D	334726	6236392
VC5E	334678	6236371

Note: Coordinates are in MGA.

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

Ms Orla Murray
Environmental Scientist – Coastal & Marine
WorleyParsons
Level 12, 141 Walker Street
North Sydney NSW 2060

Dear Ms Murray

Caltex Dredging Project Supplementary Sediment Sampling and Analysis Plan

I refer to your letter dated 20 September 2011, regarding the Supplementary Sediment Sampling and Analysis Plan (SAP) for the Caltex Dredging Project, Botany Bay, New South Wales.

The Department has reviewed the supplementary SAP and has identified some areas where further information or clarification is required. These comments are provided at Attachment A and will need to be addressed in a revised SAP.

If you have any further questions please contact Ms Eszter Szabo on 02 6274 6141 or email eszter.szabo@environment.gov.au.

Yours sincerely

Mahani Taylor
A/g Director
Ports and Marine Section
27 October 2011

Attachment A: Comments on the Caltex Dredging Project Supplementary SAP

As part of the review of the Supplementary SAP, the department's technical reviewer made the following points regarding the Sampling and Analysis Implementation Report (Rev 1) – Worley Parsons (September 2011), please address the following:

Appendix 2 Caltex Maintenance Dredging: Sampling and Analysis Implementation Report (Rev 1) – Worley Parsons (September 2011)

The Sampling and Analysis Implementation Report states that the intended volume was 24,630 m^3 (including a 0.3 m over dredging tolerance). The document proposes that the three dredge areas be regarded as one dredge area; however the results for the testing show that Area 3 is different in chemical characteristics than Areas 1 and 2. This difference is apparent in the TBT levels which are significantly lower in Area 3 than Areas 1 and 2. There are also higher levels of metals (including zinc) in Area 3, which although not exceeding the *National Assessment Guidelines for Dredging, 2009* (NAGD 2009) screening levels, are different from the results shown within Areas 1 and 2. Regarding the three dredge areas as one area reduces the overall mean and 95% UCL. It is requested that the three areas be regarded separately as Areas 1 and 2 show significantly different TBT results from Area 3.

The sediments from Area 1 demonstrated TBT concentration that greatly exceeded the NAGD high of 70 µgSn/Kg and the elutriate testing showed TBT concentrations >300 times the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)* (ANZECC WQ guideline) value (6 ng/L). The report carried out initial dilution modelling on the 'All Areas Dredging' (rather than modelling each Dredge Area) and initially used the analytical modelling (as given in Appendix A (pg39) of the NAGD 2009) which demonstrated that after 4 hours of mixing the TBT concentration in water would be 0.23 µg/L if the Botany Bay disposal site was utilised and 0.094 µg/L if the Sydney Offshore Disposal site was utilised. These values are significantly higher than the ANZECC 95% or 99% Protection Level (0.006 µg/L and 0.004 µg/L, respectively).

Numerical modelling (for four dredging techniques) was then applied utilising the STFATE Model and this calculated the maximum concentration in the water following initial (4 hour) mixing as being 0.000035 µg/L for the Sydney Disposal Grounds. This is a significantly different result than the initial dilution predicted by the analytical modelling. Review of the modelling parameters has illustrated the following:

- The modelling has been based upon 'All areas' rather than the separate Dredge Areas which has lowered the 95% UCL value. The 'worst-case' 95% UCL (Area 1) would have been more appropriate to use.
- More importantly, the modelling report states the following:

  Material was assumed to be entirely sand based on WorleyParsons (2011), in which it was found that based on testing of nine samples in the area to be dredged, there was (by mass) 93% sand, 4% clay, 1% silt, and 1% gravel. It was considered that the measured 93% proportion sand was equivalent to 100% sand for the purpose of the investigation reported herein.

  This assumption is not considered appropriate, given the modelling should have focused upon the portion of sediments that are of concern which, as TBT will preferentially bind to clays and silts rather than sand, is the clay and silt portion (approximately 7%). By 'discarding' the clay and silt portion the sediment type of most concern, which stays in suspension longer and hence is more of an issue in terms of water quality, has been excluded from the modelling.

Given the above, it is considered that the results from the modelling may not represent the correct situation and the modelling has not demonstrated that the sediments are suitable for ocean disposal at the designated Sydney Offshore Spoil Ground.

Caltex Dredging: Supplementary Sampling and Analysis Plan (Rev 0) – Worley Parsons (September 2011)

The Supplementary SAP states that the intended volume is now 90,300 m^3 of maintenance and capital dredging (including over dredging). This is an increase from the 24,630 m^3 (including 0.3 m over dredging tolerance) of solely maintenance dredging stated within the SAP implementation document and volume of 33,800 m^3 stated within the original SAP (March 2011).

Comment number	Comment
1	• Page 14 states that the total proposed maintenance dredge material (including over dredging tolerance) is 90,300 m^3. Confirmation is needed that this is both the capital and maintenance dredging total. Please also confirm if the dredging tolerance is as stated previously (0.3 m).
2	• Given the increase in proposed dredging to 90,300 m^3, it is considered that the dredging should be regarded as three separate areas. This is supported by the results from the original testing demonstrating that Areas 1 and 2 differ in characteristics from Area 3 (especially in relation to the TBT levels). The number of samples proposed is sufficient to allow consideration of the dredge areas separately.
3	• It is noted that 20% of samples will be tested for metals and no samples are proposed for testing of BTEX, OC Pesticides or PCBs. Although it appears that previous testing has indicated that these are unlikely to be contaminants of concern, using the precautionary principle the department requests that 20% of samples also be tested for BTEX, OC Pesticides and PCBs.
4	• The recent failure of the Caltex Refinery's onsite stormwater management system resulted in an oily discharge to the marine environment. As such, the Supplementary SAP proposes that all surface samples (which number 5 of the 10 samples proposed) be tested for PAHs, TPHs and TOC. The number of samples is considered sufficient; however, given the spill was located closer to the shore at the Caltex Refinery, it is considered that the distribution of the surface samples is unsuitable and sampling would be more appropriate in Area 3 and the Area 1 swing circle/southerly approach. This could be undertaken by taking additional surface samples adjacent to the vibrocore locations.
5	• Particle size analysis (PSA) is only being proposed for the vibrocore locations within the Area 3 Fixed Berths. Given the limited previous PSA information available, the significantly increased dredge volume, and the consideration that TBT levels are likely linked to the clay/silt portion of the sediments, it is requested that further PSA testing be undertaken within Areas 1 and 2.
6	• The Supplementary SAP proposes TBT testing of all 10 new samples – this is considered appropriate. However, the Supplementary SAP also states that

	no further elutriate testing is proposed if the results are consistent with those undertaken previously. Given the difference in the TBT results between the three areas and the increase in dredge volume, it is requested that further elutriate testing be undertaken on a proportion of the samples (at a minimum of one per Area).
7	• Once the additional sampling has been undertaken, the initial dilution will require recalculating using either the analytical modelling or the numerical modelling (with the appropriate parameters applied in regards to percentage of clays/silts and grain size). The data should then be presented for each Dredge Area in regards to the TBT levels for all samples taken to date. The suitability of the sediments for unconfined ocean disposal should be summarised at this point along with the proposed dredge method.
8	**Conclusion** In summary, the number of additional sampling locations is considered appropriate for the dredge volume now proposed; however, the inclusion of additional particle size analysis (to better inform disposal options) and relocation of the proposed PAH and TPH sample locations is requested. As TBT levels (both sediment and elutriate) have previously been shown to be significantly higher than the NAGD and ANZECC Guidelines for two of the three dredge areas proposed, and given the increase in dredge volume by over 50,000m^3, elutriate testing should be undertaken on at least one sample per area during the additional testing. Further to this, it is recommended that once the additional sampling and analysis are complete, the initial dilution is recalculated (using the analytical modelling or numerical modelling with appropriate parameters applied) and all data analysed and presented in terms of the three Dredge Areas and the suitability of the sediments for ocean disposal.

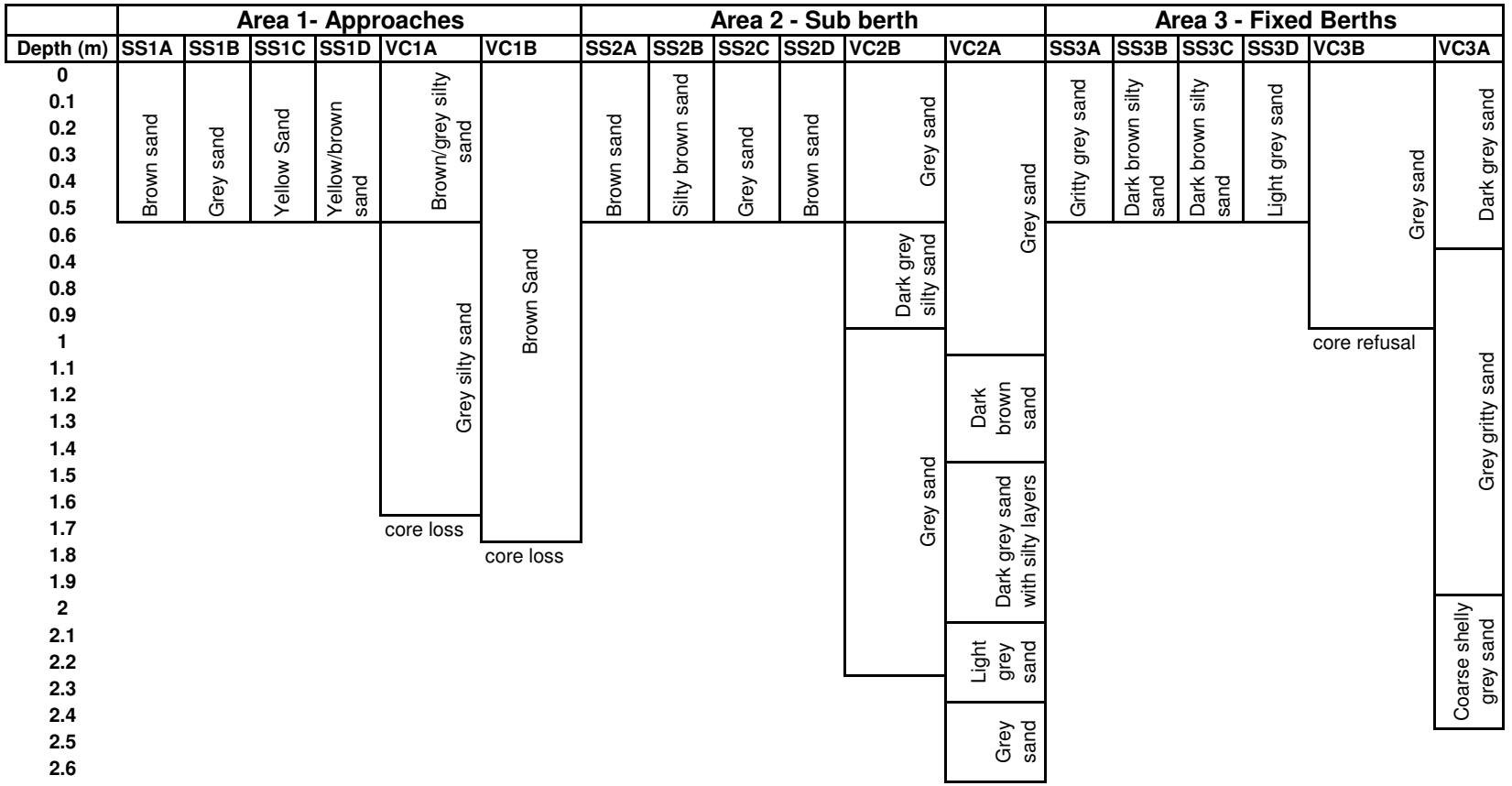
Appendix 2 Coordinates of Sample Locations (MGA94, Zone 56)

Dredge Area	Sampling Month	Sampling Date	Site	Easting	Northing
Area 1	Nov-09	16/11/2009	VC1A	334913	6236845
Area 1	Nov-09	16/11/2009	VC1A	334913	6236845
Area 1	Nov-09	16/11/2009	VC1A	334913	6236845
Area 1	Nov-09	18/11/2009	VC1B	334961	6237004
Area 1	Nov-09	18/11/2009	VC1B	334961	6237004
Area 1	Nov-09	18/11/2009	VC1B	334961	6237004
Area 1	Nov-09	18/11/209	SS1A	334990	6236845
Area 1	Nov-09	18/11/209	SS1B	335043	6236927
Area 1	Nov-09	17/11/2009	SS1C	334979	6236957
Area 1	Nov-09	17/11/2009	SS1D	334976	6237063
Area 1	Mar-10	5/05/2010	SS4A	334719	6237227
Area 1	Mar-10	5/05/2010	SS4E	334961	6237004
Area 1	Mar-10	5/05/2010	SS4F	334706	6236820
Area 1	Mar-10	5/05/2010	SS4G	334751	6236724
Area 1	Mar-10	3/05/2010	SS4H	334643	6236668
Area 1	Mar-10	3/05/2010	SS4I	334805	6236632
Area 1	Mar-10	3/05/2010	SS4J	334956	6236600
Area 1	Mar-10	5/05/2010	VC4B	334913	6236845
Area 1	Mar-10	5/05/2010	VC4B	334913	6236845
Area 1	Mar-10	5/05/2010	VC4B	334913	6236845
Area 1	Mar-10	5/05/2010	VC4B	334913	6236845
Area 1	Mar-10	3/05/2010	VC4C	334715	6236704
Area 1	Mar-10	3/05/2010	VC4C	334715	6236704
Area 1	Mar-10	3/05/2010	VC4C	334715	6236704
Area 1	Mar-10	3/05/2010	VC4C	334715	6236704
Area 1	Mar-10	3/05/2010	VC4D	334903	6236607
Area 1	Mar-10	3/05/2010	VC4D	334903	6236607
Area 1	Mar-10	3/05/2010	VC4D	334903	6236607
Area 1	Mar-10	3/05/2010	VC4D	334903	6236607
Area 1	Nov-11	17/11/2011	VC5A	334754	6236535
Area 1	Nov-11	17/11/2011	VC5A	334754	6236535
Area 1	Nov-11	17/11/2011	VC5A	334754	6236535
Area 1	Nov-11	17/11/2011	SS5A	334786	6237329
Area 1	Nov-11	17/11/2011	SS5B	334771	6237281
Area 1	Nov-11	17/11/2011	SS5C	334929	6237192
Area 1	Nov-11	17/11/2011	SS5D	334683	6236802
Area 2	Nov-09	16/11/2009	VC2A	334575	6237068
Area 2	Nov-09	16/11/2009	VC2A	334575	6237068
Area 2	Nov-09	16/11/2009	VC2A	334575	6237068
Area 2	Nov-09	16/11/2009	VC2A	334575	6237068
Area 2	Nov-09	16/11/2009	VC2A	334575	6237068
Area 2	Nov-09	17/11/2009	VC2B	334653	6237038
Area 2	Nov-09	17/11/2009	VC2B	334653	6237038
Area 2	Nov-09	17/11/2009	VC2B	334653	6237038
Area 2	Nov-09	17/11/2009	VC2B	334653	6237038
Area 2	Nov-09	17/11/2009	SS2A	334586	6237173
Area 2	Nov-09	17/11/2009	SS2B	334696	6237128
Area 2	Nov-09	17/11/2009	SS2C	334767	6237070
Area 2	Nov-09	17/11/2009	SS2D	334721	6237060
Area 2	Mar-10	5/05/2010	SS4B	334767	6237070
Area 2	Mar-10	5/05/2010	SS4C	334721	6237060
Area 2	Mar-10	5/05/2010	SS4D	334681	6237016
Area 2	Mar-10	5/05/2010	VC4A	334653	6237038
Area 2	Mar-10	5/05/2010	VC4A	334653	6237038
Area 2	Mar-10	5/05/2010	VC4A	334653	6237038

Dredge Area	Sampling Month	Sampling Date	Site	Easting	Northing
Area 2	Mar-10	5/05/2010	VC4A	334653	6237038
Area 3	Nov-09	16/11/2009	VC3A	334703	6236492
Area 3	Nov-09	16/11/2009	VC3A	334703	6236492
Area 3	Nov-09	16/11/2009	VC3A	334703	6236492
Area 3	Nov-09	16/11/2009	VC3A	334703	6236492
Area 3	Nov-09	16/11/2009	VC3B	334718	6236521
Area 3	Nov-09	16/11/2009	VC3B	334718	6236521
Area 3	Nov-09	16/11/2009	SS3A	334642	6236398
Area 3	Nov-09	16/11/2009	SS3B	334714	6236404
Area 3	Nov-09	16/11/2009	SS3C	334728	6236439
Area 3	Nov-09	16/11/2009	SS3D	334752	6236477
Area 3	Nov-11	17/11/2011	SS5E	334761	6237457
Area 3	Nov-11	17/11/2011	VC5B	334676	6236439
Area 3	Nov-11	17/11/2011	VC5B	334676	6236439
Area 3	Nov-11	17/11/2011	VC5B	334676	6236439
Area 3	Nov-11	17/11/2011	VC5C	334734	6236454
Area 3	Nov-11	17/11/2011	VC5C	334734	6236454
Area 3	Nov-11	17/11/2011	VC5D	334723	6236391
Area 3	Nov-11	17/11/2011	VC5D	334723	6236391
Area 3	Nov-11	17/11/2011	VC5D	334723	6236391
Area 3	Nov-11	17/11/2011	VC5E	334707	6236382
Area 3	Nov-11	17/11/2011	VC5E	334707	6236382
Area 3	Nov-11	17/11/2011	VC5E	334707	6236382

All coordinates in MGA94 (Zone 56)

Appendix 3 Core Logs


Area 1- Approaches
Area 2 - Sub berth
Area 3 - Fixed Berths
Depth (m)
SS1A
SS1B
SS1C
SS1D
VC1A
VC1B
SS2A
SS2B
SS2C
SS2D
VC2B
VC2A
SS3A
SS3B
SS3C
SS3D
VC3B
VC3A
0
0.1
0.2
0.3
0.4
0.5
0.6
0.4
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
Brown sand
Grey sand
Yellow Sand
Yellow/brown sand
Brown/grey silty sand
Grey silty sand
core loss
Brown Sand
core loss
Brown sand
Silty brown sand
Grey sand
Brown sand
Grey sand
Dark grey silty sand
Grey sand
Dark brown sand
Dark grey sand with silty layers
Light grey sand
Grey sand
Gritty grey sand
Dark brown silty sand
Dark brown silty sand
Light grey sand
Grey sand
core refusal
Dark grey sand
Grey gritty sand
Coarse shelly grey sand

VIBROCORE LOG

WorleyParsons
resources & energy

VIBROCORE # SS4A
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	5/03/2010
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334719 **Water depth:**
Equipment: Diver collected surface core **(ID):** 96 mm **Northing:** 6237227 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver collected surface cores	0			Fine to medium grained yellow sand. Some small mud balls				TBT, TOC, PAH's, Metals,OCPs, PCB's, BTEX, TPH's				
	0.5			Core terminated at 0.5m								
	1											
	2											
	3											
	4											

VIBROCORE LOG

WorleyParsons
resources & energy

VIBROCORE # SS4B
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	5/03/2010
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor:	McLennans Diving Service	**Core diameter (OD):**	100 m	**Easting:**	334767
Equipment:	Diver collected surface core	**(ID):**	96 mm	**Northing:**	6237070

Water depth:
Datum: WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver collected surface cores	0			Fine to medium grained light grey sand. Some small mud balls				TBT, TOC				
	0.5			Core terminated at 0.5m								
	1											
	2											
	3											
	4											

VIBROCORE LOG

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VIBROCORE # SS4C
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	5/03/2010
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor:	McLennans Diving Service	**Core diameter (OD):**	100 m	**Easting:**	334721
Equipment:	Diver collected surface core	**(ID):**	96 mm	**Northing:**	6237060

Water depth:
Datum: WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver collected surface cores	0			Fine to medium grained yellow/ light grey sand. Some small mud balls				TBT, TOC				
	0.5			Core terminated at 0.5m								
	1											
	2											
	3											
	4											

VIBROCORE LOG

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VIBROCORE # SS4D
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	5/03/2010
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334681 **Water depth:**
Equipment: Diver collected surface core **(ID):** 96 mm **Northing:** 6237016 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver collected surface cores	0			Fine to medium grained yellow/ light grey sand. Some small mud balls ~ 10cm in diameter				TBT, TOC				
	0.5			Core terminated at 0.5m								
	1											
	2											
	3											
	4											

VIBROCORE LOG

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VIBROCORE # SS4E
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	5/03/2010
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334961 **Water depth:**
Equipment: Diver collected surface core **(ID):** 96 mm **Northing:** 6237004 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver collected surface cores	0			Fine to medium grained yellow sand				TBT, TOC				
	0.5			Core terminated at 0.5m								
	1											
	2											
	3											
	4											

VIBROCORE LOG

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VIBROCORE # SS4F
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	5/03/2010
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334706 **Water depth:**
Equipment: Diver collected surface core **(ID):** 96 mm **Northing:** 6236820 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver collected surface cores	0			Grey muddy sand				TBT, TOC, PAH's, metals				
	0.5			Core terminated at 0.5m								
	1											
	2											
	3											
	4											

VIBROCORE LOG

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VIBROCORE # SS4G
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	5/03/2011
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334751 **Water depth:**
Equipment: Diver collected surface core **(ID):** 96 mm **Northing:** 6236724 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver collected surface cores	0			Grey sand. Fine to medium grained with some mud balls				TBT, TOC, PAH's, metals				Field Triplicates (SS4GX, Y and Z)
	0.5			Core terminated at 0.5m								
	1											
	2											
	3											
	4											

VIBROCORE LOG

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VIBROCORE # SS4H
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	4/03/2010
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334643 **Water depth:**
Equipment: Diver collected surface core **(ID):** 96 mm **Northing:** 6236668 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver collected surface cores	0			Dark grey muddy sand at surface overlying grey to light grey/yellow medium grained sand				TBT, TOC, PAH's, metals				
	0.5			Core terminated at 0.5m								
	1											
	2											
	3											
	4											

VIBROCORE LOG

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VIBROCORE # SS4I
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334805 **Water depth:**
Equipment: Diver collected surface core **(ID):** 96 mm **Northing:** 6236632 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver collected surface cores	0			Grey to light grey sand, medium grained				TBT, TOC, PAH's, Metals,OCPs, PCB's, BTEX, TPH's				
	0.5			Core terminated at 0.5m								
	1											
	2											
	3											
	4											

VIBROCORE LOG

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VIBROCORE # SS4J
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	4/03/2010
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor:	McLennans Diving Service	**Core diameter (OD):**	100 m	**Easting:**	334956	**Water depth:**
Equipment:	Diver collected surface core	**(ID):**	96 mm	**Northing:**	6236600	**Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver collected surface cores	0			Grey/ yellow medium grained sand				TBT, TOC, PAH's, metals				Split triplicates ST1 and ST2 for TBT, TOC, metals and PAHs
	0.5			Core terminated at 0.5m								
	1											
	2											
	3											
	4											

VIBROCORE LOG

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VIBROCORE # VC4A
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	5/03/2010
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334653 **Water depth:**
Equipment: Rossfelder vibrocorer **(ID):** 96 mn **Northing:** 6237038 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver assisted vibrocoring	0.5			Yellow/light grey sand, fine to medium grained. Inclusion of aggregate and coarse shell at 0.7m 0.8m				TBT, TOC				
	1			Medium grained light grey to grey sand with fine shell. Aggregate from 1m (in 1 of three triplicate cores) including a strong odour				TBT, TOC				
	1.5			Medium to coarse grained grey sand with some fine shell				TBT, TOC				
	2							TBT, TOC				
	2.4			Core discontinued at 1.25m and 2.42m								
	3											
	4											

VIBROCORE LOG

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VIBROCORE # VC4B
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	5/03/2010
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334913 **Water depth:**
Equipment: Rossfelder vibrocorer **(ID):** 96 mm **Northing:** 6236845 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver assisted vibrocoring	0.3			Mottled yellow/ grey sand. Medium grained				TBT, TOC				
				Light grey medium grained sand with some coarse coal-like gravel				TBT, TOC				
	1											
								TBT, TOC				
	1.5											
								TBT, TOC				
	2			Light grey medium grained sand								
								TBT, TOC				
	2.9			Core discontinued at 2.9m								
	3											
	4											

VIBROCORE LOG

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VIBROCORE # VC4C
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	4/03/2010
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334715 **Water depth:**
Equipment: Rossfelder vibrocorer **(ID):** 96 mm **Northing:** 6236704 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver assisted vibrocoring	0.5			Fine to medium grained grey meddy sand				TBT, TOC, PAH's, metals				
								TBT, TOC, PAH's, Metals,OCPs, PCB's, BTEX, TPH's				
	1			Medium to coarse grained grey/ yellow sand with some fine shell				TBT, TOC, PAH's, metals				
	1.5			Grey to yellow sand, medium to coarse grained				TBT, TOC, PAH's, metals				
	1.7			Grey to dark grey medium grained muddy sand				TBT, TOC, PAH's, metals				
	2			Grey to dark grey sand				TBT, TOC, PAH's, metals				
	3			Core discontinued at 3m								
	4											

VIBROCORE LOG

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VIBROCORE # VC4D
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	4/03/2010
PROJECT:	Caltex Dredging	**DATE LOGGED**	
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-02448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334903 **Water depth:**
Equipment: Rossfelder vibrocorer **(ID):** 96 mm **Northing:** 6236607 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver assisted vibrocoring	0.5			Grey sand, medium grained. Mottled with dark grey muddy sand				TBT, TOC, PAH's, metals				
	1			Light grey/yellow sand				TBT, TOC, PAH's, metals				
	1.5			Light grey/yellow sand				TBT, TOC, PAH's, metals				
	2			Yellow sand medium grained/ dark grey medium grained sand. Decomposing wood observed at 1.8m				TBT, TOC, PAH's, metals				
	3			Core discontinued at 3m				TBT, TOC, PAH's, metals				
	4											

LOG SHEET

Job: Caltex Dredging
Job Number: 301015-02448
Client: Caltex Refineries NSW Pty Ltd

Sample ID	SS5A + SS5X1 + SS5X2
Date	17/11/2011
Time	12:20
ID of Sampler	O. Murray
Type of Sample (triplicate, replicate	Field triplicate
Water Depth (m)	12.9m
Depth of Sample (m)	0.25m
Coordinates	334786, 6237329
Weather conditions	Overcast with drizzle. Calm water
Sample Description	
Sediment Characteristics (texture, colour, odour, sorting, firmness etc)	Yellow grey sand
Comments (presence of foreign material, organic matter, biota, variability between replicates etc)	
Lab Analysis	PSA, TBT, TOC, OC/OP, PCB, metals, BTEX

LOG SHEET

Job: Caltex Dredging
Job Number: 301015-02448
Client: Caltex Refineries NSW Pty Ltd

Sample ID	SS5B
Date	17/11/2011
Time	13:00
ID of Sampler	O. Murray
Type of Sample (triplicate, replicate	Sample
Water Depth (m)	~12.5m
Depth of Sample (m)	0.25m
Coordinates	334771, 6237281
Weather conditions	Overcast with drizzle. Calm water
Sample Description	
Sediment Characteristics (texture, colour, odour, sorting, firmness etc)	Yellow grey sand with some balls of mud
Comments (presence of foreign material, organic matter, biota, variability between replicates etc)	
Lab Analysis	TBT, TOC

LOG SHEET

Job: Caltex Dredging
Job Number: 301015-02448
Client: Caltex Refineries NSW Pty Ltd

Sample ID	SS5C
Date	17/11/2011
Time	12:00
ID of Sampler	O. Murray
Type of Sample (triplicate, replicate	Sample
Water Depth (m)	13.0m
Depth of Sample (m)	0.25m
Coordinates	334929, 6237192
Weather conditions	Overcast with drizzle. Calm water
Sample Description	
Sediment Characteristics (texture, colour, odour, sorting, firmness etc)	Yellow/ grey sand, trace fines
Comments (presence of foreign material, organic matter, biota, variability between replicates etc)	Limited organic debris (wood) and some polychaetes present
Lab Analysis	TBT, TOC, PSA (limited material available for PSA)

LOG SHEET

Job: Caltex Dredging
Job Number: 301015-02448
Client: Caltex Refineries NSW Pty Ltd

Sample ID	SS5D + SS5Y1 + SS5Y2
Date	17/11/2011
Time	10:30
ID of Sampler	O. Murray
Type of Sample (triplicate, replicate	Split triplicate
Water Depth (m)	12.7m
Depth of Sample (m)	0.25m
Coordinates	334726, 6236392
Weather conditions	Overcast with drizzle. Calm water
Sample Description	
Sediment Characteristics (texture, colour, odour, sorting, firmness etc)	Grey silt/ sand
Comments (presence of foreign material, organic matter, biota, variability between replicates etc)	Some polychaetes present
Lab Analysis	PSA, TBT, TOC, TRH, OC.OP, PCB, PAH, metals, BTEX

LOG SHEET

Job: Caltex Dredging
Job Number: 301015-02448
Client: Caltex Refineries NSW Pty Ltd

Sample ID	SS5E (new location in north end of berth pocket)
Date	17/11/2011
Time	13:30
ID of Sampler	O. Murray
Type of Sample (triplicate, replicate	Sample
Water Depth (m)	12m
Depth of Sample (m)	0.25m
Coordinates	334736, 6237408
Weather conditions	Overcast with drizzle. Calm water
Sample Description	
Sediment Characteristics (texture, colour, odour, sorting, firmness etc)	Grey sand/ mud
Comments (presence of foreign material, organic matter, biota, variability between replicates etc)	Contained numerous chunks of hard black material up to 4cm in length similar to material found at VC5D and VC5E. Polychaete worms present. Was not possible to retrieve any sample at original coordinates due to hard black surface layer. Seven attempts tried at original location at sth end of berth pocket
Lab Analysis	PSA, TBT, TOC, PAH, TRH

VIBROCORE LOG

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VIBROCORE # VC5A
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	18/11/2011, 11:14
PROJECT:	Caltex Dredging	**DATE LOGGED**	18/11/2011, 14:00
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-002448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334676 **Water depth:** 12.7m
Equipment: Rossfelder vibrocorer **(ID):** 96 mr **Northing:** 6236535 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver assisted vibrocoring	0			Grey fine to medium grained sand with coarse shell. Large pieces of hard organic matter at 0.8m and 1m.	100% (i.e. Core depth = 2.7m, recovery = 2.7m, loss of 0m)	D	PSD	TBT, TOC, TRH, OC/OP, PCB, PAH, metals, BTEX, VOCs/ SVOCs, ASS				Sandy shelly surface sediments. Vibrocoring frame required.
	1							TBT, TOC				
	1.45			Black clay interbedded with layers of grey sand and soft mud.		VSt - VD - S	PSD	TBT, TOC				
	2			Dark grey fine to medium grained sand.		MD						Depth of dredge design approximately 2m
	2.7			Core terminated at 2.7m								
	3											
	4											

VIBROCORE LOG

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VIBROCORE # VC5B
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	18/11/2011, 09:50
PROJECT:	Caltex Dredging	**DATE LOGGED**	18/11/2011, 15:30
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-002448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334676 **Water depth:** 13.2m
Equipment: Rossfelder vibrocorer **(ID):** 96 mr **Northing:** 6236439 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver assisted vibrocoring	0			Dark grey/ black muddy sand and shell (large, coarse mussel shells). Strong H2S odour.	80% (i.e. Core depth = 2.7m, recovery = 2.2m, loss of 0.5m)	MD - VD		TBT, TOC, TRH, PAH, ASS				Sandy silty surface sediments. Vibrocoring frame required.
	0.8			Dark grey/ black clay. Very hard at 0.8-0.9m. Strong H2S odour.		VSt - Hd		TBT, TOC, ASS				
	1.3			Grey to dark grey sandy clay/ clayey sand.		VSt		TBT, TOC, ASS				
	2											Depth of dredge design approximately 2m
	2.2			Core terminated at 2.2m								
	3											
	4											

VIBROCORE LOG

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VIBROCORE # VC5C
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	18/11/2011, 12:50
PROJECT:	Caltex Dredging	**DATE LOGGED**	18/11/2011,
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-002448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334734 **Water depth:** 12.8m
Equipment: Rossfelder vibrocorer **(ID):** 96 mr **Northing:** 6236454 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver assisted vibrocoring	0.4			Dark grey muddy sand interbedded with mud. Some large shell present.	86% (i.e. Core depth = 1.4m, recovery = 1.2m, loss of 0.2m)	Hd		TBT, TOC, TRH, OC/OP, PCB, PAH, metals, BTEX, ASS				Surface sediments comprised shelly sand Core retrieved following several attempts. First attempts penetrated ~100mm of sand before terminating in black 'rock' such as found at surface on VC5D. Vibrocoring frame required.
	1			Black clay (shale like). Brittle, dry and flaking.		Hd	PSD	TBT, TOC, ASS				
	1.2			Core terminated at 1.2m								
	2											Depth of dredge design approximately 1.5m
	3											
	4											

VIBROCORE LOG

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VIBROCORE # VC5D
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	17/11/2011, 11:15
PROJECT:	Caltex Dredging	**DATE LOGGED**	18/11/2011,
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-002448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 334723 **Water depth:** 12.5m
Equipment: Rossfelder vibrocorer **(ID):** 96 mr **Northing:** 6236391 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver assisted vibrocoring	1			Broken up pieces (up to 0.1m in length) of very hard black peat interspersed with black viscous fluid. Approximately 1L of black viscous fluid leaked out of core when cut open. Strong odour. Some material with fibrous (wood like) appearance. Denser material from 0.6m caused core to bend at ~1m	100% (i.e. Core depth = 2.5m, recovery = 3.5m, loss of 0m, expansion of 140%)	Hd solid with oil		TBT, TOC, VOCs/ SVOCs				Hard packed black surface with chalky texture. Round pebbly rocks formed from excessive vibration to get core to penetrate.
	1.8											Depth of dredge design approximately 1.5m (or 2.1m down core log if assuming an expansion of 140%
	2			Dark grey/ brown muddy sand and black viscous fluid.		MD		TBT, TOC, OC/OP, PCB, metals, BTEX, VOCs/ SVOCs				
	2.1			Dark red/brown clay.		VSt	PSD	TBT, TOC, TRH, OC/OP, PCB, metals, BTEX, VOCs/ SVOCs, ASS				
	3			Dark grey clay/ clayey sand.		VSt						
	4			Core terminated at 3.5m								

VIBROCORE LOG

WorleyParsons
resources & energy

VIBROCORE # VC5E
SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd	**DATE COLLECTED:**	17/11/2011, 14:15
PROJECT:	Caltex Dredging	**DATE LOGGED**	18/11/2011, 12:00
LOCATION:	Caltex berths/ approaches Botany Bay	**LOGGED BY:**	OM
JOB NUMBER:	301015-002448	**CHECKED BY:**	AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 m **Easting:** 345636 **Water depth:** 12.5m
Equipment: Rossfelder vibrocorer **(ID):** 96 mr **Northing:** 6236373 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test: PSD	Sample/ Test: Geochem	Lab Results: % Fines (< 75µm)	Lab Results: % Sand (>75µm)	Lab Results: % Gravel (> 2mm)	Field Records/Comments
Diver assisted vibrocoring	0			Small (<5cm) broken up pieces of very hard black material and soft black sandy mud with black viscous fluid. Large fragments of organic mater (wood like) at 0.4-0.5m.	100% (i.e. Core depth = 1m, recovery = 1.65m, loss of 0m, expansion of 165%)	VD	PSD	TBT, TOC, VOCs/ SVOCs				Surface sediments comprised silty sand.
				Black sandy mud with coarse shell (>1cm). Layer of consolidated shell at 0.8-0.85m.		VS		TBT, TOC				
	0.85			Hard black clay.		VD						
	1			Black mud interbedded with 0.1m layers of black clay at 1.1m and at 1.4m.		S - St	PSD	TBT, TOC, VOCs/ SVOCs				
	1.65			Core terminated at 1.65m								Depth of dredge design approximately 1.5m (or 2.5m down core log for an expansion of 165%)
	2											
	3											
	4											

Appendix 4 Standard Operating Procedures

STANDARD OPERATING PROCEDURES FOR SEDIMENT SAMPLING & SUBSAMPLING

1. location of sampling to be confirmed by on-board GPS.
2. the coordinates of the sample location, date, time, weather conditions and water depth should be recorded in the field log book.
3. for coring:
    a. core deployed and lowered to sea bed
    b. depth of penetration of the core recorded
    c. core recovered, capped, and placed on vessel deck
4. for surface cores:
    a. diver deployed to sea bed
    b. 0.5m surface core collected and capped
    c. three surface cores taken the field replicate location
5. steps 1 to 4 repeated at each core/surface core location.
6. surfaces to be covered in plastic sheeting prior to subsampling.
7. cores from each location split, logged and photographed.
8. core compaction calculation and each core subsampled.
9. for each surface 0.5m vibrocore depth increment, sediment from the two vibrocores homogenised into one sample.
10. for each surface core/0.5m vibrocore depth increment, collect relevant sediment required e.g.:
    a. one sub-sample for chemical analysis (1-3 x150 ml glass jars)
    b. one sub-sample for TBT elutriate analysis (2x250ml glass jars)
    c. one subsample for ASS testing (1x250 ml plastic bag with air extruded)
    d. one subsamples for PSD testing (1x250 ml plastic bag)
    e. 1L sub-sample for sediment toxicity testing
    f. 2L sub-sample for elutriate toxicity testing.
11. samples homogenised (excluding samples for VOCs testing, ASS testing and toxicity testing) and transferred to the appropriate containers using stainless steel implements.

12. sample containers filled with zero headspace.
13. each container tightly sealed to avoid loss of sample and labelled with a unique identification number.
14. outside of each sample container washed with sea water to avoid cross contamination.
15. samples to be packed in ice in an esky immediately after sampling to maintain the temperature below 4°C. If overnight storage is required, freeze samples for chemical and ASS testing. Samples for whole sediment toxicity testing and elutriate toxicity testing to be cooled to 4°C and kept in the dark.
16. all sampling equipment should be decontaminated before the next sampling event by rinsing equipment in water to remove visible sediment, followed by a Decon 90 rinse.

Appendix 5 CSIRO Recommendations for Elutriate and Toxicity Testing and Offshore Disposal Option

CSIRO Land and Water (CLW)
Centre for Environmental Contaminants Research (CECR)
Lucas Heights Science and Technology Centre
New Illawarra Road, Lucas Heights NSW 2234
Private Mailbag 7, Bangor NSW 2234 Australia
Telephone: (02) 9710 6807 • Facsimile: (02) 9710 6837 • ABN 41 687 119 230

Our Ref: TBT contamination in proposed maintenance dredging area of Botany Bay – Caltex-WorleyParsons 221209.doc

Tuesday, 22 December 2009

Attention: Ali Watters and Orla Murray

Background

Caltex propose to undertake maintenance dredging in Botany Bay (Kurnell area) at three shipping berth locations: (i) berth approach, (ii) sub-berth and (iii) fixed berth. Samples collected by vibrocoring and surface sampling have been found to comprise 89-98% sand, generally <0.2% TOC and concentrations of all contaminants were below guidelines except for tributyltin (TBT). Elevated concentrations of TBT were observed for all three areas above the NAGD screening levels. In the three areas the 95% UCLs of the mean TBT concentrations normalised to 1% TOC were calculated to be: (i) Area 1 - 88 µgSn/kg, (ii) Area 2 - 165 µgSn/kg, and (iii) Area 3 - 21 µgSn/kg.

Three samples for which the ISQG-High value was exceeded were subjected to elutriate testing. The elutriate TBT concentrations for two out of the three selected samples were above the ANZECC water quality guideline indicating that TBT in the sediments is bioavailable. The maximum measured elutriate concentration was 70 ng TBT/L, compared to the WQG value of 6 ng/L.

Caltex would like to pursue further testing to determine if the dredge material can be shown to be suitable for ocean disposal or placement within Botany Bay. WorleyParsons have requested that CSIRO advise the types of further testing required.

Recommendations

Based on the information provided, the TBT concentrations are low, but exceed the NAGD / ANZECC Maximum ISQG-High values (TV) for whole-sediment and water (elutriates) – hence prompting further consideration. The major environmental concerns are:

For waters:

- Dissolved TBT released from the sediments during unconfined sea disposal could exceed water quality guidelines (WQG) and cause toxic effects to biota.

Notes:

- the 'accuracy' of dissolved TBT analyses is expected to be 50%, at best (the methods are not considered very robust) and rates of adsorptive losses to collection containers can be significant.
- elutriate tests are likely to underestimate the concentration in the sediment pore water (1:4, sediment:water).
- for sandy sediments, extraction of porewater is not practice and considered unnecessary, given the analytical uncertainties associated with TBT analyses.
- dissolved TBT concentrations from the elutriate tests show exceedances of the WQG-TBT of 6 ng/L.
- significant dilution is expected following disposal and the dissolved TBT and concentrations are very unlikely to remain above the WQG-TBT value for long.

- according to the NAGD, allowable dilution is that which occurs after four hours of mixing so dilution of 100-fold would be conservative, especially for offshore disposal sites on the NSW shelf. It would be surprising if dissolved TBT exceeded WQG four hours after disposal unless TBT elutriates are massively above ANZECC/ARMCANZ WQG. They are not.
- the WQG-TBT is a continuous chronic-effects guideline.

Advice for waters:

- Determine a 95% UCL for dissolved TBT in elutriates for samples that exceed the ISQG-High value (undertake additional sediment sampling and elutriate testing).

- Multiple the 95% UCL for dissolved TBT in elutriates by 10 (arbitrary) to take into account possible differences to porewater TBT) (a conservative measure)
- Calculate the expected dilutions based on knowledge of disposal site
- Calculate the expected dissolved TBT in waters at the disposal site

The cost of this exercise will be as determined by WorleyParsons.

- If the WQG for TBT is exceeded, then there will be a requirement for toxicity testing.

- If necessary, confirm the absence of toxicity in elutriate waters prepared from sediments with TBT concentrations >ISQG-High (and preferably >95% UCL of 165 µg/kg 1%TOC)
- The preferred test would be 48-h oyster larval development (performed by Ecotox services Australasia, ESA). Such tests should be conducted in polycarbonate containers to minimise adsorption of TBT to container walls. ESA laboratory will prepare 1:4 elutriate and commence toxicity test immediately following. Cost per test =$1850/test. Would suggest testing three TBT-contaminated sediments and one 'blind control' sediment collected from a nearby location for which TBT < TV.

Uncertainty / risks:

- The absence of toxicity would not ensure that other toxic effects from dissolved TBT (e.g. imposex in snails and immuno-supression in bivalves) could not occur. However, we would expect that the WQG would need to be exceeded continuously for such chronic effects to occur.

For whole sediments:

- At the disposal site, TBT concentrations of deposited sediments may retain, or develop, porewater TBT concentrations that exceed the WQG-TBT and potentially cause toxic effects to benthic invertebrates. There is a need to assess potential effects in these whole sediments, to simulate the post-settlement condition.

Notes:

- the most notable effect of TBT to benthic biota is imposex in snails and immuno-supression in bivalves. Beyond measuring porewater TBT concentrations (which itself is very challenging), there are no reliable 'laboratory-based' tests for these effects.
- literature indicates that the lowest dissolved TBT concentration that is likely to cause lethality to benthic invertebrates are >100 ng/L (e.g. for the harpacticoid copepod, *T. japonicus*, acute lethality from TBT occurs with LC50 and LC20 values of 0.15 and ~0.05 µg TBT/L). No data exist for tests using Australian species.

Advice for sediments:

- Confirm the absence of toxicity to benthic invertebrates using chronic whole-sediment toxicity tests.

- given uncertainties in testing/unavailability of pore water, and that the ISQG-High (Maximum Level) are being exceeded, this is considered a necessary precaution.
- we recommend that chronic effects (reproduction) to the epibenthic amphipod, *Melita plumulosa* (native to NSW) be assessed. While this species may not inhabit ocean disposal sites, it is relatively sensitive to contaminants and exposed to contaminants via both dissolved and dietary exposure routes. M plumulosa is therefore a useful surrogate for possible toxic effects to other species. Worth noting is that acute lethality from copper to *T. japonicus* occurs at an 96-h LC50 of 1020 µg/L, for *M. plumulosa* the 96-h LC50 is 120 µg/L, i.e. *M. plumulosa* may be more sensitive to contaminants (and TBT) than *T. japonicus*.
- We suggest initially testing three TBT-contaminated sediments that exceed the ISQG-High (Maximum Level) and one 'blind control' sediment collected from a nearby location for which TBT < TV. Additional in-house controls will be undertaken.

- Estimated cost = Full cost for sediment toxicity testing =

Project management and reporting costs

- A report will be prepared that will discuss the results in terms of NAGD / ANZECC and likelihood for ecological effects from maintenance dredging in Botany Bay and unconfined sea disposal of the sediments
- Cost =
- Total estimated total cost of CSIRO components =

Additional notes:

* Assumes dredging will occur as three zones, but the likelihood of effects from TBT will be assessed more broadly
* Information on sediment heterogeneity and depth profiles not available
* The SQGs for TBT were derived from the WQG based on effects on gastropods (imposex) as a sensitive endpoint using equilibrium partitioning. If pore water concentrations exceed the WQG then there are potential ecological effects. Therefore toxicity testing on organisms of unknown sensitivity to TBT may be a little arbitrary. If the WQG values are exceeded there is a potential problem, taking into account uncertainties in TBT analysis, potential losses and the fact that elutriate tests are conservative. To take a counter argument you could reason that the half life of TBT in sediments is about 3 years, although in paint flakes this could be longer. Also probably need to know something about the depth profile in the sediments and sample heterogeneity.
* It may also be argued, that given that the disposal site is dispersive that fine sediments may not be there or would be significantly diluted over a period of years.
* No TBT-sensitive tests using bivalves or snails. Methods are not available for testing for imposex other than via benthic surveys which we don't believe are appropriate. It may be possible to demonstrate that bivalves or snails do not accumulate TBT during 1-2 month exposures. However, it would not be possible to link this information to development of immuno-supression or imposex.
* another potential chronic whole-sediment toxicity test species is the harpacticoid copepod, *Nitocra spinipes*, which is also present in NSW sediments. Chronic tests are also available using this species, although the methods are currently less robust than the chronic *M. plumulosa* tests.

Regards,

Dr Stuart Simpson
Principal Research Scientist
CSIRO Centre for Environmental Contaminants Research
Stuart.Simpson@csiro.au

CSIRO Land and Water (CLW)
Centre for Environmental Contaminants Research (CECR)
Lucas Heights Science and Technology Centre
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Telephone: (02) 9710 6807 • Facsimile: (02) 9710 6800 • ABN 41 687 119 230

Ali Watters and Orla Murray
WorleyParsons
Level 12, 141 Walker Street
North Sydney NSW 2060

30 May, 2011

Dear Ali and Orla,

Assessment of potential ecological effects of TBT contamination from proposed maintenance dredging area of Botany Bay – Caltex

You have requested advice on the potential ecological impacts of maintenance dredging proposed by Caltex in Botany Bay (Kurnell area) at three shipping berth locations: (i) Area 1 - berth approach, (ii) Area 2 - sub-berth, and (iii) Area 3 - fixed berth. Samples collected by vibrocoring and surface sampling have been found to comprise 89-98% sand, generally <0.2% TOC and concentrations of all contaminants were below guidelines except for tributyltin (TBT).

To determine if the dredge material is suitable for ocean disposal, a range of testing has been undertaken in accordance with the National Assessment Guidelines for Dredging (NAGD, 2009). This report summaries the outcomes of this testing.

Results

The test results provided show that elevated concentrations of TBT exist within the sediments of all three areas and are above the NAGD (2009) screening level of 9 µg Sn/kg (dry weight, normalised to 1% TOC) and above the ISQG-High value of 80 µg Sn/kg in two of the areas. In the three areas the 95% UCLs of the mean TBT concentrations normalised to 1% TOC were calculated to be: (i) Area 1 - 1200 µg Sn/kg, (ii) Area 2 - 360 µg Sn/kg, and (iii) Area 3 - 57 µg Sn/kg. Overall for the sediment from all areas the 95% UCL of the mean TBT concentration normalised to 1% TOC was calculated to be 360 µg Sn/kg (on an area basis).

For a range of samples for which the ISQG-High value was exceeded, elutriate testing has determined that the elutriate TBT concentrations may exceed the ANZECC/ARMCANZ (2000) water quality guideline value of 6 ng/L. For the three areas the elutriate TBT concentrations (mean±standard deviation) were calculated to be: (i) Area 1 – 1840±1980 ng/L, (ii) Area 2 - 15±14 ng/L, and (iii) Area 3 - 41±67 ng/L. The high variability in the results was expected due to the large range of sediment properties. Overall for the sediment from all areas the elutriate TBT concentration (mean±standard deviation) was calculated to be 730±1470 ng/L (on an area basis).

Toxicity tests were undertaken on elutriates prepared from three sediment samples exhibiting elutriate TBT concentrations of 160, 1030 and 3340 ng/L. These were 48-h larval development tests using the rock oyster *Saccostrea commercialis*, and no toxicity was exhibited for any of the samples.

Whole-sediment toxicity tests were also undertaken on three sediment samples with concentrations of 230, 505 and 1040 µg Sn/kg. These were 10-day chronic amphipod

reproduction toxicity test using the amphipod *Melita plumulosa*, and no toxicity was exhibited for any of the samples.

Assessment in relation to NAGD

The sediments from Area 1 had TBT concentrations that greatly exceed the ISQG-High value of 80 µg Sn/kg and elutriate waters had TBT concentrations >300 times the water quality guideline value of 6 ng/L. Using numerical dilution modelling (undertaken by WorleyParsons), it was calculated that the maximum concentration of TBT in the water at the Sydney Offshore Spoil Ground following initial mixing would be 0.000035 µg/L. Continuous exceedence of the WQG in the marine waters at the offshore spoil ground is therefore unlikely.

It is understood that disposal within Botany Bay is no longer being considered, howeverthe likely dilution would be much less than at the Sydney Offshore Spoil Ground. On this basis, there remains potential for dissolved TBT concentrations to exceed WQG at a disposal site within Botany Bay.

Although the sediments have high concentrations of TBT, the elutriate and whole-sediment toxicity tests indicate that TBT is unlikely to cause chronic toxic effects to benthic organisms. The tests used are considered to be the most sensitive available currently and it is not recommended that further ecotoxicological tests be undertaken.

Uncertainty exists regarding the potential for bioaccumulation of TBT by aquatic organisms that colonise and inhabit the sediments at either disposal site selected. The bioaccumulation of TBT has the potential to lead to imposex in organisms such as gastropods and immuno-supression in some bivalve species. For such effects to be considered possible, firstly, a significant abundance these organism types would need to be present at the disposal site, and secondly, TBT concentrations within the sediment porewaters would need to continuously exceed the water quality guideline value at the disposal site. The likelihood and significance of such effects should be considered in relation to the nature and desired properties of the disposal site.

Based on the chemical and ecotoxicological tests, the sediments are generally considered to be suitable for ocean disposal at the designated Sydney Offshore Spoil Ground. The sediments from Area 2 and 3 may also be suitable for disposal within Botany Bay, however, this should be considered in relation to the nature and desired attributes of the disposal site.

Finally, for any dredging and spoil disposal program, careful consideration should be given to design and execution of the operations. It would be desirable that materials of perceived lower quality (physical and chemical) should be deposited beneath materials of higher quality at the disposal site.

Regards,

Dr Stuart Simpson
Principal Research Scientist
CSIRO Centre for Environmental Contaminants Research
Stuart.Simpson@csiro.au

Appendix 6 Laboratory Results

ACID SULFATE SOIL LABORATORY RESULTS

Maggie Kahi

From: Nathan King
Sent: Wednesday, 9 December 2009 12:54 PM
To: Maggie Kahi; Matthew Goodwin
Subject: FW: further testing - ES0917731, ES0917543, ES0917657

From: Frank Ferraro
Sent: Wednesday, 9 December 2009 11:33 AM
To: Samples Brisbane; Nathan King
Cc: Jacob Waugh
Subject: FW: further testing - ES0917731, ES0917543, ES0917657

Hi Nathan,

Can you please re-batch the samples below as per client request? All samples are in Brisbane.

Regards

Frank

From: Watters, Ali (Sydney) [mailto:Ali.STONE@WorleyParsons.com]
Sent: Wednesday, 9 December 2009 12:12 PM
To: Samples Sydney
Cc: Jacob Waugh; Charlie Pierce; Hannaford, Nick (Sydney)
Subject: further testing - ES0917731, ES0917543, ES0917657

Could you please arrange the following further ASS testing -

ALS Method - EA033 Chromium Suite – Complete

1 VC1A1 (0-0.6) ES0917731-005
2 VC1A1 (1.2-1.7) ES0917731-007
3 VC2A (1.0-1.4) ES0917543-004
4 VC2B (0-0.5) ES0917657-008
5 VC2B (0.9-1.5) ES0917657-010
6 VC3B (0-0.5) ES0917657-005
7 SS1D ES0917657-015
8 SS2D ES0917657-012
9 SS3A ES0917657-004
10 SS3C ES0917657-001

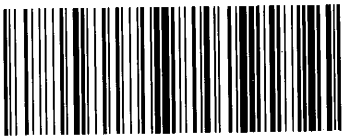
Thanks

Ali

Ali Watters
Principal Environmental Engineer
Coastal and Marine
WorleyParsons

Tel: +61 2 8456 7264 (direct)
Fax: +61 2 8923 6877

Environmental Division
Brisbane
Work Order
EB0919644



Telephone : +61-7-3243 7222

Street address
Level 12
141 Walker Street
North Sydney NSW 2060

Postal address
PO Box 1812
North Sydney NSW 2059

CERTIFICATE OF ANALYSIS

Work Order	: **EB0919644**	Page	: 1 of 4
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Brisbane
Contact	: MR NICK HANNAFORD	Contact	: Tim Kilmister
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: Nicholas.Hannaford@WorleyParsons.com	E-mail	: Services.Brisbane@alsenviro.com
Telephone	: +61 02 8456 7374	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 8923 6877	Facsimile	: +61-7-3243 7218
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 09-DEC-2009
Sampler	: NICK HANNAFORD	Issue Date	: 21-DEC-2009
Site	: ----		
		No. of samples received	: 10
Quote number	: SY/503/09	No. of samples analysed	: 10

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

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

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*
Kim McCabe	Senior Inorganic Chemist	Inorganics

General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient 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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- **Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.**
- **Retained Acidity not required because pH KCl greater than or equal to 4.5**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID	VC1A1 (0-0.6)	VC1A1 (1.2-1.7)	VC2A (1.0-1.4)	VC2B (0-0.5)	VC2B (0.9-1.5)
				Client sampling date / time	18-NOV-2009 15:00	18-NOV-2009 15:00	17-DEC-2009 11:00	18-NOV-2009 15:00	18-NOV-2009 15:00
					EB0919644-001	EB0919644-002	EB0919644-003	EB0919644-004	EB0919644-005
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		**9.6**	**9.6**	**7.2**	**9.6**	**5.7**
Titratable Actual Acidity (23F)	----	2	mole H+ / t		<2	<2	<2	<2	**8**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.02	% S		**0.03**	**0.06**	**0.22**	**0.07**	**0.16**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		**17**	**40**	**137**	**45**	**102**
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3		**2.90**	**2.25**	**0.35**	**3.64**	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t		**580**	**449**	**71**	**726**	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S		**0.93**	**0.72**	**0.11**	**1.16**	----
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	**0.14**	<0.02	**0.18**
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	**90**	<10	**111**
Liming Rate	----	1	kg CaCO3/t		<1	<1	**7**	<1	**8**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: VC3B (0-0.5)	SS1D	SS2D	SS3A	SS3C
				Client sampling date / time: 18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00
				EB0919644-006	EB0919644-007	EB0919644-008	EB0919644-009	EB0919644-010
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**9.4**	**9.6**	**9.7**	**9.6**	**9.0**
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.02	% S	**0.10**	<0.02	<0.02	**0.06**	**0.27**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**60**	<10	<10	**37**	**167**
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**3.46**	**0.61**	**2.40**	**9.14**	**16.3**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**691**	**121**	**479**	**1830**	**3260**
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**1.11**	**0.19**	**0.77**	**2.93**	**5.22**
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	<1

QUALITY CONTROL REPORT

Work Order	: **EB0919644**	Page	: 1 of 5
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Brisbane
Contact	: MR NICK HANNAFORD	Contact	: Tim Kilmister
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: Nicholas.Hannaford@WorleyParsons.com	E-mail	: Services.Brisbane@alsenviro.com
Telephone	: +61 02 8456 7374	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 8923 6877	Facsimile	: +61-7-3243 7218
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 09-DEC-2009
Sampler	: NICK HANNAFORD	Issue Date	: 21-DEC-2009
Order number	: ----		
		No. of samples received	: 10
Quote number	: SY/503/09	No. of samples analysed	: 10

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

This document is issued in accordance with NATA accreditation requirements.

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*
Kim McCabe	Senior Inorganic Chemist	Inorganics

General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient 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 (%)*
EA033-A: Actual Acidity (QC Lot: 1198174)									
EB0919465-001	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	7	6	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	6.0	6.0	0.0	0% - 20%
EB0919644-005	VC2B (0.9-1.5)	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	8	6	26.1	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.7	5.9	3.4	0% - 20%
EA033-B: Potential Acidity (QC Lot: 1198174)									
EB0919465-001	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EB0919644-005	VC2B (0.9-1.5)	EA033: Chromium Reducible Sulfur (22B)	----	0.02	% S	0.16	0.17	0.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	102	105	2.4	0% - 50%

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 1198174)								
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	----	----	----	----
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 1198174)								
EA033: Chromium Reducible Sulfur (22B)	----	0.02	% S	<0.02	----	----	----	----
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 1198174)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	----	----	----	----
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----

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.**

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB0919644**	Page	: 1 of 6
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MR NICK HANNAFORD	Contact	: Tim Kilmister
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: Nicholas.Hannaford@WorleyParsons.com	E-mail	: Services.Brisbane@alsenviro.com
Telephone	: +61 02 8456 7374	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 8923 6877	Facsimile	: +61-7-3243 7218
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 09-DEC-2009
Sampler	: NICK HANNAFORD	Issue Date	: 21-DEC-2009
Order number	: ----		
		No. of samples received	: 10
Quote number	: SY/503/09	No. of samples analysed	: 10

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
EA033-A: Actual Acidity							
80* dried soil							
VC2A (1.0-1.4)	**17-DEC-2009**	**17-DEC-2009**	17-DEC-2010	✓	**19-DEC-2009**	17-MAR-2010	✓
80* dried soil							
VC1A1 (0-0.6), VC1A1 (1.2-1.7), VC2B (0-0.5), VC2B (0.9-1.5), VC3B (0-0.5), SS1D, SS2D, SS3A, SS3C	**18-NOV-2009**	**17-DEC-2009**	18-NOV-2010	✓	**19-DEC-2009**	17-MAR-2010	✓
EA033-B: Potential Acidity							
80* dried soil							
VC2A (1.0-1.4)	**17-DEC-2009**	**17-DEC-2009**	17-DEC-2010	✓	**19-DEC-2009**	17-MAR-2010	✓
80* dried soil							
VC1A1 (0-0.6), VC1A1 (1.2-1.7), VC2B (0-0.5), VC2B (0.9-1.5), VC3B (0-0.5), SS1D, SS2D, SS3A, SS3C	**18-NOV-2009**	**17-DEC-2009**	18-NOV-2010	✓	**19-DEC-2009**	17-MAR-2010	✓
EA033-C: Acid Neutralising Capacity							
80* dried soil							
VC2A (1.0-1.4)	**17-DEC-2009**	**17-DEC-2009**	17-DEC-2010	✓	**19-DEC-2009**	17-MAR-2010	✓
80* dried soil							
VC1A1 (0-0.6), VC1A1 (1.2-1.7), VC2B (0-0.5), VC2B (0.9-1.5), VC3B (0-0.5), SS1D, SS2D, SS3A, SS3C	**18-NOV-2009**	**17-DEC-2009**	18-NOV-2010	✓	**19-DEC-2009**	17-MAR-2010	✓

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
EA033-D: Retained Acidity							
80* dried soil VC2A (1.0-1.4)	**17-DEC-2009**	**17-DEC-2009**	17-DEC-2010	✓	**19-DEC-2009**	17-MAR-2010	✓
80* dried soil VC1A1 (0-0.6), VC1A1 (1.2-1.7), VC2B (0-0.5), VC2B (0.9-1.5), VC3B (0-0.5), SS1D, SS2D, SS3A, SS3C	**18-NOV-2009**	**17-DEC-2009**	18-NOV-2010	✓	**19-DEC-2009**	17-MAR-2010	✓
EA033-E: Acid Base Accounting							
80* dried soil VC2A (1.0-1.4)	**17-DEC-2009**	**17-DEC-2009**	17-DEC-2010	✓	**19-DEC-2009**	17-MAR-2010	✓
80* dried soil VC1A1 (0-0.6), VC1A1 (1.2-1.7), VC2B (0-0.5), VC2B (0.9-1.5), VC3B (0-0.5), SS1D, SS2D, SS3A, SS3C	**18-NOV-2009**	**17-DEC-2009**	18-NOV-2010	✓	**19-DEC-2009**	17-MAR-2010	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	2	16	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	16	**6.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- **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.**

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **EB0919644**		
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Brisbane
Contact	: MR NICK HANNAFORD	Contact	: Tim Kilmister
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: Nicholas.Hannaford@WorleyParsons.com	E-mail	: Services.Brisbane@alsenviro.com
Telephone	: +61 02 8456 7374	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 8923 6877	Facsimile	: +61-7-3243 7218
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----		
C-O-C number	: ----	Quote number	: ES2009WORPAR0232 (SY/503/09)
Site	: ----		
Sampler	: NICK HANNAFORD	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 09-DEC-2009	Issue Date	: 11-DEC-2009 12:52
Client Requested Due Date	: 22-DEC-2009	Scheduled Reporting Date	: **22-DEC-2009**

Delivery Details

Mode of Delivery	: Samples on hand	Temperature	: AMBIENT
No. of coolers/boxes	: RE-BATCH	No. of samples received	: 10
Sercurity Seal	: Intact.	No. of samples analysed	: 10

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **Sample(s) have been received within recommended holding times.**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Maggie Kahi.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - EA033 Chromium Suite for Acid Sulphate Soils
EB0919644-001	18-NOV-2009 15:00	VC1A1 (0-0.6)	✓
EB0919644-002	18-NOV-2009 15:00	VC1A1 (1.2-1.7)	✓
EB0919644-003	17-DEC-2009 11:00	VC2A (1.0-1.4)	✓
EB0919644-004	18-NOV-2009 15:00	VC2B (0-0.5)	✓
EB0919644-005	18-NOV-2009 15:00	VC2B (0.9-1.5)	✓
EB0919644-006	18-NOV-2009 15:00	VC3B (0-0.5)	✓
EB0919644-007	18-NOV-2009 15:00	SS1D	✓
EB0919644-008	18-NOV-2009 15:00	SS2D	✓
EB0919644-009	18-NOV-2009 15:00	SS3A	✓
EB0919644-010	18-NOV-2009 15:00	SS3C	✓

Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParsons.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - XTab (XTAB)	Email	Nicholas.Hannaford@WorleyParsons.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com
- EDI Format - XTab (XTAB)	Email	ali.watters@worleyparsons.com

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1126260**	Page	: 1 of 3
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: Caltex	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: 301015-02448		
C-O-C number	: ----	Date Samples Received	: 06-DEC-2011
Sampler	: O. MURRAY	Issue Date	: 13-DEC-2011
Site	: ----		
		No. of samples received	: 3
Quote number	: EN/034/11	No. of samples analysed	: 3

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

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

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*
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

General Comments

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

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

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

- **ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: VC5C 0.5-1	VC5B 0.8-1.3	VC5B 1.3-1.6	----	----
				Client sampling date / time: 18-NOV-2011 15:00	18-NOV-2011 15:00	18-NOV-2011 15:00	----	----
				EB1126260-001	EB1126260-002	EB1126260-003	----	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**5.7**	**6.5**	**4.1**	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**50**	<2	**38**	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	**0.08**	<0.02	**0.06**	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.325**	**1.86**	**1.25**	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**203**	**1160**	**779**	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	----	**1.28**	----	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	----	**256**	----	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	----	**0.41**	----	----	----
EA033-D: Retained Acidity								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	----	----	**0.20**	----	----
HCl Extractable Sulfur (20Be)	----	0.02	% S	----	----	**0.31**	----	----
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	----	----	**0.11**	----	----
acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t	----	----	**52**	----	----
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	----	----	**0.08**	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	----	----
Net Acidity (sulfur units)	----	0.02	% S	**0.40**	**1.59**	**1.39**	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	**253**	**993**	**869**	----	----
Liming Rate	----	1	kg CaCO3/t	**19**	**74**	**65**	----	----

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **EB1126260**	Page	: 1 of 5
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: Caltex	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 06-DEC-2011
Sampler	: O. MURRAY	Issue Date	: 13-DEC-2011
Order number	: 301015-02448		
		No. of samples received	: 3
Quote number	: EN/034/11	No. of samples analysed	: 3

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

This Quality Control Report contains the following information:

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

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

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*
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient 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 (%)*
EA033-A: Actual Acidity (QC Lot: 2084548)									
EB1126093-001	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	10	10	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.7	5.6	1.8	0% - 20%
EA033-B: Potential Acidity (QC Lot: 2084548)									
EB1126093-001	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.083	0.084	1.9	0% - 50%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	52	53	0.0	No Limit

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 2084548)								
EA033: pH KCl (23A)	----	0.1	pH Unit	----	4.5 pH Unit	97.8	93	120
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	30 mole H+ / t	99.6	93	120
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 2084548)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	.28 % S	86.3	80	120
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 2084548)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	101	89	111
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----
EA033-D: Retained Acidity (QCLot: 2084548)								
EA033: Net Acid Soluble Sulfur (20Je)	----	0.02	% S	<0.02	----	----	----	----
EA033: acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.02	.038 % S	92.6	90	110
EA033: HCl Extractable Sulfur (20Be)	----	0.02	% S	<0.02	.06 % S	106	93	120

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.**

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1126260**	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: Caltex	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 06-DEC-2011
Sampler	: O. MURRAY	Issue Date	: 13-DEC-2011
Order number	: 301015-02448		
		No. of samples received	: 3
Quote number	: EN/034/11	No. of samples analysed	: 3

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
EA033-E: Acid Base Accounting							
80* dried soil (EA033) VC5C 0.5-1, VC5B 0.8-1.3, VC5B 1.3-1.6	**18-NOV-2011**	**12-DEC-2011**	17-NOV-2012	✓	**12-DEC-2011**	11-MAR-2012	✓
EA033-C: Acid Neutralising Capacity							
80* dried soil (EA033) VC5C 0.5-1, VC5B 0.8-1.3, VC5B 1.3-1.6	**18-NOV-2011**	**12-DEC-2011**	17-NOV-2012	✓	**12-DEC-2011**	11-MAR-2012	✓
EA033-A: Actual Acidity							
80* dried soil (EA033) VC5C 0.5-1, VC5B 0.8-1.3, VC5B 1.3-1.6	**18-NOV-2011**	**12-DEC-2011**	17-NOV-2012	✓	**12-DEC-2011**	11-MAR-2012	✓
EA033-B: Potential Acidity							
80* dried soil (EA033) VC5C 0.5-1, VC5B 0.8-1.3, VC5B 1.3-1.6	**18-NOV-2011**	**12-DEC-2011**	17-NOV-2012	✓	**12-DEC-2011**	11-MAR-2012	✓
EA033-D: Retained Acidity							
80* dried soil (EA033) VC5C 0.5-1, VC5B 0.8-1.3, VC5B 1.3-1.6	**18-NOV-2011**	**12-DEC-2011**	17-NOV-2012	✓	**12-DEC-2011**	11-MAR-2012	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	1	10	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- **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.**

ALS Group
Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **EB1126260**		
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: Caltex	Page	: 1 of 2
Order number	: 301015-02448		
C-O-C number	: ----	Quote number	: EM2011WORPAR0266 (EN/034/11)
Site	: ----		
Sampler	: O. MURRAY	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 06-DEC-2011	Issue Date	: 08-DEC-2011 22:22
Client Requested Due Date	: 16-DEC-2011	Scheduled Reporting Date	: **16-DEC-2011**

Delivery Details

Mode of Delivery	: Samples on hand	Temperature	: AMBIENT
No. of coolers/boxes	: REBATCH	No. of samples received	: 3
Security Seal	: N/A	No. of samples analysed	: 3

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - EA033 Chromium Suite for Acid Sulphate Soils
EB1126260-001	18-NOV-2011 15:00	VC5C 0.5-1	✓
EB1126260-002	18-NOV-2011 15:00	VC5B 0.8-1.3	✓
EB1126260-003	18-NOV-2011 15:00	VC5B 1.3-1.6	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

MS ORLA MURRAY

- *AU Certificate of Analysis - NATA (COA)	Email	orla.murray@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	orla.murray@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	orla.murray@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	orla.murray@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	orla.murray@worleyparsons.com
- Chain of Custody (CoC) (COC)	Email	orla.murray@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	orla.murray@worleyparsons.com

CHAIN OF CUSTODY DOCUMENTATION

ALS Laboratory Group

CLIENT: WORPAR	SAMPLER:
ADDRESS / OFFICE:	MOBILE:
PROJECT MANAGER (PM):	PHONE:
PROJECT ID: ES1125458	EMAIL REPORT TO:
SITE: P.O. NO.:	EMAIL INVOICE TO: (if different to report)
RESULTS REQUIRED (Date): QUOTE NO.:	**ANALYSIS REQUIRED including SUITES** (note - suite codes must be listed to attract suite prices)

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

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

Notes: e.g. Highly contaminated samples e.g. "High PAHs expected". ... LORs etc.

please give Sample #1 to Chris to pulp.

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles	CS Suite
1	VC5C 0.5-1	Pulp	18/11				x
2	VC5B 0.8-1.3	Pulp	18/11				x
3	VC5B 1.3-1.6	Pulp	18/11				x

Work Order
EB1126260

Telephone : +61-7-3243 7222

RELINQUISHED BY:		RECEIVED BY		METHOD OF SHIPMENT
Name:	Date:	Name: C. Bryant	Date: 6-12-11	Con' Note No:
Of:	Time:	Of: ALS	Time: 1341	
Name:	Date:	Name:	Date:	Transport Co:
Of:	Time:	Of:	Time:	

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

ALS LABORATORY GROUP

CERTIFICATE OF ANALYSIS

Work Order	: **EB1201570**	Page	: 1 of 3
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: CALTEX	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: 301015-02448		
C-O-C number	: ----	Date Samples Received	: 18-JAN-2012
Sampler	: ----	Issue Date	: 24-JAN-2012
Site	: ----		
		No. of samples received	: 3
Quote number	: EN/034/11	No. of samples analysed	: 3

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

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

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*
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

General Comments

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

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

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

- **ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.**
- **ASS: EA033 (CRS Suite): Retained Acidity not required because pH KCl greater than or equal to 4.5**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: VCSC 0-0.5	VCSA 0-0.5	VCSB 0-0.8	----	----
				Client sampling date / time: 18-NOV-2011 15:00	18-NOV-2011 15:00	18-NOV-2011 15:00	----	----
				EB1201570-001	EB1201570-002	EB1201570-003	----	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**8.7**	**9.6**	**9.3**	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.300**	**0.020**	**0.122**	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**187**	**13**	**76**	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**5.99**	**9.10**	**24.8**	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**1200**	**1820**	**4960**	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**1.92**	**2.91**	**7.96**	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	----	----
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	----	----
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	----	----

QUALITY CONTROL REPORT

Work Order	: **EB1201570**	Page	: 1 of 5
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: CALTEX	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-JAN-2012
Sampler	: ----	Issue Date	: 24-JAN-2012
Order number	: 301015-02448		
		No. of samples received	: 3
Quote number	: EN/034/11	No. of samples analysed	: 3

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

This document is issued in accordance with NATA accreditation requirements.

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*
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient 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 (%)*
EA033-A: Actual Acidity (QC Lot: 2137223)									
EB1201415-001	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	8.6	8.7	1.2	0% - 20%
EB1201570-003	VCSB 0-0.8	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	9.3	9.4	1.1	0% - 20%
EA033-B: Potential Acidity (QC Lot: 2137223)									
EB1201415-001	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.543	0.554	2.0	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	339	346	2.0	0% - 20%
EB1201570-003	VCSB 0-0.8	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.122	0.127	3.5	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	76	79	3.5	No Limit
EA033-C: Acid Neutralising Capacity (QC Lot: 2137223)									
EB1201415-001	Anonymous	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	1.74	1.69	3.2	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.56	0.54	3.2	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	348	337	3.2	0% - 20%
EB1201570-003	VCSB 0-0.8	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	24.8	24.8	0.3	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	7.96	7.93	0.3	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	4960	4950	0.3	0% - 20%

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 2137223)								
EA033: pH KCl (23A)	----	0.1	pH Unit	----	4.5 pH Unit	102	93	120
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	30 mole H+ / t	103	93	120
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 2137223)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	.28 % S	85.4	80	120
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 2137223)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	107	89	111
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----

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.**

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1201570**	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: CALTEX	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-JAN-2012
Sampler	: ----	Issue Date	: 24-JAN-2012
Order number	: 301015-02448		
		No. of samples received	: 3
Quote number	: EN/034/11	No. of samples analysed	: 3

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
EA033-A: Actual Acidity							
80* dried soil VCSC 0-0.5, VCSA 0-0.5, VCSB 0-0.8	**18-NOV-2011**	**23-JAN-2012**	17-NOV-2012	✓	**24-JAN-2012**	22-APR-2012	✓
EA033-B: Potential Acidity							
80* dried soil VCSC 0-0.5, VCSA 0-0.5, VCSB 0-0.8	**18-NOV-2011**	**23-JAN-2012**	17-NOV-2012	✓	**24-JAN-2012**	22-APR-2012	✓
EA033-C: Acid Neutralising Capacity							
80* dried soil VCSC 0-0.5, VCSA 0-0.5, VCSB 0-0.8	**18-NOV-2011**	**23-JAN-2012**	17-NOV-2012	✓	**24-JAN-2012**	22-APR-2012	✓
EA033-D: Retained Acidity							
80* dried soil VCSC 0-0.5, VCSA 0-0.5, VCSB 0-0.8	**18-NOV-2011**	**23-JAN-2012**	17-NOV-2012	✓	**24-JAN-2012**	22-APR-2012	✓
EA033-E: Acid Base Accounting							
80* dried soil VCSC 0-0.5, VCSA 0-0.5, VCSB 0-0.8	**18-NOV-2011**	**23-JAN-2012**	17-NOV-2012	✓	**24-JAN-2012**	22-APR-2012	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	2	12	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	1	12	**8.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	12	**8.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- **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.**

CHAIN OF CUSTODY DOCUMENTATION

CLIENT:	WORLEY PARSON-INFRASTRUCTURE	SAMPLER:	
ADDRESS / OFFICE:	NORTH SYDNEY	MOBILE:	
PROJECT MANAGER (PM):	O.MURRAY	PHONE	
PROJECT ID:	CALTEX	EMAIL REPORT TO	
	P.O. NO.: 301015-02448	EMAIL INVOICE TO	
RESULTS REQUIRED (Date):	QUOTE NO EN-034-11	**ANALYSIS REQUIRED including SUITES** (note - suite codes must be listed to attract suite prices)	

Australian Laboratory Services Pty Ltd

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

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		Chromium Suite																				COMMENTS
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles																					
1	VCSC 0-0.5	S	18/11/11			1	X																				
2	VCSA 0-0.5	S	18/11/11			1	X																				
3	VCSB 0-0.8	S	18/11/11			1	X																				

Environmental Division
Brisbane
Work Order
EB1201570

Telephone : +61-7-3243 7222

RELINQUISHED BY:		RECEIVED BY		Method of Transport	
Name:	Date:	Name:	Date:	Con.Note No.	
Of:	Time:	Of:	Time:		
Name:	Date:	Name:	Date:	Transport	
Of:	Time:	Of:	Time:		

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

ALS Environmental

PARTICLE SIZE DISTRIBUTION RESULTS

CERTIFICATE OF ANALYSIS

Work Order	: **ES0917542**	Page	: 1 of 3
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 26-NOV-2009
Site	: ----		
		No. of samples received	: 6
Quote number	: SY/503/09	No. of samples analysed	: 4

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

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dianne Blane		Newcastle

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 insuffient 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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID	VC2A 1.4-2.0	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6	----
				Client sampling date / time	17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]	----
					ES0917542-003	ES0917542-004	ES0917542-005	ES0917542-006	----
EA150: Particle Sizing									
+75µm	----	1	%		**90**	**95**	**98**	**94**	----
+150µm	----	1	%		**84**	**88**	**98**	**88**	----
+300µm	----	1	%		**50**	**41**	**74**	**46**	----
+425µm	----	1	%		**12**	**9**	**32**	**19**	----
+600µm	----	1	%		<1	**1**	**10**	**10**	----
+1180µm	----	1	%		<1	<1	**1**	**5**	----
+2.36mm	----	1	%		<1	<1	<1	**2**	----
+4.75mm	----	1	%		<1	<1	<1	<1	----
+9.5mm	----	1	%		<1	<1	<1	<1	----
+19.0mm	----	1	%		<1	<1	<1	<1	----
+37.5mm	----	1	%		<1	<1	<1	<1	----
+75.0mm	----	1	%		<1	<1	<1	<1	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		**7**	**4**	**2**	**5**	----
Silt (2-60 µm)	----	1	%		**3**	**2**	<1	<1	----
Sand (0.06-2.00 mm)	----	1	%		**90**	**94**	**98**	**93**	----
Gravel (>2mm)	----	1	%		<1	<1	<1	**2**	----
Cobbles (>6cm)	----	1	%		<1	<1	<1	<1	----

CERTIFICATE OF ANALYSIS

Work Order	: **ES0917660**	Page	: 1 of 3
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 18-NOV-2009
Sampler	: NH	Issue Date	: 01-DEC-2009
Site	: ----		
		No. of samples received	: 3
Quote number	: SY/503/09	No. of samples analysed	: 3

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

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dianne Blane		Newcastle

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 insuffient 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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID	VC3B_0-0.5	VC2B_0-0.5	VC2B_0.5-0.9	----	----
				Client sampling date / time	17-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	----	----
					ES0917660-001	ES0917660-002	ES0917660-003	----	----
EA150: Particle Sizing									
+75µm	----	1	%		**95**	**96**	**89**	----	----
+150µm	----	1	%		**90**	**94**	**83**	----	----
+300µm	----	1	%		**39**	**51**	**44**	----	----
+425µm	----	1	%		**9**	**13**	**15**	----	----
+600µm	----	1	%		**2**	**2**	**5**	----	----
+1180µm	----	1	%		**1**	**1**	**1**	----	----
+2.36mm	----	1	%		<1	**1**	<1	----	----
+4.75mm	----	1	%		<1	<1	<1	----	----
+9.5mm	----	1	%		<1	<1	<1	----	----
+19.0mm	----	1	%		<1	<1	<1	----	----
+37.5mm	----	1	%		<1	<1	<1	----	----
+75.0mm	----	1	%		<1	<1	<1	----	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		**4**	**4**	**9**	----	----
Silt (2-60 µm)	----	1	%		**2**	**1**	**2**	----	----
Sand (0.06-2.00 mm)	----	1	%		**94**	**95**	**89**	----	----
Gravel (>2mm)	----	1	%		<1	<1	<1	----	----
Cobbles (>6cm)	----	1	%		<1	<1	<1	----	----

QUALITY CONTROL REPORT

Work Order	: **ES0917542**	Page	: 1 of 5
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 26-NOV-2009
Order number	: ----		
		No. of samples received	: 6
Quote number	: SY/503/09	No. of samples analysed	: 4

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

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dianne Blane		Newcastle

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 insuffient 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 Limit

- **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.

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**

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.**

QUALITY CONTROL REPORT

Work Order	: **ES0917660**	Page	: 1 of 5
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-NOV-2009
Sampler	: NH	Issue Date	: 01-DEC-2009
Order number	: ----		
		No. of samples received	: 3
Quote number	: SY/503/09	No. of samples analysed	: 3

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

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Signatories

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Signatories	*Position*	*Accreditation Category*
Dianne Blane		Newcastle

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 insuffient 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 Limit

- **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.

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**

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.**

Certificate of Analysis

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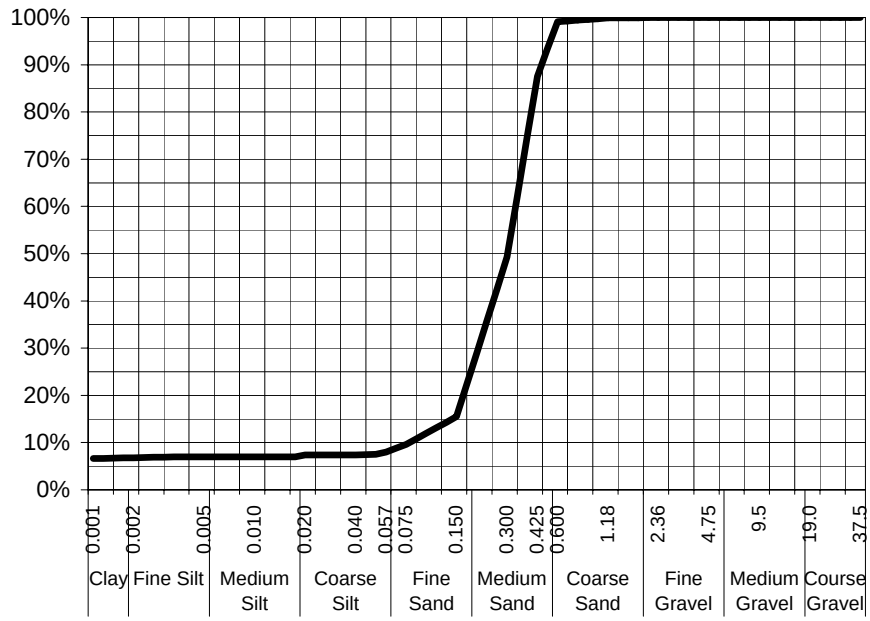
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT:	Ali Watters	**DATE REPORTED:**	26-Nov-2009
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	17-Nov-2009
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES0917542-003 / PSD
PROJECT:	Caltex Maintenance Dredging	**SAMPLE ID:**	VC2A 1.4-2.0

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	99%
0.425	88%
0.300	49%
0.150	16%
0.075	10%
Particle Size (microns)	
57	8%
40	7%
20	7%
10	7%
5	7%
4	7%
1	7%

Samples analysed as received.

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand & fines

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density 2.65 Assumed

Analysed: 20-Nov-09

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

NATA Accreditation: 825 Site: Newcastle
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Senior Analyst
Authorised Signatory

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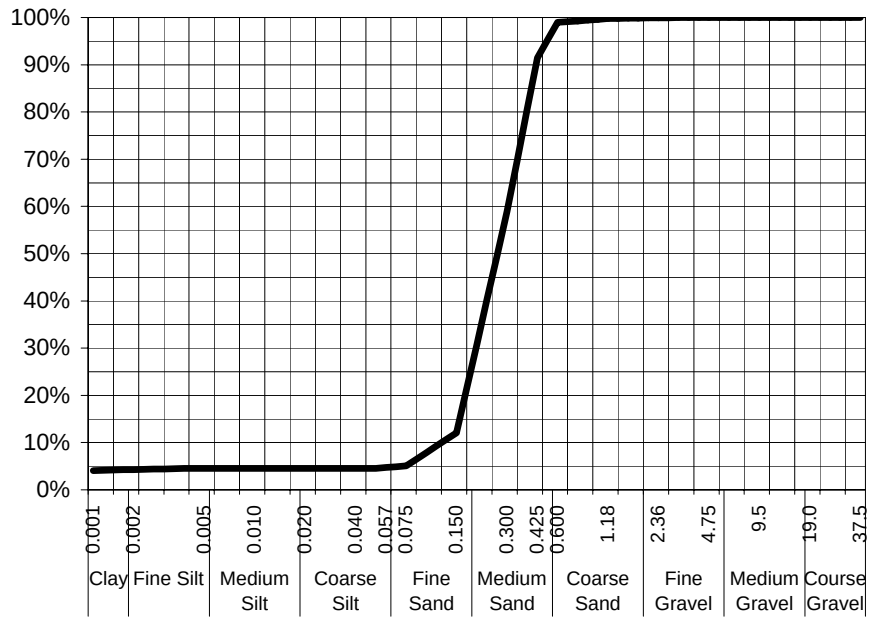
Newcastle, NSW

CLIENT:	Ali Watters	**DATE REPORTED:**	26-Nov-2009
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	17-Nov-2009
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES0917542-004 / PSD
PROJECT:	Caltex Maintenance Dredging	**SAMPLE ID:**	VC2A 2.3-2.6

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	99%
0.425	91%
0.300	59%
0.150	12%
0.075	5%
Particle Size (microns)	
57	5%
40	5%
20	5%
10	5%
5	5%
4	5%
1	4%

Samples analysed as received.

Sample Comments:		**Analysed:**	20-Nov-09
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	Sand & fines	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.2/AS1289.3.6.3	**Hydrometer Type**	ASTM E100
Soil Particle Density	2.65 Assumed		

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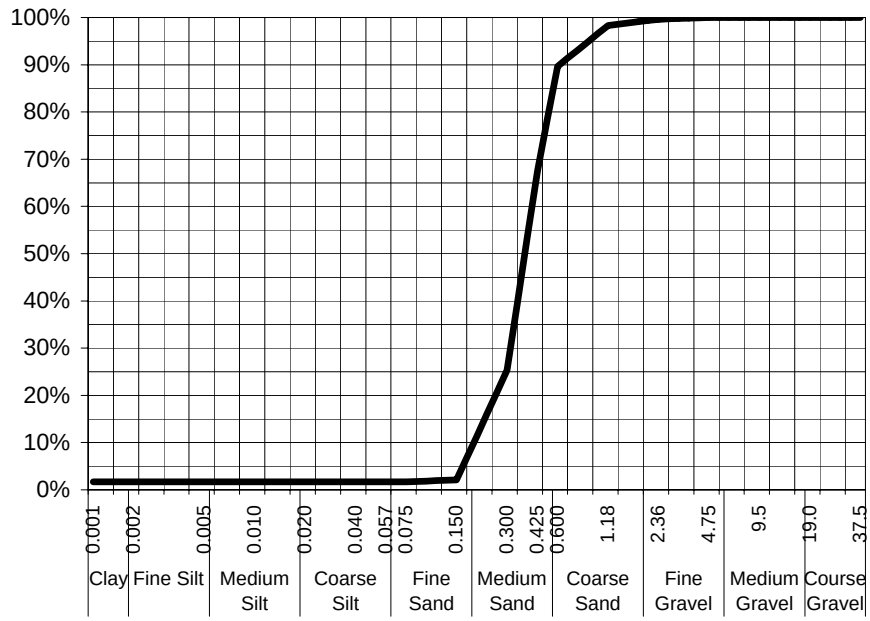
CLIENT:	Ali Watters	**DATE REPORTED:**	26-Nov-2009
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	17-Nov-2009
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES0917542-005 / PSD
PROJECT:	Caltex Maintenance Dredging	**SAMPLE ID:**	VC1A 1.2-1.6

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	98%
0.600	90%
0.425	67%
0.300	25%
0.150	2%
0.075	2%
Particle Size (microns)	
57	2%
40	2%
20	2%
10	2%
5	2%
4	2%
1	2%

Samples analysed as received.

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density 2.65 Assumed

Analysed: 20-Nov-09

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

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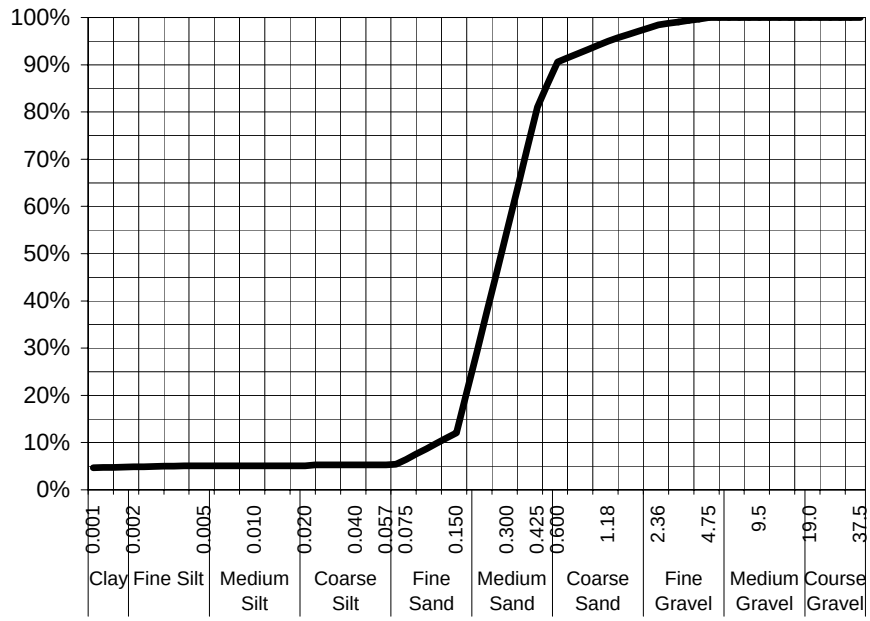
CLIENT:	Ali Watters	**DATE REPORTED:**	26-Nov-2009
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	17-Nov-2009
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES0917542-006 / PSD
PROJECT:	Caltex Maintenance Dredging	**SAMPLE ID:**	VC3A 0-0.6

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	98%
1.18	95%
0.600	91%
0.425	81%
0.300	55%
0.150	12%
0.075	6%
Particle Size (microns)	
57	5%
40	5%
20	5%
10	5%
5	5%
4	5%
1	5%

Samples analysed as received.

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand, shell & vegetation

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density 2.65 Assumed

Analysed: 20-Nov-09

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

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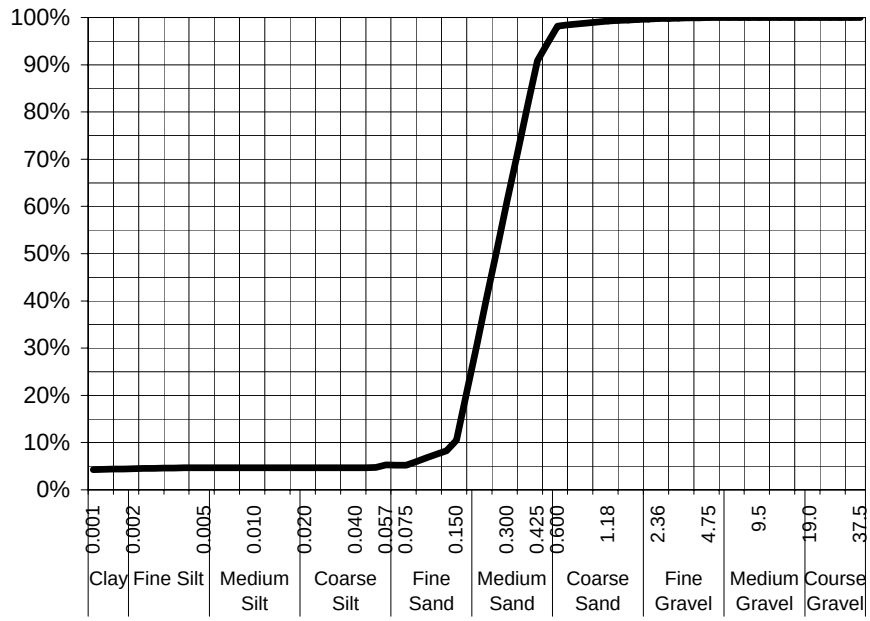
CLIENT:	Ali Watters	**DATE REPORTED:**	1-Dec-2009
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2009
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES0917660-001 / PSD
PROJECT:	Caltex Maintenance Dredging	**SAMPLE ID:**	VC3B_0-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	98%
0.425	91%
0.300	61%
0.150	11%
0.075	5%
Particle Size (microns)	
57	5%
40	5%
20	5%
10	5%
5	5%
4	5%
1	4%

Samples analysed as received.

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand & fines

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density 2.65 Assumed

Analysed: 26-Nov-09

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

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ALS Environmental

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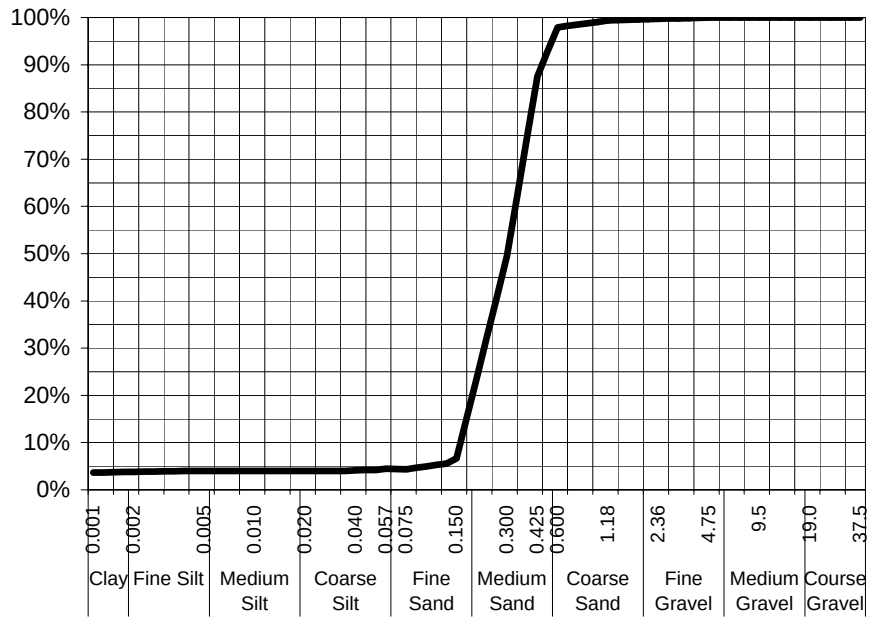
CLIENT:	Ali Watters	**DATE REPORTED:**	1-Dec-2009
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2009
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES0917660-002 / PSD
PROJECT:	Caltex Maintenance Dredging	**SAMPLE ID:**	VC2B_0-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	98%
0.425	88%
0.300	50%
0.150	7%
0.075	4%
Particle Size (microns)	
57	4%
40	4%
20	4%
10	4%
5	4%
4	4%
1	4%

Samples analysed as received.

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand & fines

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density 2.65 Assumed

Analysed: 26-Nov-09

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

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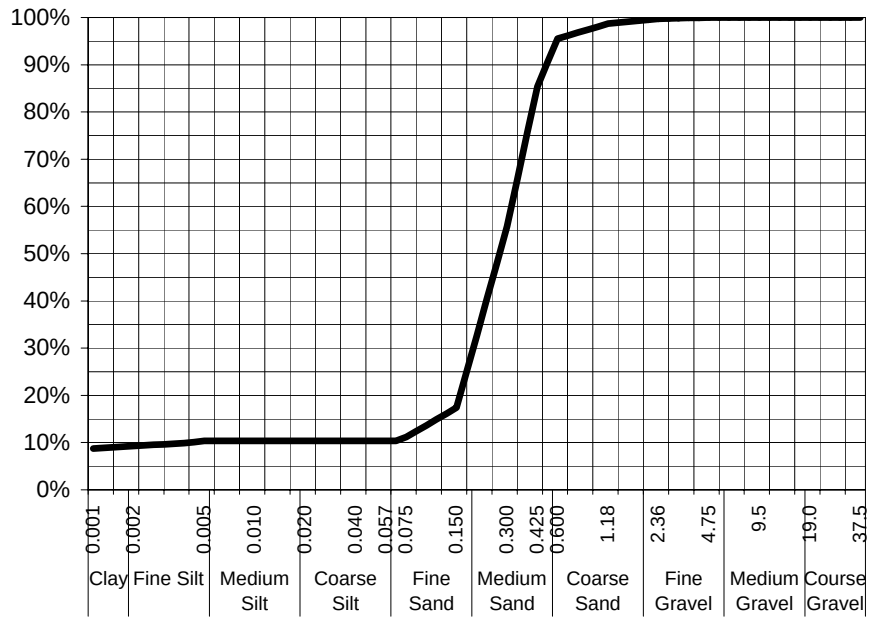
ALS Environmental

Newcastle, NSW

CLIENT:	Ali Watters	**DATE REPORTED:**	1-Dec-2009
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2009
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES0917660-003 / PSD
PROJECT:	Caltex Maintenance Dredging	**SAMPLE ID:**	VC2B_0.5-0.9

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	96%
0.425	85%
0.300	56%
0.150	17%
0.075	11%
Particle Size (microns)	
57	10%
40	10%
20	10%
10	10%
5	10%
4	10%
1	9%

Samples analysed as received.

Sample Comments:		**Analysed:**	26-Nov-09
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	Sand & fines	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.2/AS1289.3.6.3	**Hydrometer Type**	ASTM E100
Soil Particle Density	2.65 Assumed		

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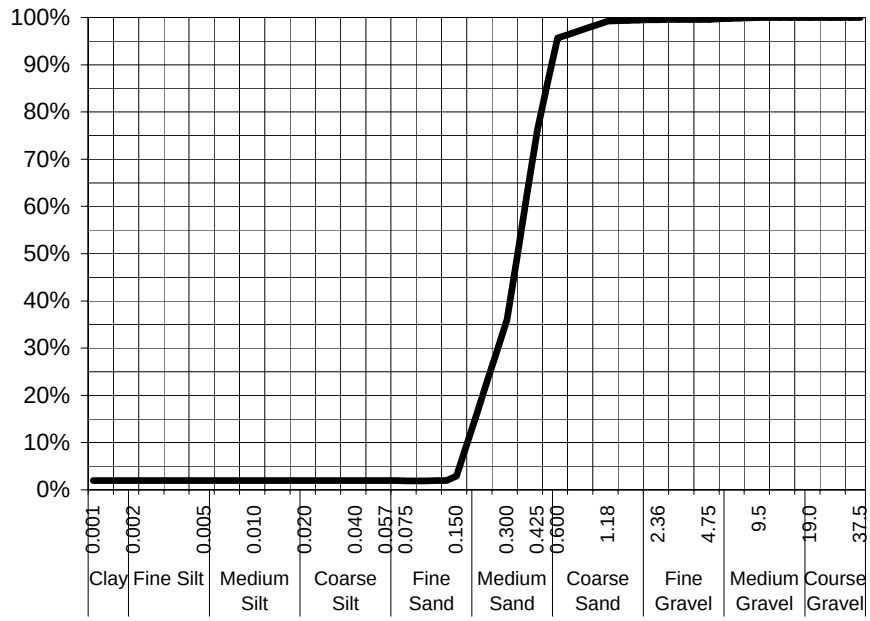
ALS Environmental

Newcastle, NSW

CLIENT:	Ali Watters	**DATE REPORTED:**	1-Dec-2009
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	19-Nov-2009
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES0917732-001 / PSD
PROJECT:	Caltex Maintenance Dredging	**SAMPLE ID:**	VC1A1 0-0.6

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	96%
0.425	76%
0.300	36%
0.150	3%
0.075	2%
Particle Size (microns)	
57	2%
40	2%
20	2%
10	2%
5	2%
4	2%
1	2%

Samples analysed as received.

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density 2.65 Assumed

Analysed: 25-Nov-09

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

NATA Accreditation: 825 Site: Newcastle
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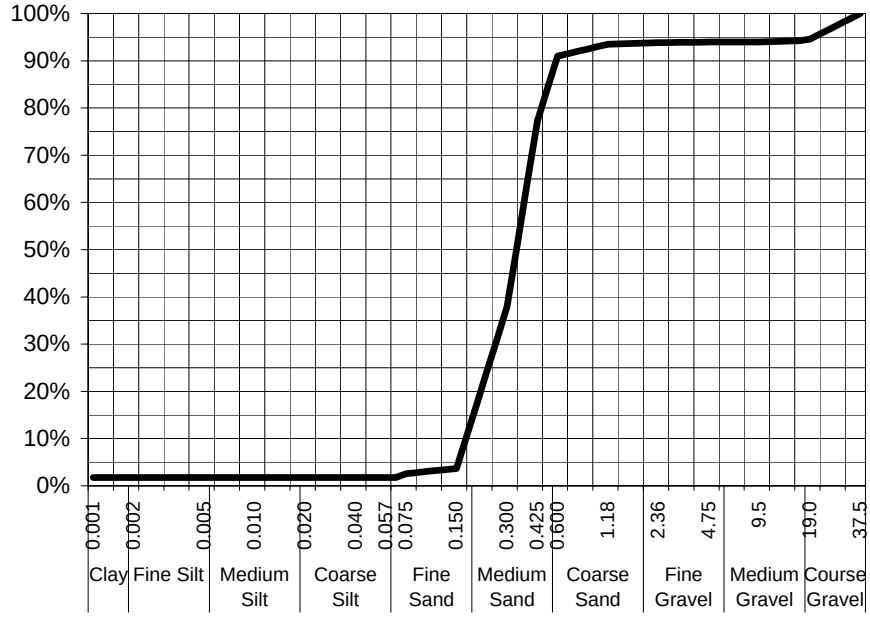
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT:	Ali Watters	**DATE REPORTED:**	1-Dec-2009
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	19-Nov-2009
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES0917732-002 / PSD
PROJECT:	Caltex Maintenance Dredging	**SAMPLE ID:**	VC1A1 0.6-1.2

Particle Size Distribution



Particle Size (mm)	Percent Passing
37.5	100%
19.0	95%
9.5	94%
4.75	94%
2.36	94%
1.18	93%
0.600	91%
0.425	77%
0.300	38%
0.150	4%
0.075	3%
Particle Size (microns)	
57	2%
40	2%
20	2%
10	2%
5	2%
4	2%
1	2%

Samples analysed as received.

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density 2.65 Assumed

Analysed: 25-Nov-09

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

NATA Accreditation: 825 Site: Newcastle
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Dianne Blane
Senior Analyst
Authorised Signatory

Certificate of Analysis

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fax 02 4968 0349
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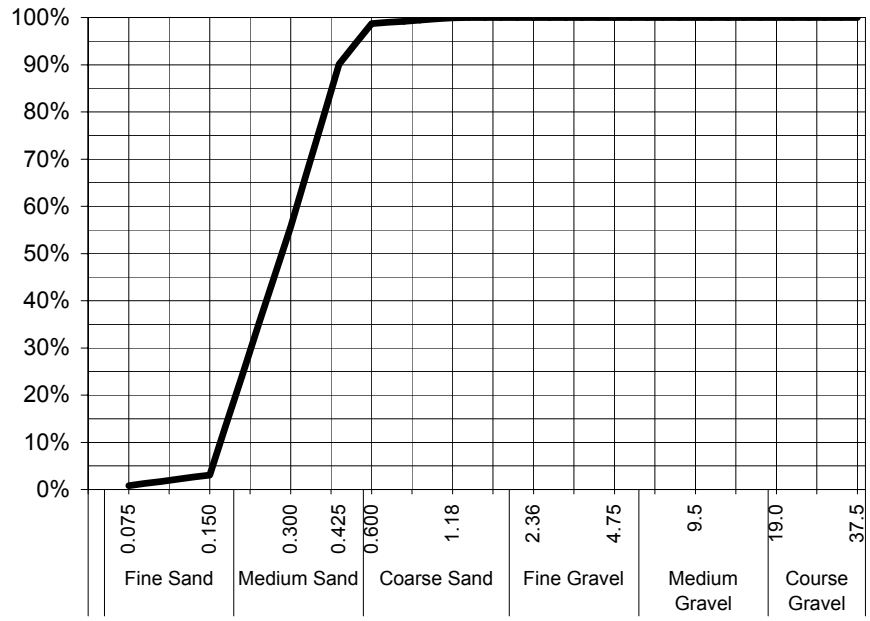
ALS Environmental

Newcastle, NSW

CLIENT:	Orla Murray	**DATE REPORTED:**	28-Nov-2011
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2011
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES1125458-001 / PSD
PROJECT:	Caltex	**SAMPLE ID:**	SS5A

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	99%
0.425	90%
0.300	56%
0.150	3%
0.075	1%

Samples analysed as received.
** Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006. Typical sediment SPD values used for calculations*

Median Particle Size (mm)	0.225

Sample Comments:

Analysed: 25-Nov-11

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
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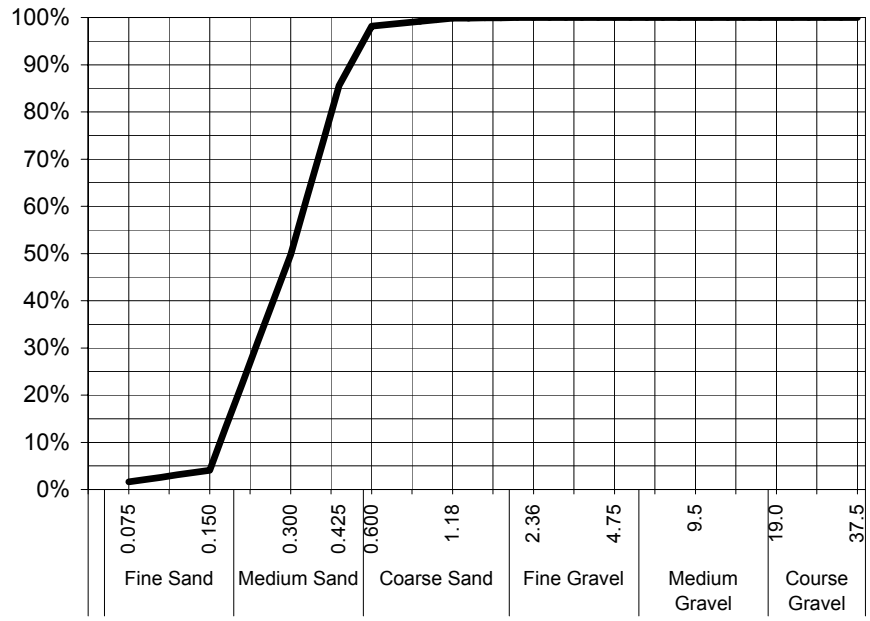
ALS Environmental

Newcastle, NSW

CLIENT:	Orla Murray	**DATE REPORTED:**	28-Nov-2011
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2011
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES1125458-005 / PSD
PROJECT:	Caltex	**SAMPLE ID:**	SS5C

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	98%
0.425	86%
0.300	50%
0.150	4%
0.075	2%

Samples analysed as received.
** Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006. Typical sediment SPD values used for calculations*

Median Particle Size (mm)	0.300

Sample Comments:

Analysed: 25-Nov-11

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
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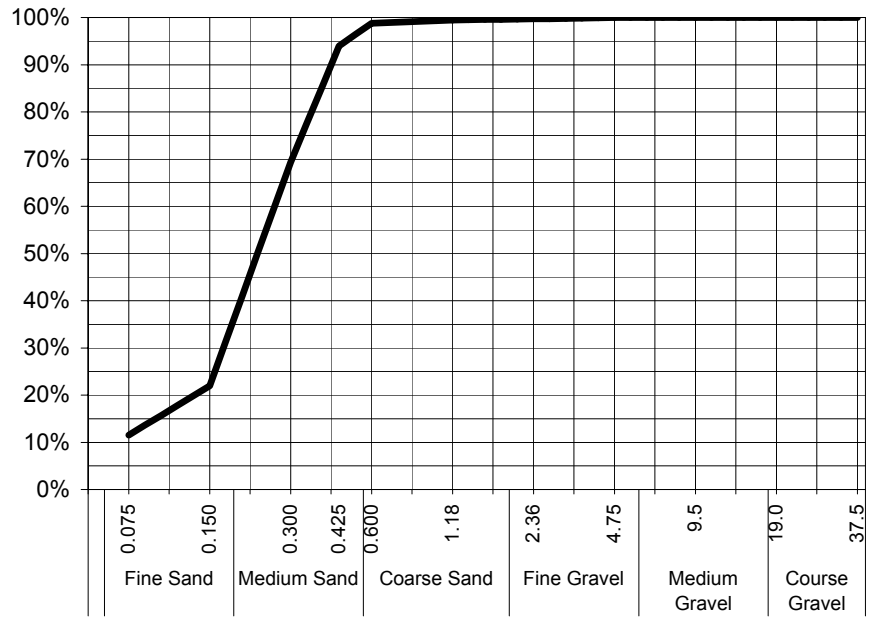
ALS Environmental

Newcastle, NSW

CLIENT:	Orla Murray	**DATE REPORTED:**	28-Nov-2011
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2011
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES1125458-006 / PSD
PROJECT:	Caltex	**SAMPLE ID:**	SS5D

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	99%
0.425	94%
0.300	69%
0.150	22%
0.075	12%

Samples analysed as received.
** Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006. Typical sediment SPD values used for calculations*

Median Particle Size (mm)	0.150

Sample Comments:

Analysed: 25-Nov-11

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand and fines

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
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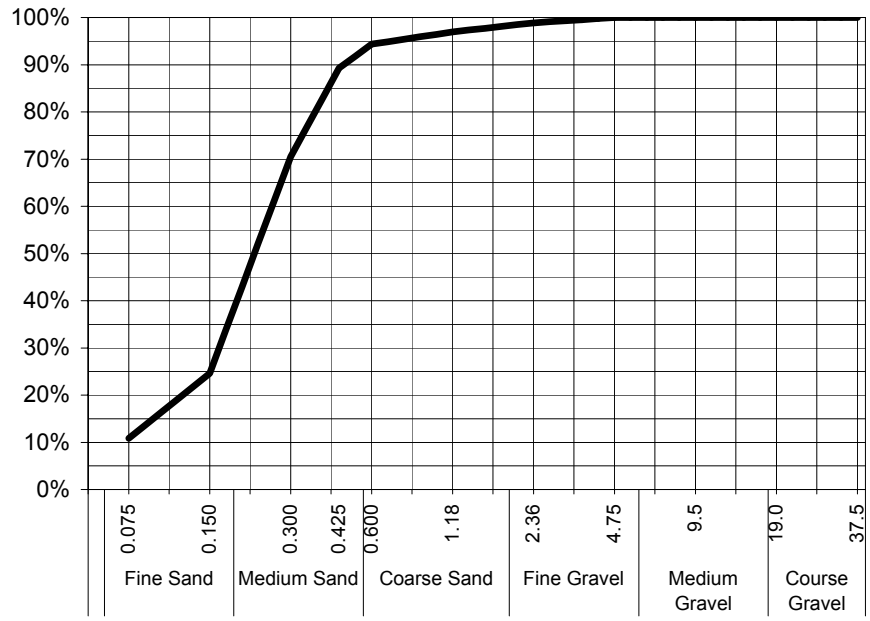
ALS Environmental

Newcastle, NSW

CLIENT:	Orla Murray	**DATE REPORTED:**	28-Nov-2011
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2011
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES1125458-009 / PSD
PROJECT:	Caltex	**SAMPLE ID:**	SS5E

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	99%
1.18	97%
0.600	94%
0.425	89%
0.300	70%
0.150	25%
0.075	11%

Samples analysed as received.
** Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006. Typical sediment SPD values used for calculations*

Median Particle Size (mm)	0.150

Sample Comments:

Analysed: 25-Nov-11

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand and fines

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
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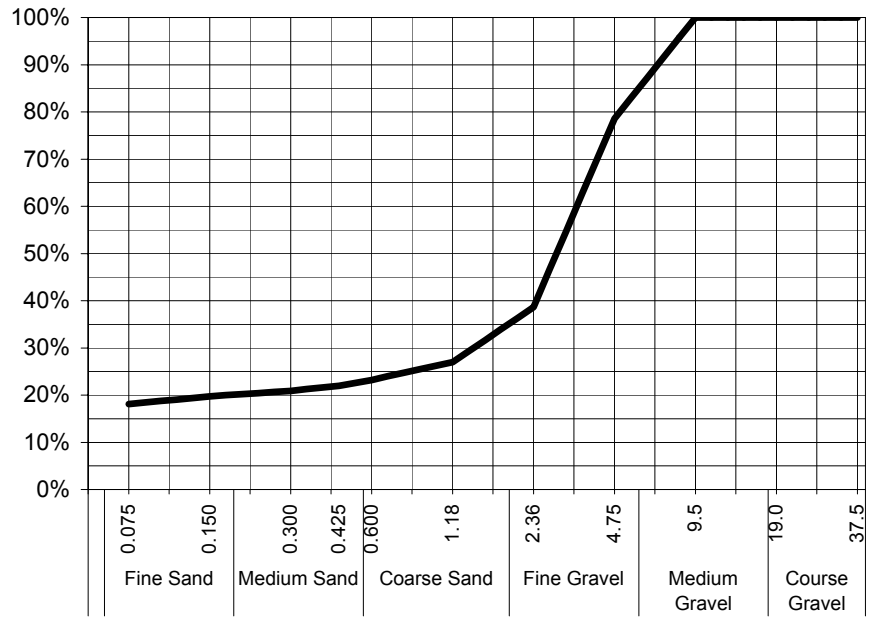
ALS Environmental

Newcastle, NSW

CLIENT:	Orla Murray	**DATE REPORTED:**	28-Nov-2011
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2011
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES1125458-020 / PSD
PROJECT:	Caltex	**SAMPLE ID:**	VC5C 0.5-1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	79%
2.36	39%
1.18	27%
0.600	23%
0.425	22%
0.300	21%
0.150	20%
0.075	18%

Samples analysed as received.
** Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006. Typical sediment SPD values used for calculations*

Median Particle Size (mm)	2.360

Sample Comments:

Analysed: 25-Nov-11

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Gravel, coarse sand and fines

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
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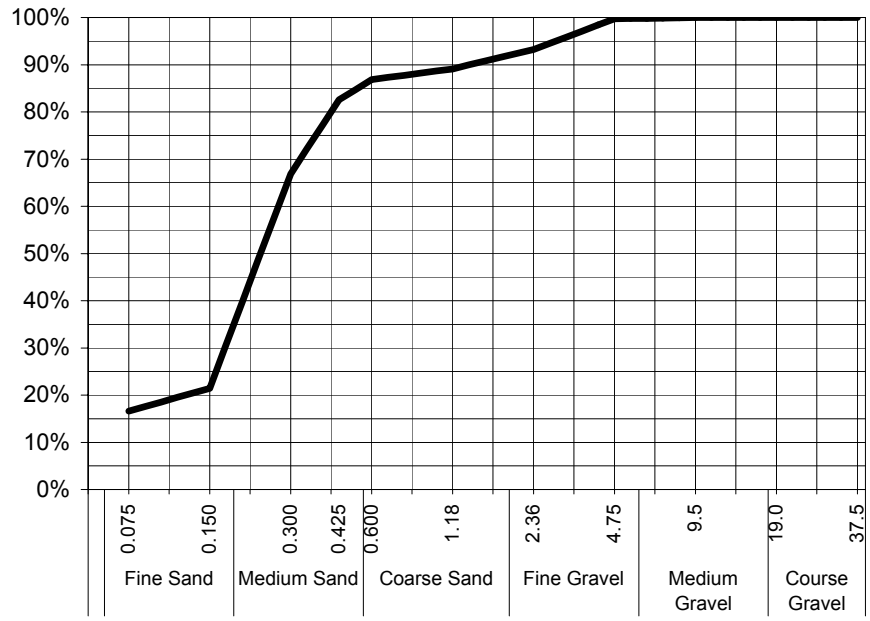
ALS Environmental

Newcastle, NSW

CLIENT:	Orla Murray	**DATE REPORTED:**	28-Nov-2011
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2011
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES1125458-026 / PSD
PROJECT:	Caltex	**SAMPLE ID:**	VCSD_2.1-3.1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	93%
1.18	89%
0.600	87%
0.425	83%
0.300	67%
0.150	21%
0.075	17%

Samples analysed as received.
** Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.*
Typical sediment SPD values used for calculations

Median Particle Size (mm)	0.150

Sample Comments:

Analysed: 25-Nov-11

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand and fines

Test Method: AS1289.3.6.1

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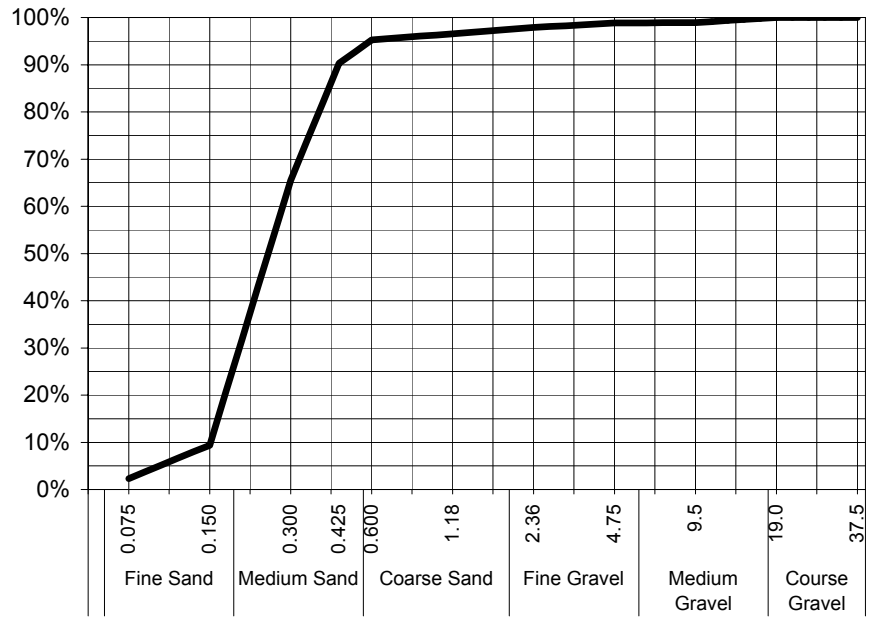
CLIENT:	Orla Murray	**DATE REPORTED:**	28-Nov-2011
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2011
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES1125458-028 / PSD
PROJECT:	Caltex	**SAMPLE ID:**	VCSA(0-0.5)

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	99%
4.75	99%
2.36	98%
1.18	97%
0.600	95%
0.425	90%
0.300	65%
0.150	9%
0.075	2%

Samples analysed as received.
** Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.*
Typical sediment SPD values used for calculations

Median Particle Size (mm)	0.150

Sample Comments:

Analysed: 25-Nov-11

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand

Test Method: AS1289.3.6.1

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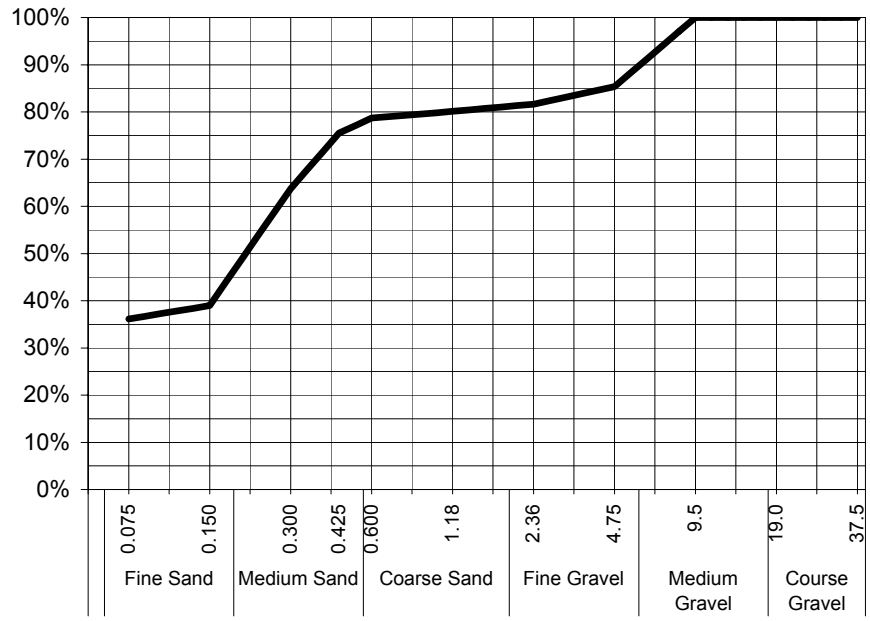
ALS Environmental

Newcastle, NSW

CLIENT:	Orla Murray	**DATE REPORTED:**	28-Nov-2011
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2011
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES1125458-030 / PSD
PROJECT:	Caltex	**SAMPLE ID:**	VCSA1.5-2

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	85%
2.36	82%
1.18	80%
0.600	79%
0.425	76%
0.300	64%
0.150	39%
0.075	36%

Samples analysed as received.
** Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.*
Typical sediment SPD values used for calculations

Median Particle Size (mm)	0.150

Sample Comments:

Analysed: 25-Nov-11

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand, fines and gravel

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
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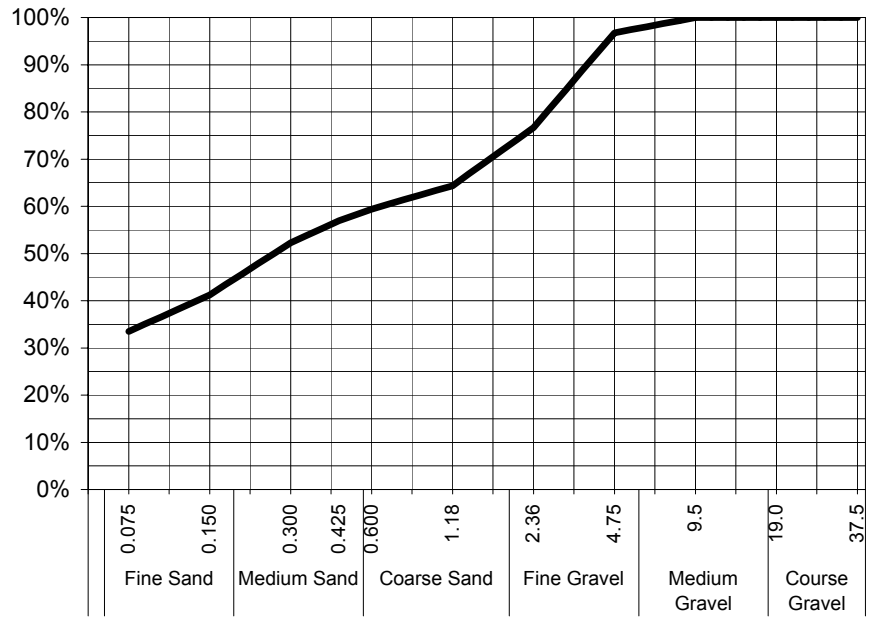
ALS Environmental

Newcastle, NSW

CLIENT:	Orla Murray	**DATE REPORTED:**	28-Nov-2011
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2011
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES1125458-036 / PSD
PROJECT:	Caltex	**SAMPLE ID:**	VCSE 0-0.6

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	97%
2.36	77%
1.18	64%
0.600	59%
0.425	57%
0.300	52%
0.150	41%
0.075	33%

Samples analysed as received.
** Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006. Typical sediment SPD values used for calculations*

Median Particle Size (mm)	0.150

Sample Comments:

Analysed: 25-Nov-11

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand, fines and gravel

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
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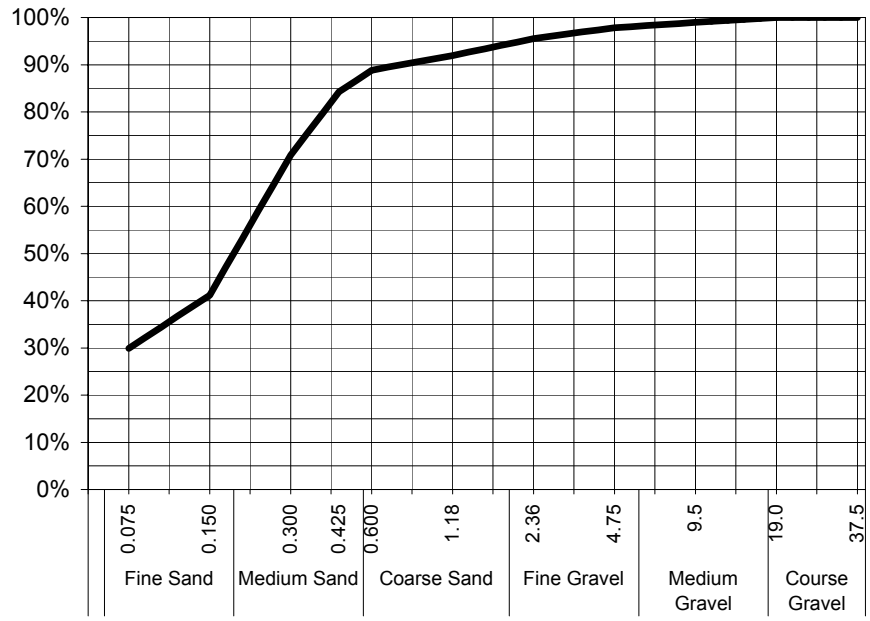
ALS Environmental

Newcastle, NSW

CLIENT:	Orla Murray	**DATE REPORTED:**	28-Nov-2011
COMPANY:	Worley Parsons - Infrastructure MWE	**DATE RECEIVED:**	18-Nov-2011
ADDRESS:	Level 10/141 Walker Street North Sydney, NSW, Australia 2060	**REPORT NO:**	ES1125458-037 / PSD
PROJECT:	Caltex	**SAMPLE ID:**	VCSE 1-1.6

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	89%
0.425	84%
0.300	71%
0.150	41%
0.075	30%

Samples analysed as received.
** Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006. Typical sediment SPD values used for calculations*

Median Particle Size (mm)	0.150

Sample Comments:

Analysed: 25-Nov-11

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand and fines

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
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Dianne Blane
Laboratory Supervisor, Newcastle
Authorised Signatory

GEOCHEMISTRY LABORATORY RESULTS

CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: WORLEY PARSONS	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE: N. SYDNEY		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes No N/A
PROJECT: CALTEX MAINTENANCE DREDGING	ALS QUOTE NO.: SY/503/09	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Free ice / frozen ice bricks preser Yes No N/A
ORDER NUMBER:			Random Sample Temperature on 4-6C °C
PROJECT MANAGER: ALI WATTERS	CONTACT PH: 0422 763 386		Other comment:
SAMPLER: NICK HANNAFORD	SAMPLER MOBILE 0402365428	RELINQUISHED BY:	RECEIVED BY: Joseph ALS Sydney
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME:	DATE/TIME: 17/11/09 17:20
Email Reports to (will default to PM if no other addresses are listed):		RELINQUISHED BY:	RECEIVED BY:
Email Invoice to (will default to PM if no other addresses are listed):		DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Subcon / Forward Lab / Split WO
Lab / Analysis: Sydney ALS
Organised By / Date:
Relinquished By / Date:
Connote / Courier:
WO No: ES0917514
Attach By PO / Internal Sheet:

TBT + TOC : ES0917544
PSD : ES0917541
PH Fox : ES0917543

Environmental Division
Sydney
Work Order
ES0917541

Telephone : +61-2-8784 8555

ANALYSIS REQUIRED including SUITES (NB. Suite Cod
Where Metals are required, specify Total (unfiltered bottle required) or

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)	CONTAINER INFORMATION																		Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pHf & pHox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
14	VC1A 0-0.5	17/11 am	S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	STORE remaining sample - will select following review of results
	VC1A 0-0.5X	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
15	VC1A 0.5-1.2	17/11 am	S	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	STORE	STORE	
	VC1A 0.5-1.2Y	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
3	VC2A 0-1.0	17/11 am	S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	
4	VC2A 0-1.0 DUP	17/11 am	S	Glass bottle/bags	1	✓	✓	✓	✓	—	—	—	—	—	—	—	—	STORE	STORE	
16	VC2A 0-1.0 X	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
5	VC2A 1.0-1.4	17/11 am	S	Glass bottle/bags	3	✓	✓	✓	✓	—	—	—	—	—	[illegible]	✓	✓	STORE	STORE	
17	VC2A 1.0-1.4Y	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
6	VC2A 1.4-2.0	17/11 am	S	Glass bottle/bags	4	✓	✓	✓	✓	—	—	—	—	—	✓	✓	✓	STORE	STORE	
18	VC2A 1.4-2.0Z	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
7	VC2A 2.0-2.3	17/11 am	S	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	[illegible]	✓	✓	STORE	STORE	
8	VC2A 2.3-2.6	17/11 pm	S	Glass bottle/bags	4	-	-	-	-	-	-	-	-	-	-	-	-	STORE	STORE	
19	VC2A 2.3-2.6X	17/11 pm	S	Glass bottle/bags	2	HOLD												STORE	STORE	
9			S	Glass bottle/bags														STORE	STORE	
	VC1A 1.2-1.6	17/11 pm	S	Glass bottle/bags	4	-	-	-	-	-	-	-	-	-	-	-	-	STORE	STORE	
20	VC1A 1.2-1.6Z	17/11 pm	S	Glass bottle/bags	2	Hold												STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	

CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: Worley Parsons	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)	
OFFICE: N. Sydney	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact?	(Yes) No N/A
PROJECT: Caltex maintenance & redy	ALS QUOTE NO.:	Free ice / frozen ice bricks present upon receipt?	(Yes) No N/A
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle) COC: (1) 2 3 4 5 6 7	Random Sample Temperature on Receipt:	4.6 C
PROJECT MANAGER: Al; Watters	CONTACT PH: 0422763387 OF: 1 2 3 4 5 6 7	Other comment:	
SAMPLER: Nick Hennafor	SAMPLER MOBILE: 0402365423		
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed):			
Email Invoice to (will default to PM if no other addresses are listed):			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	Jon/Stephen ALS Sydney. DATE/TIME: 17/11/9 17:20	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).												Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pHf & pHfox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
10	UC3a 0-0.6		S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	
(21)	UC3a 0-0.6x		S	Glass bottle/bags	2	Hold												STORE	STORE	
11	UC3a 0.6-1.3		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
(22)	UC3a 0.6-1.3y		S	Glass bottle/bags	2	Hold												STORE	STORE	
12	UC3a 1.3-1.9		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
(23)	UC3a 1.3-1.9z		S	Glass bottle/bags	2	Hold												STORE	STORE	
13	UC3a 1.9-2.4		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
Not received	UC3b 0.5-09		S	Glass bottle/bags	3													STORE	STORE	
	UC3b 0-0.5x		S	Glass bottle/bags	4													STORE	STORE	
	UC3b 0-0.5x		S	Glass bottle/bags	2	Hold												STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
				TOTAL		30	30	30	30	18	6	6	6	6	6	30	30	?	?	

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

ES0917541

Uma Nagendiram

From: Charlie Pierce
Sent: Thursday, 19 November 2009 11:41 AM
To: Uma Nagendiram; Peter Donaghy; Frank Ferraro; Edwandy Fadjar; Alex Rossi
Cc: Jacob Waugh
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Dear Everyone,

The client has requested that we no longer test sample 001 and sample ~~002~~ 003 for the tests shown below. Please stop these tests immediately. If testing has been completed, please let me know.

Dear Frank

Can you confirm that:
VC3B0.5-0.9
VC3B0-0.5
VC3B0-0.5x

Were not received?

Kind Regards

Charlie Pierce
Laboratory Manager - Sydney
ALS Laboratory Group
Environmental Division
Sydney, Australia
Phone: + 61 2 8784 8555
Fax: + 61 2 8784 8500
Mobile: +61 0466309729
www.alsglobal.com

From: Hannaford, Nick (Sydney) [mailto:Nicholas.Hannaford@WorleyParsons.com]
Sent: Thursday, 19 November 2009 11:20 AM
To: Charlie Pierce
Cc: Watters, Ali (Sydney)
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Hi Charlie,

Please see the following amendments to the attached SRN below.

Lab ID	Our ID	Change
ES0917541-001 #1	VC1A 0-0.5	No longer require the following tests: EP090 (TBT) ← ES0917541 #4 EP131A (OC Pesticides) ✓ EP131B (PCBs) ✓ EP080-UT (TPH(C6-C9)/BTEX) ✓ ES0917541 #1 + #3 EP071SD (TPH C10-C36) ✓ EA150-H (Particle Sizing) ← ES0917542 (#1 + #2
		No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides)

ES0917541-003	VC2A 0-1.0	EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)

I also note that on the second copy of the COD form that you sent Ali it is stated that the following samples were not received:
VC3B0.5-0.9
VC3B0-0.5
VC3B0-0.5x

However on the first copy of the CoC these are given a lab ID. These samples are also missing from the SRN. Please advise.

Regards,

Nick Hannaford
Environmental Scientist
WorleyParsons
Tel: +61 2 8456 7357
Fax: +62 2 8923 6877
WorleyParsons Services Pty Ltd
Level 11, 141 Walker St
Nth Sydney NSW 2060
WorleyParsons | www.worleyparsons.com

From: Watters, Ali (Sydney)
Sent: Wednesday, November 18, 2009 2:47 PM
To: Hannaford, Nick (Sydney)
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

FYI

From: ALSE Sydney Aus [mailto:alse.sydney.aus@als.com.au]
Sent: Wednesday, 18 November 2009 2:39 PM
To: Watters, Ali (Sydney)
Subject: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

This e-mail has been automatically generated.

-- PLEASE DO NOT REPLY --

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES0917541**	Page	: 1 of 10
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 27-NOV-2009
Site	: ----		
		No. of samples received	: 23
Quote number	: SY/503/09	No. of samples analysed	: 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 Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

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*
Celine Conceicao	Spectroscopist	Inorganics
Edwandy Fadjar	Senior Organic Chemist	Organics
Hoa Nguyen	Inorganic Chemist	Inorganics

General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient 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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- **EG020T: Poor precision was obtained for Chromium on sample ES0917541 #6 due to sample heterogeneity. Results have been confirmed by re-extraction and reanalysis.**
- **EP071-SD: The result for sample VC3A 0-0.6 was confirmed by re-extraction and re-analysis.**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: VC1A 0-0.5	VC1A 0.5-1.2	VC2A 0-1.0	VC2A 0-1.0 DUP	VC2A 1.0-1.4
				Client sampling date / time: 17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00
				ES0917541-001	ES0917541-002	ES0917541-003	ES0917541-004	ES0917541-005
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**18.3**	**19.9**	**17.1**	**16.9**	**15.4**
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1.00	mg/kg	<1.00	<1.00	<1.00	<1.00	**15.0**
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	**0.1**
Chromium	7440-47-3	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	**14.5**
Copper	7440-50-8	1.0	mg/kg	**4.1**	**3.3**	<1.0	<1.0	<1.0
Cobalt	7440-48-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**3.1**
Lead	7439-92-1	1.0	mg/kg	**1.6**	**2.6**	<1.0	<1.0	**1.4**
Manganese	7439-96-5	10	mg/kg	<10	<10	<10	<10	<10
Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	**2.4**
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	**1.9**
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	**22.8**
Zinc	7440-66-6	1.0	mg/kg	**6.1**	**16.5**	**1.4**	**1.4**	**3.3**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	**0.71**	<0.01	<0.01	<0.01	<0.01
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	<4	<4	<4	<4	<4
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	<4	<4
Fluoranthene	206-44-0	4	µg/kg	<4	<4	<4	<4	<4
Pyrene	129-00-0	4	µg/kg	<4	<4	<4	<4	<4
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	<4	<4
Chrysene	218-01-9	4	µg/kg	<4	<4	<4	<4	<4
Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	<4	<4	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	<4	<4	<4
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<4	<4
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	<4	<4	<4	<4
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	<4
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	<4	<4
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: VC1A 0-0.5	VC1A 0.5-1.2	VC2A 0-1.0	VC2A 0-1.0 DUP	VC2A 1.0-1.4
				Client sampling date / time: 17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00
				ES0917541-001	ES0917541-002	ES0917541-003	ES0917541-004	ES0917541-005
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
^ Sum of PAHs	----	4	µg/kg	<4	<4	<4	<4	<4
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	**86.1**	**76.0**	**73.7**	**87.4**	**101**
Anthracene-d10	1719-06-8	0.1	%	**89.8**	**94.7**	**95.6**	**97.5**	**89.8**
4-Terphenyl-d14	1718-51-0	0.1	%	**85.2**	**89.3**	**98.2**	**99.1**	**76.5**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: VC2A 1.4-2.0	VC2A 2.0-2.3	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6
				Client sampling date / time: 17-NOV-2009 10:00	17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]
				ES0917541-006	ES0917541-007	ES0917541-008	ES0917541-009	ES0917541-010
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**25.6**	**23.4**	**21.3**	**20.4**	**24.0**
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1.00	mg/kg	**3.21**	<1.00	**1.18**	<1.00	**1.98**
Cadmium	7440-43-9	0.1	mg/kg	**0.1**	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	**24.4**	**3.1**	**3.4**	**1.7**	**5.0**
Copper	7440-50-8	1.0	mg/kg	**4.6**	**2.3**	**3.2**	**2.8**	**3.1**
Cobalt	7440-48-4	0.5	mg/kg	**0.7**	<0.5	<0.5	<0.5	<0.5
Lead	7439-92-1	1.0	mg/kg	**10.7**	**4.2**	**3.1**	<1.0	**9.0**
Manganese	7439-96-5	10	mg/kg	**12**	<10	<10	**34**	<10
Nickel	7440-02-0	1.0	mg/kg	**2.3**	<1.0	<1.0	<1.0	**1.3**
Selenium	7782-49-2	0.1	mg/kg	**0.3**	<0.1	<0.1	<0.1	**0.2**
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2.0	mg/kg	**6.2**	**3.0**	**2.6**	<2.0	**6.4**
Zinc	7440-66-6	1.0	mg/kg	**49.8**	**11.0**	**6.9**	**2.2**	**18.4**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	**0.55**	**0.04**	**0.03**	<0.01	**0.06**
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	----	----	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg	----	----	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg	----	----	<3	<3	**13**
C29 - C36 Fraction	----	5	mg/kg	----	----	<5	<5	**15**
^ C10 - C36 Fraction (sum)	----	3	mg/kg	----	----	----	----	**28**
C10 - C36 Fraction (sum)	----	3	mg/kg	----	----	<3	<3	----
EP080-SD: BTEX								
Benzene	71-43-2	0.2	mg/kg	----	----	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg	----	----	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	----	----	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	----	----	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	----	----	<0.2	<0.2	<0.2
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
alpha-BHC	319-84-6	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
beta-BHC	319-85-7	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
delta-BHC	319-86-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
4.4`-DDD	72-54-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
4.4`-DDE	72-55-9	0.50	µg/kg	----	----	<0.50	<0.50	<0.50

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: VC2A 1.4-2.0	VC2A 2.0-2.3	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6
				Client sampling date / time: 17-NOV-2009 10:00	17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]
				ES0917541-006	ES0917541-007	ES0917541-008	ES0917541-009	ES0917541-010
EP131A: Organochlorine Pesticides - Continued								
4.4`-DDT	50-29-3	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
^ DDT (total)	----	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Dieldrin	60-57-1	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
^ Endosulfan (sum)	115-29-7	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Endrin	72-20-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Heptachlor	76-44-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Heptachlor epoxide	1024-57-3	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
gamma-BHC	58-89-9	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Methoxychlor	72-43-5	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
cis-Chlordane	5103-71-9	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
trans-Chlordane	5103-74-2	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
^ Total Chlordane (sum)	----	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Oxychlordane	27304-13-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1016	12974-11-2	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1221	11104-28-2	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1232	11141-16-5	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1242	53469-21-9	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1248	12672-29-6	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1254	11097-69-1	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1260	11096-82-5	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	**5**	**5**	<5	**16**
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	**10**	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	**10**	**4**
Fluorene	86-73-7	4	µg/kg	**4**	<4	<4	**7**	<4
Phenanthrene	85-01-8	4	µg/kg	**42**	<4	<4	**29**	**14**
Anthracene	120-12-7	4	µg/kg	**9**	<4	<4	**4**	<4
Fluoranthene	206-44-0	4	µg/kg	**65**	<4	<4	**29**	**21**
Pyrene	129-00-0	4	µg/kg	**61**	<4	<4	**23**	**22**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: VC2A 1.4-2.0	VC2A 2.0-2.3	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6
				Client sampling date / time: 17-NOV-2009 10:00	17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]
				ES0917541-006	ES0917541-007	ES0917541-008	ES0917541-009	ES0917541-010
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benz(a)anthracene	56-55-3	4	µg/kg	**39**	<4	<4	**14**	**14**
Chrysene	218-01-9	4	µg/kg	**31**	<4	<4	**14**	**12**
Benzo(b)fluoranthene	205-99-2	4	µg/kg	**44**	<4	<4	**15**	**16**
Benzo(k)fluoranthene	207-08-9	4	µg/kg	**19**	<4	<4	**6**	**7**
Benzo(e)pyrene	192-97-2	4	µg/kg	**17**	<4	<4	**8**	**9**
Benzo(a)pyrene	50-32-8	4	µg/kg	**40**	<4	<4	**12**	**15**
Perylene	198-55-0	4	µg/kg	**8**	<4	<4	<4	**7**
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	**29**	<4	<4	**10**	**13**
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	**12**	<4	<4	<4	<4
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	**23**	<4	<4	**9**	**12**
Coronene	191-07-1	5	µg/kg	**7**	<5	<5	<5	**7**
^ Sum of PAHs	----	4	µg/kg	**460**	**5**	**5**	**190**	**190**
EP080-SD: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	----	----	**91.3**	**109**	**102**
Toluene-D8	2037-26-5	0.1	%	----	----	**107**	**110**	**106**
4-Bromofluorobenzene	460-00-4	0.1	%	----	----	**95.5**	**104**	**103**
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	----	**72.9**	**42.4**	**46.6**
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	**72.9**	**42.2**	**45.1**
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	**75.3**	**72.7**	**108**	**82.9**	**105**
Anthracene-d10	1719-06-8	0.1	%	**82.9**	**80.1**	**87.2**	**87.5**	**85.1**
4-Terphenyl-d14	1718-51-0	0.1	%	**81.0**	**83.2**	**84.9**	**86.0**	**81.4**

Analytical Results

Sub-Matrix: SOIL			Client sample ID	VC3A 0.6-1.3	VC3A 1.3-1.9	VC3A 1.9-2.4	----	----
			Client sampling date / time	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]	----	----
Compound	CAS Number	LOR	Unit	ES0917541-011	ES0917541-012	ES0917541-013	----	----
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**22.6**	**21.6**	**22.2**	----	----
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	----	----
Arsenic	7440-38-2	1.00	mg/kg	**2.34**	<1.00	**10.1**	----	----
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
Chromium	7440-47-3	1.0	mg/kg	**2.8**	**3.0**	**2.3**	----	----
Copper	7440-50-8	1.0	mg/kg	**1.9**	**2.6**	<1.0	----	----
Cobalt	7440-48-4	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Lead	7439-92-1	1.0	mg/kg	**3.4**	**9.0**	**1.4**	----	----
Manganese	7439-96-5	10	mg/kg	<10	<10	<10	----	----
Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	<1.0	----	----
Selenium	7782-49-2	0.1	mg/kg	**0.1**	<0.1	**0.2**	----	----
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
Vanadium	7440-62-2	2.0	mg/kg	**2.5**	**2.1**	**3.9**	----	----
Zinc	7440-66-6	1.0	mg/kg	**5.8**	**30.1**	**2.3**	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	**0.03**	**0.04**	<0.01	----	----
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	**9**	**5**	<5	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	----	----
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	----	----
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	----	----
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	----	----
Phenanthrene	85-01-8	4	µg/kg	<4	<4	<4	----	----
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	----	----
Fluoranthene	206-44-0	4	µg/kg	<4	**4**	<4	----	----
Pyrene	129-00-0	4	µg/kg	<4	**5**	<4	----	----
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	----	----
Chrysene	218-01-9	4	µg/kg	<4	<4	<4	----	----
Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	<4	<4	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	<4	----	----
Perylene	198-55-0	4	µg/kg	<4	<4	<4	----	----
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	<4	<4	----	----
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	----	----
Coronene	191-07-1	5	µg/kg	<5	<5	<5	----	----

Analytical Results

Sub-Matrix: SOIL				Client sample ID	VC3A 0.6-1.3	VC3A 1.3-1.9	VC3A 1.9-2.4	----	----
				Client sampling date / time	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]	----	----
Compound	CAS Number	LOR	Unit		ES0917541-011	ES0917541-012	ES0917541-013	----	----
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Sum of PAHs	----	4	µg/kg		**9**	**15**	<4	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		**79.9**	**112**	**83.1**	----	----
Anthracene-d10	1719-06-8	0.1	%		**86.6**	**83.0**	**85.9**	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		**83.1**	**80.2**	**83.3**	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP080-SD: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	74.7	127
Toluene-D8	2037-26-5	74.8	129
4-Bromofluorobenzene	460-00-4	75.3	127
EP131S: OC Pesticide Surrogate			
Dibromo-DDE	21655-73-2	10	136
EP131T: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	10	164
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	30	115
Anthracene-d10	1719-06-8	27	133
4-Terphenyl-d14	1718-51-0	18	137

Hi All,

The following changes have been made to the below batches as per the client request.

NEWCASTLE PSD BATCH
ES0917542 – Cancelled analysis on samples **1 and 2** in this batch

BRISBANE TBT AND TOC BATCH
ES0917544 – Cancelled TBT on samples **1 and 3**. **TOC is still needed for these samples.**

SYDNEY BATCH
ES0917541 – Cancelled UT OC/PCB as well as Low Level TPH and BTEX on samples **1 and 3**. **This means metals, mercury and Sediment PAH's still need to continue on these samples.**

Jacob Waugh
Production Co-ordinator
ALS Laboratory Group
Environmental Division
Sydney, Australia
Phone: +61 2 8784 8555
Fax: +61 2 8784 8500
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From: Charlie Pierce
Sent: Thursday, 19 November 2009 11:41 AM
To: Uma Nagendiram; Peter Donaghy; Frank Ferraro; Edwandy Fadjar; Alex Rossi
Cc: Jacob Waugh
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Dear Everyone,

The client has requested that we no longer test sample 001 and sample 002 for the tests shown below. Please stop these tests immediately. If testing has been completed, please let me know.

Dear Frank

Can you confirm that:
VC3B0.5-0.9
VC3B0-0.5
VC3B0-0.5x

Were not received?

Kind Regards

Charlie Pierce
Laboratory Manager - Sydney
ALS Laboratory Group
Environmental Division
Sydney, Australia
Phone: + 61 2 8784 8555
Fax: + 61 2 8784 8500
Mobile: +61 0466309729
www.alsglobal.com

From: Hannaford, Nick (Sydney) [mailto:Nicholas.Hannaford@WorleyParsons.com]
Sent: Thursday, 19 November 2009 11:20 AM
To: Charlie Pierce
Cc: Watters, Ali (Sydney)
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Hi Charlie,

Please see the following amendments to the attached SRN below.

Lab ID	Our ID	Change
ES0917541-001	VC1A 0-0.5	No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides) EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)
ES0917541-003	VC2A 0-1.0	No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides) EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)

I also note that on the second copy of the COD form that you sent Ali it is stated that the following samples were not received:
VC3B0.5-0.9
VC3B0-0.5
VC3B0-0.5x

However on the first copy of the CoC these are given a lab ID. These samples are also missing from the SRN. Please advise.

Regards,

Nick Hannaford
Environmental Scientist
WorleyParsons
Tel: +61 2 8456 7357
Fax: +62 2 8923 6877
WorleyParsons Services Pty Ltd
Level 11, 141 Walker St
Nth Sydney NSW 2060
WorleyParsons | www.worleyparsons.com

Right-click here to

From: Watters, Ali (Sydney)
Sent: Wednesday, November 18, 2009 2:47 PM
To: Hannaford, Nick (Sydney)
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

FYI

Right-click here to

From: ALSE Sydney Aus [mailto:alse.sydney.aus@als.com.au]
Sent: Wednesday, 18 November 2009 2:39 PM
To: Watters, Ali (Sydney)
Subject: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

This e-mail has been automatically generated.

-- PLEASE DO NOT REPLY --

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protection throughout their company resources. However, ALS cannot guarantee any attachment is virus free and will not be held liable for any disruption to business. It is highly recommended that all attachments received are scanned prior to opening.

QUALITY CONTROL REPORT

Work Order	: **ES0917541**	Page	: 1 of 11
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 27-NOV-2009
Order number	: ----		
		No. of samples received	: 23
Quote number	: SY/503/09	No. of samples analysed	: 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

This document is issued in accordance with NATA accreditation requirements.

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*
Celine Conceicao	Spectroscopist	Inorganics
Edwandy Fadjar	Senior Organic Chemist	Organics
Hoa Nguyen	Inorganic Chemist	Inorganics

General Comments

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

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (QC Lot: 1168181)									
EB0918142-001	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	30.9	30.4	1.9	0% - 20%
EP0906633-009	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	27.5	27.2	1.0	0% - 20%
EA055: Moisture Content (QC Lot: 1168182)									
ES0917541-005	VC2A 1.0-1.4	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	15.4	16.8	8.9	0% - 50%
ES0917612-005	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	13.1	12.0	8.9	0% - 50%
EA055: Moisture Content (QC Lot: 1168642)									
ES0917541-008	VC2A 2.3-2.6	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	21.3	21.4	0.5	0% - 20%
ES0917644-004	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	13.8	12.6	9.5	0% - 50%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 1166950)									
ES0917498-001	Anonymous	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	0.1	<0.1	0.0	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	0.8	0.6	34.0	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	0.6	0.4	28.1	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	6.5	5.6	15.1	0% - 50%
		EG020-SD: Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	0.0	No Limit
		EG020-SD: Chromium	7440-47-3	1.0	mg/kg	65.8	56.0	16.0	0% - 20%
		EG020-SD: Copper	7440-50-8	1.0	mg/kg	102	87.3	15.2	0% - 20%
		EG020-SD: Lead	7439-92-1	1.0	mg/kg	163	142	13.9	0% - 20%
		EG020-SD: Nickel	7440-02-0	1.0	mg/kg	10.5	8.5	21.4	No Limit
		EG020-SD: Zinc	7440-66-6	1.0	mg/kg	346	301	14.0	0% - 20%
		EG020-SD: Arsenic	7440-38-2	1.00	mg/kg	16.2	14.4	12.0	0% - 50%
		EG020-SD: Manganese	7439-96-5	10	mg/kg	99	161	47.5	0% - 50%
		EG020-SD: Vanadium	7440-62-2	2.0	mg/kg	37.7	33.2	12.7	0% - 50%
ES0917541-006	VC2A 1.4-2.0	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	0.1	0.2	0.0	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	0.3	0.6	68.1	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	0.2	0.0	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	0.7	1.4	60.6	No Limit
		EG020-SD: Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	0.0	No Limit
		EG020-SD: Chromium	7440-47-3	1.0	mg/kg	24.4	32.9	# 29.5	0% - 20%
		EG020-SD: Copper	7440-50-8	1.0	mg/kg	4.6	9.0	64.0	No Limit
		EG020-SD: Lead	7439-92-1	1.0	mg/kg	10.7	17.1	45.9	0% - 50%
		EG020-SD: Nickel	7440-02-0	1.0	mg/kg	2.3	4.2	59.9	No Limit
		EG020-SD: Zinc	7440-66-6	1.0	mg/kg	49.8	49.4	0.8	0% - 20%
		EG020-SD: Arsenic	7440-38-2	1.00	mg/kg	3.21	9.25	96.9	No Limit
		EG020-SD: Manganese	7439-96-5	10	mg/kg	12	21	58.2	No Limit
		EG020-SD: Vanadium	7440-62-2	2.0	mg/kg	6.2	11.2	57.3	No Limit

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 (%)*
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1166949)									
ES0917498-001	Anonymous	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	1.91	1.99	4.3	0% - 20%
ES0917541-006	VC2A 1.4-2.0	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.55	0.47	16.8	0% - 20%
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1166947)									
ES0917541-001	VC1A 0-0.5	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	<5	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1169136)									
ES0917541-008	VC2A 2.3-2.6	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD: BTEX (QC Lot: 1169136)									
ES0917541-008	VC2A 2.3-2.6	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP131A: Organochlorine Pesticides (QC Lot: 1168438)									
ES0917541-008	VC2A 2.3-2.6	EP131A: Aldrin	309-00-2	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-BHC	319-84-6	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-BHC	319-85-7	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: delta-BHC	319-86-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDD	72-54-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDE	72-55-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDT	50-29-3	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: DDT (total)	----	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Dieldrin	60-57-1	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-Endosulfan	959-98-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-Endosulfan	33213-65-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan sulfate	1031-07-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan (sum)	115-29-7	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin	72-20-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin aldehyde	7421-93-4	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin ketone	53494-70-5	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor	76-44-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor epoxide	1024-57-3	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: gamma-BHC	58-89-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Methoxychlor	72-43-5	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: cis-Chlordane	5103-71-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: trans-Chlordane	5103-74-2	0.50	µg/kg	<0.50	<0.50	0.0	No Limit

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 (%)*
EP131A: Organochlorine Pesticides (QC Lot: 1168438) - continued									
ES0917541-008	VC2A 2.3-2.6	EP131A: Total Chlordane (sum)	----	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
EP131B: Polychlorinated Biphenyls (as Aroclors) (QC Lot: 1168439)									
ES0917541-008	VC2A 2.3-2.6	EP131B: Total Polychlorinated biphenyls	----	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1016	12974-11-2	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1221	11104-28-2	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1232	11141-16-5	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1242	53469-21-9	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1248	12672-29-6	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1254	11097-69-1	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1260	11096-82-5	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1166946)									
ES0917541-001	VC1A 0-0.5	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.0	No Limit
ES0917541-011	VC3A 0.6-1.3	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	5	0.0	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	5	28.6	No Limit

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 (%)*
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1166946) - continued									
ES0917541-011	VC3A 0.6-1.3	EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	4	0.0	No Limit
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	9	21	81.8	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	9	7	24.9	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.0	No Limit

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1166950)								
EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	----	----	----	----
EG020-SD: Arsenic	7440-38-2	1.0	mg/kg	<1.00	13.1 mg/kg	99.2	70	130
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	2.76 mg/kg	95.7	70	130
EG020-SD: Chromium	7440-47-3	1.0	mg/kg	<1.0	60.9 mg/kg	97.9	70	130
EG020-SD: Copper	7440-50-8	1.0	mg/kg	<1.0	54.7 mg/kg	93.6	70	130
EG020-SD: Cobalt	7440-48-4	10	mg/kg	<10.0	24.5 mg/kg	104	70	130
EG020-SD: Lead	7439-92-1	1.0	mg/kg	<1.0	54.8 mg/kg	95.3	70	130
EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	136 mg/kg	90.6	70	130
EG020-SD: Nickel	7440-02-0	1.0	mg/kg	<1.0	55.2 mg/kg	95.0	70	130
EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	5.6 mg/kg	96.8	70	130
EG020-SD: Vanadium	7440-62-2	2	mg/kg	<2.0	34 mg/kg	91.3	70	130
EG020-SD: Zinc	7440-66-6	1.0	mg/kg	<1.0	104 mg/kg	96.9	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1166949)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.090 mg/kg	104	74.2	126
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1166947)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	5 mg/kg	88.0	75.2	116
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	5 mg/kg	93.0	75.3	113
EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	5 mg/kg	111	72.6	117
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1169136)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	26 mg/kg	114	68.4	128
EP080-SD: BTEX (QCLot: 1169136)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	120	67.5	125
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	1 mg/kg	87.6	69	122
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	1 mg/kg	104	65.3	126
EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	2.0 mg/kg	81.8	66.5	124
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	1 mg/kg	116	66.7	123
EP131A: Organochlorine Pesticides (QCLot: 1168438)								
EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	5 µg/kg	110	31.7	140
EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	5 µg/kg	124	24.5	150
EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	5 µg/kg	110	36.9	139
EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	5 µg/kg	111	38.2	137
EP131A: 4.4`-DDD	72-54-8	0.5	µg/kg	<0.50	5 µg/kg	128	42.5	141

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP131A: Organochlorine Pesticides (QCLot: 1168438) - continued								
EP131A: 4.4`-DDE	72-55-9	0.5	µg/kg	<0.50	5 µg/kg	65.9	34.8	140
EP131A: 4.4`-DDT	50-29-3	0.5	µg/kg	<0.50	5 µg/kg	94.8	38	143
EP131A: DDT (total)	----	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	5 µg/kg	111	43.2	134
EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	5 µg/kg	99.5	23.7	139
EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	5 µg/kg	105	35.8	138
EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	5 µg/kg	90.6	7.45	158
EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	5 µg/kg	95.2	21.6	162
EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	5 µg/kg	88.3	19.3	131
EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	5 µg/kg	100	17.9	141
EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	5 µg/kg	124	31	153
EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	5 µg/kg	108	34.3	138
EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	5 µg/kg	98.0	18.6	146
EP131A: gamma-BHC	58-89-9	0.5	µg/kg	<0.50	5 µg/kg	118	30.7	145
EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	5 µg/kg	95.7	15	157
EP131A: cis-Chlordane	5103-71-9	0.5	µg/kg	<0.50	5 µg/kg	138	22.3	145
EP131A: trans-Chlordane	5103-74-2	0.5	µg/kg	<0.50	5 µg/kg	107	42.4	139
EP131A: Total Chlordane (sum)	----	0.5	µg/kg	<0.50	----	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 1168439)								
EP131B: Total Polychlorinated biphenyls	----	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1016	12974-11-2	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1221	11104-28-2	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1232	11141-16-5	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1242	53469-21-9	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1248	12672-29-6	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1254	11097-69-1	5	µg/kg	<5.0	50 µg/kg	112	61.3	121
EP131B: Aroclor 1260	11096-82-5	5	µg/kg	<5.0	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1166946)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	91.6	----	----
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	93.2	----	----
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	86.2	----	----
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	109	----	----
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	93.1	----	----
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	88.8	----	----
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	86.7	----	----
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	87.3	----	----
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	87.5	----	----
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	86.3	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1166946) - continued								
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	86.6	----	----
EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	25 µg/kg	99.2	----	----
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	78.3	----	----
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	75.3	----	----
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	84.5	----	----
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	53.2	----	----
EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	85.0	----	----
EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	86.9	----	----
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	79.2	----	----
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	71.0	----	----
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1166950)							
ES0917498-001	Anonymous	EG020-SD: Arsenic	7440-38-2	50 mg/kg	94.9	70	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	97.0	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	85.8	70	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	81.9	70	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	77.8	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	96.0	70	130
		EG020-SD: Zinc	7440-66-6	250 mg/kg	75.4	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1166949)							
ES0917498-001	Anonymous	EG035T-LL: Mercury	7439-97-6	0.50 mg/kg	117	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1166947)							
ES0917541-001	VC1A 0-0.5	EP071-SD: C10 - C14 Fraction	----	19.75 mg/kg	86.3	70	130
		EP071-SD: C15 - C28 Fraction	----	87.25 mg/kg	89.8	70	130
		EP071-SD: C29 - C36 Fraction	----	60 mg/kg	108	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1169136)							
ES0917541-008	VC2A 2.3-2.6	EP080-SD: C6 - C9 Fraction	----	26 mg/kg	106	70	130
EP080-SD: BTEX (QCLot: 1169136)							
ES0917541-008	VC2A 2.3-2.6	EP080-SD: Benzene	71-43-2	2.5 mg/kg	76.8	70	130
		EP080-SD: Toluene	108-88-3	2.5 mg/kg	95.6	70	130
		EP080-SD: Ethylbenzene	100-41-4	2.5 mg/kg	72.9	70	130
		EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	77.8	70	130
		EP080-SD: ortho-Xylene	95-47-6	2.5 mg/kg	74.3	70	130
EP131A: Organochlorine Pesticides (QCLot: 1168438)							
ES0917541-008	VC2A 2.3-2.6	EP131A: Aldrin	309-00-2	5 µg/kg	90.9	31.7	140
		EP131A: alpha-BHC	319-84-6	5 µg/kg	82.6	24.5	150
		EP131A: beta-BHC	319-85-7	5 µg/kg	88.2	36.9	139
		EP131A: delta-BHC	319-86-8	5 µg/kg	84.0	38.2	137
		EP131A: 4.4`-DDD	72-54-8	5 µg/kg	130	42.5	141
		EP131A: 4.4`-DDE	72-55-9	5 µg/kg	64.4	34.8	140
		EP131A: 4.4`-DDT	50-29-3	5 µg/kg	116	38	143
		EP131A: Dieldrin	60-57-1	5 µg/kg	88.9	43.2	134
		EP131A: alpha-Endosulfan	959-98-8	5 µg/kg	79.8	23.7	139
		EP131A: beta-Endosulfan	33213-65-9	5 µg/kg	94.4	35.8	138
		EP131A: Endosulfan sulfate	1031-07-8	5 µg/kg	108	7.45	158

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP131A: Organochlorine Pesticides (QCLot: 1168438) - continued							
ES0917541-008	VC2A 2.3-2.6	EP131A: Endrin	72-20-8	5 µg/kg	73.1	21.6	162
		EP131A: Endrin aldehyde	7421-93-4	5 µg/kg	61.7	19.3	131
		EP131A: Endrin ketone	53494-70-5	5 µg/kg	101	17.9	141
		EP131A: Heptachlor	76-44-8	5 µg/kg	82.5	31	153
		EP131A: Heptachlor epoxide	1024-57-3	5 µg/kg	79.2	34.3	138
		EP131A: Hexachlorobenzene (HCB)	118-74-1	5 µg/kg	67.3	18.6	146
		EP131A: gamma-BHC	58-89-9	5 µg/kg	89.3	30.7	145
		EP131A: Methoxychlor	72-43-5	5 µg/kg	104	15	157
		EP131A: cis-Chlordane	5103-71-9	5 µg/kg	117	22.3	145
		EP131A: trans-Chlordane	5103-74-2	5 µg/kg	84.1	42.4	139
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 1168439)							
ES0917541-008	VC2A 2.3-2.6	EP131B: Aroclor 1254	11097-69-1	50 µg/kg	65.8	61.3	121
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1166946)							
ES0917541-001	VC1A 0-0.5	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	78.5	70	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	84.7	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	89.6	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	105	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	95.5	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	97.6	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	89.0	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	113	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	108	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	114	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	96.5	70	130
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	25 µg/kg	116	70	130
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	81.5	70	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	82.0	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	102	70	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	74.9	70	130
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	25 µg/kg	114	70	130
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	25 µg/kg	112	70	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	110	70	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	86.4	70	130

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES0917541**	Page	: 1 of 6
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 27-NOV-2009
Order number	: ----		
		No. of samples received	: 23
Quote number	: SY/503/09	No. of samples analysed	: 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
EA055: Moisture Content								
Soil Glass Jar - Unpreserved								
VC1A 0-0.5,	VC1A 0.5-1.2,	**17-NOV-2009**	**----**	----	----	**19-NOV-2009**	24-NOV-2009	✓
VC2A 0-1.0,	VC2A 0-1.0 DUP,							
VC2A 1.0-1.4,	VC2A 1.4-2.0,							
VC2A 2.0-2.3,	VC2A 2.3-2.6,							
VC1A 1.2-1.6,	VC3A 0-0.6,							
VC3A 0.6-1.3,	VC3A 1.3-1.9,							
VC3A 1.9-2.4								
EG020-SD: Total Metals in Sediments by ICPMS								
Soil Glass Jar - Unpreserved								
VC1A 0-0.5,	VC1A 0.5-1.2,	**17-NOV-2009**	**18-NOV-2009**	15-DEC-2009	✓	**19-NOV-2009**	16-MAY-2010	✓
VC2A 0-1.0,	VC2A 0-1.0 DUP,							
VC2A 1.0-1.4,	VC2A 1.4-2.0,							
VC2A 2.0-2.3,	VC2A 2.3-2.6,							
VC1A 1.2-1.6,	VC3A 0-0.6,							
VC3A 0.6-1.3,	VC3A 1.3-1.9,							
VC3A 1.9-2.4								
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved								
VC1A 0-0.5,	VC1A 0.5-1.2,	**17-NOV-2009**	**18-NOV-2009**	15-DEC-2009	✓	**19-NOV-2009**	15-DEC-2009	✓
VC2A 0-1.0,	VC2A 0-1.0 DUP,							
VC2A 1.0-1.4,	VC2A 1.4-2.0,							
VC2A 2.0-2.3,	VC2A 2.3-2.6,							
VC1A 1.2-1.6,	VC3A 0-0.6,							
VC3A 0.6-1.3,	VC3A 1.3-1.9,							
VC3A 1.9-2.4								

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
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
Soil Glass Jar - Unpreserved								
VC2A 2.3-2.6,	VC1A 1.2-1.6,	**17-NOV-2009**	**18-NOV-2009**	01-DEC-2009	✓	**19-NOV-2009**	28-DEC-2009	✓
VC3A 0-0.6								
Soil Glass Jar - Unpreserved								
VC2A 2.3-2.6,	VC1A 1.2-1.6,	**17-NOV-2009**	**20-NOV-2009**	01-DEC-2009	✓	**23-NOV-2009**	01-DEC-2009	✓
VC3A 0-0.6								
EP080-SD: BTEX								
Soil Glass Jar - Unpreserved								
VC2A 2.3-2.6,	VC1A 1.2-1.6,	**17-NOV-2009**	**20-NOV-2009**	01-DEC-2009	✓	**23-NOV-2009**	01-DEC-2009	✓
VC3A 0-0.6								
EP131A: Organochlorine Pesticides								
Soil Glass Jar - Unpreserved								
VC2A 2.3-2.6,	VC1A 1.2-1.6,	**17-NOV-2009**	**19-NOV-2009**	01-DEC-2009	✓	**24-NOV-2009**	29-DEC-2009	✓
VC3A 0-0.6								
EP131B: Polychlorinated Biphenyls (as Aroclors)								
Soil Glass Jar - Unpreserved								
VC2A 2.3-2.6,	VC1A 1.2-1.6,	**17-NOV-2009**	**19-NOV-2009**	01-DEC-2009	✓	**24-NOV-2009**	29-DEC-2009	✓
VC3A 0-0.6								
EP132B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved								
VC1A 0-0.5,	VC1A 0.5-1.2,	**17-NOV-2009**	**18-NOV-2009**	01-DEC-2009	✓	**20-NOV-2009**	28-DEC-2009	✓
VC2A 0-1.0,	VC2A 0-1.0 DUP,							
VC2A 1.0-1.4,	VC2A 1.4-2.0,							
VC2A 2.0-2.3,	VC2A 2.3-2.6,							
VC1A 1.2-1.6,	VC3A 0-0.6,							
VC3A 0.6-1.3,	VC3A 1.3-1.9,							
VC3A 1.9-2.4								

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	6	57	**10.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	2	13	**15.4**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	6	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	2	16	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	2	18	**11.1**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	3	**33.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	5	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	**16.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	13	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	6	**16.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	16	**6.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	5	**20.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	**16.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	13	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	6	**16.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	16	**6.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	5	**20.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	**16.7**	**5.0**	✓	ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	13	**7.7**	**5.0**	✓	ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	6	**16.7**	**5.0**	✓	ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	16	**6.3**	**5.0**	✓	ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	18	**5.6**	**5.0**	✓	ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	3	**33.3**	**5.0**	✓	ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	5	**20.0**	**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 (1999) Schedule B(3) (Method 102)
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 Mercury by FIMS (Low Level)	EG035T-LL	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3)
TPH - Semivolatile Fraction	EP071-SD	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 504)
TPH Volatiles/BTEX in Sediments	EP080-SD	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 501)
Organochlorine Pesticides (Ultra-trace)	EP131A	SOIL	USEPA Method 3640 (GPC cleanup),3620 (Florisil), 8081/8082 (GC/uECD/uECD) This technique is compliant with NEPM (1999) Schedule B(3) (Method 504)
PCB's (Ultra-trace)	EP131B	SOIL	USEPA Method 3640 (GPC cleanup),3620 (Florisil), 8081/8082 (GC/uECD/uECD) This technique is compliant with NEPM (1999) Schedule B(3) (Method 504)
PAHs in Sediments by GCMS(SIM)	EP132B-SD	SOIL	8270 GCMS Capillary column, SIM mode using large volume programmed temperature vaporisation injection.

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)
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids/ Sample Cleanup	ORG17A-UTP	SOIL	In-house, Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. Samples are extracted, concentrated (by KD) and exchanged into an appropriate solvent for GPC and florisil cleanup as required.
Tumbler Extraction of Solids for LVI (Non-concentrating)	ORG17D	SOIL	In house: 10g of sample, Na2SO4 and surrogate are extracted with 50mL 1:1 DCM/Acetone by end over end tumbling. An aliquot is concentrated by nitrogen blowdown to a reduced volume for analysis if required.

Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EG020-SD: Total Metals in Sediments by ICPMS	ES0917541-006	VC2A 1.4-2.0	**Chromium**	7440-47-3	29.5 %	0-20%	**RPD exceeds LOR based limits**

- **For all matrices, no Method Blank value 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.

- **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.**

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **ES0917541**		
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 3
Order number	: ----		
C-O-C number	: ----	Quote number	: ES2009WORPAR0232 (SY/503/09)
Site	: ----		
Sampler	: NH	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 17-NOV-2009	Issue Date	: 19-NOV-2009 14:47
Client Requested Due Date	: 27-NOV-2009	Scheduled Reporting Date	: **27-NOV-2009**

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 4.6'C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 23
Sercurity Seal	: Intact.	No. of samples analysed	: 13

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.
- OC/PCB/TPH/BTEX CANCELLED FOR SAMPLES 1 & 3 AS PER Nick Hannaford ON 19/11/09
- **Samples received in appropriately pretreated and preserved containers.**
- **Sample(s) have been received within recommended holding times.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- **Sample UC3b 0.5-0.9, UC3b 0-0.5 and UC3b 0-0.5x not received by ALS Sydney and this applies to batch ES0917542, ES0917543 and ES0917544.**
- **This batch is split into ES0917542 for PSD, ES0917543 for Ph FOX and ES0917544 for TBT and TOC.**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EG020-SD Total Metals in Sediments by ICPMS (NODG)	SOIL - EG035T-LL Total Mercury by FIMS - Low Level	SOIL - EP071 - SD TPH ultra trace in sediments	SOIL - EP080-SD TPH(V)/BTEX in Sediments	SOIL - EP131A OC Pesticides (Ultratrace)	SOIL - EP131B PCB's (Ultratrace)
ES0917541-001	17-NOV-2009 10:00	VC1A 0-0.5		✓	✓	✓				
ES0917541-002	17-NOV-2009 10:00	VC1A 0.5-1.2		✓	✓	✓				
ES0917541-003	17-NOV-2009 10:00	VC2A 0-1.0		✓	✓	✓				
ES0917541-004	17-NOV-2009 10:00	VC2A 0-1.0 DUP		✓	✓	✓				
ES0917541-005	17-NOV-2009 10:00	VC2A 1.0-1.4		✓	✓	✓				
ES0917541-006	17-NOV-2009 10:00	VC2A 1.4-2.0		✓	✓	✓				
ES0917541-007	17-NOV-2009 10:00	VC2A 2.0-2.3		✓	✓	✓				
ES0917541-008	[17-NOV-2009]	VC2A 2.3-2.6		✓	✓	✓	✓	✓	✓	✓
ES0917541-009	[17-NOV-2009]	VC1A 1.2-1.6		✓	✓	✓	✓	✓	✓	✓
ES0917541-010	[17-NOV-2009]	VC3A 0-0.6		✓	✓	✓	✓	✓	✓	✓
ES0917541-011	[17-NOV-2009]	VC3A 0.6-1.3		✓	✓	✓				
ES0917541-012	[17-NOV-2009]	VC3A 1.3-1.9		✓	✓	✓				
ES0917541-013	[17-NOV-2009]	VC3A 1.9-2.4		✓	✓	✓				
ES0917541-014	17-NOV-2009 10:00	VC1A 0-0.5X	✓							
ES0917541-015	17-NOV-2009 10:00	VC1A 0.5-1.2Y	✓							
ES0917541-016	17-NOV-2009 10:00	VC2A 0-1.0X	✓							
ES0917541-017	17-NOV-2009 10:00	VC2A 1.0-1.4Y	✓							
ES0917541-018	17-NOV-2009 10:00	VC2A 1.4-2.0Z	✓							
ES0917541-019	[17-NOV-2009]	VC2A 3-2.6X	✓							
ES0917541-020	[17-NOV-2009]	VC1A 1.2-1.6Z	✓							
ES0917541-021	[17-NOV-2009]	VC3A 0-0.6X	✓							
ES0917541-022	[17-NOV-2009]	VC3A 0.6-1.3Y	✓							
ES0917541-023	[17-NOV-2009]	VC3A 1.3-1.9Z	✓							

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - EP132B-SD Ultra-trace PAHs in Sediments
ES0917541-001	17-NOV-2009 10:00	VC1A 0-0.5	✓
ES0917541-002	17-NOV-2009 10:00	VC1A 0.5-1.2	✓
ES0917541-003	17-NOV-2009 10:00	VC2A 0-1.0	✓
ES0917541-004	17-NOV-2009 10:00	VC2A 0-1.0 DUP	✓
ES0917541-005	17-NOV-2009 10:00	VC2A 1.0-1.4	✓
ES0917541-006	17-NOV-2009 10:00	VC2A 1.4-2.0	✓
ES0917541-007	17-NOV-2009 10:00	VC2A 2.0-2.3	✓
ES0917541-008	[17-NOV-2009]	VC2A 2.3-2.6	✓
ES0917541-009	[17-NOV-2009]	VC1A 1.2-1.6	✓
ES0917541-010	[17-NOV-2009]	VC3A 0-0.6	✓
ES0917541-011	[17-NOV-2009]	VC3A 0.6-1.3	✓
ES0917541-012	[17-NOV-2009]	VC3A 1.3-1.9	✓
ES0917541-013	[17-NOV-2009]	VC3A 1.9-2.4	✓

Requested Deliverables

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com

CHAIN OF CUSTODY

ALS Laboratory: please tick →

Environmental Division
Sydney
Work Order
ES0917542

Telephone : +61-2-8784 8555

CLIENT: WORLEY PARSONS	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY	
OFFICE: N. SYDNEY	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact?	Yes / No / N/A
PROJECT: CALTEX MAINTENANCE DREDGING	ALS QUOTE NO.: SY/503/09	Free ice / frozen ice bricks present upo:	Yes / No / N/A
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Random Sample Temperature on Rec:	4.6 °C
PROJECT MANAGER: ALI WATTERS	CONTACT PH: 0422 763 386	Other comment:	
SAMPLER: ALICE HAMMERTON	SAMPLER MOBILE: 0402365428		
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed):			
Email Invoice to (will default to PM if no other addresses are listed):			
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	30/8 Stephen ALS Sydney DATE/TIME: 17/11/09 17:20	DATE/TIME:	DATE/TIME:

Subcon / Forward Lab / Split WO
Lab / Analysis: ALS Newcastle
Organised By / Date: 17/11/09 PSD only
Relinquished By / Date:
Connote / Courier:
WO No: ES0917542
Attach By PO / Internal Sheet:

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)
Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

ALS SYD BATCH ONLY: ES0917541
PSD: ES0917543
PAH for TOC/TBT: ES0917544

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W) CONTAINER INFORMATION						ANALYSIS REQUIRED													Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pHf & pHfox)	EA033 (chromium)	(TOC/Elutriate)	
1	VC1A 0-0.5	17/11 am	S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	STORE remaining sample - will select following review of results
	VC1A 0-0.5X	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
	VC1A 0.5-1.2	17/11 am	S	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	STORE	STORE	
	VC1A 0.5-1.2Y	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
2	VC2A 0-1.0	17/11 am	S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	
	VC2A 0-1.0 DUP	17/11 am	S	Glass bottle/bags	1	✓	✓	✓	✓	-	-	-	-	-	-	-	-	STORE	STORE	
	VC2A 0-1.0 X	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
	VC2A 1.0-1.4	17/11 am	S	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	[illegible]	✓	✓	STORE	STORE	
	VC2A 1.0-1.4Y	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
3	VC2A 1.4-2.0	17/11 am	S	Glass bottle/bags	4	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	STORE	STORE	
	VC2A 1.4-2.0Z	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
	VC2A 2.0-2.3	17/11 am	S	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	[illegible]	✓	✓	STORE	STORE	
4	VC2A 2.3-2.6	17/11 pm	S	Glass bottle/bags	4	-	-	-	-	-	-	-	-	-	-	-	-	STORE	STORE	
	VC2A 2.3-2.6X	17/11 pm	S	Glass bottle/bags	2	Hold												STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
5	VC1A 12-1.6	17/11 pm	S	Glass bottle/bags	4	-	-	-	-	-	-	-	-	-	-	-	-	STORE	STORE	
	VC1A 12-1.6Z	17/11 pm	S	Glass bottle/bags	2	Hold												STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	

CHAIN OF CUSTODY

ALS Laboratory please tick →

CLIENT: Wiley Parsons	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)
OFFICE: N Sydney	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):		Custody Seal Intact? Yes No N/A
PROJECT: Calga main levee drainage	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Free Ice / Frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER:			Random Sample Temperature on Receipt: 4.6 °C
PROJECT MANAGER: Al Watford	CONTACT PH: 0422763387		Other comment:
SAMPLER: Nick Hannaford	SAMPLER MOBILE: 0402365423	RELINQUISHED BY:	RECEIVED BY: Soo-Steph ASS Sydney.
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed):		DATE/TIME:	DATE/TIME: 17/11/9 17:20
Email Invoice to (will default to PM if no other addresses are listed):			

RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).													Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pHf & pHfox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions or samples requiring specific QC analysis etc.
6	UC3a 0-0.6		S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	
	UC3a 0-0.6x		S	Glass bottle/bags	2	Hold												STORE	STORE	
	UC3a 0.6-1.3		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
	UC3a 0.6-1.3x		S	Glass bottle/bags	2	Hold												STORE	STORE	
	UC3a 1.3-1.9		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
	UC3a 1.3-1.9x		S	Glass bottle/bags	2	Hold												STORE	STORE	
	UC3a 1.9-2.4		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
	UC3b 0.5-0.9		S	Glass bottle/bags														STORE	STORE	
7	UC3b 0-0.5		S	Glass bottle/bags														STORE	STORE	
	UC3b 0-0.5x		S	Glass bottle/bags	2	Hold												STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
						30	30	30	30	18	6	6	6	6	6	30	30	?	?	

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

CERTIFICATE OF ANALYSIS

Work Order	: **ES0917542**	Page	: 1 of 3
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 26-NOV-2009
Site	: ----		
		No. of samples received	: 6
Quote number	: SY/503/09	No. of samples analysed	: 4

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

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dianne Blane		Newcastle

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 insuffient 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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID	VC2A 1.4-2.0	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6	----
				Client sampling date / time	17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]	----
					ES0917542-003	ES0917542-004	ES0917542-005	ES0917542-006	----
EA150: Particle Sizing									
+75µm	----	1	%		**90**	**95**	**98**	**94**	----
+150µm	----	1	%		**84**	**88**	**98**	**88**	----
+300µm	----	1	%		**50**	**41**	**74**	**46**	----
+425µm	----	1	%		**12**	**9**	**32**	**19**	----
+600µm	----	1	%		<1	**1**	**10**	**10**	----
+1180µm	----	1	%		<1	<1	**1**	**5**	----
+2.36mm	----	1	%		<1	<1	<1	**2**	----
+4.75mm	----	1	%		<1	<1	<1	<1	----
+9.5mm	----	1	%		<1	<1	<1	<1	----
+19.0mm	----	1	%		<1	<1	<1	<1	----
+37.5mm	----	1	%		<1	<1	<1	<1	----
+75.0mm	----	1	%		<1	<1	<1	<1	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		**7**	**4**	**2**	**5**	----
Silt (2-60 µm)	----	1	%		**3**	**2**	<1	<1	----
Sand (0.06-2.00 mm)	----	1	%		**90**	**94**	**98**	**93**	----
Gravel (>2mm)	----	1	%		<1	<1	<1	**2**	----
Cobbles (>6cm)	----	1	%		<1	<1	<1	<1	----

Hi All,

The following changes have been made to the below batches as per the client request.

NEWCASTLE PSD BATCH
ES0917542 – Cancelled analysis on samples **1 and 2** in this batch

BRISBANE TBT AND TOC BATCH
ES0917544 – Cancelled TBT on samples **1 and 3**. **TOC is still needed for these samples.**

SYDNEY BATCH
ES0917541 – Cancelled UT OC/PCB as well as Low Level TPH and BTEX on samples **1 and 3**. **This means metals, mercury and Sediment PAH's still need to continue on these samples.**

Jacob Waugh
Production Co-ordinator
ALS Laboratory Group
Environmental Division
Sydney, Australia
Phone: +61 2 8784 8555
Fax: +61 2 8784 8500
www.alsglobal.com

From: Charlie Pierce
Sent: Thursday, 19 November 2009 11:41 AM
To: Uma Nagendiram; Peter Donaghy; Frank Ferraro; Edwandy Fadjar; Alex Rossi
Cc: Jacob Waugh
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Dear Everyone,

The client has requested that we no longer test sample 001 and sample 002 for the tests shown below. Please stop these tests immediately. If testing has been completed, please let me know.

Dear Frank

Can you confirm that:
VC3B0.5-0.9
VC3B0-0.5
VC3B0-0.5x

Were not received?

Kind Regards

Charlie Pierce
Laboratory Manager - Sydney
ALS Laboratory Group
Environmental Division
Sydney, Australia
Phone: + 61 2 8784 8555
Fax: + 61 2 8784 8500
Mobile: +61 0466309729
www.alsglobal.com

From: Hannaford, Nick (Sydney) [mailto:Nicholas.Hannaford@WorleyParsons.com]
Sent: Thursday, 19 November 2009 11:20 AM
To: Charlie Pierce
Cc: Watters, Ali (Sydney)
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Hi Charlie,

Please see the following amendments to the attached SRN below.

Lab ID	Our ID	Change
ES0917541-001	VC1A 0-0.5	No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides) EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)
ES0917541-003	VC2A 0-1.0	No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides) EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)

I also note that on the second copy of the COD form that you sent Ali it is stated that the following samples were not received:
VC3B0.5-0.9
VC3B0-0.5
VC3B0-0.5x

However on the first copy of the CoC these are given a lab ID. These samples are also missing from the SRN. Please advise.

Regards,

Nick Hannaford
Environmental Scientist
WorleyParsons
Tel: +61 2 8456 7357
Fax: +62 2 8923 6877
WorleyParsons Services Pty Ltd
Level 11, 141 Walker St
Nth Sydney NSW 2060
WorleyParsons | www.worleyparsons.com

Right-click here to

From: Watters, Ali (Sydney)
Sent: Wednesday, November 18, 2009 2:47 PM
To: Hannaford, Nick (Sydney)
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

FYI

Right-click here to

From: ALSE Sydney Aus [mailto:alse.sydney.aus@als.com.au]
Sent: Wednesday, 18 November 2009 2:39 PM
To: Watters, Ali (Sydney)
Subject: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

This e-mail has been automatically generated.

-- PLEASE DO NOT REPLY --

ALS acknowledges the risks associated with supplying electronic media reports based on client requirements. This type of format has the ability to embed viruses within the code and, as such, ALS has introduced a three tier layer of

protection throughout their company resources. However, ALS cannot guarantee any attachment is virus free and will not be held liable for any disruption to business. It is highly recommended that all attachments received are scanned prior to opening.

QUALITY CONTROL REPORT

Work Order	: **ES0917542**	Page	: 1 of 5
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 26-NOV-2009
Order number	: ----		
		No. of samples received	: 6
Quote number	: SY/503/09	No. of samples analysed	: 4

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

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dianne Blane		Newcastle

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 insuffient 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 Limit

- **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.

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**

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.**

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES0917542**	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 26-NOV-2009
Order number	: ----		
		No. of samples received	: 6
Quote number	: SY/503/09	No. of samples analysed	: 4

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
EA150: Particle Sizing								
Snap Lock Bag								
VC2A 1.4-2.0,	VC2A 2.3-2.6,	**17-NOV-2009**	**---**	---	----	**24-NOV-2009**	16-MAY-2010	✓
VC1A 1.2-1.6,	VC3A 0-0.6							
EA150: Soil Classification based on Particle Size								
Snap Lock Bag								
VC2A 1.4-2.0,	VC2A 2.3-2.6,	**17-NOV-2009**	**---**	---	----	**24-NOV-2009**	16-MAY-2010	✓
VC1A 1.2-1.6,	VC3A 0-0.6							

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:

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	

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
Particle Size Analysis (Sieving)	EA150	SOIL	Particle Size Analysis by Sieving according to AS1289.3.6.1 - 1995
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003

Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- **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.**

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **ES0917542**		
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----		
C-O-C number	: ----	Quote number	: ES2009WORPAR0223 (EN/034/09)
Site	: ----		
Sampler	: NH	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 17-NOV-2009	Issue Date	: 20-NOV-2009 17:53
Client Requested Due Date	: 27-NOV-2009	Scheduled Reporting Date	: **27-NOV-2009**

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 4.6'C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 6
Sercurity Seal	: Intact.	No. of samples analysed	: 4

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.
- Particle Size cancelled for Samples 1 & 2 as per Nick Hannaford on 19/11/09
- **Samples received in appropriately pretreated and preserved containers.**
- **PSD analysis will be conducted by ALS Newcastle.**
- **Sample(s) have been received within recommended holding times.**
- **This batch for PSD only and split from ES0917541**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	(On Hold) SOIL No analysis requested	SOIL - EA150H Particle Sizing by Hydrometer
ES0917542-001	17-NOV-2009 10:00	VC1A 0-0.5	✓	
ES0917542-002	17-NOV-2009 10:00	VC2A 0-1.0	✓	
ES0917542-003	17-NOV-2009 10:00	VC2A 1.4-2.0		✓
ES0917542-004	[17-NOV-2009]	VC2A 2.3-2.6		✓
ES0917542-005	[17-NOV-2009]	VC1A 1.2-1.6		✓
ES0917542-006	[17-NOV-2009]	VC3A 0-0.6		✓

Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParsons.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParsons.com
- Trigger - Subcontract Report (SUBCO)	Email	Nicholas.Hannaford@WorleyParsons.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com
- Trigger - Subcontract Report (SUBCO)	Email	ali.watters@worleyparsons.com

CHAIN OF CUSTODY

ALS Laboratory: please tick →

Environmental Division
Sydney
Work Order
ES0917543

Telephone : +61-2-8784 8555

CLIENT: WORLEY PARSONS	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY	
OFFICE: NSW SYDNEY	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact?	Yes / No / N/A
PROJECT: CALTEX MAINTENANCE DREDGING	ALS QUOTE NO.: SY/503/09	Free ice / frozen ice bricks present	Yes / No / N/A
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle) COC: (1) 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Random Sample Temperature on R	4.6 °C
PROJECT MANAGER: AU WATTERS	CONTACT PH: 0422 763 386	Other comment:	
SAMPLER: MICK HANNAFORD	SAMPLER MOBILE: 0402365428	RELINQUISHED BY:	RECEIVED BY: Joy Stephens ALS Sydney
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME:	DATE/TIME: 17/11/9 17:20
Email Reports to (will default to PM if no other addresses are listed):		RELINQUISHED BY:	RECEIVED BY:
Email Invoice to (will default to PM if no other addresses are listed):		DATE/TIME:	DATE/TIME:
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:			

Subcon / Forward Lab / Split WO
Lab / Analysis: ~~ALS Brisbane~~
Organised By / Date: PH fax only.
Relinquished By / Date: 17/11/9
Connote / Courier:
WO No: ES0917543
Attach By PO / Internal Sheet:

ALS SYD BATCH ONLY: ES0917541
PSD: ES0917542
TOC + TBT: ES0917544

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION			ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).													Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pHf & pHfox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	VC1A 0-0.5	12/11 am	S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	STORE remaining sample - will select following review of results
	VC1A 0-0.5X	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
2	VC1A 0.5-1.2	17/11 am	S	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	STORE	STORE	
	VC1A 0.5-1.2Y	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
3	VC2A 0-1.0	17/11 am	S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	
	VC2A 0-1.0 DUP	17/11 am	S	Glass bottle/bags	1	✓	✓	✓	✓	-	-	-	-	-	-	-	-	STORE	STORE	
	VC2A 0-1.0 X	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
4	VC2A 1.0-1.4	17/11 am	S	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	STORE	STORE	
	VC2A 1.0-1.4Y	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
5	VC2A 1.4-2.0	17/11 am	S	Glass bottle/bags	4	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	STORE	STORE	
	VC2A 1.4-2.0Z	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE	
6	VC2A 2.0-2.3	17/11 am	S	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	STORE	STORE	
7	VC2A 2.3-2.6	17/11 pm	S	Glass bottle/bags	4	-	-	-	-	-	-	-	-	-	-	-	-	STORE	STORE	
	VC2A 2.3-2.6X	17/11 pm	S	Glass bottle/bags	2	Hold												STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
8	VC1A 12-16	17/11 pm	S	Glass bottle/bags	4	-	-	-	-	-	-	-	-	-	-	-	-	STORE	STORE	
	VC1A 12-16Z	17/11 pm	S	Glass bottle/bags	2	Hold												STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	

CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: Worley Parsons	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):		FOR LABORATORY USE ONLY (Circle)
OFFICE: N Sydney			Custody Seal Intact? Yes / No / N/A
PROJECT: Caltex maintenance dredging	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt? Yes / No / N/A
ORDER NUMBER:		COC: (1) 2 3 4 5 6 7	Random Sample Temperature on Receipt: 4.6 C
PROJECT MANAGER: Al Watford	CONTACT PH: 0422763331	OF: 1 2 3 4 5 6 7	Other comment:
SAMPLER: Nick Hannaford	SAMPLER MOBILE: 0402365423	RELINQUISHED BY:	RECEIVED BY: Soo-Steph ALS Sydney.
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed):		DATE/TIME:	DATE/TIME: 17/11/9 17:20
Email Invoice to (will default to PM if no other addresses are listed):		RELINQUISHED BY:	RECEIVED BY:
		DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS (MATRIX: Solid(S) Water(W))			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price). Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).													Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pHf & pHfox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
9	UC3a 0-0.6		S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	
	UC3a 0-0.6x		S	Glass bottle/bags	2	Hold												STORE	STORE	
10	UC3a 0.6-1.3		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
	UC3a 0.6-1.3y		S	Glass bottle/bags	2	Hold												STORE	STORE	
11	UC3a 1.3-1.9		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
12	UC3a 1.3-1.9z		S	Glass bottle/bags	2	Hold												STORE	STORE	
	UC3a 1.9-2.4		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
Not received	UC3bo-0.5-09		S	Glass bottle/bags	3													STORE	STORE	
	UC3bo-0.5x		S	Glass bottle/bags	2													STORE	STORE	
	UC3bo-0.5z		S	Glass bottle/bags	2	Hold												STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
						30	30	30	30	18	6	6	6	6	6	30	30	?	?	

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

CERTIFICATE OF ANALYSIS

Work Order	: **ES0917543**	Page	: 1 of 5
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 23-NOV-2009
Site	: ----		
		No. of samples received	: 12
Quote number	: EN/034/09	No. of samples analysed	: 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 Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

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*
Kim McCabe	Senior Inorganic Chemist	Inorganics

General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient 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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- **Analysis conducted by ALS Brisbane, NATA Site No. 818.**
- **pH FOX Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Vigorous; 4 - Very Vigorous**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: VC1A 0-0.5	VC1A 0.5-1.2	VC2A 0-1.0	VC2A 1.0-1.4	VC2A 1.4-2.0
				Client sampling date / time: 17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00
				ES0917543-001	ES0917543-002	ES0917543-003	ES0917543-004	ES0917543-005
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**8.9**	**9.0**	**7.1**	**7.4**	**8.8**
pH (Fox)	----	0.1	pH Unit	**6.0**	**6.3**	**2.0**	**1.9**	**6.5**
Reaction Rate	----	1	Reaction Uni	**2**	**2**	**2**	**4**	**2**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: VC2A 2.0-2.3	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6	VC3A 0.6-1.3
				Client sampling date / time: 17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]
				ES0917543-006	ES0917543-007	ES0917543-008	ES0917543-009	ES0917543-010
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**8.9**	**8.8**	**9.0**	**8.8**	**8.9**
pH (Fox)	----	0.1	pH Unit	**6.5**	**6.5**	**6.2**	**6.5**	**6.5**
Reaction Rate	----	1	Reaction Uni	**2**	**2**	**2**	**2**	**2**

Analytical Results

Sub-Matrix: SOIL			Client sample ID	VC3A 1.3-1.9	VC3A 1.9-2.4	----	----	----
			Client sampling date / time	[17-NOV-2009]	[17-NOV-2009]	----	----	----
Compound	CAS Number	LOR	Unit	ES0917543-011	ES0917543-012	----	----	----
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**8.9**	**8.9**	----	----	----
pH (Fox)	----	0.1	pH Unit	**6.6**	**6.6**	----	----	----
Reaction Rate	----	1	Reaction Uni	**1**	**1**	----	----	----

QUALITY CONTROL REPORT

Work Order	: **ES0917543**	Page	: 1 of 5
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 23-NOV-2009
Order number	: ----		
		No. of samples received	: 12
Quote number	: EN/034/09	No. of samples analysed	: 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

This document is issued in accordance with NATA accreditation requirements.

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*
Kim McCabe	Senior Inorganic Chemist	Inorganics

General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient 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 (%)*
EA003 :pH (field/fox) (QC Lot: 1168129)									
ES0917543-001	VC1A 0-0.5	EA003: Reaction Rate	----	1	--	2	2	0.0	No Limit
		EA003: pH (F)	----	0.1	pH Unit	8.9	9.0	1.1	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	6.0	6.0	0.0	0% - 20%
ES0917543-010	VC3A 0.6-1.3	EA003: Reaction Rate	----	1	--	2	2	0.0	No Limit
		EA003: pH (F)	----	0.1	pH Unit	8.9	9.0	1.1	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	6.5	6.5	0.0	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.

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**

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.**

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES0917543**	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 23-NOV-2009
Order number	: ----		
		No. of samples received	: 12
Quote number	: EN/034/09	No. of samples analysed	: 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
EA003 :pH (field/fox)								
Snap Lock Bag - frozen								
VC1A 0-0.5,	VC1A 0.5-1.2,	**17-NOV-2009**	**----**	----	----	**23-NOV-2009**	17-NOV-2010	✓
VC2A 0-1.0,	VC2A 1.0-1.4,							
VC2A 1.4-2.0,	VC2A 2.0-2.3,							
VC2A 2.3-2.6,	VC1A 1.2-1.6,							
VC3A 0-0.6,	VC3A 0.6-1.3,							
VC3A 1.3-1.9,	VC3A 1.9-2.4							

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
pH field/fox	EA003	2	12	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH field/fox	EA003	SOIL	Ahern et al 1998 - determined on a 1:5 soil/water extract designed to simulate field measured pH and pH after the extract has been oxidised with peroxide.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- **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.**

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **ES0917543**		
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----		
C-O-C number	: ----	Quote number	: ES2009WORPAR0223 (EN/034/09)
Site	: ----		
Sampler	: NH	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 17-NOV-2009	Issue Date	: 19-NOV-2009 12:03
Client Requested Due Date	: 23-NOV-2009	Scheduled Reporting Date	: **23-NOV-2009**

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 4.6'C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 12
Sercurity Seal	: Intact.	No. of samples analysed	: 12

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **PH FOX analysis will be conducted by ALS Brisbane**
- **Sample(s) have been received within recommended holding times.**
- **Thisb batch for PHFOX only and split from ES0917541**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - EA003 pH field/fox
ES0917543-001	17-NOV-2009 10:00	VC1A 0-0.5	✓
ES0917543-002	17-NOV-2009 10:00	VC1A 0.5-1.2	✓
ES0917543-003	17-NOV-2009 10:00	VC2A 0-1.0	✓
ES0917543-004	17-NOV-2009 10:00	VC2A 1.0-1.4	✓
ES0917543-005	17-NOV-2009 10:00	VC2A 1.4-2.0	✓
ES0917543-006	17-NOV-2009 10:00	VC2A 2.0-2.3	✓
ES0917543-007	[17-NOV-2009]	VC2A 2.3-2.6	✓
ES0917543-008	[17-NOV-2009]	VC1A 1.2-1.6	✓
ES0917543-009	[17-NOV-2009]	VC3A 0-0.6	✓
ES0917543-010	[17-NOV-2009]	VC3A 0.6-1.3	✓
ES0917543-011	[17-NOV-2009]	VC3A 1.3-1.9	✓
ES0917543-012	[17-NOV-2009]	VC3A 1.9-2.4	✓

Requested Deliverables

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com

CHAIN OF CUSTODY

ALS Laboratory: please tick →

Environmental Division
Sydney
Work Order
ES0917544

Telephone : +61-2-8784 8555

CLIENT: WORLEY PARSONS	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):	FOR LABORATORY US	
OFFICE: N. SYDNEY	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact?	Yes / No / N/A
PROJECT: CALTEX MAINTENANCE DREDGING	ALS QUOTE NO.: SY/503/09	COC SEQUENCE NUMBER (Circle) COC: (1) 2 3 4 5 6 7	Free ice / frozen ice bricks p: Yes / No / N/A
ORDER NUMBER:		OF: 1 2 3 4 5 6 7	Random Sample Temperati: 4.6C °C
PROJECT MANAGER: AL WATTERS	CONTACT PH: 0422 763 386		Other comment:
SAMPLER: NICK HRADNAFORD	SAMPLER MOBILE: 0402365428	RELINQUISHED BY:	RECEIVED BY: Joy Stephens ALS Sydney
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):		DATE/TIME: 17/11/09 17:20
Email Reports to (will default to PM if no other addresses are listed):		DATE/TIME:	RELINQUISHED BY:
Email Invoice to (will default to PM if no other addresses are listed):			DATE/TIME:
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:			RECEIVED BY: DATE/TIME:

Subcon / Forward Lab / Split WO
Lab / Analysis: ALS Brisbane
Organised By / Date: 17-11-09 TBT/TOC
Relinquished By / Date:
Connote / Courier:
WO No: ES0917544
Attach By PO / Internal Sheet:

ALS SYD BATCH ONLY : ES0917541
PSD : ES0917542
PH FOX : ES0917543

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)
Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION			ANALYSIS REQUIRED including SUITES														Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pH* & pHfox)	EA033 (chromium)	(TCLP/Elutriate)		Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	VC1A 0-0.5	17/11 am	S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE		STORE remaining sample - will select following review of results
	VC1A 0-0.5X	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE		
2	VC1A 0.5-1.2	17/11 am	S	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	STORE	STORE		
	VC1A 0.5-1.2Y	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE		
			S	Glass bottle/bags														STORE	STORE		
3	VC2A 0-1.0	17/11 am	S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE		
4	VC2A 0-1.0 DUP	17/11 am	S	Glass bottle/bags	1	✓	✓	✓	✓	-	-	-	-	-	-	-	-	STORE	STORE		
	VC2A 0-1.0 X	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE		
5	VC2A 1.0-1.4	17/11 am	S	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	STORE	STORE		
	VC2A 1.0-1.4Y	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE		
6	VC2A 1.4-2.0	17/11 am	S	Glass bottle/bags	4	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	STORE	STORE		
	VC2A 1.4-2.0Z	17/11 am	S	Glass bottle/bags	2	HOLD												STORE	STORE		
7	VC2A 2.0-2.3	17/11 am	S	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	STORE	STORE		
8	VC2A 2.3-2.6	17/11 pm	S	Glass bottle/bags	4	-	-	-	-	-	-	-	-	-	-	-	-	STORE	STORE		
	VC2A 2.3-2.6X	17/11 pm	S	Glass bottle/bags	2	Hold												STORE	STORE		
			S	Glass bottle/bags														STORE	STORE		
9	VC1A 1.2-1.6	17/11 pm	S	Glass bottle/bags	4	-	-	-	-	-	-	-	-	-	-	-	-	STORE	STORE		
	VC1A 1.2-1.6Z	17/11 pm	S	Glass bottle/bags	2	Hold												STORE	STORE		
			S	Glass bottle/bags														STORE	STORE		

CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: Wesley Parsons	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)
OFFICE: N Sydney	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):		Custody Seal Intact? Yes / No / N/A
PROJECT: Carter maintenance & recharge	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt? Yes / No / N/A
ORDER NUMBER:		COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: 4.6 °C
PROJECT MANAGER: Al Watford	CONTACT PH: 0422763331	OF: 1 2 3 4 5 6 7	Other comment:
SAMPLER: Nick Hannaford	SAMPLER MOBILE: 0402365428	RELINQUISHED BY:	RECEIVED BY: Somastepano ALS Sydney.
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed):		DATE/TIME:	DATE/TIME: 17/11/19 17:20
Email Invoice to (will default to PM if no other addresses are listed):			

RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).												Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pHf & pHfox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
10	UC3a 0-0.6		S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	
	UC3a 0-0.6x		S	Glass bottle/bags	2	Hold												STORE	STORE	
11	UC3a 0.6-1.3		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
	UC3a 0.6-1.3x		S	Glass bottle/bags	2	Hold												STORE	STORE	
12	UC3a 1.3-1.9		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
	UC3a 1.3-1.9x		S	Glass bottle/bags	2	Hold												STORE	STORE	
13	UC3a 1.9-2.4		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
14	UC3bo.5-09		S	Glass bottle/bags	3													STORE	STORE	
15	UC3bo-0.5		S	Glass bottle/bags	4													STORE	STORE	
	UC3bo-0.5x		S	Glass bottle/bags	2	Hold												STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
						30	30	30	30	18	6	6	6	6	6	30	30	?	?	

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

CERTIFICATE OF ANALYSIS

Work Order	: **ES0917544**	Page	: 1 of 6
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 27-NOV-2009
Site	: ----		
		No. of samples received	: 13
Quote number	: EN/034/09	No. of samples analysed	: 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 Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

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	Organic Instrument Chemist	Inorganics
Matt Frost	Organic Instrument Chemist	Organics
Stephen Hislop	Senior Inorganic Chemist	Stafford Minerals - AY

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 insuffient 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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- **TBT: Matrix spike recovery not determined due to sample heterogeneity.**
- **TBT: Sample VC1A 1.2-1.6 required dilution due to the presence of high level contaminants. LOR values have been adjusted accordingly. Surrogate recovery not determined.**

Analytical Results

Sub-Matrix: SOIL			Client sample ID	VC1A 0-0.5	VC1A 0.5-1.2	VC2A 0-1.0	VC2A 0-1.0 DUP	VC2A 1.0-1.4
			Client sampling date / time	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00
Compound	CAS Number	LOR	Unit	ES0917544-001	ES0917544-002	ES0917544-003	ES0917544-004	ES0917544-005
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	0.02	%	**0.07**	**0.08**	<0.02	<0.02	**1.13**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: VC2A 1.4-2.0	VC2A 2.0-2.3	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6
				Client sampling date / time: 17-NOV-2009 10:00	17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]
				ES0917544-006	ES0917544-007	ES0917544-008	ES0917544-009	ES0917544-010
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	----	----	**20.1**	**17.5**	**27.9**
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	0.02	%	**0.61**	**0.12**	**0.14**	**0.03**	**0.69**
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	----	----	**5.4**	**26.8**	**5.0**
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	----	----	**100**	**Not Determined**	**88.2**

Analytical Results

Sub-Matrix: SOIL				Client sample ID	VC3A 0.6-1.3	VC3A 1.3-1.9	VC3A 1.9-2.4	----	----
				Client sampling date / time	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]	----	----
Compound	CAS Number	LOR	Unit		ES0917544-011	ES0917544-012	ES0917544-013	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	0.02	%		**0.19**	**0.25**	**0.14**	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP090S: Organotin Surrogate			
Tripropyltin	----	34	108

Hi All,

The following changes have been made to the below batches as per the client request.

NEWCASTLE PSD BATCH
ES0917542 – Cancelled analysis on samples **1 and 2** in this batch

BRISBANE TBT AND TOC BATCH
ES0917544 – Cancelled TBT on samples **1 and 3**. **TOC is still needed for these samples.**

SYDNEY BATCH
ES0917541 – Cancelled UT OC/PCB as well as Low Level TPH and BTEX on samples **1 and 3**. **This means metals, mercury and Sediment PAH's still need to continue on these samples.**

Jacob Waugh
Production Co-ordinator
ALS Laboratory Group
Environmental Division
Sydney, Australia
Phone: +61 2 8784 8555
Fax: +61 2 8784 8500
www.alsglobal.com

From: Charlie Pierce
Sent: Thursday, 19 November 2009 11:41 AM
To: Uma Nagendiram; Peter Donaghy; Frank Ferraro; Edwandy Fadjar; Alex Rossi
Cc: Jacob Waugh
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Dear Everyone,

The client has requested that we no longer test sample 001 and sample 002 for the tests shown below. Please stop these tests immediately. If testing has been completed, please let me know.

Dear Frank

Can you confirm that:
VC3B0.5-0.9
VC3B0-0.5
VC3B0-0.5x

Were not received?

Kind Regards

Charlie Pierce
Laboratory Manager - Sydney
ALS Laboratory Group
Environmental Division
Sydney, Australia
Phone: + 61 2 8784 8555
Fax: + 61 2 8784 8500
Mobile: +61 0466309729
www.alsglobal.com

From: Hannaford, Nick (Sydney) [mailto:Nicholas.Hannaford@WorleyParsons.com]
Sent: Thursday, 19 November 2009 11:20 AM
To: Charlie Pierce
Cc: Watters, Ali (Sydney)
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Hi Charlie,

Please see the following amendments to the attached SRN below.

Lab ID	Our ID	Change
ES0917541-001	VC1A 0-0.5	No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides) EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)
ES0917541-003	VC2A 0-1.0	No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides) EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)

I also note that on the second copy of the COD form that you sent Ali it is stated that the following samples were not received:
VC3B0.5-0.9
VC3B0-0.5
VC3B0-0.5x

However on the first copy of the CoC these are given a lab ID. These samples are also missing from the SRN. Please advise.

Regards,

Nick Hannaford
Environmental Scientist
WorleyParsons
Tel: +61 2 8456 7357
Fax: +62 2 8923 6877
WorleyParsons Services Pty Ltd
Level 11, 141 Walker St
Nth Sydney NSW 2060
WorleyParsons | www.worleyparsons.com

Right-click here to

From: Watters, Ali (Sydney)
Sent: Wednesday, November 18, 2009 2:47 PM
To: Hannaford, Nick (Sydney)
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

FYI

Right-click here to

From: ALSE Sydney Aus [mailto:alse.sydney.aus@als.com.au]
Sent: Wednesday, 18 November 2009 2:39 PM
To: Watters, Ali (Sydney)
Subject: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

This e-mail has been automatically generated.

-- PLEASE DO NOT REPLY --

ALS acknowledges the risks associated with supplying electronic media reports based on client requirements. This type of format has the ability to embed viruses within the code and, as such, ALS has introduced a three tier layer of

protection throughout their company resources. However, ALS cannot guarantee any attachment is virus free and will not be held liable for any disruption to business. It is highly recommended that all attachments received are scanned prior to opening.

QUALITY CONTROL REPORT

Work Order	: **ES0917544**	Page	: 1 of 5
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 27-NOV-2009
Order number	: ----		
		No. of samples received	: 13
Quote number	: EN/034/09	No. of samples analysed	: 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

This document is issued in accordance with NATA accreditation requirements.

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	Organic Instrument Chemist	Inorganics
Matt Frost	Organic Instrument Chemist	Organics
Stephen Hislop	Senior Inorganic Chemist	Stafford Minerals - AY

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 insuffient sample for analysis.

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (QC Lot: 1171420)									
ES0917544-008	VC2A 2.3-2.6	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	20.1	20.0	0.0	0% - 20%
ES0917655-005	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	18.6	19.0	2.2	0% - 50%
EP005: Total Organic Carbon (TOC) (QC Lot: 1169775)									
ES0917544-001	VC1A 0-0.5	EP005: Total Organic Carbon	----	0.02	%	0.07	0.07	0.0	No Limit
ES0917544-011	VC3A 0.6-1.3	EP005: Total Organic Carbon	----	0.02	%	0.19	0.18	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 1170808)									
EB0918340-003	Anonymous	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	1.9	1.4	33.6	No Limit
ES0917604-075	Anonymous	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	1.9	1.4	26.4	No Limit

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP005: Total Organic Carbon (TOC) (QCLot: 1169775)								
EP005: Total Organic Carbon	----	0.02	%	<0.02	100 %	101	70	130
EP090: Organotin Compounds (QCLot: 1170808)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	105	24.1	129

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP090: Organotin Compounds (QCLot: 1170808)							
ES0917544-008	VC2A 2.3-2.6	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	# Not Determined	20	130

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES0917544**	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 27-NOV-2009
Order number	: ----		
		No. of samples received	: 13
Quote number	: EN/034/09	No. of samples analysed	: 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
EA055: Moisture Content								
Soil Glass Jar - Unpreserved								
VC2A 2.3-2.6, VC3A 0-0.6	VC1A 1.2-1.6,	**17-NOV-2009**	**----**	----	----	**23-NOV-2009**	24-NOV-2009	✓
EP005: Total Organic Carbon (TOC)								
Pulp Bag								
VC1A 0-0.5, VC2A 0-1.0, VC2A 1.0-1.4, VC2A 2.0-2.3, VC1A 1.2-1.6, VC3A 0.6-1.3, VC3A 1.9-2.4	VC1A 0.5-1.2, VC2A 0-1.0 DUP, VC2A 1.4-2.0, VC2A 2.3-2.6, VC3A 0-0.6, VC3A 1.3-1.9,	**17-NOV-2009**	**20-NOV-2009**	15-DEC-2009	✓	**23-NOV-2009**	15-DEC-2009	✓
EP090: Organotin Compounds								
Soil Glass Jar - Unpreserved								
VC2A 2.3-2.6, VC3A 0-0.6	VC1A 1.2-1.6,	**17-NOV-2009**	**23-NOV-2009**	01-DEC-2009	✓	**25-NOV-2009**	02-JAN-2010	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	2	11	**18.2**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organotin Analysis	EP090	2	18	**11.1**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	2	13	**15.4**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Organotin Analysis	EP090	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	13	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organotin Analysis	EP090	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	13	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Organotin Analysis	EP090	1	18	**5.6**	**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 (1999) Schedule B(3) (Method 102)
Total Organic Carbon	EP005	SOIL	In-house. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automaticaly measured by infra-red detector.
Organotin Analysis	EP090	SOIL	(USEPA SW 846 - 8270D) Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quanitified against an established calibration curve.

Preparation Methods	Method	Matrix	Method Descriptions
Organotin Sample Preparation	ORG35	SOIL	In house. 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.

Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP090: Organotin Compounds	ES0917544-008	VC2A 2.3-2.6	**Tributyltin**	56573-85-4	Not Determined	----	**Matrix spike recovery not determined due to sample matrix interference.**

- **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

Sub-Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP090S: Organotin Surrogate	ES0917544-009	VC1A 1.2-1.6	**Tripropyltin**	----	Not Determined	----	**Surrogate recovery not determined due to (target or non-target) matrix interferences**

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.**

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **ES0917544**		
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----		
C-O-C number	: ----	Quote number	: ES2009WORPAR0223 (EN/034/09)
Site	: ----		
Sampler	: NH	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 17-NOV-2009	Issue Date	: 20-NOV-2009 10:56
Client Requested Due Date	: 27-NOV-2009	Scheduled Reporting Date	: **27-NOV-2009**

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 4.6'C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 13
Sercurity Seal	: Intact.	No. of samples analysed	: 13

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.
- TBT cancelled for Samples 1 & 3 as per Nick Hannaford on 19/11/09
- **Samples received in appropriately pretreated and preserved containers.**
- **TBT AND TOC analysis will be conducted by ALS Brisbane**
- **Sample(s) have been received within recommended holding times.**
- **Sample id UC3b0.5-0.9 and UC3b 0-0.5 were not received.**
- **This batch for TBT & TOC only and split from ES0917541**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EP005 (solids) Total Organic Carbon (TOC) soils	SOIL - EA055-103 Moisture Content	SOIL - EP090 (solids) Organotins
ES0917544-001	17-NOV-2009 10:00	VC1A 0-0.5	✓		
ES0917544-002	17-NOV-2009 10:00	VC1A 0.5-1.2	✓		
ES0917544-003	17-NOV-2009 10:00	VC2A 0-1.0	✓		
ES0917544-004	17-NOV-2009 10:00	VC2A 0-1.0 DUP	✓		
ES0917544-005	17-NOV-2009 10:00	VC2A 1.0-1.4	✓		
ES0917544-006	17-NOV-2009 10:00	VC2A 1.4-2.0	✓		
ES0917544-007	17-NOV-2009 10:00	VC2A 2.0-2.3	✓		
ES0917544-008	[17-NOV-2009]	VC2A 2.3-2.6	✓	✓	✓
ES0917544-009	[17-NOV-2009]	VC1A 1.2-1.6	✓	✓	✓
ES0917544-010	[17-NOV-2009]	VC3A 0-0.6	✓	✓	✓
ES0917544-011	[17-NOV-2009]	VC3A 0.6-1.3	✓		
ES0917544-012	[17-NOV-2009]	VC3A 1.3-1.9	✓		
ES0917544-013	[17-NOV-2009]	VC3A 1.9-2.4	✓		

Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParsons.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParsons.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com

CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: Wesley Person	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Cir	Environmental Division Sydney
OFFICE: North Sydney	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact?	Work Order
PROJECT: Caltex maintenance dredging	ALS QUOTE NO.:	Free ice / frozen ice bricks present upon rec	**ES0917649**
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle) COC 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt:	Yes (No) N/A / Yes No N/A / 0-6 °C
PROJECT MANAGER: Ali Wilkes CONTACT PH: 0427 763 386		Other comment:	
SAMPLER: Nick Hamerton SAMPLER MOBILE: 0402365428	RELINQUISHED BY:	RECEIVED BY: Frank ALS	RELINQUISHED BY: RECEIVED BY:
COC emailed to ALS? (YES / NO) EDD FORMAT (or default):	DATE/TIME:	DATE/TIME: 18/11/09 5:15pm	DATE/TIME: DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):			
Email Invoice to (will default to PM if no other addresses are listed):			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Telephone : +61-2-8784 8555

CONTRACT WORK
WO:
LAB: ALS Brisbane/Newcastle
DATE: 19/11/09
TBT/TOC:
SPLIT:
PHf/PHox:
PSD:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be Where Metals are required, specify Total (unfiltered bottle required) or Dissolved													Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pHf & pHfox)	EA033 (chromium)	(TCLP/Elutriate)	
1	SS3c		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	STORE remaining sample - will select following review of results
(16)	SS3cx		S	Glass bottle/bags	2	Hold												STORE	STORE	
2	SS3d		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
(17)	SS3dx		S	Glass bottle/bags	2	Hold												STORE	STORE	
3	SS3b		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
(18)	SS3bx		S	Glass bottle/bags	2	Hold												STORE	STORE	
4	SS3a		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
(19)	SS3ax		S	Glass bottle/bags	2	Hold												STORE	STORE	
5	UC3b0-0.5		S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	
6	UC3b0-0.5x		S	Glass bottle/bags	2	✓	✓	✓	✓							✓	✓	STORE	STORE	
7	UC3b0.5-09		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
8	UC2B0-0.5		S	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	
(20)	UC2B0-0.5x		S	Glass bottle/bags	2	Hold												STORE	STORE	
9	UC2B0.5-0.9		S	Glass bottle/bags	4	✓	✓	✓	✓	[redacted]					✓	✓	✓	STORE	STORE	
(21)	UC2B0.5-0.9x		S	Glass bottle/bags	2	Hold												STORE	STORE	
10	UC2B0.9-1.5		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
(22)	UC2B09-1.5x		S	Glass bottle/bags	2	Hold												STORE	STORE	
11	UC2B 1.5-2.2		S	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
(23)	UC2B 1.5-2.2x		S	Glass bottle/bags	2	Hold												STORE	STORE	

CHAIN OF CUSTODY

ALS Laboratory: **please tick →**

CLIENT: Worley Parsons	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)
OFFICE: NSW Sydney	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):		Custody Seal Intact? Yes No N/A
PROJECT: Cotter maintenance dredging	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)	Free Ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER:		COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: Ali Watters	CONTACT PH: 0422 763 336	OF: 1 2 3 4 5 6 7	Other comment:
SAMPLER: Nick Hennaford	SAMPLER MOBILE: [redacted] 0462 365 423	RELINQUISHED BY:	RECEIVED BY: Frank - ALS
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed):		DATE/TIME:	DATE/TIME: 18/11/09 5:15pm
Email Invoice to (will default to PM if no other addresses are listed):		RELINQUISHED BY:	DATE/TIME:
			RECEIVED BY:
			DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).												Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pHf & pHfox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
12	SS2D	18/11/09 am	S	Glass bottle/bags	3	✓	✓	✓	✓	✓						✓	✓	STORE	STORE	
(24)	SS2Dx	18/11/09 am	S	Glass bottle/bags	2	Hold	~	~	~	✓						✓	✓	STORE	STORE	
13	SS1C	18/11/09 am	S	Glass bottle/bags	3	✓	✓	✓	✓	✓						✓	✓	STORE	STORE	
(25)	SS1Cx	18/11/09 am	S	Glass bottle/bags	2	Hold	~	~	~	~						✓	✓	STORE	STORE	
14	SS2A	18/11/09 am	S	Glass bottle/bags	3	✓	✓	✓	✓	✓						✓	✓	STORE	STORE	
(26)	SS2Ax	18/11/09 am	S	Glass bottle/bags	2	Hold	~	~	~	~						~	~	STORE	STORE	
15	SS1D	18/11/09 am	S	Glass bottle/bags	3	✓	✓	✓	✓	✓						✓	✓	STORE	STORE	
(27)	SS1Dx	18/11/09 am	S	Glass bottle/bags	2	Hold	~	~	~	~						~	~	STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
				TOTAL		30	30	30	30	18	6	6	6	6	6	30	30	?	?	

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

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES0917649**	Page	: 1 of 11
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 18-NOV-2009
Sampler	: NH	Issue Date	: 27-NOV-2009
Site	: ----		
		No. of samples received	: 27
Quote number	: SY/503/09	No. of samples analysed	: 15

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

This document is issued in accordance with NATA accreditation requirements.

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*
Celine Conceicao	Spectroscopist	Inorganics
Edwandy Fadjar	Senior Organic Chemist	Organics
Hoa Nguyen	Inorganic Chemist	Inorganics

General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient 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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: SS3C Client sampling date / time: 17-NOV-2009 15:00 ES0917649-001	SS3D 17-NOV-2009 15:00 ES0917649-002	SS3B 17-NOV-2009 15:00 ES0917649-003	SS3A 17-NOV-2009 15:00 ES0917649-004	VC3B0-0.5 17-NOV-2009 15:00 ES0917649-005
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**40.0**	**22.0**	**47.4**	**24.7**	**19.1**
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	**0.56**	<0.50
Arsenic	7440-38-2	1.00	mg/kg	**5.85**	**1.50**	**8.85**	**1.70**	<1.00
Cadmium	7440-43-9	0.1	mg/kg	**0.1**	<0.1	**0.2**	**0.2**	<0.1
Chromium	7440-47-3	1.0	mg/kg	**19.1**	**5.3**	**22.8**	**7.1**	**2.2**
Copper	7440-50-8	1.0	mg/kg	**15.2**	**5.1**	**21.7**	**33.2**	**1.3**
Cobalt	7440-48-4	0.5	mg/kg	**1.4**	<0.5	**1.8**	**1.5**	<0.5
Lead	7439-92-1	1.0	mg/kg	**19.9**	**4.5**	**25.5**	**60.2**	**2.4**
Manganese	7439-96-5	10	mg/kg	**33**	**12**	**40**	**14**	<10
Nickel	7440-02-0	1.0	mg/kg	**4.6**	**1.0**	**5.7**	**2.0**	<1.0
Selenium	7782-49-2	0.1	mg/kg	**0.5**	**0.2**	**1.0**	**0.2**	<0.1
Silver	7440-22-4	0.1	mg/kg	**0.1**	<0.1	**0.2**	<0.1	<0.1
Vanadium	7440-62-2	2.0	mg/kg	**15.2**	**3.8**	**19.3**	**3.6**	**2.5**
Zinc	7440-66-6	1.0	mg/kg	**64.2**	**19.1**	**95.9**	**460**	**6.3**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	**0.15**	**0.03**	**0.20**	**0.01**	**0.02**
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	----	----	----	----	<3
C10 - C14 Fraction	----	3	mg/kg	----	----	----	----	<3
C15 - C28 Fraction	----	3	mg/kg	----	----	----	----	**3**
C29 - C36 Fraction	----	5	mg/kg	----	----	----	----	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg	----	----	----	----	**3**
EP080-SD: BTEX								
Benzene	71-43-2	0.2	mg/kg	----	----	----	----	<0.2
Toluene	108-88-3	0.2	mg/kg	----	----	----	----	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	----	----	----	----	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	----	----	----	----	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	----	----	----	----	<0.2
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.50	µg/kg	----	----	----	----	<0.50
alpha-BHC	319-84-6	0.50	µg/kg	----	----	----	----	<0.50
beta-BHC	319-85-7	0.50	µg/kg	----	----	----	----	<0.50
delta-BHC	319-86-8	0.50	µg/kg	----	----	----	----	<0.50
4.4`-DDD	72-54-8	0.50	µg/kg	----	----	----	----	<0.50
4.4`-DDE	72-55-9	0.50	µg/kg	----	----	----	----	<0.50
4.4`-DDT	50-29-3	0.50	µg/kg	----	----	----	----	<0.50

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: SS3C	SS3D	SS3B	SS3A	VC3B0-0.5
				Client sampling date / time: 17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00
				ES0917649-001	ES0917649-002	ES0917649-003	ES0917649-004	ES0917649-005
EP131A: Organochlorine Pesticides - Continued								
^ DDT (total)	----	0.50	µg/kg	----	----	----	----	<0.50
Dieldrin	60-57-1	0.50	µg/kg	----	----	----	----	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg	----	----	----	----	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg	----	----	----	----	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg	----	----	----	----	<0.50
^ Endosulfan (sum)	115-29-7	0.50	µg/kg	----	----	----	----	<0.50
Endrin	72-20-8	0.50	µg/kg	----	----	----	----	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg	----	----	----	----	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg	----	----	----	----	<0.50
Heptachlor	76-44-8	0.50	µg/kg	----	----	----	----	<0.50
Heptachlor epoxide	1024-57-3	0.50	µg/kg	----	----	----	----	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	----	----	----	----	<0.50
gamma-BHC	58-89-9	0.50	µg/kg	----	----	----	----	<0.50
Methoxychlor	72-43-5	0.50	µg/kg	----	----	----	----	<0.50
cis-Chlordane	5103-71-9	0.50	µg/kg	----	----	----	----	<0.50
trans-Chlordane	5103-74-2	0.50	µg/kg	----	----	----	----	<0.50
^ Total Chlordane (sum)	----	0.50	µg/kg	----	----	----	----	<0.50
Oxychlordane	27304-13-8	0.50	µg/kg	----	----	----	----	<0.50
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1016	12974-11-2	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1221	11104-28-2	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1232	11141-16-5	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1242	53469-21-9	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1248	12672-29-6	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1254	11097-69-1	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1260	11096-82-5	5.0	µg/kg	----	----	----	----	<5.0
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	**5**	**39**	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	**13**	<5	**7**	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	**15**	<4	**12**	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	**7**	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	**45**	<4	**33**	<4	<4
Anthracene	120-12-7	4	µg/kg	**10**	<4	**9**	<4	<4
Fluoranthene	206-44-0	4	µg/kg	**108**	**4**	**54**	<4	<4
Pyrene	129-00-0	4	µg/kg	**158**	**4**	**50**	<4	<4
Benz(a)anthracene	56-55-3	4	µg/kg	**93**	<4	**28**	<4	<4

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.**

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1126260**	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: Caltex	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 06-DEC-2011
Sampler	: O. MURRAY	Issue Date	: 13-DEC-2011
Order number	: 301015-02448		
		No. of samples received	: 3
Quote number	: EN/034/11	No. of samples analysed	: 3

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
EA033-E: Acid Base Accounting							
80* dried soil (EA033) VC5C 0.5-1, VC5B 0.8-1.3, VC5B 1.3-1.6	**18-NOV-2011**	**12-DEC-2011**	17-NOV-2012	✓	**12-DEC-2011**	11-MAR-2012	✓
EA033-C: Acid Neutralising Capacity							
80* dried soil (EA033) VC5C 0.5-1, VC5B 0.8-1.3, VC5B 1.3-1.6	**18-NOV-2011**	**12-DEC-2011**	17-NOV-2012	✓	**12-DEC-2011**	11-MAR-2012	✓
EA033-A: Actual Acidity							
80* dried soil (EA033) VC5C 0.5-1, VC5B 0.8-1.3, VC5B 1.3-1.6	**18-NOV-2011**	**12-DEC-2011**	17-NOV-2012	✓	**12-DEC-2011**	11-MAR-2012	✓
EA033-B: Potential Acidity							
80* dried soil (EA033) VC5C 0.5-1, VC5B 0.8-1.3, VC5B 1.3-1.6	**18-NOV-2011**	**12-DEC-2011**	17-NOV-2012	✓	**12-DEC-2011**	11-MAR-2012	✓
EA033-D: Retained Acidity							
80* dried soil (EA033) VC5C 0.5-1, VC5B 0.8-1.3, VC5B 1.3-1.6	**18-NOV-2011**	**12-DEC-2011**	17-NOV-2012	✓	**12-DEC-2011**	11-MAR-2012	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	1	10	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- **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.**

ALS Group
Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **EB1126260**		
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: Caltex	Page	: 1 of 2
Order number	: 301015-02448		
C-O-C number	: ----	Quote number	: EM2011WORPAR0266 (EN/034/11)
Site	: ----		
Sampler	: O. MURRAY	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 06-DEC-2011	Issue Date	: 08-DEC-2011 22:22
Client Requested Due Date	: 16-DEC-2011	Scheduled Reporting Date	: **16-DEC-2011**

Delivery Details

Mode of Delivery	: Samples on hand	Temperature	: AMBIENT
No. of coolers/boxes	: REBATCH	No. of samples received	: 3
Security Seal	: N/A	No. of samples analysed	: 3

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - EA033 Chromium Suite for Acid Sulphate Soils
EB1126260-001	18-NOV-2011 15:00	VC5C 0.5-1	✓
EB1126260-002	18-NOV-2011 15:00	VC5B 0.8-1.3	✓
EB1126260-003	18-NOV-2011 15:00	VC5B 1.3-1.6	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

MS ORLA MURRAY

- *AU Certificate of Analysis - NATA (COA)	Email	orla.murray@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	orla.murray@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	orla.murray@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	orla.murray@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	orla.murray@worleyparsons.com
- Chain of Custody (CoC) (COC)	Email	orla.murray@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	orla.murray@worleyparsons.com

CHAIN OF CUSTODY DOCUMENTATION

ALS Laboratory Group

CLIENT: WORPAR	SAMPLER:
ADDRESS / OFFICE:	MOBILE:
PROJECT MANAGER (PM):	PHONE:
PROJECT ID: ES1125458	EMAIL REPORT TO:
SITE: P.O. NO.:	EMAIL INVOICE TO: (if different to report)
RESULTS REQUIRED (Date): QUOTE NO.:	**ANALYSIS REQUIRED including SUITES** (note - suite codes must be listed to attract suite prices)

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

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

Notes: e.g. Highly contaminated samples e.g. "High PAHs expected". ... LORs etc.

please give Sample #1 to Chris to pulp.

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles	CS Suite
1	VC5C 0.5-1	Pulp	18/11				x
2	VC5B 0.8-1.3	Pulp	18/11				x
3	VC5B 1.3-1.6	Pulp	18/11				x

Work Order
EB1126260

Telephone : +61-7-3243 7222

RELINQUISHED BY:		RECEIVED BY		METHOD OF SHIPMENT
Name:	Date:	Name: C. Bryant	Date: 6-12-11	Con' Note No:
Of:	Time:	Of: ALS	Time: 1341	
Name:	Date:	Name:	Date:	Transport Co:
Of:	Time:	Of:	Time:	

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

ALS LABORATORY GROUP

CERTIFICATE OF ANALYSIS

Work Order	: **EB1201570**	Page	: 1 of 3
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: CALTEX	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: 301015-02448		
C-O-C number	: ----	Date Samples Received	: 18-JAN-2012
Sampler	: ----	Issue Date	: 24-JAN-2012
Site	: ----		
		No. of samples received	: 3
Quote number	: EN/034/11	No. of samples analysed	: 3

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

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

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*
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

General Comments

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

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

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

- **ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.**
- **ASS: EA033 (CRS Suite): Retained Acidity not required because pH KCl greater than or equal to 4.5**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID	VCSC 0-0.5	VCSA 0-0.5	VCSB 0-0.8	----	----
				Client sampling date / time	18-NOV-2011 15:00	18-NOV-2011 15:00	18-NOV-2011 15:00	----	----
					EB1201570-001	EB1201570-002	EB1201570-003	----	----
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		**8.7**	**9.6**	**9.3**	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t		<2	<2	<2	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	----	----
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		**0.300**	**0.020**	**0.122**	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		**187**	**13**	**76**	----	----
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3		**5.99**	**9.10**	**24.8**	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t		**1200**	**1820**	**4960**	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S		**1.92**	**2.91**	**7.96**	----	----
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	----	----
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	----	----
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	<10	----	----
Liming Rate	----	1	kg CaCO3/t		<1	<1	<1	----	----

QUALITY CONTROL REPORT

Work Order	: **EB1201570**	Page	: 1 of 5
Client	: **WORLEY PARSONS - INFRASTRUCTURE MWE**	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: CALTEX	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-JAN-2012
Sampler	: ----	Issue Date	: 24-JAN-2012
Order number	: 301015-02448		
		No. of samples received	: 3
Quote number	: EN/034/11	No. of samples analysed	: 3

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

This document is issued in accordance with NATA accreditation requirements.

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*
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient 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 (%)*
EA033-A: Actual Acidity (QC Lot: 2137223)									
EB1201415-001	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	8.6	8.7	1.2	0% - 20%
EB1201570-003	VCSB 0-0.8	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	9.3	9.4	1.1	0% - 20%
EA033-B: Potential Acidity (QC Lot: 2137223)									
EB1201415-001	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.543	0.554	2.0	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	339	346	2.0	0% - 20%
EB1201570-003	VCSB 0-0.8	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.122	0.127	3.5	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	76	79	3.5	No Limit
EA033-C: Acid Neutralising Capacity (QC Lot: 2137223)									
EB1201415-001	Anonymous	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	1.74	1.69	3.2	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.56	0.54	3.2	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	348	337	3.2	0% - 20%
EB1201570-003	VCSB 0-0.8	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	24.8	24.8	0.3	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	7.96	7.93	0.3	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	4960	4950	0.3	0% - 20%

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 2137223)								
EA033: pH KCl (23A)	----	0.1	pH Unit	----	4.5 pH Unit	102	93	120
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	30 mole H+ / t	103	93	120
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 2137223)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	.28 % S	85.4	80	120
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 2137223)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	107	89	111
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----

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.**

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1201570**	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: CALTEX	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-JAN-2012
Sampler	: ----	Issue Date	: 24-JAN-2012
Order number	: 301015-02448		
		No. of samples received	: 3
Quote number	: EN/034/11	No. of samples analysed	: 3

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
EA033-A: Actual Acidity							
80* dried soil VCSC 0-0.5, VCSA 0-0.5, VCSB 0-0.8	**18-NOV-2011**	**23-JAN-2012**	17-NOV-2012	✓	**24-JAN-2012**	22-APR-2012	✓
EA033-B: Potential Acidity							
80* dried soil VCSC 0-0.5, VCSA 0-0.5, VCSB 0-0.8	**18-NOV-2011**	**23-JAN-2012**	17-NOV-2012	✓	**24-JAN-2012**	22-APR-2012	✓
EA033-C: Acid Neutralising Capacity							
80* dried soil VCSC 0-0.5, VCSA 0-0.5, VCSB 0-0.8	**18-NOV-2011**	**23-JAN-2012**	17-NOV-2012	✓	**24-JAN-2012**	22-APR-2012	✓
EA033-D: Retained Acidity							
80* dried soil VCSC 0-0.5, VCSA 0-0.5, VCSB 0-0.8	**18-NOV-2011**	**23-JAN-2012**	17-NOV-2012	✓	**24-JAN-2012**	22-APR-2012	✓
EA033-E: Acid Base Accounting							
80* dried soil VCSC 0-0.5, VCSA 0-0.5, VCSB 0-0.8	**18-NOV-2011**	**23-JAN-2012**	17-NOV-2012	✓	**24-JAN-2012**	22-APR-2012	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	2	12	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	1	12	**8.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	12	**8.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- **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.**

CHAIN OF CUSTODY DOCUMENTATION

CLIENT:	WORLEY PARSON-INFRASTRUCTURE	SAMPLER:	
ADDRESS / OFFICE:	NORTH SYDNEY	MOBILE:	
PROJECT MANAGER (PM):	O.MURRAY	PHONE	
PROJECT ID:	CALTEX	EMAIL REPORT TO	
	P.O. NO.: 301015-02448	EMAIL INVOICE TO	
RESULTS REQUIRED (Date):	QUOTE NO EN-034-11	**ANALYSIS REQUIRED including SUITES** (note - suite codes must be listed to attract suite prices)	

Australian Laboratory Services Pty Ltd

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

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		Chromium Suite																				COMMENTS
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles																					
1	VCSC 0-0.5	S	18/11/11			1	X																				
2	VCSA 0-0.5	S	18/11/11			1	X																				
3	VCSB 0-0.8	S	18/11/11			1	X																				

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RELINQUISHED BY:		RECEIVED BY		Method of Transport	
Name:	Date:	Name:	Date:	Con.Note No.	
Of:	Time:	Of:	Time:		
Name:	Date:	Name:	Date:	Transport	
Of:	Time:	Of:	Time:		

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

ALS Environmental