QToN # 2 - 28 Nov 14

LEGISLATIVE ASSEMBLY
FOR THE AUSTRALIAN CAPITAL TERRITORY

STANDING COMMITTEE ON PUBLIC ACCOUNTS
Brendan Smyth MLA (Chair), Mary Porter MLA (Deputy-Chair),
Nicole Lawder MLA, Yvette Berry MLA

ANSWER TO QUESTION TAKEN ON NOTICE DURING PUBLIC HEARINGS into

Appropriation (Loose Fill Asbestos Insulation Eradication) Bill 2014/15

Asked by Brendan Smyth MLA on 28 November 2014: Minister for Territory and Municipal Services took on notice the following question(s):

In relation to –

The report prepared by/for Roads ACT in relation to the extension of Nudurr Drive – can the Committee be provided with a copy of the report.

SHANE RATTENBURY MLA: The answer to the Member's question is as follows:–

Please find the requested reports attached.

RECEIVED
- 2 DEC 2014
ACT LA
COMMITTEE SUPPORT

Approved for circulation to the Standing Committee on Public Accounts

Signature: Date: 2/12/14

By the Minister for Territory and Municipal Services Mr Shane Rattenbury MLA

DRAFT

CONTAMINATION ASSESSMENT NUDURR DRIVE EXTENSION, GUNGAHLIN ACT

Prepared for:

Brown Consulting (ACT) Pty Ltd
15 Hall Street
Lyneham ACT 2602

Report Date: 4 August 2010
Project Ref: ENVICANB00280AE

Written/Submitted by:	Reviewed/Approved by:
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ENVICANB00280AE-R02a

DRAFT

4 August 2010

Brown Consulting (ACT) Pty Ltd
15 Hall Street
Lyneham ACT 2602

Attention: Julie Pearson

Dear Julie

RE: Contamination Assessment, Nudurr Drive Extension, Gungahlin ACT

Please find attached the contamination assessment report for the Draft Nudurr Drive Road reserve extension. We have provided two options for dealing with the landfill waste material and have discussed the advantages and disadvantages of each. We would be pleased to discuss these options with you. Please do not hesitate to contact the undersigned with any questions or comments.

For and on behalf of Coffey Environments Australia Pty Ltd

Sally King
Environmental Scientist

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CONTENTS

CONTENTS

CONTENTS

LIST OF ATTACHMENTS

Tables

Figures

Appendices

ABBREVIATIONS

ACM	Asbestos Containing Material
ACTPLA	Australian Capital Territory Planning and Land Authority
AHD	Australian Height Datum
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
COC	Chain of Custody
COPC	Contaminants of Potential Concern
CT	Contaminant Threshold
DQI	Data Quality Indicator
DQO	Data Quality Objective
EIL	Environmental Investigation Level
EMP	Environmental Management Plan
EPU	Environment Protection Unit
HIL	Health-based Investigation Level
LOR	Limit of Reporting
mg/L	milligrams per litre
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NSW DECC	New South Wales Department of Environment and Climate Change
NSW EPA	Environment Protection Authority of New South Wales
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl

PID	Photoionisation Detector
ppm	parts per million
QA	Quality Assurance
QC	Quality Control
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SCC	Specific Contaminant Concentration
SOP	Standard Operating Procedures
SVOC	Semi-volatile Organic Compounds
TCLP	Toxicity Characteristics Leaching Procedure
TDS	Total Dissolved Solid
TPH	Total Petroleum Hydrocarbon
USCS	Unified Soil Classification System
USEPA	United States Environment Protection Agency
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

Coffey Environments Pty Ltd was engaged by Brown Consulting (ACT) Pty Ltd, on behalf of the ACT Planning and Land Authority, to undertake a contamination assessment of an area of land located within the proposed Nudurr Drive extension in Gungahlin, ACT.

Nudurr Drive is currently an access road leading into the suburb of Palmerston which, at present, terminates at its junction with Grampians Street. It is proposed to extend Nudurr Drive from Grampians Street to Gungahlin Drive, which is located approximately 1.6 kilometres to the east. Based on this design concept, it is understood that Nudurr Drive would pass over the northwest corner of a former landfill that was used to dispose of demolition waste and asbestos. Some stockpiled material is also located on the site of unknown origin.

The objectives of the contamination assessment were to:

- Characterise the soil material present in the stockpiles located on-site to assess their suitability for beneficial reuse on-site, or if required, waste classification for off-site disposal purposes;
- Characterise the material comprising the landfill cap to assess its suitability to remain onsite; and
- Assess the thickness of the capping material and overlying fill material to assess its suitability (from a contamination perspective) as a platform on which to construct the proposed road extension; and
- Validate the results of the geophysical survey and assess the impact that this may have on the proposed Nudurr Drive.

To achieve the above objectives, Coffey Environments conducted the following scope of works:

1. A review of previous environmental reports prepared for the site;
2. Sampling of the stockpiled soil located on-site;
3. Excavation of 13 test pits and collection of representative soil samples to:
4. Laboratory analysis of a selection of soil samples for a suite of contaminants of concern; and
5. Preparation of this report.

The results indicate that the extent of the landfill appears to be consistent with the surveyed plan shown in Figure 2 and roughly corresponds to the location of the large stockpile. It is likely that the road extension will extend over landfill areas.

The capping overlying the landfill waste (to the south of Stockpile 1) and natural soils located to the north of Stockpile 1 are considered suitable to remain on-site from a contamination perspective. However, the thickness of the capping material overlying the waste is not thick enough to comply with ACT EPA requirements and requires some management to ensure that it is suitable for the road construction.

It is noted that the landfilled material is unlikely to be geotechnically suitable for the proposed road extension, although this would need to be confirmed following assessment by a suitably qualified geotechnical engineer.

The stockpiled material does not pose a risk to human health and is suitable for re-use on-site. Although its suitability for use as additional capping material would be dependent upon its geotechnical characteristics (which is outside the scope of this investigation).

In the case that it is necessary to dispose of the stockpiled material off-site, the material is currently classified as Solid Waste in accordance with the ACT *Environmental Standards: Assessment and*

Classification of Liquid and Non-Liquid Wastes (2000). Although disposal would be subject to ACT EPA approval.

The stockpiled material is likely to be suitable for re-use off site, subject to approval by ACT EPA.

Based on the results of this contamination assessment, Coffey Environments notes that there are potentially two options available for dealing with the landfill material prior to the construction of the proposed road reserve extension. These have been summarised in a table below:

Option 1	**Advantages**	**Disadvantages**
Removal of existing capping material and stockpiling on-site; Excavation of the underlying landfill material, including any asbestos containing material, and either placed within another part of the landfill that is not within the road extension footprint or disposed off-site to an appropriately licensed site or landfill facility; Backfill the void with geotechnically suitable material that will facilitate construction of the road extension.	Material to be imported to the site can be selected to ensure it will be geotechnically suitable for the road construction. No long term environmental management plan required and no requirement to accept liability for long term management of encapsulated waste.	Likely to be more expensive compared to Option 2.
Option 2	**Advantages**	**Disadvantages**
Installation of additional capping layer across the footprint of the proposed road reserve. To ensure the cap will facilitate construction of the proposed road extension, it will be necessary to ensure the cap construction meets relevant geotechnical requirements. Given the unconsolidated nature of the landfilled material, achieving necessary compaction requirements may not be possible.	Less expensive than option 1	Requirement for long term management of encapsulated waste to be managed through an EMP. The liability for maintaining the containment of the waste will need to be managed in perpetuity or whilever the waste is encapsulated. Such liability may not be acceptable to stakeholders. The waste material underlying the capping material may not be geotechnically suitable for the road foundations.

As discussed above both options have advantages and disadvantages. Coffey would recommend that if option 2 is considered, consultation with relevant stakeholders is conducted to ensure that the on-going management liability of the encapsulated waste is acceptable. Additionally, the viability of option 2 would be dependent on the outcome of a geotechnical assessment of the suitability of the waste material.

1 INTRODUCTION

1.1 Background

Coffey Environments Pty Ltd (Coffey Environments) was engaged by Brown Consulting (ACT) Pty Ltd, on behalf of the ACT Planning and Land Authority (ACTPLA), to undertake a contamination assessment of an area of land located within the proposed Nudurr Drive extension in Gungahlin, ACT (the site). The site is presently a vacant paddock situated immediately south of the suburb of Palmerston.

Nudurr Drive is currently an access road leading into the suburb of Palmerston which, at present, terminates at its junction with Grampians Street. It is proposed to extend Nudurr Drive from Grampians Street to Gungahlin Drive, which is located approximately 1.6 kilometres to the east. Based on this design concept, it is understood that Nudurr Drive would pass over the northwest corner of a former landfill used to store asbestos, as identified during Coffey Environment's previous investigations (Reference: ENVICANB00280AB, dated 13 August 2009).

With reference to the ACT Territory Plan (2008), the site is currently zoned TSZ1 – Transport; NUZ3 – Hills Ridges and Buffer Areas and NUZ1 - Broadacre. In addition to the above zones, an overlay provision of FUA – Future Urban Areas is also applicable to the site.

Figure 1 shows the location of the site.

1.2 Summary of Previous Investigations

A Phase 1 Environmental Site Assessment (P1 ESA) was undertaken by Coffey Environments in August 2009 (ENVICANB00280AB-R01). The investigation included a desktop review of available current and historical information, a geophysical survey, and preparation of a report that concluded the following:

- The site was originally used as a quarry where clay was sourced for brick manufacturing activities;
- The site was formerly used for landfilling of asbestos collected during the ACT asbestos removal program conducted during the 1980s and 1990s;
- The asbestos waste was disposed of in sealed bags and containers in accordance with regulator requirements, in a number of locations in proximity to each other on various dates between 1986 and 1991. The location was indicated on drawings provided by the client;
- Further to asbestos waste disposal the site was used for landfilling of general building waste between 1991 and 2001; and
- The landfill has been capped using a combination of material sourced during the excavation of the quarry, with the potential for uncontrolled fill to be present.

The extent of the asbestos landfill is presented in Figure 2.

The result of the geophysical survey of the site indicated that the capping material was likely to comprise a thickness of between 0.5m and 1.5m in the area of the proposed Nudurr Drive extension.

The P1 ESA (Coffey, 2009) also concluded the suitability of the capping material for the construction of the extension to Nudurr Drive is not known from a contamination perspective.

The P1 ESA (Coffey, 2009) provided the following recommendations with respect to the proposed road way extension:

1. Undertake soil sampling to characterise the soil material present in the mound in the northern part of the site and the stockpile adjacent to the western site boundary should be undertaken to assess its suitability for beneficial reuse on-site, or if required, waste classification for off-site disposal purposes; and
2. Undertake intrusive investigations of the landfill capping material with the following aims:
    a. Characterise the material comprising the landfill cap to assess the suitability of this material to remain onsite;
    b. Assess the suitability of the capping material for the construction of Nudurr Drive from a geotechnical perspective
    c. Assess the thickness of the capping material and validate the results of the geophysical survey and assess the impact that this may have on the proposed Nudurr Drive.

It was also recommended that should intrusive investigations be undertaken appropriate occupational health and safety measures should be implemented to provide appropriate protection to workers and nearby residents. This should include preparation of dust management and air monitoring plans during the soil assessment works.

Further, it was recommended, given the uncertainty of the source and composition of the material present in the landfill capping, soil stockpile and soil mound, that a broad contaminant screen analysis be undertaken on a select number of soil samples collected from the capping material, soil stockpile and soil mound. The broad contaminant screen analysis should include the following analytes:

- Metal screen (8 metals, arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury)
- Cyanide;
- Fluoride;
- TPH;
- BTEX;
- Semi-volatile organic compounds;
- Total phenols;
- Volatile halogenated compounds;
- pH; and
- Asbestos.

Finally, it was also noted in the P1 ESA (Coffey, 2009) that landfills pose an environmental risk to groundwater via the leaching of contamination from the waste material. The risk of this occurring is generally higher in older landfills which are generally unlined with impermeable barriers, thereby presenting a contamination pathway between the waste and the surrounding soils.

Should total concentrations of contamination in soil be detected which pose some concern to possible leaching into groundwater, leachate analysis using Toxicity Characteristic Leaching Process (TCLP) should be undertaken to assess the possible risk of contamination to groundwater. If the results of TCLP analysis suggest that there may be a risk of groundwater contamination, a groundwater assessment should be undertaken (given the proximity of the land-fill to the residents of Palmerston).

Monitoring well locations would be selected based on the potential for identifying potential contamination (i.e. down hydraulic gradient) from the landfill.

1.3 Objectives

The objectives of this contamination assessment have been developed to address soil contamination issues as detailed below:

1. Characterise the soil material present in the stockpile in the northern part of the site and the stockpile adjacent to the western site boundary to assess its suitability for beneficial reuse on-site, or if required, waste classification for off-site disposal purposes;
2. Characterise the material comprising the landfill cap to assess its suitability to remain onsite; and
3. Assess the thickness of the capping material and overlying fill material to assess its suitability (from a contamination perspective) as a platform on which to construct the proposed road extension; and
4. Validate the results of the geophysical survey and assess the impact that this may have on the proposed Nudurr Drive.

Investigation of the contamination status of the groundwater or the waste underlying the cap was not included in the objectives for this phase of work.

The objective of this work does not include assessment of the suitability of the capping material for the construction of Nudurr Drive from a geotechnical perspective.

1.4 Scope of Works

To achieve the objectives described above, Coffey Environments conducted the following scope of works:

1. Soil sampling of the stockpiled soil located on-site to assess its suitability for beneficial re-use on-site, and/or to classify the material for off-site disposal if required;
2. Excavation of test pits within the investigation area and collection of representative soil samples.
3. Laboratory analysis of a selection of soil samples for a suite of contaminants of potential concern (COPC); and
4. Preparation of this report in general accordance with the *Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 1997).

2 SITE DETAILS

2.1 Site History

The site history has previously been reported in the P1 ESA (Coffey 2009). A summary is provided below:

Anecdotal information provided by Mark Heckenberg (Project Officer, Environment Protection Unit (EPU)) and Bob Taylor (ACTPLA) indicated that:

- The site was originally a clay quarry used to source clay material for the Mitchell Brickworks;
- After quarrying activities ceased, the quarry was used for the disposal of asbestos containing material (ACM) removed during the ACT asbestos removal program of the 1980's and 1990's. It is understood that the asbestos was double-bagged and encapsulated in crates or shipping containers and buried beneath a soil capping layer measuring approximately 1m in thickness;
- Soil sourced from the quarry was used as the capping material above the asbestos waste;
- The site was later used by Delta Demolitions for the disposal of general building spoil accumulated during the refurbishment of a government building in the late 1990's. Delta were ordered to remediate the site by the Environmental Protection Authority after 2001; and
- It was understood that the thickness of the capping material initially placed over the landfill was insufficient and additional soil material was placed to elevate the site to the present ground surface.

Based on the review of historical aerial photographs of the site, it appears that construction of the landfill began between 1961 and 1968, with use of the landfill commencing between 1968 and 1980. Capping of the landfill appears to have occurred sporadically between 1986 and 1995.

From the aerial photographs, it appears that more than one layer of waste material was deposited in the landfill with a soil capping layer separating each layer.

A search of the EPU notices indicates that the site is not listed on the Register of Contaminated Sites, however the contaminated land record refers to the presence of an historical asbestos disposal facility.

The record indicates that the landfill was capped by three to four metres of fill material.

2.2 Site Condition

The site is a vacant parcel of land whose surface is covered by a mix of grass and exposed soil.

A large stockpile is located within the northern portion of the site, while a second smaller stockpile is located near the western site boundary. Both stockpiles are grass covered. Figure 3 shows the approximate location of the stockpiles.

A chain-link fence runs through the centre of the site on an east-west axis immediately to the south of the large stockpile.

Based on visual observations during field works the extent of the stockpiles has been estimated as follows:

Stockpile ID	Estimated dimensions and volume based on visual observations
Stockpile 1 (larger stockpile adjacent to the northern boundary of the site)	185m x 2.5m x 4m Approximate volume = 1850m^3
Stockpile 2 (smaller stockpile adjacent to the western site boundary)	56m x 4m x 2m Approximate volume = 448m^3
Total stockpile volume	2300m^3

The estimated volume of each stockpile, provided above is based on visual observations during the site works conducted in June 2010. It is apparent that the current size and extent of the stockpiles (as shown on Figure 2) is much smaller than was previously surveyed and reported on the surveyed drawing provided by Brown Consulting and reported in the P1 ESA (Coffey 2009). The reason for this decrease in size and extent of the stockpiles is not clear. Although, it is possible that the material in the stockpiles is being utilised in an uncontrolled manner by surrounding residents.

For the purpose of this assessment, Coffey Environments will rely on the current field observations to estimate the extent of the stockpiles. However it is recommended that a current survey of the material be carried out to assess the current quantities of material in each stockpile before engineerings works commence, to facilitate disposal cost estimates.

2.3 Topography and Hydrology

The 1:25,000 *Hall Topographic Map (8727-4S)* indicates that the site lies at an elevation of approximately 625m Australian Height Datum (AHD).

The site exhibits a gentle downward gradient towards the north/northwest. Consequently, surface water overflow is expected to drain towards the northwest and into the topographic low in the northwest part of the site where it is anticipated that the water would accumulate. Based on historical aerial photographs, this area was the location of a dam that may have acted as a sediment retention pond.

The closest waterway to the site is Ginninderra Creek which is located approximately 2km to the west of the site. Ginninderra Creek flows in a broadly southerly direction towards Lake Ginninderra

2.4 Surrounding Land Uses

The site is bound by the suburb of Palmerston to the north which comprises low-density residential land uses, and by vacant pastoral land to the east, west and south.

2.5 Regional Geology

The 1:50,000 *Geology of Canberra, Queanbeyan and Environs (1980)* geological map indicates that the site is underlain by the late Middle Silurian aged Canberra Formation which comprises calcareous shale, limestone, sandstone and tuff.

The geology map infers that the Gungahlin Fault is located within the vicinity of the site. It is considered most likely that this was active during metamorphic events of the Devonian period.

2.6 Site Specific Geology

The site specific subsurface lithology is based on visual observations during test pitting works and is summarised in Tables 4.1 and 4.2.

Table 4.1: Site Geology for Test Pits north of stockpile (TP1 – TP8)

Depth (m bgs)	Soil Description
0.0 – 1.2	Topsoil: brown, dry.
0.2 – 3.2	Clay/Silty Clay: red to orange brown to yellow brown, stiff. Gravel and cobbles present at depth.
0.5 -1.9	Gravel and cobbles, brown grey, coarse.
0.8 – 4.0	Shale (mudstone) bedrock, grey to grey/brown, weathered.

Table 4.2: Site Geology for Test Pits south of stockpile (TP9 – TP13)

Depth (m bgs)	Soil Description
0.0 – 1.05	FILL: Topsoil, brown, large mudstone cobbles.
0.2 – 4.0	FILL: Clay, red and brown, re-worked material, minor landfill waste present. Encountered in TP13 only.
0.2 – 1.05	FILL: Clay, soft, with miscellaneous landfill waste. Possible asbestos containing material identified within TP11.

m bgs = meters below ground surface.

2.7 Hydrogeology

The 1:100,000 *Hydrogeology of the Australian Capital Territory and Environs* (1984) map indicates that the site is located within a fractured bedrock aquifer with a yield less than 0.5L/s. The total dissolved solid (TDS) content is expected to be between 500mg/L and 1,000mg/L.

Based on topography and hydrological of the surrounding area, it is considered likely that regional groundwater would flow in a broadly westerly direction and be located at depths between 10m and 20m bgs.

3 DATA QUALITY OBJECTIVES

As stated in Appendix IV of the *Guidelines for the NSW Site Auditor Scheme 2nd ed.* (DECC, 2006), the Data Quality Objectives (DQO) process is used to "define the type, quantity and quality of data needed to support decisions relating to the environmental condition of a site".

The seven-step DQO process adopted for this investigation is provided below:

Step 1: State the Problem

The primary objectives are to:

1. Characterise the soil material present in the mound in the northern part of the site and the stockpile adjacent to the western site boundary to assess its suitability for beneficial reuse on-site, or if required, waste classification for off-site disposal purposes;
2. Characterise the material comprising the landfill cap to assess the suitability of this material to remain onsite;
3. Assess the thickness of the capping material and overlying fill material to assess its suitability as a platform (from a contamination perspective) on which to construct the proposed road extension; and validate the results of the geophysical survey and assess the impact that this may have on the proposed Nudurr Drive.

The main problems are:

- How many soil samples should be collected?
- At what depth should soil samples be collected?
- What sample layout should be used to achieve the above objectives?
- What analytes should be tested?

Step 2: Identify the Decision

Is the site suitable for proposed road reserve extension in its current state?

Step 3: Identify Inputs to the Decision

The primary inputs to assessing the above include:

- Information presented in previous investigations including the results of the desktop study and geophysical investigation.
- Results of the investigations set out in this sampling plan.
- Relevant legislation and regulatory guidelines.

Step 4: Define the Study Boundaries

The investigation area has not yet been vertically or laterally defined, however generally comprises the northern portion of the former asbestos landfill in the general vicinity of the area subjected to the ground penetrating radar scan. This is defined in Figure 2 as the green hatched area. The investigation also includes sampling the stockpiled areas shaded brown on the attached Figure 3.

The intrusive environmental works will assist in the delineation of the vertical and lateral extent of contamination on-site, if any.

Step 5: Develop a Decision Rule

Are all QA/QC samples within the required range?

- *If Yes*; then data is considered suitable and reliable for the purpose of the investigation.
- *If No*; then data is not considered suitable and reliable for the purpose of the investigation. In this case:
  - Assess, if identified, any anomalies are due to heterogeneous nature of the sample, reported contaminant concentrations (i.e. close to laboratory limit of reporting (LOR), or poor field or laboratory techniques and, based on this, assess the suitability of the results for inclusion in the data set.
  - If an anomaly is considered to be a result of laboratory error, request re-analysis of the sample in question by the project laboratory or a secondary laboratory.

Where data is considered suitable and reliable for the purpose of the investigation, do the contaminant concentrations exceed the proposed assessment criteria?

- *If Yes*; then further investigation may be necessary to delineate the vertical and lateral extent of the impact. Remediation or on-going management may also be required.
- *If No*; then the site is considered suitable for the proposed land use.

Step 6: Specify Limits of Decision Errors

There are two types of decision errors:

- Sampling errors, which occur when the samples collected are not representative of the conditions within the investigation area; and
- Measurement errors, which occur during sample collection, handling, preparation, analysis and data reduction.

The null hypotheses for this study are:

1) The soils comprising the mound, stockpile and landfill cap are suitable for reuse on the site.

These errors may lead the decision maker to make the following errors:

- Deciding that the soils are suitable for the proposed site use when they are actually not; and
- Deciding that the soils are not suitable for the proposed site use when they actually are.

2) The soils comprising the landfill cap are of acceptable thickness.

These errors may lead the decision maker to make the following errors:

- Deciding that the landfill cap soils are not of sufficient thickness for the proposed site use when they are actually not; and
- Deciding that the landfill cap soils are not of sufficient thickness for the proposed site use when they actually are.

An assessment will be made as to the likelihood of a decision error being made based on the results of a QA/QC assessment and the closeness of the data to assessment criteria. Additionally, statistical methods may be utilised, where applicable, such as 95% Upper Confidence Limit calculations,

The limits for assessment are nominated in Section 8.3.

Step 7: Optimise the Design for Obtaining Data

Based on the previous Steps 1 to 6 of the DQO process, the optimal design for obtaining the required data is presented in the following sections (i.e. proposed field and laboratory programs).

4 SAMPLING AND ANALYSIS METHODOLOGY

4.1 Potential Contaminants of Concern

Based on information presented in the P1ESA (Coffey Environments, 2009, ref: ENVICANB00280AB-R01), a summary of the areas of concern (AECs) and associated potential chemicals of concern is presented in Table 1.

Table 1: Summary of Areas of Environmental Concern

AEC	Potential Chemicals of Concern
Landfill Capping Material	Heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury), PAHs, PCBs, TPH, BTEX, asbestos
Stockpiled Material	Heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury), PAHs, PCBs, TPH, BTEX, asbestos

Notes to Table 1: PAH: Polycyclic Aromatic Hydrocarbons; PCBs: Polychlorinated Biphenyls; TPH: Total Petroleum Hydrocarbons; BTEX: Benzene, Toluene, Ethylbenzene and Xylene

Given the uncertainty of the source and composition of the material present in the landfill capping, soil stockpile and soil mound, it is noted that a broad contaminant screen analysis should also be undertaken on a select number of soil samples collected from the capping material and stockpiled soil. The broad contaminant screen analysis should include the following analytes:

- Cyanide;
- Fluoride;
- Semi-volatile Organic Compounds (SVOCs) screen and;
- Volatile Halogenated Compounds (VHCs) screen;
- Total phenols; and
- pH.

For more detailed information regarding the areas of environmental concern and the potential contaminants of concern, please refer to the P1ESA (Coffey Environments, 2009, ref: ENVICANB00280AB-R01).

4.2 Sampling and Analysis

Coffey Environments adopted a sampling strategy based on a systematic grid pattern for both the stockpile sampling and the test pit sampling. The purpose of this was to ensure that a sufficient spatial (lateral) coverage of the site was achieved with no clustering of sampling points, while ensuring that the sampling density remained in accordance with the relevant guidelines.

Details of the sampling strategy are provided in the table below:

Table 2: Sampling and Analysis Plan and Rationale

Issue	Scope	Rationale
Assess the suitability of Stockpile 1 (located along the northern boundary of the site) for reuse on-site.	• Collect representative soil samples from the stockpiled material at a sampling ratio of approximately one (1) sample per 25m^3 of homogenous material in accordance with *ACT EPA Practice Note No3 Contaminated Sites Requirements for Re-use and Disposal of Contaminated Soil.* • Based on an estimated volume of approximately 1850m^3 a total of 74 soil samples were collected.	Upon construction of the road extension, it will be required to remove the stockpiled soils. No information is currently available regarding the presence, or otherwise, of contamination within the stockpiled soils soil. As such, assessment of the soil is required to characterise the suitability of the material for reuse on-site or, alternatively, facilitate appropriate off-site disposal. In addition, assessment of the stockpiled soil will provide an indication as to whether the material is prone to leaching and, consequently, may have impacted underlying groundwater.
Assess the suitability of Stockpile 2 (located adjacent to the western site boundary) for reuse on-site.	• Collect representative soil samples from the stockpiled material at a sampling ratio of approximately one (1) sample per 25m^3 of homogenous material in accordance with *ACT EPA Practice Note No3 Contaminated Sites Requirements for Re-use and Disposal of Contaminated Soil.* • Based on an estimated volume of approximately 448m^3 a total of 19 soil samples were collected.	Upon construction of the road extension, it will be required to remove the stockpiled soils. No information is currently available regarding the presence, or otherwise, of contamination within the stockpiled soil. As such, assessment of the soil is required to characterise the suitability of the material for reuse on-site or, alternatively, facilitate appropriate off-site disposal. In addition, assessment of the stockpiled soil will provide an indication as to whether the material is prone to leaching and, consequently, may have impacted underlying groundwater.
Assess the contamination status of the capping material and overlying fill soils (outside the footprint of the stockpiled soils) within the area of the proposed road extension.	• Identify the location of the asbestos landfill. • Identify the location of the southern boundary of the proposed Nudurr Drive extension in the vicinity of the landfill. • The investigation area will be in general accordance with the area subjected to the geophysical survey conducted in 2009 (ref: ENVICANB00280AB-R01, Figure 4) excluding the area covered by the mounded soil. This equates to an area of approximately 5,000m^2. Figure 2 identifies the approximate extent of	• Sampling of the cap will facilitate characterisation of the capping material from a contamination perspective and will assess whether it is considered suitable to remain on-site. • Sampling of the fill soils overlying the cap will provide a similar outcome. • Further, the sampling will allow the thickness of the cap and overlying fill soils to be confirmed. • In addition, assessment of the capping material and overlying fill soils will provide an indication as to whether the material is prone to leaching and, consequently, may have impacted

Issue	Scope	Rationale
	this area. • A total of 13 test pits will be excavated across the investigation area in accordance with the Sampling Design Guidelines (NSW EPA, 1995, endorsed by the ACT EPA). Test pits will be excavated on a general grid pattern and extended to depths sufficient to intercept the asbestos fill located beneath the capping material. Test pits will be excavated using a backhoe to reduce disturbance to the landfill. • Samples will be collected from the surface (0.0m), 0.5m, 1.0m and every metre thereafter until the target depth, or refusal, is encountered, whichever is shallower. • The test pit will be reinstated by returning excavated soil to the hole in the order they were removed, and replacing the capping material to create the appropriate seal.	underlying groundwater. • The proposed sampling method (i.e. test pitting) is considered most suitable for this purpose as it allows a visual assessment of the subsurface to be made and the identification of potential asbestos containing fragments possible. It should be noted that the appropriate environmental and health controls would need to be implemented during test pitting activities in accordance with the relevant ACT EPA and WorkCover requirements. •

All samples collected from the stockpiled soils were analysed for the TPH, BTEX, PAH, PCBs, metals, asbestos. Representative samples from the mounded and stockpiled soils were also analysed for SVOC and VOC screens at a rate of 25% of total samples analysed.

Two representative samples from each test pit excavated into the landfill cap across the investigation area were selected for analysis for TPH, BTEX, PAH, PCBs, metals, asbestos and four representative samples were analysed for SVOC and VOC screens.

The remainder of the samples are held as contingency samples by the laboratory, should further analysis be required to assist with contamination delineation (pending receipt of earlier analysis results).

The samples collected were analysed for targeted contaminant/s of concern are summarised in Table 3.

Table 3: Schedule of Analysis

Sampling Location	Analytes	Number of Primary Samples to be Analysed
Stockpile 1 (ST1 to ST74)	TPH, BTEX, PAH, PCBs, metals, asbestos	74 primary samples (ST1 to ST74) were analysed for TPH, BTEX, PAH, PCBs, metals, asbestos
	SVOCs and VOCs screens	3 primary samples (ST14, ST32, ST55) were analysed for SVOC and VOC screens

Sampling Location	Analytes	Number of Primary Samples to be Analysed
Stockpile 2 (ST75 to ST93)	TPH, BTEX, PAH, PCBs, metals, asbestos	19 primary samples (ST75 to ST93) were analysed for TPH, BTEX, PAH, PCBs, metals, asbestos
	SVOCs and VOCs screens	1 primary sample (ST82) was analysed for SVOC and VOC screens
Assessment of Capping Material Test Pits: TP1 to TP13	TPH, BTEX, PAH, PCB, metals, asbestos	26 primary samples (TP1 to TP13 from various depths) were analysed for TPH, BTEX, PAH, PCBs, metals, asbestos
	SVOCs and VOCs screens	4 primary soils (TP10/0.5N, TP10/0.5S, TP11/0.5, TP12/0.5) were analysed for SVOCs and VOCs screens

Note: The number of samples detailed above does not include QA/QC samples. These were collected and analysed at the rate detailed in Section 8.1 of this document.

4.3 Soil Sampling Methodology

Sample collection was conducted in general accordance with general industry standards, the National Environment Protection (Assessment of Contamination) Measure (1999), and the Australian Standards AS4482.1 and AS4482.2, *Guide To Investigation and Sampling of Sites with Potentially Contaminated Soil (Part 1 Non-volatile and semi-volatile compounds; and Part 2 Volatile Substances)*.

4.3.1 Stockpile Sampling

A trowel was used when collecting samples from the surface or from shallow depths within the stockpiled material.

A hand auger was used when collecting samples from deeper within the stockpiled soils (i.e. at depths unable to be reached using a trowel). The hand auger was advanced to the desired depth to collect the sample, and withdrawn. The soil remaining in the hand auger was extracted and placed into the appropriate sample container.

4.3.2 Test Pits

Excavation of test pits was carried out within the investigation area to allow visual inspection of the subsurface. The test pits were excavated to the required depth using a backhoe. Representative soil samples were collected by hand from the centre of the backhoe bucket to prevent cross contamination. Disposable nitrile gloves were worn during sample collection and changed between each sample.

4.3.3 Investigation Supervision

Investigation and sampling of the stockpiles and test pits was undertaken by Srijeeta De (Environmental Technician) and David Walters (Environmental Engineer), respectively. Both Srijeeta and David are

experienced in conducting environmental investigations and posses the relevant health and safety training.

4.3.4 Field Screening

Soil samples were screened using a photo-ionisation detector (PID) which was calibrated daily to 100ppm benzene equivalent using iso-butylene gas.

Field screening results are included on the soil logs presented in Appendix C.

4.3.5 Decontamination

Sampling equipment was decontaminated between each sampling location as follows:

- The surface of all the sampling equipment was scrubbed with a wire brush to remove soil and/or gross contamination;
- The equipment was washed in a bucket filled with a solution of Decon 90, using a brush that could reach all surfaces;
- The equipment was then rinsed in clean potable water; and
- The equipment was allowed to air dry.

4.3.6 Sample Storage and Preservation

Samples for chemical analysis were placed into labelled, laboratory supplied and prepared sample jars. Samples for asbestos were placed zip lock bags, which were then placed then in a second zip lock bag.

Each sample receptacle was labelled with the project number, collection date, individual sampling location number and the depth of sample collection.

Sample jars were placed directly into an ice filled esky in preparation for transportation to the primary or secondary laboratory.

4.3.7 Analysis

Primary and duplicate samples collected were forwarded to a National Association of Testing Authority (NATA) for the analysis required. Laboratory analysis was in accordance with the requirements of Schedule B3 of the NEPC (1999) NEPM *Guideline on Laboratory Analysis of Potentially Contaminated Soils.*

Triplicate samples were forwarded to a National Association of Testing Authority (NATA) for the analysis required. Laboratory analysis will be in accordance with the requirements of Schedule B3 of the NEPC (1999) National Environment Protection Measure (NEPM) *Guideline on Laboratory Analysis of Potentially Contaminated Soils.*

4.4 Health and Safety and Environmental Management Plans

Given the potential for asbestos to be present in the landfill waste material, the investigations were undertaken in accordance with relevant health and safety legislation and regulations endorsed by ACT Workcover. A site specific health and safety plan (H&SP) was prepared to cover the investigations to be undertaken as part of this SAP.

In addition, all the investigations were undertaken in accordance with relevant environmental protection legislation and regulations, and the Environmental Management Plan (EMP) prepared by Coffey Environments. A copy of the EMP is presented in Appendix A.

The EMP provides the following information applicable to the works conducted on-site:

- A summary of relevant health and safety standards;
- A summary of the areas of environmental concerns and associated chemicals of potential concern;
- Primary occupational health risk associated with the works;
- Personal protective equipment to be worn during the works; and
- Environmental hazards (including asbestos and dust) and associated control measures.

Given the potential for asbestos to be encountered during fieldwork, the EMP required that air monitoring be carried out throughout the duration of sampling.

Air monitoring was conducted by Coffey Environments between Wednesday 9th June - Friday 11th June 2010. The monitoring was conducted in accordance with the *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres, 2nd Edition* [NOHSC:3003 (2005)].

Air monitoring results are presented in Appendix B. All air monitoring results were reported to be below the lowest detectable limit of 0.01 fibres/mL for static air monitoring.

4.5 Summary of Sampling Methodology

Table 7.1 provides a summary of the methodology adopted by Coffey Environments during the course of fieldwork.

Table 7.1: Soil Sampling Methodology

Activity	Detail / Comments
Date of Field Activities	Wednesday 9 to Friday 11 June 2010
Test Pitting and Sampling	A total of 13 test pits (TP1 – TP13) were excavated using an excavator to depths between 0.6m and 4.0m bgs. Representative soil samples were collected from the test pits at roughly 100mm sample intervals.
Stockpile Sampling	A total of 93 soils samples were collected from the stockpiled soil. Samples collected from the near surface within the stockpile were collected by hand, while those collected from deeper within the stockpile were collected using a hand auger.
Soil Logging	Soil type classifications and descriptions are based on Coffey Environments' Standard Operating Procedure (SOP), which is generally based on the Unified Soil Classification System (USCS) and Australian Standards *Guide to the investigation and sampling of sites with potentially contaminated soil – Part 1: Non-volatile and semi-volatile compounds* (AS4482.1-2005). Test pit logs are included in Appendix C.

Activity	Detail / Comments
Soil Sampling	Sample collection was conducted according to Coffey Environments' SOP, which are based on standard industry practices. Soil samples were collected using disposable nitrile gloves and placed immediately into laboratory prepared and supplied glass sample jars.
Soil Screening	Soil samples collected from the test pits were screened using a Photoionisation Detector (PID) which was calibrated daily to 100ppm benzene equivalent using iso-butylene gas.
Sample Preservation and Transport	Samples were stored in a chilled esky filled while on-site and in transit to the laboratory. Samples were transported under Chain of Custody (COC) protocol to SGS Australia Pty Ltd (SGS) and LabMark for analysis. COCs are included in Appendix D.
Decontamination of Drilling Equipment	Decontamination of the hand auger used for stockpile sampling was completed according to Coffey Environments' SOP and included the use of Decon-90 and potable water between each sampling location.
Disposal of Soil Cuttings	Following the completion of sampling, the spoil generated on-site during test pitting was re-instated back into the test pit excavations in the order that it was removed. Nominal compaction was conducted using the bucket of the excavator.

5 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

5.1 Field QA/QC

To ensure the useability of the data obtained as part of this assessment, Coffey Environments collected intra-laboratory duplicate samples and inter-laboratory triplicate samples at a rate of 5% of the total number of primary samples.

Duplicate and triplicate samples were obtained by collecting a larger than normal soil sample, splitting it into equal portions and placing them directly into separate sample jars. One sample jar was then labelled as normal, while the duplicate and triplicate jars were labelled with an anonymous sample identification number.

Primary, duplicate and triplicate sample combinations are listed in Table 8.1.

Table 8.1: QC Samples Collected

Primary Sample	Duplicate Sample	Laboratory	Triplicate Sample	Laboratory
TP4/0.0	TP4/0.0 DUP	SGS	TP4/0.0 TRIP	LabMark
TP9/0.5	TP9/0.5 DUP	SGS	TP9/0.5 TRIP	LabMark
ST11	QC1	SGS	QC1A	LabMark
ST31	QC2	SGS	QC2A	LabMark
ST56	QC3	SGS	QC3A	LabMark
ST75	QC4	SGS	QC4A	LabMark
ST86	QC5	SGS	QC5A	LabMark

5.2 Laboratory QA/QC

In accordance with standard industry practice, the laboratories performed internal QA/QC assessments. The assessments are typically described as a multi-level approach whereby standard laboratory control procedures are implemented including laboratory duplicates, method blanks, matrix spikes and surrogate spikes.

5.3 Quality Assurance / Quality Control Indicators

QA/QC indicators for the project were based on the analysis of field and laboratory quality control sample results. Specific indicators for field and laboratory QA/QC samples are shown in the Table 8.2.

Table 8.2: Quality Assurance / Quality Control Indicators

Type of Quality Control Sample	Control Limit
Duplicate Samples	Relative Percentage Difference (RPD) within 50% for soil
Triplicate Samples	RPD within 50% for soil
Spikes	Recoveries within the following ranges 70% - 130% for inorganics / metals 60% - 140% for organics 10-140% for SVOC and speciated phenols
Blanks	Analytes not detected.

(1) RPD can be expected to be higher for organic analysis than for inorganics and for low concentrations of analytes.

5.4 Field QA/QC Results

With the exception of the outliers listed below, the calculated RPDs were acceptable for duplicate and triplicate pairs.

Table E – RPDs Outside Acceptable Range

Primary Sample	QC Sample	Analyte	RPD %
ST11	QCA1	Lead	66
ST56	QC3A	Lead	91
TP4/0.0	TP4/0.0 Dup	Chromium	188
		Copper	182
		Nickel	185
		Zinc	186
TP9/0.5	TP9/0.5 Dup	Zinc	53
TP9/0.5	TP9/0.5 Trip	Lead	55
		Zinc	137

Where RPDs were outside the acceptable range, sampling procedures, laboratory analytical methods and laboratory results were investigated. A detailed review of analytical results with RPD exceedences indicates that the unacceptable results are not considered to compromise the integrity of the analytical results as all primary and duplicate/triplicate samples reported concentrations significantly less than the adopted assessment criteria.

In summary, Coffey Environments considers that the field QC results are acceptable for the purposes of this investigation.

5.5 Laboratory QA/QC Results

NATA accredited analytical laboratories were used for all laboratory testing.

Laboratory QC analytical results are summarised below.

1. Target analytes remained below laboratory detection limits in all laboratory method blank samples.
2. The RPDs for laboratory duplicates were generally within the acceptable range, with the exception of a few outliers.
3. Some analytes reported laboratory control samples, matrix spikes and surrogate samples outside the acceptable range.

In consideration of the chemical concentrations reported for the primary samples, these anomalies identified within the laboratory data are considered unlikely to affect the integrity of the results. In summary, Coffey Environments considers that the laboratory QC results are acceptable for the purposes of this investigation.

6 BASIS FOR ASSESSMENT CRITERIA

6.1 Regulatory Framework for Soil Assessment

To assess the significance of any potential contaminants that may be detected through laboratory analysis of soil samples collected from test pits excavated across the site, reference needs to be made to environmental and/or human health threshold levels or acceptance criteria. Investigation levels are selected based on set criteria of land usage and potential environmental impact.

6.2 Soil Assessment Investigation Levels

The assessment has been undertaken in accordance with the ACT EPA (1997) Environment Protection Act and will use the following assessment criteria adopted for this project:

- ACT EPA Practice Note No. 4 – *Contaminated Sites – Requirements for Transport & Disposal of Asbestos Contaminated Wastes.*
- ACT EPA Practice Note No.3 – *Contaminated Sites – Requirements for Re-use and Disposal of Contaminated Soil.*
- NEPC (1999) *National Environmental Protection (Assessment of Site Contamination) Measure* (NEPM). NEPC (1999) provides soil investigation levels (health-based investigation levels (HILs) and ecological investigation levels (EILs) for various land uses and a decision-making process for assessing suitability of a site for a proposed land use sites.
- NSW DECC (2006) *Guidelines for the NSW Auditor Scheme* (Second Edition).
- NSW EPA (1994) *Guidelines for Assessing Service Station Sites.*

Human exposure settings based on land use have been established for health based investigation levels (HILs). These are published in NEPC (1999) and are listed below:

A. 'Standard' residential with garden/accessible soil (home-grown produce contributing less than 10% of vegetable and fruit intake; no poultry): this category includes children's day-care centres, kindergartens, preschools and primary schools.

B. Residential with substantial vegetable garden (contributing 10% or more of vegetable and fruit intake) and/or poultry providing any egg or poultry meat dietary intake.

C. Residential with substantial vegetable garden (contributing 10% or more of vegetable and fruit intake); poultry excluded.

D. Residential with minimal opportunities for soil access: includes dwellings with fully and permanently paved yard space such as high-rise apartments and flats.

E. Parks, recreational open space and playing fields: includes secondary schools.

F. Commercial/Industrial: includes premises such as shops and offices as well as factories and industrial sites.

For details on derivation of HILs for human exposure settings based on land use see Schedule B(7A) of NEPC (1999).

The proposed use of Nudurr Drive is as roadway which is considered to be generally consistent with a commercial/industrial land use.

Therefore, soil investigation results have been compared against:

1. Health based threshold concentrations for commercial/industrial land use, Column F, Table 5-A (NEPC, 1999).

Currently, there are no nationally endorsed HILs for volatile petroleum hydrocarbons. Sensitive land use thresholds for petroleum based organic contaminants published in NSW EPA (1994) will be used (without multiplication) to supplement the published HIL F.

Currently there are no set guidelines in NSW or the ACT for assessment of asbestos in soils. A criterion of "no asbestos detected" will be adopted as an initial screening level for assessing soil asbestos analytical results. Where asbestos is detected other Australian guidelines may be considered.

Where there are no published Australian assessment criteria available, the LOR was used as an initial screen. Where the LORs are exceeded other internationally endorsed criteria may be referenced from various sources such as USEPA guidelines.

Nominated ILs for soil are summarised in Table 9.1, and are included with the soil analytical results in Tables 1 to 4.

Table 9.1: Adopted Soil Assessment Criteria

Contaminant	NEPC (1999) HIL F (commercial/industrial)	NSW EPA (1994)
Benzene	-	1
Toluene	-	1.4
Ethylbenzene	-	3.1
Total Xylenes	-	14
TPH(C6-C9)	-	65
TPH(C10-C36)	-	1,000
Benzo(a)pyrene	5	-
PAHs (Total)	100	-
PCB (Total)	50	-
Arsenic	500	-
Cadmium	100	-
Chromium (VI)	500	-
• Copper	• 5,000	• -
Lead	1,500	-
Mercury	75	-
Nickel	3,000	-
Zinc	35,000	-

6.3 Waste Classification

ACT EPA requirements for re-use and disposal of contaminated soil are detailed in *Practice Note No. 3 – Requirements for Re-use and Disposal of Contaminated Soil*. This requires that disposal application is submitted to ACT EPU for approval. The application should include the soil investigation results in the form of a report which includes an assessment of the classification of the waste in accordance with ACT's *Environmental Standards: Assessment and Classification of Liquid and Non-liquid Wastes (*2000).

Waste disposal applications must be approved by the ACT EPU before the waste can be disposed.

6.4 Thickness of capping material

The ACT EPA *Practice Note No. 4 – Requirements for Transport and Disposal of Asbestos* details ACT EPA requirements for transport and disposal of asbestos.

This document outlines specific disposal requirements for asbestos waste and specifies depth of cover for asbestos material based on whether the asbestos is in a bonded matrix (ACM) or fibres and dust as follows:

- The asbestos waste must be covered to a depth of at least:
  - 1.0m below ground surface (in the case of stabilised asbestos waste in bonded matrix); or
  - 3.0m below ground surface (in the (in the case of asbestos fibre and dust waste).

7 RESULTS

7.1 Subsurface Conditions

7.1.1 Stockpiles

The stockpiled material located on-site typically comprises homogeneous brown to dark brown low plasticity sandy clay with occasional gravel and brick fragments. No staining or odours were noted within the material inspected and all PID readings were recorded below 10ppm.

7.1.2 Test Pits

The material encountered during the test pit investigations was observed to fall into two distinct categories as described below:

- Area 1 (Test pits TP1 to TP8) - The area located to the north of Stockpile 1 was characterised by naturally occurring stiff clays overlying shale bedrock. No staining or odours were noted and PID readings were generally less than 2.1ppm, excluding sample TP4_0.0 which recorded a PID of 19.9ppm. The lithology suggests that this portion of the site does not form part of the landfilled area.
- Area 2 (Test pits TP9 to TP13) - This area is located to the south of Stockpile 1 and was characterised by shallow topsoil material (i.e. between approximately 100mm and 200mm in thickness) overlying miscellaneous mixed waste. The waste was observed to include plastic bags, plastic and glass bottles, tiles, bricks, concrete, wood, scrap metal including corrugated iron sheeting, and metal drums. In addition, what appeared to be fragments of asbestos containing material (ACM) were encountered in test pit TP11. PID readings were recorded between 0.1ppm and 218ppm.

7.2 Laboratory Results

7.2.1 Stockpiles

The results of the laboratory analysis indicated that all samples reported concentrations of TPH, BTEX, PAH, PCB, VOC and SVOCs less than the laboratory detection limit.

Detectable concentrations of trace metals were reported, however these were below the adopted assessment criteria for commercial/industrial land use.

In addition, no asbestos fibres were detected in any of the samples collected from the stockpiled soil.

7.2.2 Test Pits

The results of the laboratory analysis indicated that all samples reported concentrations of TPH, BTEX, Total PAH, PCB, VOC and SVOCs less than the laboratory detection limit.

Although detectable concentrations of benzo(a)pyrene and trace metals were reported, these were below the adopted assessment criteria for commercial/industrial land use.

In addition, no asbestos fibres were detected in any of the samples collected from the test pits.

7.3 Thickness of Capping Material

The soils overlying the waste material comprising the landfill were observed to be no greater than 200mm in thickness and comprised loose sandy topsoils. This was much less than previously anticipated based on the geophysical survey results.

8 DISCUSSION

8.1 Landfill Cap Characterisation

Field observations during test pitting works indicated that the northern extent of the landfill broadly corresponds to the location of the large stockpile. The approximate extent of the landfill material is consistent with the area of extent previously identified in the surveyed drawing provided in Figure 2. Based on the field observations, it is likely that the northern extent of the landfill will extend into the proposed road reserve corridor.

The waste material is characterised by general demolition wastes such a concrete, bricks and scrap metals, plus general domestic waste such as plastic bags, plastic and glass bottles. Although a small fragment of ACM was encountered in TP11, large quantities of double bagged material, as described in earlier reports, were not encountered within the landfill. There was no evidence of putrescible materials during the investigations and this is consistent with the site history.

Field observations indicated that the capping material overlying the landfill waste is relatively thin (i.e. between 100mm and 200mm thick) and comprises topsoil with cobbles. The capping overlying the waste does not comply with the specifications presented in Practice Note No. 4 which requires that at least 1.0m of capping be placed over bonded asbestos waste.

In summary, the capping overlying the landfill waste (to the south of Stockpile 1) and natural soils located to the north of Stockpile 1 are considered suitable to remain on-site from a contamination perspective. However, the thickness of the capping material overlying the waste is not thick enough to comply with ACT EPA requirements.

8.2 Stockpile Characterisation

The purpose of the stockpile sampling was to characterise the material to assess whether it was suitable to remain on-site and to enable classification to facilitate off-site disposal, if required.

Field observations indicated that the material comprising the stockpiles consists of relatively homogenous (uniform) soils with occasional gravel and brick fragments. The contaminant concentrations within the stockpiled soil were below the health-based assessment criteria and the material comprising the stockpiles is considered suitable to remain on-site.

In the case that it is necessary to dispose of the soil off-site, in accordance with the ACT *Environmental Standards: Assessment and Classification of Liquid and Non-Liquid Wastes* (2000) the material is currently classified as Solid Waste. However, a waste disposal application must be approved by ACT EPA before disposal to an approved waste disposal facility.

The stockpiled material may also be re-used off site, subject to approval by ACT EPA. Details of the analytical results and intended site for soil re-use must be provided to ACT EPA for approval for disposal must be provided.

8.3 Potential Impacts to Groundwater

The concentrations detected in the capping material and stockpiled material were considered to be low and unlikely to pose a risk of leaching into groundwater. It is noted that this does not include an

assessment of the waste material underlying the capping layer, which was not considered as part of the scope for this investigation.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

9.1.1 Landfill Capping Material

The extent of the landfill appears to be consistent with the surveyed plan shown in Figure 2 and roughly corresponds to the location of the large stockpile. It is likely that the road extension will extend over landfill areas.

The capping overlying the landfill waste (to the south of Stockpile 1) and natural soils located to the north of Stockpile 1 are considered suitable to remain on-site from a contamination perspective. However, the thickness of the capping material overlying the waste is not thick enough to comply with ACT EPA requirements and requires some management to ensure that it is suitable for the road construction. Options for this management are provided in section 9.2.

It is noted that the landfilled material is unlikely to be geotechnically suitable for the proposed road extension, although this would need to be confirmed following assessment by a suitably qualified geotechnical engineer.

9.1.2 Stockpiled Material

Based on the results of this investigation it is considered that the stockpiled material does not pose a risk to human health and is suitable for re-use on-site. Although its suitability for use as additional capping material would be dependent upon its geotechnical characteristics (which is outside the scope of this investigation).

In the case that it is necessary to dispose of the soil off-site, the material is currently classified as Solid Waste in accordance with the ACT *Environmental Standards: Assessment and Classification of Liquid and Non-Liquid Wastes* (2000). Although disposal would be subject to ACT EPA approval.

The stockpiled material may also be re-used off site, subject to approval by ACT EPA.

9.2 Recommendations

Based on the results of this contamination assessment, Coffey Environments notes that there are potentially two options available for dealing with the landfilled areas prior to the construction of the proposed road reserve extension.

These have been summarised in a table below:

• **Option 1**	• **Advantages**	• **Disadvantages**
• Removal of existing capping material and stockpiling on-site; • Excavation of the underlying landfill material, including any asbestos containing material, and either placed within another part of the landfill that is not within the road extension footprint or disposed off-site to an appropriately licensed site or landfill facility; • Backfill the void with geotechnically suitable material that will facilitate construction of the road extension.	• Material to be imported to the site can be selected to ensure it will be geotechnically suitable for the road construction. • No long term environmental management plan required and no requirement to accept liability for long term management of encapsulated waste.	• Likely to be more expensive compared to Option 2.
• **Option 2**	• **Advantages**	• **Disadvantages**
• Installation of additional capping layer across the footprint of the proposed road reserve. • To ensure the cap will facilitate construction of the proposed road extension, it will be necessary to ensure the cap construction meets relevant geotechnical requirements. • Given the unconsolidated nature of the landfilled material, achieving necessary compaction requirements may not be possible.	• Less expensive than option 1	• Requirement for long term management of encapsulated waste to be managed through an EMP. The liability for maintaining the containment of the waste will need to be managed in perpetuity or whilever the waste is encapsulated. Such liability may not be acceptable to stakeholders. • The waste material underlying the capping material may not be geotechnically suitable for the road foundations.

As discussed above both options have advantages and disadvantages. Coffey would recommend that if option 2 is considered, consultation with relevant stakeholders is conducted to ensure that the on-going management liability of the encapsulated waste is acceptable. Additionally, the viability of option 2 would be dependent on the outcome of a geotechnical assessment of the suitability of the waste material.

Both options presented above would require the preparation of a remediation action plan which would provide specific details of the remediation strategy and would provide information regarding environmental controls to be implemented at the site, specifically with regards to the management of asbestos containing material and potentially contaminated landfill material.

10 REFERENCES

ACT EPA Practice Note No.3 – *Contaminated Sites – Requirements for Re-use and Disposal of Contaminated Soil.*

ACT EPA Practice Note No. 4 – *Contaminated Sites – Requirements for Transport & Disposal of Asbestos Contaminated Wastes.*

AS4482.1-2005. *Guide to the investigation and sampling of sites with potentially contaminated soil – Part 1: Non-volatile and semi-volatile compounds.*

Coffey Environments (2009) *Phase 1 Environmental Site Assessment, C09017.1 Gungahlin Asbestos Soil Site Investigation.*

Coffey Environments (2010a) *Sampling and Analysis Plan, Nudurr Drive Road Reserve, Gungahlin ACT.*

Coffey Environments (2010b) *Environmental Management Plan, Nudurr Drive Road Reserve Extension, Gungahlin ACT.*

NEPC (1999) *National Environmental Protection (Assessment of Site Contamination) Measure* (NEPM).

NOHSC:3003 (2005) *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres, 2nd Edition.*

NSW EPA (1995) *Sampling Design Guidelines.*

NSW EPA (1997) *Guidelines for Consultants Reporting on Contaminated Sites.*

NSW EPA (1994) *Guidelines for Assessing Service Station Sites.*

NSW DEC (2006) *Guidelines for the NSW Site Auditor Scheme* (2nd ed.)

Environment ACT (2000) *Environmental Standards: Assessment and Classification of Liquid and Non-liquid Wastes.*

DRAFT

Tables

Contamination Assessment
Nudurr Drive Extension, Gungahlin, ACT

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Table 1
Soil Analytical Results
Nudurr Drive Extension
ENVICANB00280AE

Sample ID	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10	ST11	QC1	RPD	QC1A	RPD	ST12	ST13	ST14	ST15	ST16
Sample Depth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sample Date	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	-	9/06/2010	-	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010

Chemical Group	Chemical Name	Units	EQL	ACT Environmental Standards Inert Waste (1)	ACT Environmental Standards Solid Waste (1)	NEPM 1999 HIL F	NSW EPA 1994 Terrestial Organisms																		
TPH	TPH C6 - C9 Fraction	mg/kg	20	650	650		65	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	NA	<10	NA	<20	<20	<20	<20	<20
	TPH C10 - C14 Fraction	mg/kg	20					<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	NA	<50	NA	<20	<20	<20	<20	<20
	TPH C15 - C28 Fraction	mg/kg	50					<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	NA	<100	NA	<50	<50	<50	<50	<50
	TPH C29 - C36 Fraction	mg/kg	50					<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	NA	<100	NA	<50	<50	<50	<50	<50
	TPH+C10 - C36 (Sum of total)	mg/kg		500	10000		1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BTEX	Benzene	mg/kg	0.1	1	10		1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.2	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Toluene	mg/kg	0.1	28.8	288		1.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Ethylbenzene	mg/kg	0.1	60	600		3.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Xylene-Total	mg/kg	0.3	100	1000		14	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	NA	<1.5	NA	<0.3	<0.3	<0.3	<0.3	<0.3
Metals	Arsenic	mg/kg	3	10	100	5000		8	7	8	7	8	8	7	6	7	6	6	7	15	-	-	7	7	7	7	7
	Cadmium	mg/kg	0.3	2	20	100		<0.6	0.4	0.5	0.4	0.3	0.5	0.4	0.4	0.4	0.4	0.8	0.95	17	-	-	0.5	0.5	0.4	0.4	0.4
	Chromium (III+VI)	mg/kg	0.3	10	100			42	53	73	52	39	59	55	28	28	42	29	27	7	-	-	69	53	44	44	60
	Copper	mg/kg	0.5			5000		32	18	19	16	20	13	9.8	18	25	12	42	55	27	-	-	21	21	11	17	10
	Lead	mg/kg	1	10	100	1500	300	8	17	21	15	9.3	22	19	10	7	15	6	6	0	3	66	20	13	25	10	19
	Mercury	mg/kg	0.05	0.4	4	75		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05
	Nickel	mg/kg	0.5	4	40	3000		19	10	11	12	14	11	11	15	21	17	25	27	4	-	-	15	18	12	17	11
	Zinc	mg/kg	0.5			35000		20	14	13	16	16	12	11	18	20	13	25	27	8	-	-	18	20	12	19	13
PAH	Acenaphthene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Acenaphthylene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Benz(a)anthracene	mg/kg	0.1					<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Benzo(a) pyrene	mg/kg	0.05	0.06	0.6	5		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NA	<0.5	NA	<0.05	<0.05	<0.05	<0.05	<0.05
	Benzo(b)&(k)fluoranthene	mg/kg	0.2					<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA	<1.0	NA	<0.2	<0.2	<0.2	<0.2	<0.2
	Benzo(g,h,i)perylene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Chrysene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Dibenz(a,h)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Fluoranthene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Fluorene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Naphthalene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Phenanthrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	PAHs (Sum of total)	mg/kg	1.75	200	200	100		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB	Arochlor 1221	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior-1016	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1232	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1242	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1248	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1254	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1260	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1262	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1268	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1
	PCBs (Sum of total)	mg/kg	0.9	2	<50	50		<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	NA	<0.5	NA	<0.9	<0.9	<0.9	<0.8	<0.9
OCP	4,4-DDE	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-	-
	a-BHC	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Aldrin	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Aldrin + Dieldrin	mg/kg				50		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	b-BHC	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	cis-Chlordane	mg/kg	0.1			250		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	d-BHC	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	DDD	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	DDT	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	DDT+DDE+DDD	mg/kg				1000		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Dieldrin	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Endosulfan I	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Endosulfan II	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Endosulfan sulphate	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Endrin	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Endrin aldehyde	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Endrin ketone	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	g-BHC (Lindane)	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Heptachlor	mg/kg	0.1			50		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Heptachlor epoxide	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Hexachlorobenzene	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	Methoxychlor	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
	trans-chlordane	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.1	"	"
Organophosphorus Pesticides	Dichlorvos	mg/kg	<1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-
	Dimethoate	mg/kg	<1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<1	"	"
	Diazanon	mg/kg	<0.5					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.5	"	"
	Fenitrothion	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.2	"	"
	Malathion	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.2	"	"
	Chlorpyrifos-ethyl	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.2	"	"
	Parathion-ethyl	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.2	"	"
	Bromofos-ethyl	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.2	"	"
	Methidation	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.2	"	"
	Ethion	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.2	"	"
	Azinphos-methyl	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	<0.2	"	"

(1) Maximum values of specific contaminant concentrations for classification without TCLP (ACT Environmental Standards, 2000).

Indicates concentrations exceeding adopted asssessment criteria

coffey environments
SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

Table 1
Soil Analytical Results
Nudurr Drive Extension
ENVICANB00280AE

Sample ID	ST17	ST18	ST19	ST20	ST21	ST22	ST23	ST24	ST25	ST26	ST27	ST28	ST29	ST30	ST31	QC2	RPD	QC2A	RPD	ST32
Sample Depth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sample Date	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	-	9/06/2010	-	9/06/2010

Chemical Group	Chemical Name	Units	EQL	ACT Environmental Standards Inert Waste [1]	ACT Environmental Standards Solid Waste [1]	NEPM 1999 HIL F	NSW EPA 1994 Terrestial Organisms																			
TPH	TPH C6 - C9 Fraction	mg/kg	20	650	650		65	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	NA	<10	NA	<20
	TPH C10 - C14 Fraction	mg/kg	20					<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	NA	<50	NA	<50
	TPH C15 - C28 Fraction	mg/kg	50					<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	NA	<100	NA	<50
	TPH C29 - C36 Fraction	mg/kg	50					<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	NA	100	NA	<50
	TPH+C10 - C36 (Sum of total)	mg/kg		500	10000		1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		100	-	-
BTEX	Benzene	mg/kg	0.1	1	10		1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.2	NA	<0.1
	Toluene	mg/kg	0.1	28.8	288		1.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Ethylbenzene	mg/kg	0.1	60	600		3.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Xylene Total	mg/kg	0.3	100	1000		14	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	NA	<1.5	NA	<0.3
Metals	Arsenic	mg/kg	3	10	100	5000		7	7	5	6	6	6	11	7	6	7	4	5	4	7	7	9	25	-	-	4
	Cadmium	mg/kg	0.3	2	20	100		0.4	0.4	0.4	0.4	0.3	0.4	0.5	0.3	0.3	0.3	<0.3	0.3	<0.3	0.4	0.4	0.5	22	-	-	<0.3
	Chromium (III+VI)	mg/kg	0.3	10	100			26	61	59	50	40	28	31	43	38	46	25	38	28	46	52	64	21	-	-	31
	Copper	mg/kg	0.5			5000		24	9.6	9	17	13	23	24	19	9	12	7.7	8.5	8.2	15	16	22	32	-	-	8.1
	Lead	mg/kg	1	10	100	1500	300	18	19	17	15	14	10	13	13	16	15	6	11	9	13	15	16	5	10	40	9.6
	Mercury	mg/kg	0.05	0.4	4	75		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	<0.05
	Nickel	mg/kg	0.5	4	40	3000		23	9.5	10	12	13	18	28	15	11	12	12	12	13	11	14	15	7	-	-	10
	Zinc	mg/kg	0.5			35000		39	15	13	13	15	25	30	16	12	17	11	13	12	14	19	20	5	-	-	12
PAH	Acenaphthene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Acenaphthylene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Benz(a)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Benzo(a) pyrene	mg/kg	0.05	0.06	0.8	5		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NA	<0.5	NA	<0.05
	Benzo(b&/k)fluoranthene	mg/kg	0.2					<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA	<1.0	NA	<0.2
	Benzo(g,h,i)perylene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Chrysene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Dibenz(a,h)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Fluoranthene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Fluorene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Naphthalene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Phenanthrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	PAHs (Sum of total)	mg/kg	1.75	200	200	100		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
PCB	Arochlor 1221	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Aroclor 1016	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Aroclor 1232	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Aroclor 1242	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Aroclor 1248	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Aroclor 1254	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Aroclor 1260	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Aroclor 1262	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	Aroclor 1268	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1
	PCBs (Sum of total)	mg/kg	0.9	2	<50	50		<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	NA	<0.5	NA	<0.9
OCP	4,4-DDE	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	<0.1
	a-BHC	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Aldrin	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Aldrin + Dieldrin	mg/kg				50		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	b-BHC	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	cis-Chlordane	mg/kg	0.1			250		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	d-BHC	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	DDD	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	DDT	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	DDT+DDE+DDD	mg/kg				1000		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Dieldrin	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Endosulfan I	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Endosulfan II	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Endosulfan sulphate	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Endrin	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Endrin aldehyde	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Endrin ketone	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	g-BHC (Lindane)	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Heptachlor	mg/kg	0.1			50		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Heptachlor epoxide	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Hexachlorobenzene	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	Methoxychlor	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.1
	trans-chlordane	mg/kg	0.1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	
Organophosphorus Pesticides	Dichlorvos	mg/kg	<1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	<1
	Dimethoate	mg/kg	<1					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.5
	Diazanon	mg/kg	<0.5					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.2
	Fenitrothion	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.2
	Malathion	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.2
	Chlorpyrifos-ethyl	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.2
	Parathion-ethyl	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.2
	Bromofos-ethyl	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.2
	Methidation	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.2
	Ethion	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.2
	Azinphos-methyl	mg/kg	<0.2					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	<0.2

(1) Maximum values of specific contaminant concentrations for classification without TCLP (ACT Environmental Standards, 2000).

Indicates concentrations exceeding adopted asssessment criteria

coffey environments
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Table 1
Soil Analytical Results
Nudurr Drive Extension
ENVICANB00280AE

Sample ID	ST33	ST34	ST35	ST36	ST37	ST38	ST39	ST40	ST41	ST42	ST43	ST44	ST45	ST46	ST47	ST48	ST49	ST50	ST51	ST52
Sample Depth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sample Date	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	10/06/2010

Chemical Group	Chemical Name	Units	EQL	ACT Environmental Standards Inert Waste [1]	ACT Environmental Standards Solid Waste [1]	NEPM 1999 HIL F	NSW EPA 1994 Terrestial Organisms																			
TPH	TPH C6 - C9 Fraction	mg/kg	20	650	650		65	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	TPH C10 - C14 Fraction	mg/kg	20					<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	TPH C15 - C28 Fraction	mg/kg	50					<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	TPH C29 - C36 Fraction	mg/kg	50					<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	TPH+C10 - C36 (Sum of total)	mg/kg		500	10000		1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BTEX	Benzene	mg/kg	0,1	1	10		1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Toluene	mg/kg	0,1	28,8	288		1,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Ethylbenzene	mg/kg	0,1	60	600		3,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Xylene Total	mg/kg	0,3	100	1000		14	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Metals	Arsenic	mg/kg	3	10	100	5000		5	5	6	5	6	6	7	7	6	6	9	9	8	12	12	12	<0,3	<0,3	0,3	<0,3
	Cadmium	mg/kg	0,3	2	20	100		<0,3	<0,3	<0,3	<0,3	0,4	<0,3	0,4	0,3	0,4	<0,3	0,4	<0,3	<0,3	0,3	0,3	<0,3	<0,3	0,3	<0,3	<0,3
	Chromium (III+VI)	mg/kg	0,3	10	100			36	43	42	35	49	36	61	43	45	43	59	37	38	38	43	42	32	52	37	35
	Copper	mg/kg	0,5			5000		8,2	8,7	22	9,5	15	19	12	10	12	9	20	14	12	13	14	13	13	14	21	13
	Lead	mg/kg	1	10	100	1500	300	11	13	12	10	14	7	14	13	23	8	11	17	14	17	14	12	13	14	5	5
	Mercury	mg/kg	0,05	0,4	4	75		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	0,09	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
	Nickel	mg/kg	0,5	4	40	3000		12	12	13	12	12	17	13	13	9,8	25	23	15	13	17	18	19	14	19	22	25
	Zinc	mg/kg	0,5			35000		13	14	13	13	15	18	13	13	10	24	34	24	20	19	25	29	22	19	12	21
PAH	Acenaphthene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Acenaphthylene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Anthracene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Benz(a)anthracene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Benzo(a) pyrene	mg/kg	0,05	0,08	0,8	5		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
	Benzo(b)&(k)fluoranthene	mg/kg	0,2					<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2
	Benzo(g,h,i)perylene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Chrysene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Dibenz(a,h)anthracene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Fluoranthene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Fluorene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Indeno(1,2,3-c,d)pyrene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Naphthalene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Phenanthrene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Pyrene	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	PAHs (Sum of total)	mg/kg	1,75	200	200	100		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB	Arochlor 1221	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Aroclor 1016	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Aroclor 1232	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Aroclor 1242	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Aroclor 1248	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Aroclor 1254	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Aroclor 1260	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Aroclor 1262	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	Aroclor 1268	mg/kg	0,1					<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
	PCBs (Sum of total)	mg/kg	0,9	2	<50	50		<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9	<0,9
OCP	4,4-DDE	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	a-BHC	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aldrin	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aldrin + Dieldrin	mg/kg				50		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	b-BHC	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	cis-Chlordane	mg/kg	0,1			250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	d-BHC	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDD	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDT	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDT+DDE+DDD	mg/kg				1000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dieldrin	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endosulfan I	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endosulfan II	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endosulfan sulphate	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin aldehyde	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin ketone	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	g-BHC (Lindane)	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heptachlor	mg/kg	0,1			50		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heptachlor epoxide	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hexachlorobenzene	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methoxychlor	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	trans-chlordane	mg/kg	0,1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organophosphorus Pesticides	Dichlorvos	mg/kg	<1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dimethoate	mg/kg	<1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Diazanon	mg/kg	<0,5					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Fenitrothion	mg/kg	<0,2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Malathion	mg/kg	<0,2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chlorpyrifos-ethyl	mg/kg	<0,2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Parathion-ethyl	mg/kg	<0,2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromofos-ethyl	mg/kg	<0,2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methidation	mg/kg	<0,2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ethion	mg/kg	<0,2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Azinphos-methyl	mg/kg	<0,2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(1) Maximum values of specific contaminant concentrations for classification without TCLP (ACT Environmental Standards, 2000).

Indicates concentrations exceeding adopted asssessment criteria

coffey environments
SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

Table 1
Soil Analytical Results
Nudurr Drive Extension
ENVICANB00280AE

Sample ID	ST53	ST54	ST55	ST56	QC3	RPD	QC3A	RPD	ST57	ST58	ST59	ST60	ST61	ST62	ST63	ST64	ST65	ST66	ST67	ST68
Sample Depth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sample Date	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	-	10/06/2010	-	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010

Chemical Group	Chemical Name	Units	EQL	ACT Environmental Standards Inert Waste [1]	ACT Environmental Standards Solid Waste [1]	NEPM 1999 HIL F	NSW EPA 1994 Terrestial Organisms																		
TPH	TPH C6 - C9 Fraction	mg/kg	20	650	650		65	<20	<20	<20	<20	<20	NA	<10	NA	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	TPH C10 - C14 Fraction	mg/kg	20					<20	<20	<20	<20	<20	NA	<50	NA	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	TPH C15 - C28 Fraction	mg/kg	50					<50	<50	<50	<50	<50	NA	<100	NA	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	TPH C29 - C36 Fraction	mg/kg	50					<50	<50	<50	<50	<50	NA	<100	NA	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	TPH+C10– C36 (Sum of total)	mg/kg		500	10000		1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BTEX	Benzene	mg/kg	0.1	1	10		1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.2	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Toluene	mg/kg	0.1	28.8	288		1.4	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Ethylbenzene	mg/kg	0.1	60	600		3.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Xylene Total	mg/kg	0.3	100	1000		14	<0.3	<0.3	<0.3	<0.3	<0.3	NA	<1.5	NA	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Metals	Arsenic	mg/kg	3	10	100	5000		10	16	10	6	6	0	-	-	6	7	5	5	5	8	5	6	5	6	6	6	7
	Cadmium	mg/kg	0.3	2	20	100		<0.3	<0.3	<0.3	0.8	0.96	17	-	-	0.5	0.94	0.6	0.5	0.5	0.8	0.8	0.5	0.7	0.7	0.5	<0.3
	Chromium (III+VI)	mg/kg	0.3	10	100			47	37	39	26	24	15	-	-	31	20	27	31	43	24	28	31	29	27	31	33
	Copper	mg/kg	0.5			5000		16	16	15	36	36	0	-	-	25	64	19	13	20	24	24	30	33	20	19	12
	Lead	mg/kg	1	10	100	1500	300	6	3	7	8	7	13	3	91	8	7	5	6	10	9	7	6	7	8	9	8
	Mercury	mg/kg	0.05	0.4	4	75		<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Nickel	mg/kg	0.5	4	40	3000		24	24	24	26	28	7	-	-	22	32	27	32	19	29	30	30	26	34	22	20
	Zinc	mg/kg	0.5			35000		16	12	13	24	31	25	-	-	19	29	21	20	17	27	25	26	25	26	24	19
PAH	Acenaphthene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Acenaphthylene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Benz(a)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Benzo(a) pyrene	mg/kg	0.05	0.08	0.8	5		<0.05	<0.05	<0.05	<0.05	<0.05	NA	<0.5	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Benzo(b)&(k)fluoranthene	mg/kg	0.2					<0.2	<0.2	<0.2	<0.2	<0.2	NA	<1.0	NA	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Benzo(g,h,i)perylene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Chrysene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Dibenz(a,h)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Fluoranthene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Fluorene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Naphthalene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Phenanthrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	PAHs (Sum of total)	mg/kg	1.75	200	200	100		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB	Arochlor 1221	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1016	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1232	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1242	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1248	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1254	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1260	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1262	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Arocior 1268	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	PCBs (Sum of total)	mg/kg	0.9	2	<50	50		<0.9	<0.9	<0.9	<0.9	<0.9	NA	<0.5	NA	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
OCP	4,4-DDE	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	a-BHC	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aldrin	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aldrin + Dieldrin	mg/kg				50		-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	b-BHC	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	cis-Chlordane	mg/kg	0.1			250		-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	d-BHC	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDD	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDT	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDT+DDE+DDD	mg/kg				1000		-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dieldrin	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endosulfan I	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endosulfan II	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endosulfan sulphate	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin aldehyde	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin ketone	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	g-BHC (Lindane)	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heptachlor	mg/kg	0.1			50		-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heptachlor epoxide	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hexachlorobenzene	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methoxychlor	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	trans-chlordane	mg/kg	0.1					-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organophosphorus Pesticides	Dichlorvos	mg/kg	<1					-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dimethoate	mg/kg	<1					-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Diazanon	mg/kg	<0.5					-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Fenitrothion	mg/kg	<0.2					-	-	<0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Malathion	mg/kg	<0.2					-	-	<0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chlorpyrifos-ethyl	mg/kg	<0.2					-	-	<0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Parathion-ethyl	mg/kg	<0.2					-	-	<0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromofos-ethyl	mg/kg	<0.2					-	-	<0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methidation	mg/kg	<0.2					-	-	<0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ethion	mg/kg	<0.2					-	-	<0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Azinphos-methyl	mg/kg	<0.2					-	-	<0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(1) Maximum values of specific contaminant concentrations for classification without TCLP (ACT Environmental Standards, 2000).

Indicates concentrations exceeding adopted asssessment criteria

coffey environments
SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

Table 1
Soil Analytical Results
Nudurr Drive Extension
ENVICANB00280AE

Sample ID	ST69	ST70	ST71	ST72	ST73	ST74	ST75	QC4	RPD	QC4A	RPD	ST76	ST77	ST78	ST79	ST80	ST81	ST82	ST83	ST84
Sample Depth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sample Date	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	11/06/2010	11/06/2010	-	11/06/2010	-	11/06/2010	11/06/2010	11/06/2010	11/06/2010	11/06/2010	11/06/2010	11/06/2010	11/06/2010	11/06/2010

Chemical Group	Chemical Name	Units	EQL	ACT Environmental Standards Inert Waste [1]	ACT Environmental Standards Solid Waste [1]	NEPM 1999 HIL F	NSW EPA 1994 Terrestial-Organisms																	
TPH	TPH C6 - C9 Fraction -	mg/kg	20	650	650		65	<20	<20	<20	<20	<20	<20	<20	<20	NA	<10	NA	<20	<20	<20	<20	<20	<20	<20	<20
	TPH C10 - C14 Fraction	mg/kg	20					<20	<20	<20	<20	<20	<20	<20	<20	NA	<50	NA	<20	<20	<20	<20	<20	<20	<20	<20
	TPH C15 - C28 Fraction	mg/kg	50					<50	<50	<50	<50	<50	<50	<50	<50	NA	<100	NA	<50	<50	<50	<50	<50	<50	<50	<50
	TPH C29 - C36 Fraction	mg/kg	50					<50	<50	<50	<50	<50	<50	<50	<50	NA	<100	NA	<50	<50	<50	<50	<50	<50	<50	<50
	TPH+C10 - C36 (Sum of total)	mg/kg		500	10000		1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BTEX	Benzene	mg/kg	0.1	1	10		1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.2	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Toluene	mg/kg	0.1	28.8	288		1.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Ethylbenzene	mg/kg	0.1	60	600		3.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<1.5	NA	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
	Xylene Total	mg/kg	0.3	100	1000		14	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	NA	<1.5	NA	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Metals	Arsenic	mg/kg	3	10	100	5000		7	7	7	6	5	9	4	5	22	-	-	4	<3	6	7	7	7	5	7
	Cadmium	mg/kg	0.3	2	20	100		0.8	0.7	<0.5	0.3	0.4	0.6	<0.5	<0.5	-	-	-	<0.3	<0.3	<0.3	<0.3	0.3	<0.5	<0.3	<0.5
	Chromium (III+VI)	mg/kg	0.3	10	100			25	37	26	35	38	70	24	26	8	-	-	23	31	27	31	44	33	27	27
	Copper	mg/kg	0.5			5000		27	29	14	12	13	11	16	16	0	-	-	15	16	10	12	20	13	13	12
	Lead	mg/kg	1	10	100	1500	300	7	9.9	7	8	9	21	11	11	0	12	9	10	11	5	8	9.9	6	6	6
	Mercury	mg/kg	0.05	0.4	4	75		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Nickel	mg/kg	0.5	4	40	3000 - 35000		25	23	26	18	17	10	16	18	12	-	-	15	14	17	18	17	23	20	21
	Zinc	mg/kg	0.5					24	23	28	21	20	18	59	66	11	-	-	70	68	22	23	19	26	28	28
PAH	Acenaphthene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Acenaphthylene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Benz(a)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Benzo(a) pyrene	mg/kg	0.05	0.08	0.8	5		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NA	<0.5	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Benzo(b&/or)fluoranthene	mg/kg	0.2					<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA	<1.0	NA	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Benzo(g,h,i)perylene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Chrysene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Dibenz(a,h)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Fluoranthene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Fluorene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Naphthalene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Phenanthrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Pyrene	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	PAHs (Sum of total)	mg/kg	1.75	200	200	100		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB	Arochlor 1221	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1016	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1232	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1242	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1248	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1254	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1260	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1262	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1268	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	PCBs (Sum of total)	mg/kg	0.9	2	<50	50		<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	NA	<0.5	NA	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
OCP	4,4-DDE	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	a-BHC	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Aldrin	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Aldrin + Dieldrin	mg/kg				50		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	b-BHC	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	cis-Chlordane	mg/kg	0.1			250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	d-BHC	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	DDD	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	DDT	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	DDT+DDE+DDD	mg/kg				1000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Dieldrin	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Endosulfan I	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Endosulfan II	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Endosulfan sulphate	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Endrin	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Endrin aldehyde	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Endrin ketone	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	g-BHC (Lindane)	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Heptachlor	mg/kg	0.1			50		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Heptachlor epoxide	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Hexachlorobenzene	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	Methoxychlor	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-
	trans-chlordane	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-
Organophosphorus Pesticides	Dichlorvos	mg/kg	<1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-
	Dimethoate	mg/kg	<1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	Diazanon	mg/kg	<0.5					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	Fenitrothion	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	Malathion	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	Chlorpyrifos-ethyl	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	Parathion-ethyl	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	Bromofos-ethyl	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	Methidation	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	Ethion	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	Azinphos-methyl	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	-

(1) Maximum values of specific contaminant concentrations for classification without TCLP (ACT Environmental Standards, 2000).

Indicates concentrations exceeding adopted asssessment criteria

coffey environments
SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

Table 1
Soil Analytical Results
Nudurr Drive Extension
ENVICANB00280AE

Sample ID	ST85	ST86	QC5	RPD	QC5A	RPD	ST87	ST88	ST89	ST90	ST91	ST92	ST93	TP1/0.0	TP1/0.5	TP2/0.0	TP2/1.0	TP3/0.0	TP3/0.5	TP4/0.0
Sample Depth	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0-0.2	0.5-0.6	0.0-0.2	1.0-1.2	0.0-0.2	0.5-0.6	0.0-0.2
Sample Date	11/06/2010	11/06/2010	11/06/2010	-	11/06/2010	-	11/06/2010	11/06/2010	11/06/2010	11/06/2010	11/06/2010	11/06/2010	11/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010

Chemical Group	Chemical Name	Units	EQL	ACT Environmental Standards Inert Waste [1]	ACT Environmental Standards Solid Waste [1]	NEPM 1999 HIL F	NSW EPA 1994 Terrestial Organisms																	
TPH	TPH C6 - C9 Fraction	mg/kg	20	650	650		65	<20	<20	<20	NA	<10	NA	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	TPH C10 - C14 Fraction	mg/kg	20					<20	<20	<20	NA	<50	NA	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	TPH C15 - C28 Fraction	mg/kg	50					<50	<50	<50	NA	<100	NA	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	TPH C29 - C36 Fraction	mg/kg	50					<50	<50	<50	NA	<100	NA	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	TPH+C10 - C36 (Sum of total)	mg/kg		500	10000		1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BTEX	Benzene	mg/kg	0.1	1	10		1	<0.1	<0.1	<0.1	NA	<0.2	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Toluene	mg/kg	0.1	28.8	288		1.4	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Ethylbenzene	mg/kg	0.1	60	600		3.1	<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Xylene Total	mg/kg	0.3	100	1000		14	<0.3	<0.3	<0.3	NA	<1.5	NA	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Metals	Arsenic	mg/kg	3	10	100	5000		5	5	6	18	-	-	8	6	7	5	5	6	6	<3	17	<3	<3	<3
	Cadmium	mg/kg	0.3	2	20	100		<0.3	<0.3	<0.3	-	-	-	<0.5	<0.3	<0.6	<0.3	<0.3	<0.6	<0.5	<0.3	<0.3	<0.3	<0.3	<0.3
	Chromium (III+VI)	mg/kg	0.3	10	100			27	31	36	15	-	-	37	25	36	35	24	29	35	2.1	67	2.3	0.9	2
	Copper	mg/kg	0.5			5000		12	14	17	19	-	-	11	11	13	14	13	12	13	<0.5	8.4	0.6	0.5	<0.5
	Lead	mg/kg	1	10	100	1500	300	6	6	7	15	7	15	7	4	6	6	9.3	6	8	<1	4	<1	<1	<1
	Mercury	mg/kg	0.05	0.4	4	75		<0.05	<0.05	<0.05	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Nickel	mg/kg	0.5	4	40	3000		17	18	19	5	-	-	21	19	22	21	16	23	17	<0.5	49	<0.5	0.8	<0.5
	Zinc	mg/kg	0.5			35000		19	21	20	5	-	-	25	24	26	23	22	29	23	0.6	9.2	0.5	0.9	0.99
PAH	Acenaphthene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Acenaphthylene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Benz(a)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Benzo(a) pyrene	mg/kg	0.05	0.08	0.8	5		<0.05	<0.05	<0.05	NA	<0.5	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Benzo(b&/k)fluoranthene	mg/kg	0.2					<0.2	<0.2	<0.2	NA	<1.0	NA	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Benzo(g,h,i)perylene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Chrysene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Dibenz(a,h)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Fluoranthene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Fluorene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Naphthalene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Phenanthrene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	PAHs (Sum of total)	mg/kg	1.75	200	200	100		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB	Arochlor 1221	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1016	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1232	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1242	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1248	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1254	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1260	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1262	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Aroclor 1268	mg/kg	0.1					<0.1	<0.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	PCBs (Sum of total)	mg/kg	0.9	2	<50	50		<0.9	<0.9	<0.9	NA	<0.5	NA	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
OCP	4,4-DDE	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	a-BHC	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aldrin	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aldrin + Dieldrin	mg/kg				50		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	b-BHC	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	cis-Chlordane	mg/kg	0.1			250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	d-BHC	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDD	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDT	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDT+DDE+DDD ~	mg/kg				1000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dieldrin	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endosulfan I	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endosulfan II	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endosulfan sulphate	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin aldehyde	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin ketone	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	g-BHC (Lindane)	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heptachlor	mg/kg	0.1			50		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heptachlor epoxide	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hexachlorobenzene	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methoxychlor	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	trans-chlordane	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organophosphorus Pesticides	Dichlorvos	mg/kg	<1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dimethoate	mg/kg	<1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Diazanon	mg/kg	<0.5					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Fenitrothion	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Malathion	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chlorpyrifos-ethyl	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Parathion-ethyl	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromofos-ethyl	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methidation	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ethion	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Azinphos-methyl	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(1) Maximum values of specific contaminant concentrations for classification without TCLP (ACT Environmental Standards, 2000).

Indicates concentrations exceeding adopted assessment criteria

coffey environments
SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

Table 1
Soil Analytical Results
Nudurr Drive Extension
ENVICANB00280AE

Sample ID	TP4/0.0 Dup	RPD	TP4/0.0 Trip	RPD	TP4/0.5	TP5/0.0	TP5/0.5	TP6/0.0	TP6/0.5	TP7/0.0	TP7/1.0	TP8/0.0	TP8/0.5	TP9/0.0	TP9/0.5	TP9/0.5 Dup	RPD	TP9/0.5 Trip	RPD
Sample Depth	0.0-0.2	-	0.0-0.2	-	0.5-0.6	0.0-0.2	0.5-0.6	0.0-0.2	0.5-0.6	0.0-0.2	1.0-1.2	0.0-0.2	0.5-0.6	0.0-0.2	0.5-0.6	0.5-0.6	-	0.5-0.6	-
Sample Date	9/06/2010	-	9/06/2010	-	9/06/2010	9/06/2010	9/06/2010	9/06/2010	9/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	-	10/06/2010	-

Chemical Group	Chemical Name	Units	EQL	ACT Environmental Standards Inert Waste [1]	ACT Environmental Standards Solid Waste [1]	NEPM 1999 HIL F	NSW EPA 1994 Terrestial Organisms																						
TPH	TPH C6 - C9 Fraction	mg/kg	20	650	650		65	<20	NA	<10	NA	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	NA	<10	NA
	TPH C10 - C14 Fraction	mg/kg	20					<20	NA	<50	NA	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	NA	<50	NA
	TPH C15 - C28 Fraction	mg/kg	50					<50	NA	<100	NA	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	NA	<100	NA
	TPH C29 - C36 Fraction	mg/kg	50					<50	NA	<100	NA	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	NA	100	NA
	TPH+C10 - C36 (Sum of total)	mg/kg		500	10000		1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-
BTEX	Benzene	mg/kg	0.1	1	10		1	<0.1	NA	<0.2	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.2	NA
	Toluene	mg/kg	0.1	28.8	288		1.4	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Ethylbenzene	mg/kg	0.1	60	600		3.1	<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Xylene Total	mg/kg	0.3	100	1000		14	<0.3	NA	<1.5	NA	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	NA	<1.5	NA
Metals	Arsenic	mg/kg	3	10	100	5000		<3	-	5	-	<3	<3	<3	<3	<3	<3	<3	<3	<3	8	7	9	11	20	8	12
	Cadmium	mg/kg	0.3	2	20	100		<0.3	-	<0.1	-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.6	0.3	<0.3	<0.3	-	0.1	-
	Chromium (III+VI)	mg/kg	0.3	10	100			1.3	8	40	*186*	1.4	1.4	1.3	3.4	1.5	2.5	1.3	1.3	120.	38	19	25	27	22	15
	Copper	mg/kg	0.5			5000		0.7	13	17	*182*	0.8	0.5	0.5	<0.5	<0.5	<0.5	0.9	<0.5	14	16	17	21	21	16	6
	Lead	mg/kg	1	10	100	1500	300	<1	-	6	-	<1	<1	<1	<1	<1	<1	<1	<1	24	18	53	72	30	30	*55*
	Mercury	mg/kg	0.05	0.4	4	75		<0.05	-	0.08	-	<0.05	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	0.15	
	Nickel	mg/kg	0.5	4	40	3000		1	2	24	*185*	0.8	0.5	0.7	<0.5	1.4	<0.5	0.6	<0.5	13	14	8.8	11	22	13	39
	Zinc	mg/kg	0.5			35000		0.8	0	22	*186*	0.6	0.8	<0.5	<0.5	<0.5	0.5	0.5	<0.5	10	35	430	250	*59*	81	*137*
PAH	Acenaphthene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Acenaphthylene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Anthracene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Benz(a)anthracene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.5	-
	Benzo(a) pyrene	mg/kg	0.05	0.08	0.8	5		<0.05	NA	<0.5	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	-	<0.5	-
	Benzo(b)&(k)fluoranthene	mg/kg	0.2					<0.2	NA	<1.0	NA	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA	<1.0	NA
	Benzo(g,h,i)perylene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Chrysene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Dibenz(a,h)anthracene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Fluoranthene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Fluorene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Naphthalene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Phenanthrene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Pyrene	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
	PAHs (Sum of total)	mg/kg	1.75	200	200	100		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.76	-	-	-	-
PCB	Arochlor 1221	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Aroclor 1016	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Aroclor 1232	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Aroclor 1242	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Aroclor 1248	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Aroclor 1254	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Aroclor 1260	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Aroclor 1262	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	Aroclor 1268	mg/kg	0.1					<0.1	NA	<0.5	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.5	NA
	PCBs (Sum of total)	mg/kg	0.9	2	<50	50		<0.9	NA	<0.5	NA	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	NA	<0.5	NA
OCP	4,4-DDE	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	a-BHC	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aldrin	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aldrin + Dieldrin	mg/kg				50		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	b-BHC	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	cis-Chlordane	mg/kg	0.1			250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	d-BHC	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDD	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDT	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDT+DDE+DDD	mg/kg				1000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dieldrin	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endosulfan I	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endosulfan II	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endosulfan sulphate	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin aldehyde	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin ketone	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	g-BHC (Lindane)	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heptachlor	mg/kg	0.1			50		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heptachlor epoxide	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hexachlorobenzene	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methoxychlor	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	trans-chlordane	mg/kg	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organophosphorus Pesticides	Dichlorvos	mg/kg	<1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dimethoate	mg/kg	<1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Diazanon	mg/kg	<0.5					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Fenitrothion	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Malathion	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chlorpyrifos-ethyl	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Parathion-ethyl	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromofos-ethyl	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methidation	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ethion	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Azinphos-methyl	mg/kg	<0.2					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(1) Maximum values of specific contaminant concentrations for classification without TCLP (ACT Environmental Standards, 2000).

Indicates concentrations exceeding adopted asssessment criteria

coffey environments
SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

Table 1
Soil Analytical Results
Nudurr Drive Extension
ENVICANB00280AE

Sample ID	TP10/0.5N	TP10/0.5S	TP11/0.0	TP11/0.5	TP12/0.0	TP12/0.5	TP13/0.5	TP13/0.5 Dup	RPD	TP13/2.0
Sample Depth	0.5-0.6	0.5-0.6	0.0-0.2	0.5-0.6	0.0-0.2	0.5-0.6	0.5-0.6	0.5-0.6	-	2.0-2.2
Sample Date	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	10/06/2010	-	10/06/2010

Chemical Group	Chemical Name	Units	EQL	ACT Environmental Standards Inert Waste [1]	ACT Environmental Standards Solid Waste [1]	NEPM 1999 HIL F	NSW EPA 1994 Terrestial Organisms									
TPH	TPH C6 - C9 Fraction	mg/kg	20	650	650		65	<20	<20	<20	<20	<20	<20	<20	<20	NA	<20
	TPH C10 - C14 Fraction	mg/kg	20					<20	<20	<20	<20	<20	<20	<20	<20	NA	<20
	TPH C15 - C28 Fraction	mg/kg	50					<50	<50	<50	<50	<50	<50	<50	<50	NA	<50
	TPH C29 - C36 Fraction	mg/kg	50					<50	<50	<50	<50	<50	<50	<50	<50	NA	<50
	TPH>C10 - C36 (Sum of total)	mg/kg		500	10000		1000	-	-	-	-	-	-	-	-	-	-
BTEX	Benzene	mg/kg	0.1	1	10		1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Toluene	mg/kg	0.1	28.8	288		1.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Ethylbenzene	mg/kg	0.1	60	600		3.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Xylene Total	mg/kg	0.3	100	1000		14	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	NA	<0.3
Metals	Arsenic	mg/kg	3	10	100	5000		8	6	3	5	11	6	7	7	0	7
	Cadmium	mg/kg	0.3	2	20	100		0.5	<0.3	<0.3	<0.3	0.4	0.3	0.3	0.4	-	<0.3
	Chromium (III+VI)	mg/kg	0.3	10	100			33	24	30	29	21	27	26	27	4	30
	Copper	mg/kg	0.5			5000		81	13	14	19	20	16	29	32	10	21
	Lead	mg/kg	1	10	100	1500	300	12	9	9	19	17	7	9	10	11	7
	Mercury	mg/kg	0.05	0.4	4	75		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05
	Nickel	mg/kg	0.5	4	40	3000		12	17	15	15	12	16	13	14	7	20
	Zinc	mg/kg	0.5			35000		16	26	52	96	95	14	12	12	0	15
PAH	Acenaphthene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Acenaphthylene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Benz(a)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Benzo(a) pyrene	mg/kg	0.05	0.08	0.8	5		0.08	0.1	0.06	<0.05	<0.05	<0.05	<0.05	0.06	-	<0.05
	Benzo(b)&(k)fluoranthene	mg/kg	0.2					<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA	<0.2
	Benzo(g,h,i)perylene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Chrysene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Dibenz(a,h)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Fluoranthene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Fluorene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Naphthalene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Phenanthrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	PAHs (Sum of total)	mg/kg	1.75	200	200	100		1.78	1.8	1.76	-	-	-	-	-	-	-
PCB	Arochlor 1221	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Arocior 1016	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Arocior 1232	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Arocior 1242	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Arocior 1248	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Arocior 1254	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Arocior 1260	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Arocior 1262	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	Arocior 1268	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1
	PCBs (Sum of total)	mg/kg	0.9	2	<50	50		<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	NA	<0.9
OCP	4,4-DDE	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	a-BHC	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	Aldrin	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	Aldrin + Dieldrin	mg/kg				50		<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	b-BHC	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	cis-Chlordane	mg/kg	0.1			250		<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	d-BHC	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	DDD	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	DDT	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	DDT+DDE+DDD	mg/kg				1000		<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	Dieldrin	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	Endosulfan I	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	Endosulfan II	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	Endosulfan sulphate	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	Endrin	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	Endrin aldehyde	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	Endrin ketone	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	g-BHC (Lindane)	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	Heptachlor	mg/kg	0.1			50		<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	Heptachlor epoxide	mg/kg	0.1					<0.1	<0.1	-	<0.1	-	<0.1	-	-	-	-
	Hexachlorobenzene	mg/kg	0.1					<0.1	<0.1	-	<0.1	"	<0.1	-	-	-	-
	Methoxychlor	mg/kg	0.1					<0.1	<0.1	-	<0.1	"	<0.1	-	-	-	-
	trans-chlordane	mg/kg	0.1														
								<1	<1	-	<1	-	<1	-	-	-	-
Organophosphorus Pesticides	Dichlorvos	mg/kg	<1					<1	<1	-	<1	-	<1	-	-	-	-
	Dimethoate	mg/kg	<1					<0.5	<0.5	-	<0.5	-	<0.5	-	-	-	-
	Diazanon	mg/kg	<0.5					<0.2	<0.2	-	<0.2	-	<0.2	-	-	-	-
	Fenitrothion	mg/kg	<0.2					<0.2	<0.2	-	<0.2	-	<0.2	-	-	-	-
	Malathion	mg/kg	<0.2					<0.2	<0.2	-	<0.2	-	<0.2	-	-	-	-
	Chlorpyrifos-ethyl	mg/kg	<0.2					<0.2	<0.2	-	<0.2	-	<0.2	-	-	-	-
	Parathion-ethyl	mg/kg	<0.2					<0.2	<0.2	-	<0.2	-	<0.2	-	-	-	-
	Bromofos-ethyl	mg/kg	<0.2					<0.2	<0.2	-	<0.2	-	<0.2	-	-	-	-
	Methidation	mg/kg	<0.2					<0.2	<0.2	-	<0.2	-	<0.2	-	-	-	-
	Ethion	mg/kg	<0.2					<0.2	<0.2	-	<0.2	-	<0.2	-	-	-	-
	Azinphos-methyl	mg/kg	<0.2					<0.2	<0.2	-	<0.2	-	<0.2	-	-	-	-

(1) Maximum values of specific contaminant concentrations for classification without TCLP (ACT Environmental Standards, 2000).

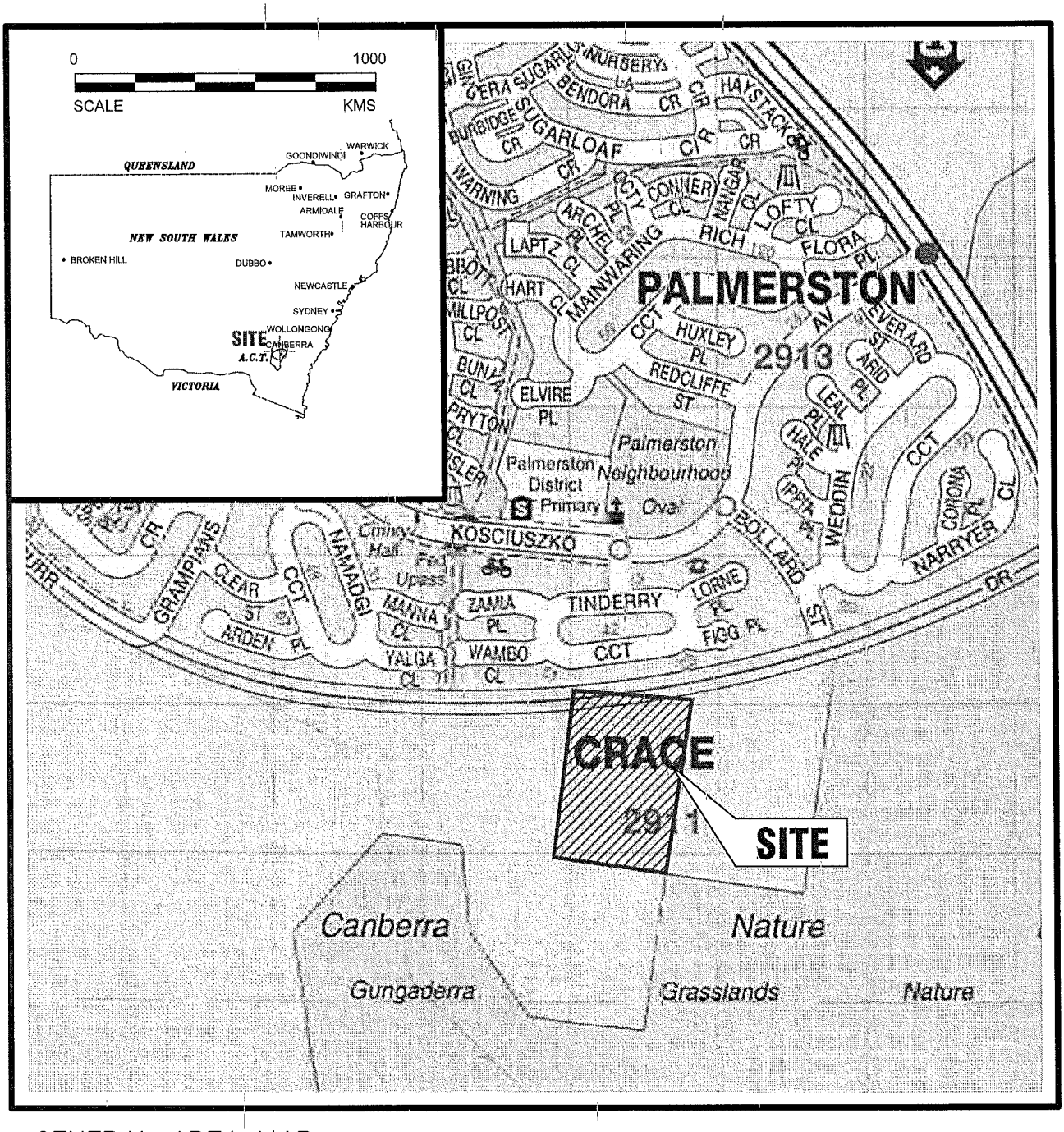
Indicates concentrations exceeding adopted asssessment criteria

DRAFT

Figures

Contamination Assessment
Nudurr Drive Extension, Gungahlin, ACT

A4



GENERAL AREA MAP

SOURCE: CANBERRA UBD STREET DIRECTORY
CANBERRA, ACT
13TH EDITION, 2008

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Rev	Date	Revision Details	Drn
A	29.06.10	P2 ESA	MV

Client: BROWN CONSULTING (ACT) PTY LTD

Project: C09017, 1 GUNGAHLIN ASBESTOS SPOIL SITE INVESTIGATION

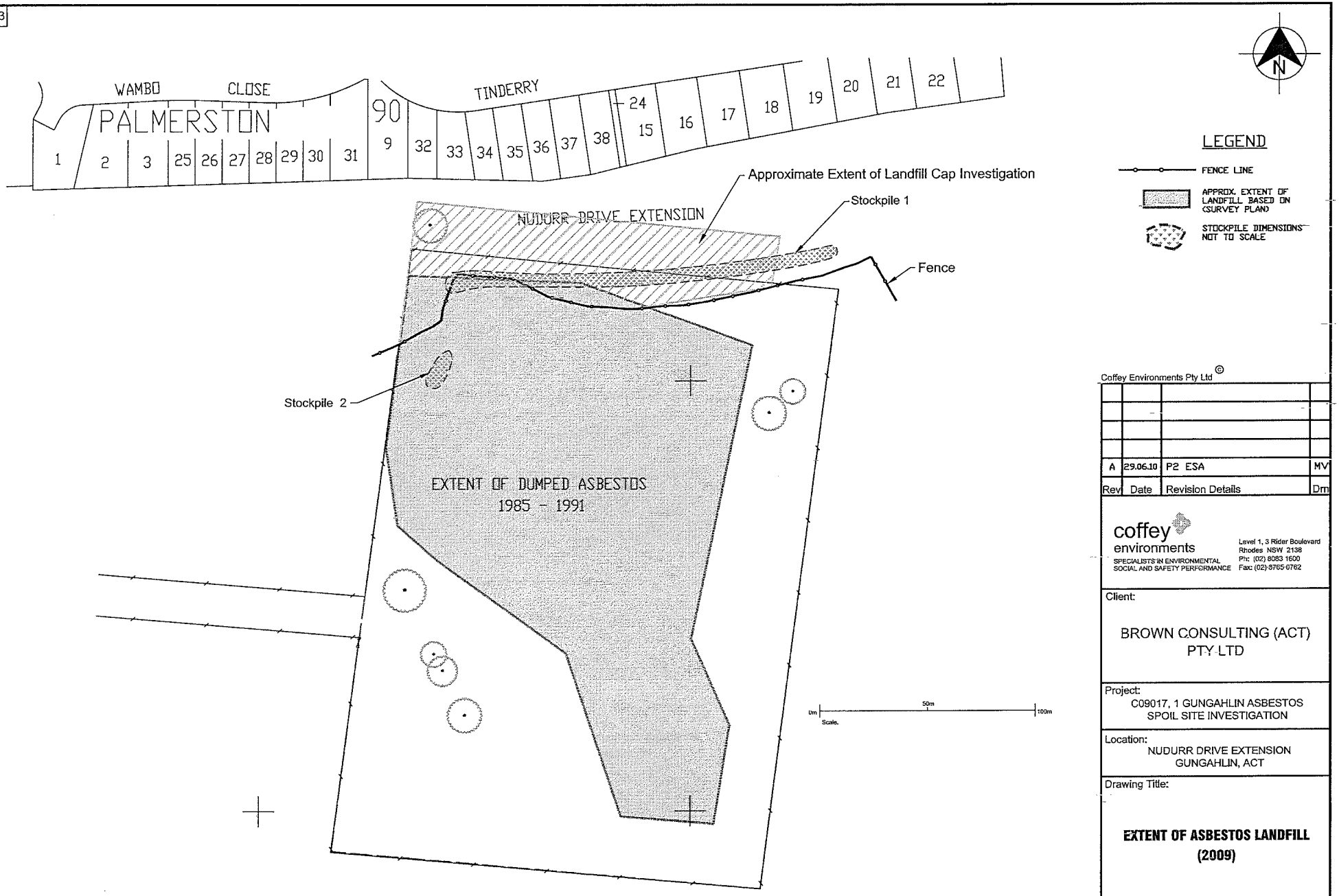
Location: NUDURR DRIVE EXTENSION GUNGAHLIN, ACT

0 0.2 0.4 0.6 0.8 1
SCALE 1:20 000 KILOMETRES

Drawing Title: **SITE LOCATION PLAN (JUNE 2010)**

Drawn	Date
MV	29.06.10
Project - Drawing No.	Figure No. / Rev.
ENVICANB00280AE-D01	1 / A

A3



N

LEGEND

- FENCE LINE
- APPROX. EXTENT OF LANDFILL BASED ON SURVEY PLAN
- STOCKPILE DIMENSIONS NOT TO SCALE

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A	29.06.10	P2 ESA	MV

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Project:

C09017, 1 GUNGAHLIN ASBESTOS SPOIL SITE INVESTIGATION

Location:

NUDURR DRIVE EXTENSION
GUNGAHLIN, ACT

Drawing Title:

EXTENT OF ASBESTOS LANDFILL (2009)

Drawn	Date	
MV	28.06.10	
Project - Drawing No.	Figure No.	Rev.
ENVICANB00280AE-D01	2	A

A3

N

LEGEND

- $TP^{\#}$ TEST PIT LOCATIONS
- FENCE LINE
- APPROX. EXTENT OF LANDFILL BASED ON SURVEY PLAN
- STOCKPILE DIMENSIONS NOT TO SCALE

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Project:
C09017, 1 GUNGAHLIN ASBESTOS SPOIL SITE INVESTIGATION

Location:
NUDURR DRIVE EXTENSION
GUNGAHLIN, ACT

Drawing Title:

SITE LAYOUT PLAN
(JUNE 2010)

Drawn	Date	
MV	28.06.10	
Project - Drawing No.	Figure No.	Rev.
ENVICANB00280AE-D01	3	A

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Appendix A
Environmental Management Plan

Contamination Assessment
Nudurr Drive Extension, Gungahlin, ACT

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SPECIALISTS IN ENVIRONMENTAL,
SOCIAL AND SAFETY PERFORMANCE

ENVIRONMENTAL MANAGEMENT PLAN
NUDURR DRIVE ROAD RESERVE EXTENSION
GUNGAHLIN ACT

Prepared for:

Brown Consulting Pty Ltd
15 Hall Street
Lyneham ACT

Report Date: 8 June 2010
Project Ref: ENVICANB00280AE

Written/Submitted by:

Sally King
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Reviewed/Approved by:

Tony Scott
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CONTENTS

CONTENTS

LIST OF ATTACHMENTS

Figures

ABBREVIATIONS

ACTPLA	Australian Capital Territory Planning and Land Authority
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
ESWMS	Environmental Safe Work Method Statement
mg/L	milligrams per litre
NOHSA	National Occupational Health and Safety Commission
P1ESA	Phase 1 Environmental Site Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PID	Photoionisation Detector
PPE	Personal Protective Equipment
SVOC	Semi-volatile Organic Compound
TPH	Total Petroleum Hydrocarbon
VHC	Volatile Halogenated Compound

1 INTRODUCTION

1.1 Background

Coffey Environments Pty Ltd (Coffey Environments) was engaged by Brown Consulting on behalf of the ACT Planning and Land Authority (ACTPLA) to undertake a contamination assessment of an area of land identified as the Nudurr Drive Extension located in Gungahlin, ACT (the site).

Nudurr Drive is currently an access road leading into the suburb of Palmerston which, at present, terminates at its junction with Grampians Street. It is proposed to extend Nudurr Drive from Grampians Street to Gungahlin Drive, which is located approximately 1.6 kilometres to the east. Based on this design concept, it is understood that Nudurr Drive would pass over the northwest corner of a former landfill used to store asbestos, as identified during Coffey's previous investigations (Reference: ENVICANB00280AB, dated 13 August 2009).

1.2 Overview of the Scope of Works

The purpose of the environmental works is to assess the presence, or otherwise, of contamination in the subsurface and in stockpiled soils in the location of proposed road reserve extension.

In particular, Coffey Environments will:

1. Undertake sampling of the stockpiled soil located on-site to assess its suitability for beneficial re-use on-site, or to classify the material for off-site disposal if required. Field staff will estimate the volume of soil contained within the two stockpiles present on-site and calculate the number of samples required for classification purposes. Samples will be collected by hand from the stockpile and submitted for laboratory analysis for a suite of contaminants of potential concern.
2. Undertake intrusive investigations of the landfill capping material to:
   - Characterise the material comprising the landfill cap to assess its suitability to remain on-site;
   - Assess the thickness of the capping material and overlying fill material to assess its suitability as a platform on which to construct the proposed road extension.

   A total of 13 test pits will be excavated across the investigation area using an excavator. Test pits will be extended to depths sufficient to intercept the base of the cap or to depths of approximately 4.0m below ground surface, whichever is shallower. Samples will be collected from each test pit and submitted for analysis for a suite of contaminants of potential concern.
3. Validate the results of the geophysical survey and assess the impact that the former landfill may have on the proposed Nudurr Drive.

2 SAFETY, HEALTH AND ENVIRONMENTAL LEGISLATION

The following provides a summary of the health and safety standards applicable to the works to be conducted on-site.

Users of this document should not consider this a complete list. Site personnel should be aware of all relevant legislation that may be applicable if changes in site conditions are experienced throughout the course of fieldwork.

2.1 Occupational Health and Safety

The ACT occupational health and safety legislation includes, but is not necessarily limited to, the following:

- Work Safety Act 2008;
- Work Safety Regulation (2009).

2.2 Asbestos

The ACT laws that manage and regulate asbestos include, but are not necessarily limited to, the following:

- Building Act 2004;
- Construction Occupations (Licensing) Act 2004;
- Dangerous Substances Act 2004;
- Dangerous Substances (General) Regulations 2004;
- Environment Protection Act 1997;
- Work Safety Act 2008;
- Work Safety Regulation (2009);
- Building Regulation 2004;
- Construction Occupations (Licensing) Regulation 2004; and
- Part 3.4 of the Dangerous Substances (General) Regulations 2004

Other information relevant to management of asbestos includes:

- Master Builders Association Asbestos Awareness and Identification Course approved by WorkCover ACT[1].

[1] Asbestos awareness includes: what asbestos is; exposure pathways; types of asbestos and where it may be present; exposure prevention; sampling methodologies including dust suppression and use of RPE and PPE and how to dispose of RPE and PPE when contaminated.

- ACT Asbestos Task Force (2005a). Asbestos Management in the ACT[2];
- National Occupational Health and Safety Commission[NOHSC:2002(2005)] Code of Practice for the Safe Removal of Asbestos
- National Occupational Health and Safety Commission [NOHSC:2018(2005)] National Code of Practice for the Management and Control of Asbestos in Workplaces
- Department of Health WA (2009) Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia
- Enhealth and the Department of Health and Ageing (2005). Management of asbestos in the non-occupational environment.

2.3 Environment

ACT environmental legislation relevant to the project includes, but is not necessarily limited to, the following:

- Environment Protection Act 1997;
- Environment Protection Regulation 2005;
- Contaminated Sites Environment Protection Policy (EPP) November 2009; and
- Department of Health WA (2009) Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia[3].

[2] The ACT Government agreed or agreed-in-principle to all of the recommendations of the Task Force Report and has since implemented a new framework for managing asbestos in the ACT from 7 September, 2007.

[3] These have recently been endorsed by ACT EPA.

3 CONTAMINANTS OF POTENTIAL CONCERN

Based on information presented in the Phase 1 ESA (Coffey Environments, 2009, ref: ENVICANB00280AB-R01), a summary of the areas of environmental concerns and associated chemicals of potential concern is presented in Table 1.

Table 1: Summary of Areas of Environmental Concern

AEC	Potential Chemicals of Concern
Landfill Capping Material	Heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury) PAHs PCBs TPH BTEX asbestos
Stockpile and Mound Material	Heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury) PAHs PCBs TPH BTEX asbestos

Notes to Table 1: PAH: Polycyclic Aromatic Hydrocarbons; PCBs: Polychlorinated Biphenyls; TPH: Total Petroleum Hydrocarbons; BTEX: Benzene, Toluene, Ethylbenzene and Xylene

Given the uncertainty of the source and composition of the material present in the landfill capping, soil stockpile and soil mound, Coffey Environments also recommends that a broad contaminant screen analysis be undertaken on a select number of soil samples collected from the capping material, soil stockpile and soil mound. The broad contaminant screen analysis should include the following analytes:

- cyanide;
- fluoride;
- semi-volatile organic compounds (SVOCs) screen and;
- volatile halogenated compounds (VHCs) screen;
- total phenols; and
- pH.

4 SAFETY HAZARDS AND CONTROL MEASURES

As a minimum, the following documentation should be available on-site prior to the commencement and throughout the duration of fieldwork:

1. Site-specific Safety Plan that includes, but is not limited to, the following information:
   - Site-specific Environmental Safe Work Method Statements (ESWMS) for each task to be undertaken on-site[4],
   - Safe Work Procedures for each task to be undertaken on-site,
   - Training requirements; and
   - Other relevant information to the completion of the project.
2. Location of underground utilities and services in the vicinity of the work site (i.e. site drawings, Dial-Before-You-Dig plans).

Only appropriately licensed personnel are to operate equipment that requires a license (i.e. excavator, etc). Licenses should be checked to ensure they are valid and current.

[4] ESWMS have priority if there is conflict with information in this document.

5 HEALTH HAZARDS AND CONTROL MEASURES

5.1 Occupational Health Hazards

The primary occupational health risk associated with the works to be undertaken on-site relates to the potential inhalation of asbestos fibres during excavation and sampling activities.

In addition, given that the site is a former landfill, there is also the potential for other contaminants to be present that may represent a risk to human health. As such, the potential for inhalation, ingestion and dermal contact with contamination must also be considered.

Risk minimisation actions will take in consideration the following controls:

- Training - all site personnel will have received suitable training regarding the chemical and physical hazards associated with the works;
- Personal hygiene – all site personnel will ensure that nitrile gloves are used at all times when handling soils. These gloves will be suitably disposed at the completion of works;
- Access – access to the work site will be restricted to site personnel only that have undergone induction training; and
- Personal Protective Equipment (PPE) – appropriate PPE is to be worn at all times during the course of fieldwork and when in the work area.

All site personnel within 3m of an excavation or soil disturbance are required to have completed the asbestos awareness and identification course run by the Master Builders association approved by WorkCover ACT[5].

5.2 Personal Protective Equipment

Personal protective equipment refers to the equipment worn by workers to reduce their exposure to hazards – physical, biological and chemical.

All field staff (including contractors) must wear the following PPE, as a minimum, at all times when on site.

- Steel capped safety boots;
- Protective gloves for handling contaminated material (i.e. disposable nitrile gloves) and/or equipment (i.e. cut resistant gloves with minimum rating of 4243);
- Coveralls/ long pants & long sleeved shirt buttoned at the sleeves;

---

[5] Staff are required to be trained in asbestos awareness including what asbestos is; exposure pathways; types of asbestos and where it may be present; exposure prevention; sampling methodologies including dust suppression and use of RPE and PPE and how to dispose of RPE and PPE when contaminated.

- High visibility safety vest/clothing; and
- A hard hat.

The following PPE must be available on-site and used when required:

- Hearing protection such as ear-muffs and/or ear plugs;
- Goggles for preventing chemical splash striking eyes;
- Tyvek® suit;
- Half-face respirator equipped with Type 3 cartridges;
- Broad brimmed hat for sun protection (with hard hat attachment); and
- Sun screen to protect against UV radiation.

5.3 Hygiene

All personnel working on site should use good hygiene practices. This should include, but not limited to the following:

- Wash hands prior to consuming food after working on the site
- No smoking onsite

5.4 Dust Suppression

Site personnel, the public, adjacent neighbours and the environment need to be protected from the effects of dust created during the works.

Factors that contribute to dust generation include:

- Wind blowing across a cleared surface of the ground;
- Loose stockpiled material; and
- The movement of machinery over the loose unsealed surface of the working site.

Throughout the duration of fieldwork, dust suppression techniques shall be employed such that there shall be no visible generation of dust.

Where necessary, a water contained within a drum will be periodically used to dampen the surface of the site where test pitting works are conducted. Hand held water sprays will be used where stockpile sampling is conducted to reduce dust generation.

In the case that strong winds are experienced, works will cease until conditions become favourable.

5.5 Asbestos Air Monitoring

During the course of the test pitting works, environmental air monitoring for asbestos fibres will be carried out. The air monitoring samplers will be placed on the boundaries of the designated work areas or the site, and will include monitoring points on boundary of the site adjoining residential development. The sample collection and analysis will be conducted in accordance with the National Occupational Health and Safety Commission (NOHSC) "Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust" [NOHSC: 3003 (2005)].

The analysis is to be performed by a NATA registered laboratory and reported on NATA endorsed certificates.

The concentration of asbestos fibres at the site boundaries should be <0.01fibres/mL of air. Table 2 provides actions to be followed based on recorded concentrations of asbestos fibres.

Table 2: Asbestos Control Limits and Actions

Control Limits	Action
<0.01fibres/mL	Continue with control measures
Between 0.01fibres/mL and 0.02fibres/mL	Review control measures
Greater than or equal to 0.02fibres/mL	Stop work until the cause of the elevated concentrations is remedied

The necessity of continuing the air monitoring programme will be regularly assessed with respect the required level of monitoring for the remainder of the project. Results will be made available to site personnel.

6 ENVIRONMENTAL HAZARDS AND CONTROL MEASURES

6.1 Noise

Increased noise levels may result from the use of machines on the site to excavate test pits.

Works will be undertaken in accordance with state and local noise regulations applicable to the site. If noise impacts arise as a result of excavation works, work will cease and modifications will be made to machinery and/or work methods to ensure compliance.

6.2 Air Quality

Airborne dust may be generated by wind action during excavation and stockpiling. This could cause a potential nuisance for the surrounding area and should be controlled.

Dust levels will be monitored visually during site work. As a precaution soil will be kept adequately moist to prevent dust generation. Should dust levels increase during the works to nuisance levels then work will cease and additional moisture will be added to the soil to lower the dust levels.

Odorous soils may be encountered during site remediation activities. Odour will be monitored by the environmental consultant or its representative at the site boundaries using olfactory senses and with a photoionisation detector (PID) calibrated with isobutylene gas, if evidence of petroleum hydrocarbons and/or solvents are noted. Should levels of photoionisable gases exceed 5ppm above background levels (as measured by the PID) at the boundary, excavation/test pitting activities will ease and the area monitored. Work may need to cease until wind conditions change or an odour masking agent or odour suppressant is added to the soil.

Exhaust systems of construction plant, vehicles and machinery will be maintained in accordance with manufactures specifications.

6.3 Erosion and Sediment Control

At this stage, excavated soils from test pits will be temporarily stockpiled on-site, however upon completion of each test pit, soils will be immediately backfilled. As such, sediment and erosion control measures are not considered necessary as part of these works.

6.4 Management of Groundwater

Groundwater is not expected to be encountered during excavation activities.

6.5 Chemicals, Dangerous Goods and Contamination

Chemical and dangerous goods, apart from those being the subject of the assessment, are not likely to be required at the site.

Refuelling of plant and equipment will occur off-site prior to the commencement, or at the completion, of site works.

7 EMERGENCY CONTACT NUMBERS

AMBULANCE/ FIRE/ POLICE		**000** (**112** from mobile)
HOSPITAL –	Calvary Hospital, Cnr Belconnen Way and Haydon Drive, Bruce ACT	02 6201 6111
POISON INFORMATION		13 11 26
LOCAL WATER AUTHORITY	ActewAGL	02 6293 5770
LOCAL POWER AUTHORITY	ActewAGL	02 6293 5770
LOCAL GAS AUTHORITY	Jemena Gas ACT	02 6203 0600
TELSTRA		1800 114 918
OPTUS		02 6222 3800
LOCAL COUNCIL	ACT	132 281
CLIENT	Brown Consulting (ACT) Pty Ltd	**WORK:** 02 6211 7100
SUB CONTRACTOR	D-Tech	**WORK:** 02 6278 7548 **MOBILE:** 0414 630 852
	Irwin and Hartshorn	**WORK:** 02 6260 1588 **MOBILE**: 0418 624 741
COFFEY ENVIRONMENTS OFFICE	Rhodes NSW	**WORK:** 02 8083 1600
COFFEY ENVIRONMENTS SITE SUPERVISOR	David Walters Srijeeta De	**MOBILE:** 0449 904 153 **MOBILE:** 0449 904 484
COFFEY ENVIRONMENTS PROJECT MANAGER -	Sally King	**MOBILE:** 0404 465 419 **WORK:** 02 8083 160
BUSINESS MANAGER	Michelle Battam	**MOBILE:** 0407 932 748 **WORK:** 02 6162 2622
HSSE MANAGER	Amanda Benson	**MOBILE:** 0409 242 459

8 REFERENCES

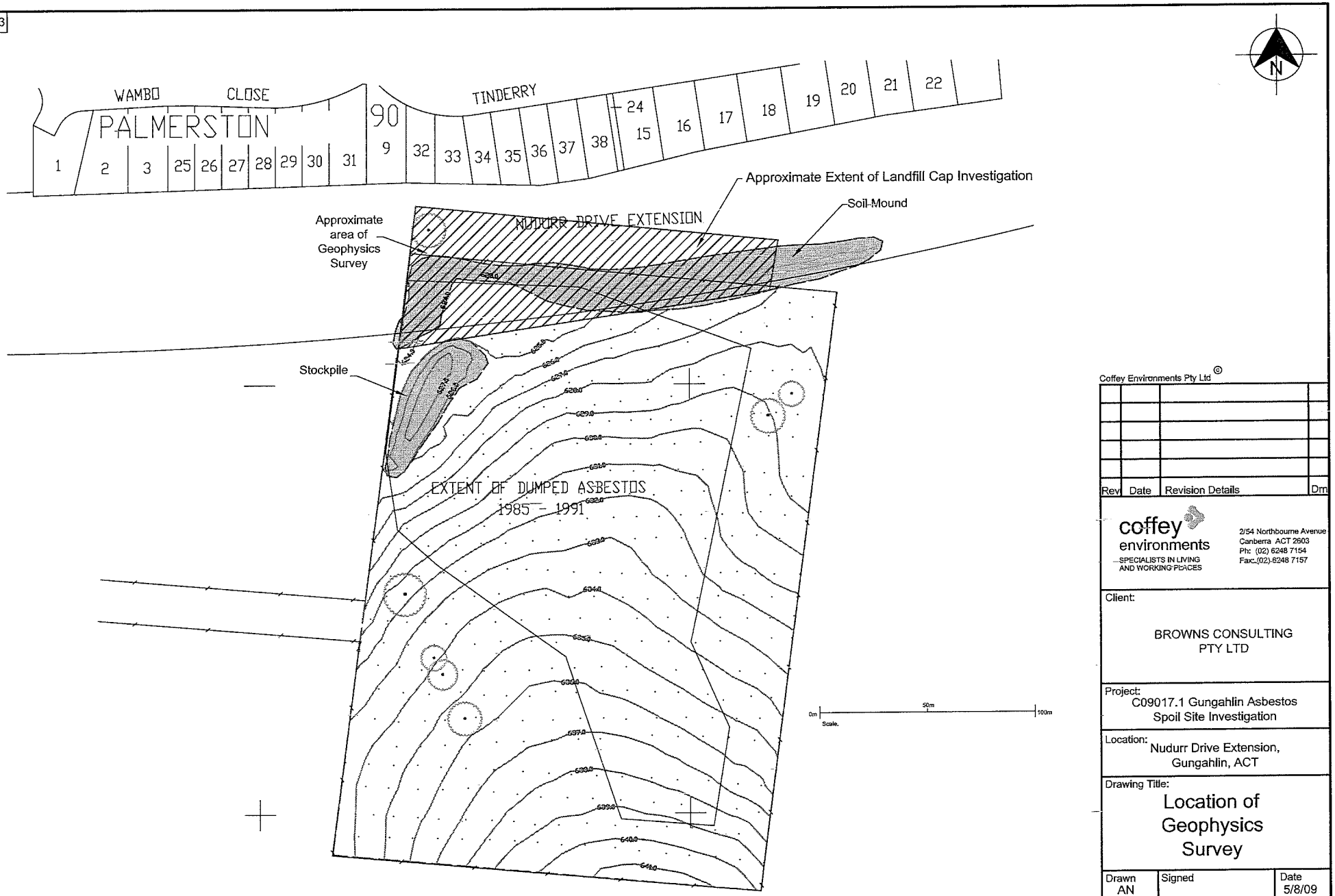
Coffey Environments (2000) Phase 1 Environmental Site Assessment, C09017.1 Gungahlin, Asbestos Soil Site Investigation (ref: ENVICANB00280AB).

NOHSC (2005) Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust [NOHSC: 3003 (2005)].

Figures

Environmental Management Plan
Nudurr Drive Road Reserve Extension

A3



Coffey Environments Pty Ltd ©

Rev	Date	Revision Details	Dm

coffey environments
SPECIALISTS IN LIVING AND WORKING PLACES
2/54 Northbourne Avenue
Canberra ACT 2603
Ph: (02) 6248 7154
Fax: (02) 6248 7157

Client:
BROWNS CONSULTING PTY LTD

Project:
C09017.1 Gungahlin Asbestos Spoil Site Investigation

Location:
Nudurr Drive Extension, Gungahlin, ACT

Drawing Title:
Location of Geophysics Survey

Drawn AN	Signed	Date 5/8/09
Checked CG	Signed	Date 5/8/09

Project - Drawing No.	Figure No.	Rev.
ENVICANB00280AA	4	A

DRAFT

Appendix B
Asbestos Monitoring Results

Contamination Assessment
Nudurr Drive Extension, Gungahlin, ACT

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SPECIALISTS IN LIVING AND WORKING PLACES

Rhodes

Analytical Report

Job No: ENVICANB00280AE-C01
Client: Brown Consulting (ACT) Pty Ltd
Client Address: 15 Hall Street
Lyneham ACT 2602

Contact: Julie Pearson
E-mail:
Date Sampled: 9/06/2010
Date Printed: 11/06/2010
Sampled By: Glenn Paris
Date Tested: 9/06/2010
Test Method: **NATA counting**

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025
Accreditation Number: 2220

Dust particulates collected and filters examined in accordance with NOHSC:3003 (2005) and in-house method WILAB 2. Fibres counted may include various substances, ie. not necessarily asbestos

Slide No	Description	Fibres	Fields	Fibres/mL
BCA-01	Boundary (south) fence - opposite Lot 20 Tinderry	0	100	<0.01
BCA-02	Native gum tree - opposite Test Pit No.1	1	100	<0.01
BCA-03	Boundary (south) fence - opposite Lot 22 Tinderry	0	100	<0.01
BCA-04	Boundary (south) fence - opposite Lot 35 Tinderry	1	100	<0.01
Blank	Field Blank	0	100	

Comment: Samples collected by Coffey Environments

Key
DOL Sample rejected due to particulate overload
NA Not Available
RPF Sample rejected due to Pump Failure
RFD Sample rejected due to Filter Damage
RUD Sample rejected due to uneven particulate deposition

Approved Counter
Glenn Paris

Approved Signatory
Glenn Paris

coffey environments
SPECIALISTS IN LIVING AND WORKING PLACES

Rhodes

Analytical Report

Job No: ENVICANB00280AE-C02
Client: Brown Consulting (ACT) Pty Ltd
Client Address: 15 Hall Street
Lyneham ACT 2602

Contact: Julie Pearson
E-mail:
Date Sampled: 11/06/2010
Date Printed: 28/06/2010
Sampled By: Srijeeta De
Date Tested: 25/06/2010
Test Method: **NATA counting**

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025 Accreditation Number: 2220

Dust particulates collected and filters examined in accordance with NOHSC:3003 (2005) and in-house method WILAB 2. Fibres counted may include various substances, ie. not necessarily asbestos

Slide No	Description	Fibres	Fields	Fibres/mL
BCA-05	SD/ Western perimeter fence -	0	100	<0.01
BCA-06	SD/ Northern fence adjacent stockpile	1	100	<0.01
BCA-07	SD/ Northern fence - midway	0	100	<0.01
BCA-08	SD/ Northern fence - eastern end	1	100	<0.01
BCA-09	SD/ Eastern boundary fence	0	100	<0.01
Blank	Field Blank	0	100	

Comment: Samples collected by Coffey Environments

Key
DOL Sample rejected due to particulate overload
NA Not Available
RPF Sample rejected due to Pump Failure
RFD Sample rejected due to Filter Damage
RUD Sample rejected due to uneven particulate deposition

Approved Counter
Glenn Paris

Approved Signatory
Glenn Paris

DRAFT

Appendix C
Test Pit Logs

Contamination Assessment
Nudurr Drive Extension, Gungahlin, ACT

coffey environments

Engineering Log - Excavation

Excavation No. **TP1**

Sheet 1 of 1

Office Job No.: **ENVICANB00280AE**

Client: **Browns Consulting**

Principal: **Julie Pearson**

Project: **Road Reserve**

Test pit location: **NUDURR DRIVE**

Date started: **9.6.2010**

Date completed: **9.6.2010**

Logged by: **DLW**

Checked by: **SK**

equipment type and model:

Pit Orientation:

Easting: m

R.L. Surface:

excavation dimensions: m long m wide

Northing: m

datum:

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	depth metres / RL	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
EI				E PID = 0.0			TOP	Topsoil:brown	D	L		
							C	CLAY:yellow/brown		VSt		
					0.5		G	GRAVEL:angular, increasing with depth, weathered grey shale		L		
				E PID = 0.4			SHAL	SHALE:bedrock		H		
					1.0			Test pit TP1 terminated at 0.8m				

Sketch

method		support		notes, samples, tests		classification symbols and soil description	consistency/density index	
N	natural exposure	S	shoring	U_{50}	undisturbed sample 50mm diameter	based on unified classification system	VS	very soft
X	existing excavation	N	nil	U_{63}	undisturbed sample 63mm diameter		S	soft
BH	backhoe bucket	penetration 1 2 3 4		D	disturbed sample	moisture	F	firm
B	bulldozer blade		no resistance ranging to refusal	V	vane shear (kPa)	D dry	St	stiff
R	ripper	water		Bs	bulk sample	M moist	VSt	very stiff
E	excavator		water level on date shown	E	environmental sample	W wet	H	hard
			water inflow	R	refusal	Wp plastic limit	Fb	friable
			water outflow			W_L liquid limit	VL	very loose
							L	loose
							MD	medium dense
							D	dense
							VD	very dense

TESTPIT ENVICANB00280AE-NUDURR DRIVE.GPJ COFFEY.GDT 14.7.10

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Engineering Log - Excavation

Excavation No. **TP2**

Sheet 1 of 1

Office Job No.: **ENVICANB00280AE**

Client: **Browns Consulting**

Principal: **Julie Pearson**

Project: **Road Reserve**

Test pit location: **NUDURR DRIVE**

Date started: **9.6.2010**

Date completed: **9.6.2010**

Logged by: **DLW**

Checked by: **SK**

equipment type and model:

Pit Orientation:

Easting: m

R.L. Surface:

excavation dimensions: m long m wide

Northing: m

datum:

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
E				E PID = 1.6				TOP	Topsoil:brown	D			
								MC	Silty CLAY:orange/brown		VSt		
				E PID = 1.5		0.5		MC	Silty CLAY:yellow/brown				
				E PID = 1.4		1.0		G	GRAVEL:brown/grey, coarse, angular		L		
						1.5							
				E PID = 1.9		2.0		SHAL	SHALE:grey thinly laminated, angular		H		
						2.5			Test pit TP2 terminated at 2.5m				

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

TESTPIT ENVICANB00280AE-NUDURR DRIVE.GPJ COFFEY.GDT 14.7.10

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