STAGE 1 ENVIRONMENTAL SITE ASSESSMENT

Canberra Brickworks Remediation Project
Block 1 Section 102 Yarralumla
Canberra Central ACT

February 2015 (Revised March 2015)

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EXECUTIVE SUMMARY

Capcorp Constructions Pty Ltd (Capcorp) has engaged Robson Environmental Pty Ltd (Robson) to undertake an Environmental Site Assessment (ESA) which required the removal of surface vegetation and exposed asbestos material (preliminary remedial works) prior to the commencement of ESA investigative works. The remedial works formed a part of the Stage 1 works presented in the Remediation Action Plan (RAP) (Robson Reference 9623_EAR_RAP_Ver 4_20140730.docx) for the remediation of the asbestos dump ('AD') and associated impacted soil.

Based on the current understanding of the area of impact, the majority of the Asbestos Dump ('AD') is located in the centre of the western boundary of the Canberra Brickworks site, Block 1 Section 102 Yarralumla ACT 2600 (Canberra Central) Denman Street, Yarralumla ACT 2600 (herein referred to as 'the site'). However, the western side of the dump encroaches on the adjoining block(s), Public Land, Block 20 Section 102 and possibly Block 1 Section 127 Yarralumla.

The objective of the Stage 1 ESA was twofold, to determine the type of contamination and it's extent within the understood area of the 'AD' for the determination of the appropriate remedial method for the site; and to assess the site (from a contamination perspective) for the redevelopment for high density residential land use Health Investigation Level 'B' (HIL B) as defined by the National Environment Protection Council 1999 – National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (amended version May 2013), herein referred to as the ASC NEPM 2013.

This ESA was based on the Robson 9 September 2014 '*Sample Analysis Quality Plan – Canberra Brickworks Remediation Project'* (Robson Reference: 9623_EAR_SAQP_20140916.docx) and was prepared to guide the assessment of the 'AD' with the objective to remove gross asbestos contamination from the surface of the 'AD' and to improve on it's characterisation. This information would then be used to refine the RAP which should increase the confidence that the appropriate remediation strategy for the 'AD' is selected for the Stage 2 remediation works to affect the site remediation goals. .

Stage 1 ESA

The Stage 1 ESA also included preliminary remedial site works which comprised of site set up, vegetation and asbestos removal. These works commenced on 17 November 2014 and were undertaken by AAC Environmental and their sub-contractor Irwin and Hartshorn Pty Ltd. The removal of the vegetation commenced on 21 November and included the removal of surface asbestos materials and visibly impacted asbestos soils. While the vegetation removal was completed on 1 December 2014 the asbestos containing material (ACM) removal continued and was completed on 8 December 2014.

Following the removal of the vegetation and the asbestos containing materials (ACM) from the surface, the ESA works were able to be undertaken with minimal risk to the investigative team.

The ESA works (test pit sampling) occurred between the 4 and the 11 December 2014, while the north to south trenching work connecting the test pits was undertaken on 12 December 2014.

The ESA works included the excavation of twenty five (25) grid based sample locations with an excavator to a target depth of 0.5 m into the natural soil horizon where possible across the site ('AD'). Of the 25, 16 locations were within the understood boundary of the 'AD' while six (6) were located down gradient within the drainage line outside the 'AD' and three (3) up gradient on the east side of the 'AD' outside the mounded vegetated area.

On completion of the test pit and sampling work four (4) north – south trenches were excavated with the aim of joining the test pits to investigate whether fill between the test pits was significantly different. On average the trenches were between two (2) and three (3) metres deep.

Following the completion of the ESA works the stockpiled vegetation was wood chipped on 15 December 2014 under the supervision of AAC who are an ACT licensed asbestos removalist. On the 16 December soil that had been disturbed was sealed with a bituminous sealant by Capcorp and the woodchips were subsequently redistributed by AAC across the surface to enhance the stabilisation of the surface prior to the anticipated commencement of the Stage 2 remedial works scheduled for later in 2015.

Field observations and the results of the laboratory analysis for the site identified asbestos sheet materials in test pits TP3, TP5, TP6, TP8 and TP13. Friable asbestos, Fibrous Asbestos (FA) and Asbestos Fines (AF) were identified in test pits TP8 and TP13. Low concentrations of Total Recoverable Hydrocarbons (TRH) and Polycyclic Aromatic Hydrocarbons were detected at test pit locations TP8, TP11 and TP13. Concentrations only exceeded the assessment criteria for Benzo (a) Pyrene (BaP TEQ) (4mg/kg) at TP13 (0.0 - 0.1m) exhibiting a concentration of 15 mg/kg. Similar concentrations of BaP TEQ were not detected at depth in this location while low concentrations of TRH were detected to a depth of 3 mbgl but were well below the assessment criteria and were not considered to be of concern.

All other contaminants of concern returned concentrations below the assessment criteria. Concentrations of lead and nickel concentrations were elevated in some locations and would require leachate analysis if the waste materials were to be disposed of to an ACT licensed landfill. However, if all material was to be disposed of to the West Belconnen Resource Management Centre (WBRMC) as asbestos waste, leachate analysis would not be required as the metal concentrations do not exceed the Commercial and Industrial land use assessment criteria which are applicable to the land use criteria set for WBRMC.

The principal contaminant of the concern is asbestos. Based on the results of the assessment, the asbestos is predominantly located in the central and southeast portion of the dump. The depth of the asbestos ranged from 0.5 metres below ground level (mbgl) at TP3 to a depth of 3.2 mbgl at TP13. Based on this information the asbestos impacted fill is confined to the upper layer within this area and is expected to occur at varying concentrations within the fill. The fill across the site covers a greater area than the asbestos contamination. Based on field observations the fill that is asbestos impacted has a high concentration of mixed-waste that

includes soil, brick, tile, metal, glass, wood, ash and slag while the fill that does not appear to contain asbestos is dominated by brick, ceramic tile with some ash and slag. Based on these observations the asbestos is confined to the surface layer of the fill within a 1,260 square metre (m^2) area of the 'AD' while the fill covers a much larger area (3,722 m^2) and is likely to extend beyond the visible boundary of the 'AD' extending toward north and east of the site toward a Lane Poole Place and the Brickwork buildings. Therefore, based on the survey data collected during the assessment the estimated volumes specific to the 'AD' of asbestos waste is 2,610.1 cubic metres (m^3) while the estimated total volume of fill soil (soil, brick, tile, glass, metal ash and slag) including the asbestos is 8,732 m^3. These figures equate to a 4,854.8 t and 16,242 t respectively when using a clay density of 1.86 t/m^3 as referenced from the Australasian Institute of Mining and Metallurgy (1995) '*Field Geologist Manual'* and do not include the fill identified around TP22 and TP23 primarily because these locations are considered to be outside the 'AD'.

However, it must be noted that the derivation of these figures is based on field observations and interpolation between data points so a degree of uncertainty must be considered. If one extends the ACM fill boundary half way between the outlying unimpacted test pits the approximate area is 2,700 m^2 and assuming an average depth of 1.5 mbgl the volume of ACM fill could be as high as 4,050 m^3 which equates to approximately 7,533 t.

Based on this information Robson recommends that the data collected and assessed in this report is suitable for the refinement of the proposed Stage 2 remedial works as proposed in the current Remediation Action Plan (RAP) with the objective of rendering the site suitable for high density residential land use as defined by the '*National Environment Protection (Assessment of Site Contamination) Measure'* (NEPM as amended, May 2013).

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1 INTRODUCTION

1.1 Background

Capcorp Constructions Pty Ltd (Capcorp) has engaged Robson Environmental Pty Ltd (Robson) to undertake an Environmental Site Assessment (ESA) which required the removal of surface vegetation and exposed asbestos material (preliminary remedial works) prior to the commencement of ESA investigative works. The remedial works formed a part of the Stage 1 works presented in the Remediation Action Plan (RAP) titled *'Remediation Action Plan, Stage 1 and 2 (Includes Hazardous Materials) Canberra Brickworks Remediation Project Downer Block 1 Section 102, Yarralumla Canberra Central ACT'* (Robson Reference 9623_EAR_RAP_Ver 4_20140730.docx) for the remediation of the asbestos dump ('AD') and associated impacted soil.

Based on the current understanding of the area of impact, the majority of the 'Asbestos Dump' 'AD' is located in the centre of the western boundary of the Canberra Brickworks site, Block 1 Section 102 Yarralumla ACT 2600 (Canberra Central) Denman Street Yarralumla ACT 2600 (herein referred to as 'the site'). However, the western side of the dump encroaches on the adjoining block(s), Public Land, Block 20 Section 102 and possibly Block 1 Section 127 Yarralumla. A site location plan and a detailed site plan are presented in **Figure 1**, **Figure 2** and **Figure 3.**

This report documents the scope of work and the results of the ESA, including the removal of vegetation, the accessible surface asbestos containing material (ACM) and the assessment of the vertical and horizontal extent of the 'AD'.

Based on the previous environmental assessment reports undertaken in 2001 and later in 2007 it was recorded that asbestos contamination was present in the area of the 'AD'. The findings of the previous assessment work are presented in the reports referenced below:

- Connell and Wagner 2001 - *Appendix F-Brickworks Contamination Report*;
- Robson Laboratories Pty Ltd (October 2006) '*Environmental Investigation – Audit Report Yarralumla Brickworks Block 1 Section 102 Yarralumla Canberra Central ACT.* (Robson reference 3144_ CL_EI Final_20061018).

The findings from these assessments triggered the need to consider the remediation of the AD to allow the safe reuse of the impacted land.

The Stage 1 ESA works were undertaken in general accordance with the ACT EPA legislation and the ACT EPA endorsed guidelines made or approved by the EPA under the *ACT Environment Protection Act 1997* including the NSW Office of Environment and Heritage (OEH, 2011) *'Guidelines for Consultants Reporting on Contaminated Sites.'*

The Stage 1 ESA has been prepared in accordance with the '*National Environment Protection (Assessment of Site Contamination) Measure'* (NEPM as amended, May 2013) and the NSW Department of Environment and Conservation (DEC, 2006) '*Guidelines for the NSW Site Auditor Scheme (2nd Edition)*' and was it's implementation was based on the Robson (2014) '*Sample Analysis Quality Plan –*

Canberra Brickworks Remediation Project' (Robson Reference: 9623_EAR_SAQP_20140916.docx).

The relevant legislation, regulations, and guidelines are listed below:

- ACT Environment Protection Act 1997;
- ACT EPA (2009) '*Contaminated Sites – Environment Protection Policy*';
- Australian Standard AS 4482.1-2005 '*Guide to the investigation and sampling of sites with potentially contaminated soil – Part 1: Non-volatile and semi-volatile compounds*';
- ACT ESDD (2014) Contaminated Sites Information Sheet 4 '*Requirements for the Re-Use and Disposal of Contaminated Soil*';
- ACT ESDD (2014) Contaminated Sites Information Sheet No. 5 '*Requirements for the Transport and Disposal of Asbestos Contaminated Wastes*';
- ACT ESDD (2014) Contaminated Sites Information Sheet No. 6 '*Management of Small Scale, Low Risk Soil Asbestos Contamination*';
- Environment ACT (2000) '*Environmental Guidelines: Assessment & Classification of Liquid & Non-Liquid Wastes'*;
- NSW Office of Environment and Heritage (OEH, 2011) 'Guidelines for Consultants Reporting on Contaminated Sites';
- NSW EPA (1995) '*Sampling Design Guidelines*';
- National Environment Protection Council (NEPC) 1999 'National Environment Protection (Assessment of Site Contamination) Measure 1999' (amended version of 2013, herein referred to as the ASC NEPM (2013));
- WA DOH (2009) '*Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*' (WA Guidelines).

1.2 Objective

The objectives of the Stage 1 ESA were as follows:

- To characterise contamination (including contaminants of concern and extent) within the area of the 'AD' for the determination of an appropriate remedial method for the site;
- To assess the site (from a contamination perspective) for the redevelopment for high density residential land use in accordance with the trigger levels defined by Health Investigation Level 'B' (HIL B) the National Environment Protection Council 1999 – National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (amended version May 2013), herein referred to as the ASC NEPM 2013.

1.3 Scope of Work

The scope of work undertaken for the ESA was as follows:

- Prepare a Site Safety Management Plan (SSMP) for the environmental works associated with the removal of vegetation, ACM and subsequent test pit sampling, trenching of soil within understood footprint of the 'AD';
- Monitor the removal of the vegetation and surface ACM to ensure works were undertaken in accordance with the RAP;
- Mobilise a suitably qualified environmental scientist and an ACT Class A Asbestos Assessor to the site to collect soil samples and provide advice related to the management of asbestos materials;
- Survey in sample points across the footprint of the 'AD' based on systematic sampling pattern;

  In accordance with Table A of the NSW EPA (1995) *'Sampling Design Guidelines*' a minimum of approximately thirteen (13) systematic sample points would be required for a site covering the combined site area of 4,500 m^2 to identify a hotspot of approximately 23.1 m diameter with 95 % confidence. In this case 15 locations are proposed within the area of impact, while seven (7) sample locations are proposed down gradient within the drainage line and three (3) up-gradient on the east side of the 'AD';

  Note: Due to a change in site conditions specifically the location of the temporary boundary fence the number of samples identified as being located down gradient within the drainage line was altered to six (6). However this did not affect the actual number of proposed sample locations as per the SAQP for this ESA.
- Connect the test pits with north - south oriented trenches to obtain a vertical and lateral profile of the 'AD' (refer **Figure 4**);
- Due to the known presence of asbestos, undertake airborne fibre monitoring to assess whether dust control measures were effective and that respirable asbestos fibres were not produced during onsite works;
- Air monitoring was undertaken in accordance with the '*Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres, 2nd Edition [NOHSC: 3003(2005)]'* and test certificates was National Association of Testing Authorities (NATA) endorsed;
- Verbal and written notification of air monitoring results was provided to the site foreman and other members of the project team prior to commencement of next days works;
- The test pits / trenches were dug with an excavator to a depth of 0.5 m below the boundary between landfill material and natural soil where practicable. Soil samples were collected and logged in general accordance with Robson Standard Operating Procedure (SOP) EAR-SOP009 *'Soil Sampling for Asbestos'* and EAR-SOP003 '*Soil Sampling and Logging*'. SOP003 stipulates the collection of samples at the ground surface (0.0 - 0.1 m), 0.5 - 0.6 m, 0.9 - 1.0 m and each metre thereafter, and at changes in lithological unit, or intersection of potential lenses of contamination;

- Soil samples collected for asbestos analysis were collected in general accordance with the method outlined in the WA Guideline as described below;

  A 10 litre (L) soil sample was collected and sieved through a 7 mm sieve. Identified ACM would be collected and weighed, and the asbestos concentration in soil at each location would then be calculated using the formula:

  $$\% \text{ Soil Asbestos} = \frac{\% \text{ Asbestos Content} \times \text{ACM (kg)}}{\text{Soil Volume (L)} \times \text{Soil Density (kg/L)}}$$

  To assess for Asbestos Fines (AF) at each sample location one (1) wetted 500 mL volume was collected. These samples were dispatched to a NATA accredited laboratory for analysis for asbestos in accordance with procedures outlined in Section 4.1.8 of the WA Guideline;

  On a number of occasions the soil was not be suitable for sieving and the material was manually broken up in the field to ensure ACM was not present within soil clods etc and sieved where possible. The sample taken for Fibrous Asbestos (FA) and Asbestos Fines (AF) analysis included combination of sieved and manual inspected soil/rock.

  Where the soil conditions resulted in the generation of dust (that is, in the presence of loose, dry soil) during the sampling process, the sampling location and samples were moistened with water applied as a fine mist to minimise the potential for dust generation during the sampling process;

- For contaminants other than asbestos, soil samples were collected from the centre of the excavator bucket using a new clean pair of nitrile gloves. This method minimised the risk of samples coming into contact with the excavator bucket which reduces the potential for cross-contamination between samples. Reusable sampling equipment (for example, hand trowel or dish) was washed and decontaminated between sample locations using Decon 90 and rinsed with tap water;
- The samples were placed into clean laboratory supplied sample containers and labelled with unique sample identification. The samples were then placed into an ice cooled esky immediately after collection and transported to a NATA accredited laboratory;
- A duplicate of each sample was screened in the field with a hand-held MiniRae® 2000 Photoionisation Detector (PID) for Volatile Organic Compounds (VOCs). The PID was calibrated daily prior to the commencement of works using fresh air and 100 parts per million (ppm) Isobutylene reference gas;
- For Quality Assurance and Quality Control (QA / QC) purposes, duplicate and triplicate samples was collected at a rate of one (1) per ten (10) and one (1) per twenty (20) primary samples respectively, in accordance with the AS 4482.1-2005. A rinsate sample was collected each day of sampling, and a Trip Spike and Trip Blank were included with each batch of samples that are sent. The QA / QC samples were labelled with no reference to the primary sample on either the sample container or the Chain of Custody (COC) documentation to reduce the potential for the analytical results to be biased by the laboratories;
- The primary soil and QA / QC samples were submitted to SGS and Envirolab Services which are NATA accredited laboratories under COC conditions in accordance with the proposed analytical plan (refer **Table L**). In general, a selection of samples were analysed for the contaminants commonly associated

with fill material including Total Recoverable Hydrocarbons (TRH), Benzene, Toluene, Xylene and Ethylbenzene (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), Speciated Phenols, Organochlorine Pesticides (OCPs), Polychlorinated Biphenyls (PCBs), eight (8) heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) and asbestos.

- A representative number of samples were analysed for the physiochemical properties of pH, cation exchange capacity (CEC), clay content, organic carbon and iron which is required for the derivation of Ecological Investigation Levels (EILs) under the ASC NEPM (2013);
- Based on the findings of the Stage 1 ESA, this report has been prepared for Capcorp and Co in accordance with the NSW Office of Environment and Heritage (OEH, 2011) *'Guidelines for Consultants Reporting on Contaminated Sites.'*

2 SITE INFORMATION

General details regarding the site are summarised in **Table A** below.

Table A: Summary of Site Details.

Site Name	'Asbestos Dump' ('AD') – Western boundary of the Canberra Brickworks (Block 1 Section 102) and the adjoining block(s), Public Land, Block 20 Section 102 and possibly Block 1 Section 127.
Site Address	Canberra Brickworks, Denman Street, Yarralumla ACT
Title Identification	Part of Block 1 Section 102 Yarralumla, ACT Canberra Central Block 764
Site Area	The 'AD' has an area of approximately 0.45 hectares
Current Zoning	According to the ACT Territory Plan which is administered by the ACT Planning and Land Authority (ACTPLA), the site is currently zoned as Rural RZ1: SUBURBAN; CZ6: LEISURE AND ACCOMMODATION.
Current Site Use	Wholesale, retail outlet for recycled timber (Thor's Hammer)
Proposed Site Use	To be confirmed but for the purposes of this Stage 1 ESA Robson understands the proposed site use will be Residential HIL 'B'.

2.1 Site Description

The site forms a portion of the Yarralumla Brickworks and is located on the western boundary of the Brickworks. A plan of the site showing the Blocks, zones and boundary survey information is provided in **Figure 2**.

The Asbestos Dump ('AD')

The 'AD' covers an area of approximately 0.45 Hectares within the Canberra Brickworks and is secured by a lockable chain wire fence. The 'AD' is obscured by blackberry vines, deciduous trees and large pines on the southwest corner of the site. The site is bisected by a dry water course which may at one stage have been engineered as a stormwater channel.

The 'AD' is best accessed from the south end and is characterised by vegetation, obvious mounds and pits of buried waste before the dump levels out along the western boundary of the site. The boundary abuts onto a thin strip of public land (Block 1 Section 127 Yarralumla) which also shows signs of fill which is suspected to be encroachment from the 'AD' which separates it from Royal Canberra Golf Course where the stormwater drain is clearly visible. Private residential properties are present on the north side of the 'AD' on Lane Poole Place.

The visible waste in the dump includes Asbestos sheeting, metal, rubber, plastic and brick waste (refer **Appendix D** for Photographs).

The Brickworks (Excluding the 'AD')

The Canberra Brickworks site is identified as Block 1 Section 102 Yarralumla and covers 9.6 hectares approximately 4.8 km southwest of Canberra City. The site slopes to the west and is bounded by a golf course to the west and residential land in all other directions. Apart from the built up areas (Kilns etc) on the central west side of the site, large pine trees line the perimeter of brickworks.

The site is bounded by the Royal Canberra Golf course to the west, Lane Poole Place and Bentham Street to the North, Schomburgk and Woollis Street to the East and South. The site may be accessed by Denman Street at the south end and is secured by a new black iron fence.

The site has two (2) distinct areas, the west side which is defined by the kiln buildings and workshops and the east side which comprises the quarry. The quarry floor is dominated by a man made lake which was mostly dry at the time of the investigation 2006.

Large areas of the site have been filled with either quarry tailings or brick waste generated from the brick manufacturing processes.

2.2 Background

The site, the Canberra Brickworks, operated between 1913 and 1976. The manufacturing of bricks on the site may have impacted the site with a range of industrial contaminants primarily, hydrocarbons, polycyclic aromatic hydrocarbons and heavy metals. Other activities that may have caused on site contamination include the use of explosives for generating raw material for the bricks, pesticides and herbicides used to maintain the grounds and the use of hazardous materials in the construction of the buildings, for example asbestos. Since the brickworks ceased operation in the 1976 the site has been used by various lessees for commercial purposes. The current lessee is Thor's Hammer which operates a large scale recycled timber business. In the 1970s, perhaps due to on-site renovation and poor management practices the western boundary of the site was apparently used as a dump site which is the focus of this Stage 1 ESA. Based on aerial photographs, the dump becomes apparent in the 1980s. It is understood that hazardous materials (predominantly asbestos) have been dumped in this location. Also, it is thought that the origin of some of the asbestos waste may have been from external sources.

In August 2006 an Environmental Investigation (Audit) was undertaken by Robson Laboratories Pty Ltd of the Canberra Brickworks Site and was based on the results of an investigation by Connell Wagner Contamination Report (2001) which identified potential on-site Areas of Environmental Concern (AEC). The aim of the Audit was to gather indicative information with regard to known Areas of Environmental Concern at the Brickworks and was not specific to the assessment of the 'AD'. As a consequence shallow drilling was undertaken on the eastern boundary of the 'AD' for environmental sampling purposes and no industrial contaminants were detected in the soil at concentrations above the sensitive land use criteria (Residential 'HIL A' Land Use). The sensitive land use criteria were applied in this Audit to allow flexibility for future land use.

In early 2007 a RAP was prepared by Robson Laboratories Pty Ltd. The project was halted as the ACT Planning and Land Authority (ACTPLA) determined that Development Approval would be required for a remedial project of this size and the perceived likely increase in cost associated with the volume of asbestos materials observed in the dump following the removal of vegetation cover.

A consequence of the partial implementation of the RAP in 2007 was soil samples were able to be taken from within the dump. The analytical results further demonstrated that the likely dominant contaminant of concern was asbestos.

These environmental assessments are further discussed in **Section 3** of this report.

2.3 Heritage

This Stage 1 ESA has been designed in consultation with ACT Heritage Council as it is known that the Yarralumla Brickworks Site is listed on the ACT Heritage Register under the ACT Heritage Act 2004. The heritage items (buildings) have been identified within the facility adjacent the proposed remediation works and will be clearly marked and protected with temporary fencing for the duration of the remedial works.

The Project Manager (Capcorp) has engaged an archaeologist to be available during the works if an assessment of an area affected by the remediation works is required.

2.4 Topography

The 'AD' is approximately 580m the Australian Height Datum (AHD) and is generally flat with a western slope towards the Royal Canberra Golf Course and appears to be located on top of what might be an old stormwater drain which is in line with a now redundant septic tank. The nearest surface water body is Warrina Inlet of Lake Burley Griffin which is approximately 600m northwest of the site.

2.5 Hydrology

Canberra has an average annual rainfall of 629mm with most of the rain falling between the months of March and May and September to November.

The dump site is unsealed and well vegetated and slopes to the west. Runoff from the sites is expected to be minimal except in very wet conditions when the soil becomes saturated. Drainage is expected to follow the old stormwater drain therefore contamination (if any) would be expected to follow the drain to the west toward Lake Burley Griffin.

2.6 Geology

Reference to the Bureau of Mineral Resources, Geology and Geophysics 1:100,000 scale Geological Series Sheet '*Canberra*' (Sheet 8727, 1992) indicates that the site is underlain by the Yarralumla Formation. The formation is described as a calcareous and tuffaceous mudstone and siltstone, with minor limestone, calc-silicate hornfels and quartz sandstone which is a suite of sedimentary deposits Silurian in age (425 m.y.).

As discussed further in **Section 3**, an environmental audit was undertaken in 2006 and a number of boreholes were located along the east side of the dump. Further, during the initial phase of the dump remediation in 2007, a number of test pits were dug in the dump itself. Based on the bore hole data and test pit data, the fill soil was

found to be approximately 2.5 m – 3 m deep overlying brown clays and yellow siltstone.

Based on this investigation the natural soils may be described generally as either a sandy clay, orange to red, exhibiting medium plasticity with minor medium grained gravels or a yellow weathered granite.

2.7 Hydrogeology

Reference to the Bureau of Mineral Resources, Geology and Geophysics (1984) 1:100,000 scale map '*Hydrogeology of the Australian Capital Territory and Environs*' indicates that the groundwater is anticipated to be hosted in a fractured rock aquifer. High yielding zones would be associated with upper and lower portions of the individual ash-flow tuffs and interbedded sediments.

The groundwater yield beneath the site is estimated to be between 0.5 litres per second (L/sec) and 1.0 L/sec, while the concentration of total dissolved solids (TDS) is estimated to be less than 500 milligrams per litre (mg/L).

Groundwater was not encountered in any of the boreholes or test pits from previous assessments. However, as the area of concern may have landfill characteristics, there is the potential for a perched aquifer to be present within or at the base of the fill material which may be contaminated. Therefore, this feature has been included in the Conceptual Site Model (CSM) to ensure this feature is considered during the proposed remedial works (Refer **Figure 5** and **Figure 5A**).

During this investigation water was encountered in two (2) of the 25 test pits, TP8 and TP10. Based on the observed sudden inflow of water into the test pit, particularly TP10 at 4.6 mbgl, and as the site had received a recent significant rainfall (53.6 mm between 1 and 7 December 2014 with 29.6 mm falling on 7 December 2014 was recorded at the Tuggeranong weather station by the Bureau of Meteorology), the water is thought to be seepage water/perched water lens and not the regional water table.

2.8 Surrounding Land Uses

The land uses surrounding the site are summarised in **Table B** below.

Table B: Summary of Surrounding Land Uses.

Direction from Site	Site Use	Description of Site Use
North	Residential	Lane Poole Place This area is Zoned 'RZ1 – Suburban
East	Brickworks infrastructure and Thor's Hammer recycled wood centre.	This area is the Canberra Brickworks site and is zoned as Rural RZ1: SUBURBAN; CZ6: LEISURE AND ACCOMMODATION.
South	Restricted Open Space, Public Space	This land is undeveloped and is currently zoned accordingly:

Direction from Site	Site Use	Description of Site Use
	and Designated Land	Directly south of the site: Block 7 Section 102 - CZ6: LEISURE AND ACCOMMODATION; PRZ2: RESTRICTED ACCESS RECREATION ZONE Block 1 Section 127 - PRZ2: RESTRICTED ACCESS RECREATION ZONE; DES: DESIGNATED
West	Two (2) blocks defined as Open Public Space are located directly adjacent the site and the Royal Canberra Golf Course (Block 2 Section 119)	This land is undeveloped and is currently zoned accordingly: Block 20 Section 102 – CZ6: LEISURE AND ACCOMMODATION Block 1 Section 127 - PRZ2: RESTRICTED ACCESS RECREATION ZONE; DES: DESIGNATED

2.9 Proposed Redevelopment

Robson understands that the aim at this stage in the planning process is to remediate the 'AD' which would include the reinstatement of the area to permit high density residential land use as defined by the ASC NEPM (2013) as Health Investigation Level HIL'B' – '*Residential with minimal opportunities for soil access includes dwellings with fully and permanently paved yard space such as high-rise buildings and flats'.*

3 PREVIOUS ENVIRONMENTAL REPORTS

The previous environmental site assessments (ESA's) undertaken of the Canberra Brickworks site (Block 1 Section 102) include studies from 2001 to present. However, the previous environmental site assessments (ESA's) and reports are not specific to the 'AD'. All reports have been included as aspects of the studies have addressed the 'AD'. These reports include:

- Connell and Wagner 2001 - *Appendix F-Brickworks Contamination Report*;
- Robson Laboratories Pty Ltd (October 2006) '*Environmental Investigation – Audit Report Yarralumla Brickworks Block 1 Section 102 Yarralumla Canberra Central ACT.* (Robson reference 3144_ CL_EI Final_20061018);
- Robson Laboratories Pty Ltd (2007) *'Remediation Action Plan - Asbestos Dump Yarralumla Brickworks Block 1 Section 102 Yarralumla Canberra Central ACT'.* (Robson reference 3144_ CL_RAP_20070612);
- Robson Environmental Pty Ltd *(2014) 'Remediation Action Plan, Stage 1 and 2 (Includes Hazardous Materials) Draft Canberra Brickworks Remediation Project Downer Block 1 Section 102, Yarralumla Canberra Central ACT'.* (Robson reference 9623_EAR_Draft RAP_Ver 3_20140407).

3.1 Summary of Previous Assessment Reports

A summary of each of these reports is presented below.

3.1.1 Connell Wagner – Brickworks Contamination Report (2001)

The study was a preliminary (Phase 1) assessment of potential site contamination and was part of a Development Control Plan (DCP) commissioned by the ACT Government. The assessment was based on interviews with persons who worked on the brickworks and a desktop study which undertook the review of available historic information.

The study identified a number of locations on the site which could be sources of on-site contamination but did not identify any potential off-site contamination sources.

The potential on-site sources of contamination identified are listed below and those located in the vicinity of the 'AD' are shown on **Figure 6**:

- Coal and Oil Storage Bunkers (NE5);
- Forklift Shed (A6);
- Model Railway Workshops (M1-M3);
- Septic Tank (ST);
- Blacksmiths Shop (M1-M3);
- Explosive Storage Area (ES);
- General fill on the site; and
- The Asbestos Dump ('AD').

Of the potential on-site sources listed above other than the 'AD', only the septic tank is located within the known boundary of the 'AD'.

The report also makes comment on the likely presence of above ground hazardous material in buildings and that the site (Brickworks) has been filled in places with materials that have been sourced from the site.

The report concludes that it is probably suitable for its intended site use (a commercial and recreational facility) provided the potential sources of contamination are investigated in accordance with Environment ACT requirements.

3.1.2 Robson Report (October 2006) – Environmental Investigation

In 2006 Robson was engaged by ACT Property Group to undertake an Environmental Investigation (Audit) of the Brickworks site. The scope of the investigation was to characterise where possible, the on-site contamination sources (the AECs) that had been identified in the Contamination Report (Desk-Top Study) undertaken by Connell-Wagner in 2001 which included the 'AD'. As this SAQP is specific to the 'AD,' only the results related to the 'AD' are briefly discussed below.

The sample locations relevant to the 'AD' are presented in **Figure 6**.

Due to access difficulties only the eastern boundary of the 'AD' was investigated. Two (2) bore holes (BH4 and BH5 (BH5A)) were drilled to auger refusal 3.2 m and 4.7 m respectively and two (2) soils samples were taken from each and analysed for a selection of the following contaminants: TPH, PAH, OCP, PCB, Eight (8) Heavy Metals As, Cd, Cr, Cu, Hg, Pb, Ni and Zn and Asbestos. Contaminants of concern were not identified above the assessment criteria (Residential 'HIL A' Land Use) in these locations.

3.1.3 Robson Report (June 2007) – Remediation Action Plan

Based on the recommendations made in the Robson (2006) Environmental Investigation (Audit), a RAP was prepared for the removal of the asbestos waste from the 'AD' and subsequent validation of the site for Sensitive Land Use ('HIL A'). The scope of the RAP included the removal of the vegetation cover, the removal of accessible surface asbestos sheet materials, separation and stockpiling of all recyclable material, the removal and stockpiling of all other waste materials for waste classification purposes, validation of the resultant excavation for Sensitive Land Use and site reinstatement.

The RAP was only partly implemented as the project was stopped by the ACT Planning and Land Association (ACTPLA) due to the requirement for Development Approval (DA) to be in place when removing significant quantities of soil. The work allowed for an improved assessment of the extent of the dump and limited soil sampling from test pits and a stockpile. The results of the remedial works have not been presented in a report format. However, from records held by Robson, the observations and a brief discussion of the analytical results are presented below.

<u>Field Observations</u>

Following the removal of the vegetation which was primarily blackberry vines from the southeast corner of the 'AD', corrugated asbestos sheeting was visible and accessible. Manual removal of the sheeting was undertaken and approximately 50 tonnes of sheeting was removed from the site before the project was discontinued due to DA requirements and budgetary constraints. Apart from the asbestos, a septic tank and fill (general builders waste including brick, concrete, metal (car bodies),

tyres and wood), evidence of other contaminants of concern (staining, olfactory indicators) were not observed.

After the vegetation had been removed, six (6) samples were taken from across the mounded dump surface and the locations included four (4) test pits, one (1) stockpile and one (1) sample from within the creek line adjacent the septic tank. In summary six (6) soil samples were taken from six (6) locations from varying depths ranging from the 0.0m to 3m across the accessible part of the 'AD'. The field work was undertaken on the 18 June 2007. The waste materials observed in the fill at these sample locations included: brick, concrete, ash, plastic and asbestos as sheet fragments and millboard insulation.

The soil samples were analysed for the following contaminants of potential concern (COPC): TPH, PAH, Heavy Metals (As, Cd, Cr, Cu, Hg, Pb, Ni & Zn), OCP, PCBs and Asbestos.

Analytical Results

Asbestos fibres were identified in the soil in four (4) of the six (6) soil samples and a low concentration of Total Petroleum Hydrocarbons (TPH) (110mg/kg TPH - C_{29}-C_{36}) was identified in the soil sample taken from one location (Test Pit 1). Apart from the asbestos all other contaminants of concern were below the assessment criteria (Residential 'HILA' Land Use).

3.1.3 Robson Report (April 2014) – Remediation Action Plan

A revised RAP was prepared for the 'AD' with the objective to remediate the site to permit mixed commercial and residential land use ('HIL B'). The RAP comprises of two (2) stages:

- Stage 1 includes the removal of the vegetation, the removal of accessible asbestos sheet materials and the implementation of an Environmental Site Assessment (ESA) to better characterise and delineate the waste;
- Based on the information derived from the ESA, Stage 2 of the RAP will be to incorporate the results of Stage 1 and amend the RAP accordingly such that remediation can be achieved in the most effective way possible.

3.1.4 Summary of Known Soil Contamination

Based on field observations and limited analytical data, the soils associated with the dump are impacted with asbestos sheet fragments and fibre bundles.

Other industrial COPCs have not been detected in the limited analytical data that is available. Despite this, future soil assessments and site validation assessments should include the other common industrial contaminants of concern namely TRH, BTEX, PAH, Phenols, OCP, PCB and eight (8) metals, unless it can be demonstrated these contaminants are not of concern.

In addition to these COPCs, the other potential contaminant sources that may comprise of additional COPCs identified by Connell Wagner (2001) include an explosive store and a septic system (present in the 'AD'). Further, as the site has been used as a dump it is possible that municipal waste may be present in the waste stream and therefore methane gas may also need to be considered as a COPC.

Based on information provided in the Connell Wagner (2001) report the Brickworks ceased operation in 1976 and aerial photographs indicate that the 'AD' is present on site from 1980. Further, the report states the Explosive Store was only used in the early life of the Brickworks pre-1920. Also the report makes no mention of municipal waste being brought onto the site.

Based on this information and on the more recent site investigations undertaken by Robson (2006 and 2007) that did not identify such sources either visually or by soil analysis, Robson considers the likelihood of contaminants related to explosives and municipal waste to be present in the dump to be unlikely.

A septic system is known to be present within the 'AD'. Based on the Connell Wagner (2001) report the septic system was in use in 2001 but Robson understands it is not currently in use and has not been in use for some years. Therefore, the likelihood of significant volumes of sewage is considered to be unlikely. Therefore this source is not expected to be a significant health or environmental risk.

However, during the course of the ESA, if field investigations reveal evidence to suggest such sources, the Contaminants of Potential Concern (COPC) should be adjusted to accommodate these finds. These include the following:

- Explosive Screen (includes nitro-glycerine);
- Pathogens: E coli, Faecal Coliforms and Total Coliforms; and
- Methane Gas.

At the time of septic tank removal and site validation it may be prudent to target the septic tank and the area for pathogens.

4 DATA QUALITY OBJECTIVES

The DQOs is a seven (7) step process used to aid the planning of environmental investigations by providing a structured methodology for assessing the most appropriate environmental data collection processes, including the identification of sample locations, number of samples required, sampling methods and defining an acceptable assessment criteria.

The DQO process has been used to aid the development of the RAP and the SAQP for this Stage 1 ESA and were prepared in general accordance with Appendix C of the Australian Standard AS4482.1-2005 '*Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil – Part 1: Non-Volatile and Semi-Volatile Compounds*' and the USEPA (2000) '*Data Quality Objectives Process for Hazardous Waste Site Investigation*' (EPA QA/G-4HW).

The DQOs developed for this project are presented in the SAQP as referenced below and have been included in **Appendix A.**

Robson Environmental Pty Ltd 16 September 2014 *–'Sample Analysis Quality Plan Stage 1 Environmental Site Assessment of the Remediation Action Plan – Canberra Brickworks Remediation Project Block 1 Section 102 Canberra Central ACT (Document Reference* 9623_EAR_SAQP_20140916.docx*)'.*

Elements of the DQOs are referred to as necessary in the following sections of this Stage 1 ESA.

5 ASSESSMENT CRITERIA

Investigation and screening level criteria as defined in the ASC NEPM (2013) are the concentrations of contaminants above which further assessment and /or appropriate remediation may be required.

Robson understands that the site is to be redeveloped for mixed-use high density residential and commercial land use. The assessment criteria applicable to this exposure scenario and sourced from the ASC NEPM (2013) are the Health-based Investigation Level (HIL) 'B'- *'Residential with minimal opportunities for soil access including dwellings with fully and permanently paved yard space such as high-rise buildings and flats'*.

The ASC NEPM 2013 also provides health screening levels (HSLs) for petroleum hydrocarbon compounds. It is considered that the dominant exposure pathway to petroleum hydrocarbon compounds would likely be via vapour inhalation, and therefore criteria sourced from Table 1A (3) have been adopted for the purpose of screening during this assessment.

In addition to the above, the ASC NEPM 2013 also provides ecological investigation levels (EILs) for common contaminants (including arsenic, copper, chromium (III), DDT, naphthalene, nickel, lead and zinc), and ecological screening levels (ESLs) for petroleum hydrocarbons (including benzene, toluene, ethylbenzene and xylene (BTEX), benzo(a)pyrene (B(a)P), and total recoverable hydrocarbon (TRH) fractions. The EILs and ESL should generally be applied to soil that will remain on the site and within the top two (2) metres (m) of the finished surface / ground level for generic land use. This generally corresponds to the root zone and habitation zone of many plant species.

For the purposes of this ESA it may not be necessary to assess the results against the EILs and ESLs as the material if assessed as unsuitable for site use which is expected, will either be assessed as suitable for BRU in a commercial/industrial setting or it will be disposed directly to land fill. However, the criteria have been included as possible assessment criteria in the event they are applicable.

EIL Ambient Background Concentrations (ABCs)

The Environmental Investigation Levels ambient background concentrations (ABCs) for copper, chromium (III), nickel, lead and zinc were determined in the following manner.

In the first instance the EIL land use setting for the site is considered to be 'urban residential and public open space' therefore the protection level for this land use setting is 80%.

It is assumed that the ecosystem is adapted to the ABC for the locality and it adding the contaminants over and above the background concentration which has an adverse affect on the environment.

For this assessment samples were to be taken in natural soils in the dump, to the east and west (down gradient) of the dump (refer **Figure 4**). Robson considers these locations to be representative with regard to the ABCs for arsenic, copper, chromium (III), DDT, naphthalene, nickel, lead and zinc.

The derived ABCs for copper, nickel chromium and zinc are presented in **Table 5** at the rear of this report and were used to derive the EILs for these metals specific for the site using the ASC NEPM Toolbox '*Ecological Investigation Levels – Interactive (Excel) Calculation Spreadsheet*' (ASC NEPM 2013) which are also presented in **Table 5.**

HSLs, ESLs and TRH Management Limits

Based on previous investigations as presented in **Section 3** the soil sampled from the bore holes east of the dump and from the test pits within the dump were silty clay. However, this investigation considers the dominant soil type to be a sandy clay. For the purpose of establishing the assessment criteria for HSL, ESL and TRH Management Limits the soils will be considered to be a clay.

To assess the suitability of the soil in the vicinity of the dump, the HSL criteria for clay has been applied while the suitability of the soil with regards to ecological considerations has been assessed against the ESL criteria for fine soil texture. For the purpose of this assessment, the depth applied to establish the HSL criteria was 0 m to < 1 m which is considered appropriate as there is a high likelihood that soil will occur within this depth range.

Following the assessment of TRH (fractions F1 – F4) impacts with consideration given to the ESL and HSLs, the TRH Management Limits may also need to be considered and these shall be sourced (when required) from Table 1(B)7 *'Management Limits for TRH Fractions F1 – F4) in Soil'* of the ASC NEPM (2013). As the proposed land use includes a residential component, the residential, parkland and open space category with a 'fine' soil texture has been used to determine the TRH Management Limits criteria.

A summary of the adopted HILs and HSLs for the 'AD' assessment are presented below in **Table C**, and the adopted EILs and ESLs are summarised in the following **Table D** overleaf.

Table C: Soil Assessment Criteria (HILs and HSLs)

Contaminant	HIL B [1] (mg/kg)	HSL B[2](Clay) (mg/kg)
ACM	0.04 % w/w	NE
Fibrous Asbestos (FA)	0.001 % w/w	NE
Asbestos Fines (AF)	0.001 % w/w	NE
Benzene	NE	0.7
Ethylbenzene	NE	NL
Toluene	NE	480
Xylene (m & p)	NE	NE
Xylene (o)	NE	NE
Xylene Total	NE	110
F1 (TPH C_6 – C_{10} minus BTEX)	NE	50
F2 (TPH greater than (>) C_{10} - C_{16} minus naphthalene)	NE	280
Carcinogenic PAHs (as B(a)P TEQ)	4	NE
Napthalene	NE	5
PAHs (Sum of total)	400	NE
Phenol	45,000	NE
DDT+DDE+DDD	600	NE
Aldrin and dieldrin	10	NE
Chlordane	90	NE
Endosulfan	400	NE
Endrin	20	NE
HCB	15	NE
Heptachlor	10	NE
Methoxychlor	500	NE
Mirex	20	NE
Toxaphene	30	NE
PCBs (Sum of total)	1	NE
Arsenic (total)	500	NE
Cadmium	150	NE
Chromium (VI)	500	NE
Copper	30,000	NE
Lead	1,200	NE
Mercury (inorganic)	120	NE
Nickel	1200	NE
Zinc	60,000	NE

Notes:

1. ASC NEPM (2013) – Table 1A(1) '*Health investigation levels for soil contaminants*' of Schedule B1 '*Guideline on Investigation Levels for Soil and Groundwater*', HIL B Exposure Setting: *'Residential with minimal opportunities for soil access including dwellings with fully and permanently paved yard space such as high-rise buildings and flats'*.

2. ASC NEPM (2013) – Table 1A (3) '*Soil HSLs for vapour intrusion*' of Schedule B1 '*Guideline on Investigation Levels for Soil and Groundwater*', HSL A & HSL B Exposure Setting: Low to high density residential. Adopted value is for a clay soil at a depth of 0 m to < 1 m.
NE = Not established, mg/kg = milligrams per kilogram, TEQ = toxicity equivalent quotient, PAH = Polycyclic Aromatic Hydrocarbons

Table D: Soil Assessment Criteria (EILs and ESLs)

Contaminant	EIL[1] (mg/kg)	ESL[2] (Fine) (mg/kg)
Benzene	NE	65
Ethylbenzene	NE	125
Toluene	NE	105
Xylene (m & p)	NE	NE
Xylene (o)	NE	NE
Xylene Total	NE	45
F1 (TPH C_6 – C_{10} minus BTEX)	NE	180 (800[4])
F2 (TPH greater than (>) C_{10} - C_{16})	NE	120 (1,000[4])
F3 (TPH > C_{16} - C_{34})	NE	1,300 (3,500[4])
F4 (TPH > C_{34} - C_{40})	NE	5,600 (10,000[4])
Carcinogenic PAHs (as B(a)P)	NE	0.7
Napthalene	170	NE
PAHs (Sum of total)	NE	NE
Phenol	NE	NE
DDT	180	NE
Aldrin and dieldrin	NE	NE
Chlordane	NE	NE
Endosulfan	NE	NE
Endrin	NE	NE
HCB	NE	NE
Heptachlor	NE	NE
Methoxychlor	NE	NE
Mirex	NE	NE
Toxaphene	NE	NE
PCBs (Sum of total)	NE	NE
Arsenic (total)	104	NE
Cadmium	NE	NE
Chromium (III)	**630**	NE
Copper	**86**	NE
Lead	1,131	NE
Mercury (inorganic)	NE	NE
Nickel	**169**	NE
Zinc	**451**	NE

Notes:

1. ASC NEPM (2013) – Table 1B (5) '*Generic EILs for aged As, Pb, fresh DDT and fresh naphthalene in soil irrespective of their physicochemical properties*'.
2. ASC NEPM (2013) – Table 1B(6) *'ESLs for TPH fractions F1 – F4, BTEX and Benzo(a)Pyrene in soil*' of Schedule B1 *'Guideline on Investigation Levels for Soil and Groundwater*', ESL setting urban residential and public open space.
3. ASC NEPM (2013) – ASC NEPM Toolbox, '*Ecological Investigation Levels – Interactive (Excel) Calculation Spreadsheet*'. Assuming the heavy metals are aged, that is, greater than two (2) years old. Soil physiochemical properties required to calculate EILs for Cu, Ni, CrIII and Zn were determined in the field through the analysis of a representative number of soil samples. Numbers in **Bold** are the site specific EILs for Cu, Ni, CrIII and Zn derived using the

field data entered into the ASC NEPM Toolbox (refer **Table 5** at the rear of this report for the site specific criteria calculations).

4. ASC NEPM (2013) Table 1B(7) *'Management Limits for TPH fractions F1-F4 in soils';* Soil texture 'fine', residential, parkland and open public space exposure setting.

NE: Not established, mg/kg = milligrams per kilogram.

The standard laboratory analysis for chromium provides a total concentration (that is, the result is unspeciated for chromium (III) and chromium (VI)). As the HIL 'B' assessment criteria for chromium (VI) is 500 mg/kg, it was considered that should the measured concentration of total chromium exceed this, then the sample would be re-analysed and speciated to measure the chromium (VI) concentration.

Statistical Evaluation

Statistical evaluation of soil analytical results may be necessary in the event of exceedences of the adopted assessment criteria. Statistical analysis should adhere to the following criteria:

- No single analytical result is to be greater than 250 % of the site criterion;
- The arithmetic mean of sample analytical results must be below the site criterion;
- The standard deviation must be less than 50 % of the site criterion.

It must also be emphasised that in the NSW EPA (1995) '*Sampling Design Guidelines*' that a site or sampling area cannot be considered to be uncontaminated or successfully remediated if the 95 % Upper Confidence Limit (UCL) of the arithmetic average concentration exceeds the assessment criterion. The 95 % UCL will therefore be considered as a primary tool to establish the efficacy of future remedial works.

Evaluation of Soil Assessment Criteria

SGS Services Pty Ltd (SGS) is the proposed primary laboratory, while Envirolab Pty Ltd (Envirolab) is the proposed secondary laboratory. Both laboratories are NATA endorsed for the proposed analytical suite.

The limits of laboratory reporting (LOR) for the analytical methods used by the primary laboratory were compared with the proposed assessment criteria. This was to ensure that the assessment criteria values exceeded the laboratory LOR. The results of the comparison are presented overleaf in **Tables E and F.**

Table E. Comparison of the Laboratory LOR with the Proposed Soil Assessment Criteria (HILs and HSLs)

Contaminant	HIL B [1] (mg/kg)	HSL B[2](Clay) (mg/kg)	Laboratory LOR (mg/kg)
Asbestos			
ACM	0.04 % w/w	NE	**0.1 g/kg (0.01 % w/w)**
Fibrous Asbestos (FA)	0.001 % w/w	NE	**0.1 g/kg (0.01 % w/w)**
Asbestos Fines (AF)	0.001 % w/w	NE	**0.1 g/kg (0.01 % w/w)**
Hydrocarbons			
Benzene	NE	0.7	0.1
Ethylbenzene	NE	NL	0.1
Toluene	NE	480	0.1
Xylene (m & p)	NE	NE	0.2
Xylene (o)	NE	NE	0.1
Xylene Total	NE	110	0.3
F1 (TPH C_6 – C_{10} minus BTEX)	NE	50	25
F2 (TPH greater than (>) C_{10} - C_{16} minus naphthalene)	NE	280	25
Polycyclic Aromatic Hydrocarbons (PAHs)			
Carcinogenic PAHs (as B(a)P TEQ)	4	NE	0.2
Napthalene	NE	5	0.1
PAHs (Sum of total)	400	NE	0.8
Phenol	45,000	NE	0.5
Organochlorine Pesticides			
DDT+DDE+DDD	600	NE	0.3 (combined)
Aldrin and dieldrin	10	NE	0.3 (combined)
Chlordane	90	NE	0.1
Endosulfan	400	NE	0.1
Endrin	20	NE	0.1
HCB	15	NE	0.1
Heptachlor	10	NE	0.1
Methoxychlor	500	NE	0.1
Mirex	20	NE	0.1
Toxaphene	30	NE	NA
PCBs (Sum of total)	1	NE	1
Metals			
Arsenic (total)	500	NE	3
Cadmium	150	NE	0.3
Chromium (VI)	500	NE	0.3
Copper	30,000	NE	0.5
Lead	1,200	NE	1
Mercury (inorganic)	120	NE	0.01
Nickel	1200	NE	0.5
Zinc	60,000	NE	0.5

Notes:

Bold: LOR is greater than the assessment criteria.

Table F. Comparison of the Laboratory LOR with the Proposed Soil Assessment Criteria (EILs and ESLs)

Contaminant	EIL[1] (mg/kg)	ESL[2] (Fine) (mg/kg)	Laboratory LOR (mg/kg)
Hydrocarbons			
Benzene	NE	65	0.1
Ethylbenzene	NE	125	0.1
Toluene	NE	105	0.1
Xylene (m & p)	NE	NE	0.2
Xylene (o)	NE	NE	0.1
Xylene Total	NE	45	0.3
F1 (TPH C_6 – C_{10} minus BTEX)	NE	180	25
F2 (TPH greater than (>) C_{10} - C_{16})	NE	120	25
F3 (TPH > C_{16} - C_{34})	NE	1300	90
F4 (TPH > C_{34} - C_{40})	NE	5600	120
Polycyclic Aromatic Hydrocarbons (PAHs)			
Carcinogenic PAHs (as B(a)P)	NE	0.7	0.2
Napthalene	170	NE	0.1
PAHs (Sum of total)	NE	NE	0.8
Phenol	NE	NE	0.5
Organochlorine Pesticides			
DDT +DDE+DDD	180	NE	0.3 (combined)
Aldrin and dieldrin	NE	NE	0.3 (combined)
Chlordane	NE	NE	0.1
Endosulfan	NE	NE	0.1
Endrin	NE	NE	0.1
HCB	NE	NE	0.1
Heptachlor	NE	NE	0.1
Methoxychlor	NE	NE	0.1
Mirex	NE	NE	0.1
Toxaphene	NE	NE	NA
PCBs (Sum of total)	NE	NE	1
Metals			
Arsenic (total)	104	NE	3
Cadmium	NE	NE	0.3
Chromium (III)	**630**	NE	0.3
Copper	**86**	NE	0.5
Lead	1,131	NE	1
Mercury (inorganic)	NE	NE	0.01
Nickel	**169**	NE	0.5
Zinc	**451**	NE	0.5

Notes:
Bold: LOR is greater than the assessment criteria.
1.ASC NEPM (2013) – ASC NEPM Toolbox, '*Ecological Investigation Levels – Interactive (Excel) Calculation Spreadsheet*'. Assuming the heavy metals are aged, that is, greater than two (2) years old. Soil physiochemical properties required to calculate EILs for Cu, Ni, CrIII and Zn were determined in the field through the analysis of a representative number of soil samples. Numbers in **Bold** are the site specific EILs for Cu, Ni, CrIII and Zn derived using the field data entered into the ASC NEPM Toolbox (refer **Table 5** at the rear of this report for the site specific criteria calculations).

With regards to the asbestos criteria and laboratory LORs, it is noted from the Australian Standard AS4964-2004 '*Method for the Qualitative Identification of Asbestos in Bulk Samples*', which is a NATA accredited method for qualitative identification of asbestos in bulk samples, that the limit of reporting (LOR) of asbestos by the laboratory is 0.1 g/kg, which is equivalent to 0.01 % weight per weight (% w/w). That is, the assessment criteria for FA and AF are therefore below the laboratory LOR. Other analytical methods for the detection of asbestos which can achieve the required FA and AF criteria are not NATA accredited methods but should be considered appropriate if required.

In the interim it is noted that the laboratories used do report in their comments section of the analytical report whether asbestos was detected but at concentrations below the LOR. If such a comment is made a precautionary approach will be adopted and the sample will be considered to exceed the assessment criteria. On the other hand, if the result is reported as being below the LOR and no additional comment is provided then the sample result will be considered to be below the assessment criteria.

Based on the review, the laboratory LOR for each analyte is considered suitable for the purpose of this ESA.

5.5.2 Classification of Soil for Off-Site Beneficial Re-Use

To permit flexibility with regard to the assessment of data collected during the ESA it may be possible to consider Beneficial Re-Use (BRU) of soil on a commercial/industrial site based on the results of the assessment.

Material assessed as unsuitable for on-site use may be suitable for BRU on other properties within the ACT (most likely day cover at the West Belconnen Resource Management Centre (WBRMC) or commercial / industrial properties).

The criteria considered to be applicable for the assessment of the material for BRU on commercial / industrial properties are the NEPM HIL 'D' which includes premises such as shops and offices as well as factories and industrial sites. HSL 'D' and ESL 'Fine' would be applied to assess hydrocarbon impacts when required. The proposed soil criteria for assessment for off-site BRU are summarised below in **Tables G and H**.

Table G: Proposed Assessment Criteria for Off-Site Beneficial Re-Use (HIL and HSL)

Contaminant	HIL D [1] (mg/kg)	HSL D[2](Clay) (mg/kg)	WA Guideline[2] (% w/w)
ACM	NE	NE	0.05
Fibrous Asbestos (FA)	NE	NE	0.001
Asbestos Fines (AF)	NE	NE	0.001
Benzene	NE	4	NA
Ethylbenzene	NE	NE	NA
Toluene	NE	NE	NA
Xylene (m & p)	NE	NE	NA

Contaminant	HIL D [1] (mg/kg)	HSL D[2](Clay) (mg/kg)	WA Guideline[2] (% w/w)
Xylene (o)	NE	NE	NA
Xylene Total	NE	NL	NA
F1 (TPH C_6 – C_{10} minus BTEX)	NE	310	NA
F2 (TPH greater than (>) C_{10} - C_{16} minus naphthalene)	NE	NE	NA
Carcinogenic PAHs (as B(a)P TEQ)	40	NE	NA
Napthalene	NE	NL	NA
PAHs (Sum of total)	4,000	NE	NA
Phenol	24,0000	NE	NA
DDT+DDE+DDD	3,600	NE	NA
Aldrin and dieldrin	45	NE	NA
Chlordane	530	NE	NA
Endosulfan	2,000	NE	NA
Endrin	100	NE	NA
HCB	80	NE	NA
Heptachlor	50	NE	NA
Methoxychlor	2,500	NE	NA
Mirex	100	NE	NA
Toxaphene	150	NE	NA
PCBs (Sum of total)	7	NE	NA
Arsenic (total)	3,000	NE	NA
Cadmium	900	NE	NA
Chromium (VI)	3600	NE	NA
Copper	240,000	NE	NA
Lead	1,500	NE	NA
Mercury (inorganic)	730	NE	NA
Nickel	6,000	NE	NA
Zinc	400,000	NE	NA

Notes:

1. NEPM (1999, amended 2013) – Table 1A(1) '*Health investigation levels for soil contaminants*' of Schedule B1 '*Guideline on Investigation Levels for Soil and Groundwater*', HIL D commercial/industrial such as shops, offices, factories and industrial sites
2. NEPM (1999, amended 2013) – Table 1A(3) '*Soil HSLs for vapour intrusion*' of Schedule B1 '*Guideline on Investigation Levels for Soil and Groundwater*', HSL D Exposure Setting: Commercial and Industrial. Adopted value is for a clay soil at a depth of 0 m to < 1 m.

NE = Not established; NA = Not Applicable; mg/kg = milligrams per kilogram; TEQ = toxicity equivalent quotient;
PAH = Polycyclic Aromatic Hydrocarbons

Table H: Proposed Assessment Criteria for Off-Site Beneficial Re-Use (EIL and ESL)

Contaminant	EIL[1] (mg/kg)	ESL[2] (Fine) (mg/kg)
Benzene	NE	95
Ethylbenzene	NE	185
Toluene	NE	135
Xylene (m & p)	NE	NE
Xylene (o)	NE	NE
Xylene Total	NE	95
F1 (TPH C_6 – C_{10} minus BTEX)	NE	215
F2 (TPH greater than (>) C_{10} - C_{16})	NE	170
F3 (TPH > C_{16} - C_{34})	NE	2500
F4 (TPH > C_{34} - C_{40})	NE	6600
Carcinogenic PAHs (as B(a)P)	NE	1.4
Napthalene	370	NE
PAHs (Sum of total)	NE	NE
Phenol	NE	NE
DDT	640	NE
Aldrin and dieldrin	NE	NE
Chlordane	NE	NE
Endosulfan	NE	NE
Endrin	NE	NE
HCB	NE	NE
Heptachlor	NE	NE
Methoxychlor	NE	NE
Mirex	NE	NE
Toxaphene	NE	NE
PCBs (Sum of total)	NE	NE
Arsenic (total)	160	NE
Cadmium	NE	NE
Chromium (III)	190 – 400 (TBD)	NE
Copper	60 – 800 (TBD)	NE
Lead	1800	NE
Mercury (inorganic)	NE	NE
Nickel	30 – 560 (TBD)	NE
Zinc	70 – 1300 (TBD)	NE

Notes:

1. NEPM (1999, amended 2013) – Table 1B (5) '*Generic EILs for aged As, Pb, fresh DDT and fresh naphthalene in soil irrespective of their physicochemical properties*'.
2. NEPM (1999, amended 2013) – Table 1B (6) *'ESLs for TPH fractions F1 – F4, BTEX and Benzo(a)Pyrene in soil*' of Schedule B1 *'Guideline on Investigation Levels for Soil and Groundwater*', ESL setting commercial and industrial.
3. NEPM (1999, amended 2013) – ASC NEPM Toolbox, '*Ecological Investigation Levels – Interactive (Excel) Calculation Spreadsheet*'. Assuming the heavy metals are aged, that is, greater than two (2) years old. Soil physiochemical properties required to calculate EILs for CrIII, Cu, Ni, and Zn (refer TBD below).

NE: Not established.
mg/kg = milligrams per kilogram.
NL: Non-limiting.
TBD: To be determined and will depend on the destination of the site. **Note:** These concentration

ranges are Added Contaminant Limits (ACLs) and the Ambient Background Concentrations (ABCs) when determined must be added to determine the EIL.

5.1 Classification of Waste Soil for Off-Site Disposal

To permit flexibility with regard to the assessment of data collected during the ESA it may be possible to consider Waste Classification from this in-situ assessment and is therefore discussed in this section.

Soil material that is considered to be unsuitable for off-site BRU at a commercial and industrial site would be disposed at a licensed waste facility in the ACT in accordance with the criteria presented in Environment ACT (2000) '*ACT's Environmental Standards: Assessment & Classification of Liquid & Non-liquid Waste*', a summary of which is provided below in **Table I**. It is also noted that soil potentially impacted with asbestos is to be classified as an '*asbestos contaminated waste*' and would therefore require removal in accordance with ACT EPA Contaminated Sites Information Sheet No. 5 (2011) '*Requirements for the Transport and Disposal of Asbestos Contaminated Wastes*'.

Table I: Soil Waste Assessment Criteria

Contaminant	Waste Classification (Environment ACT Table A3)[1] (mg/kg)		
	Inert	Solid	Industrial
Hydrocarbons (BTEX and TPH)			
Benzene	1	10	40
Ethylbenzene	60	600	2400
Toluene	28	288	1152
Xylene (m & p)	NE	NE	NE
Xylene (o)	NE	NE	NE
Xylene Total	100	1000	4000
TPH (C_6 – C_{10})	650	650	2600
TPH (C_{10} – C_{40})	5000	10000	40000
Polycyclic Aromatic Hydrocarbons (PAHs)			
Naphthalene	NE	NE	NE
Carcinogenic PAHs (as B(a)P TEQ)	0.08	0.8	3.2
PAHs (Sum of total)	200	200	800
Total Phenolics			
Phenol (non-halogenated)	28	288	1152
Organochlorine Pesticides			
DDT	NE	NE	NE
Aldrin and dieldrin	NE	NE	NE
Chlordane	NE	NE	NE
Endosulfan	NE	NE	NE

Contaminant	Waste Classification (Environment ACT Table A3)[1] (mg/kg)		
	Inert	Solid	Industrial
Endrin	NE	NE	NE
HCB	NE	NE	NE
Heptachlor	NE	NE	NE
Methoxychlor	NE	NE	NE
Mirex	NE	NE	NE
Toxaphene	NE	NE	NE
Polychlorinated Biphenyls			
PCBs (Sum of total)	2	<50	<50
Metals			
Arsenic	10	100	400
Cadmium	2	20	80
Chromium (III)	NE	NE	NE
Chromium (VI)	10	100	400
Copper	NE	NE	NE
Lead	10	100	400
Mercury (inorganic)	0.4	4	16
Nickel	4	40	160
Zinc	NE	NE	NE

Notes to Table M:
NE: Not established
[1] CT: Contaminant Threshold values for waste classification without doing the leachate test.

With regards to the above, it is noted that if exceedences of the Solid Waste Classification criteria of Table A3 are recorded, then additional laboratory analysis to determine the leachability of samples (using the Toxicity Characteristic Leaching Procedure (TCLP) may be undertaken, with the results then being compared against criteria sourced from Table A4 of Environment ACT (2000) '*ACT's Environmental Standards: Assessment & Classification of Liquid & Non-liquid Waste*'.

5.2 Airborne Fibre Monitoring Criteria

The control level for airborne fibre concentrations recorded during air monitoring will be 0.01 fibres/mL, as required by National Occupational Health and Safety Commission (NOHSC): 2002 (2005) '*Safe Removal of Asbestos, 2nd Edition*'. It is further noted that 0.01 fibres/mL represents a concentration that is 1/10th of the WorkSafe Australia's recommended Exposure Standard for all forms of asbestos of 0.1 fibres/mL, as documented in the guideline NOHSC:1003 (1995, amended 2003) '*Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment*'.

6 QUALITY ASSURANCE AND QUALITY CONTROL PROGRAMME

QA/QC methods were undertaken in accordance with Australian Standard AS4482.1-2005 *'Guide to the investigation and sampling of sites with potentially contaminated soil – Part 1: Non-volatile and semi-volatile compounds'*.

6.1 Field QA/QC

Field QA/QC sampling protocols would include the collection of the following QA/QC samples during sampling:

- A duplicate sample (intra - lab), which is a sample collected at the same place and time as the primary sample and intended to represent the same entity as closely as possible. Duplicate samples were collected at a rate of one (1) duplicate collected for every ten (10) primary samples collected;
- A triplicate sample (inter-lab), which is a sample collected at the same place and time as the primary sample and sent to a second laboratory to assess the quality of the primary laboratories testing procedures. The sample is intended to represent the same entity as the routine sample as closely as possible. Triplicate samples were collected at a rate of one (1) sample per twenty (20) primary samples collected;
- Rinsate samples were collected to assess the effectiveness of the decontamination procedures used on re-usable equipment. These samples were collected by pouring laboratory supplied deionised water over a piece of decontaminated equipment and into sample jars and analysed. One (1) rinsate sample was collected per day of sampling;
- A trip spike is a sample with known quantities of the analytes of interest supplied by the laboratory in the same type of container that is required for the analytical test of a sample collected in the field. These samples were taken from the laboratory to the sampling site and returned to the laboratory unopened. The samples are a required quality control element for volatile sampling and analysis. The laboratory checked for degradation of analyte during collection/storage/handling of field samples;
- A trip blank is laboratory supplied clean sand in a sealed sample jar. The jar was placed with the field samples and transported with the field samples to the laboratory for testing for the volatile analytes of the contaminant suite. The purpose is to determine the potential for cross contamination during sampling and sample transport.

All samples were stored in an ice cooled sealed container with chain of custody documentation and transported to a NATA registered laboratory.

All reusable sampling equipment was decontaminated between each sampling event by washing in clean tap water then in a solution of laboratory-grade phosphate free detergent (Decon 90) followed by rinsing with tap water.

7 SAMPLING METHODOLOGIES

Methodologies employed for the collection of the soil samples are summarised below. The sampling was completed in accordance with the following standards and guidelines:

- Australian Standard AS 4482.1-2005 '*Guide to the investigation and sampling of sites with potentially contaminated soil – Part 1: Non-volatile and semi-volatile compounds*';
- ACT ESDD (2014) Contaminated Sites Information Sheet 4 '*Requirements for the Re-Use and Disposal of Contaminated Soil*';
- ACT ESDD (2014) Contaminated Sites Information Sheet No. 5 '*Requirements for the Transport and Disposal of Asbestos Contaminated Wastes*';
- ACT ESDD (2014) Contaminated Sites Information Sheet No. 6 '*Management of Small Scale, Low Risk Soil Asbestos Contamination*';
- Environment ACT (2000) '*Environmental Guidelines: Assessment & Classification of Liquid & Non-Liquid Wastes'*;
- ASC NEPM (2013);
- NSW EPA (1995) '*Sampling Design Guidelines*'; and
- WA DOH (2009) '*Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*' (WA Guidelines).

In addition to the above, the sample program was undertaken in general accordance with the Robson Standard Operating Procedure (SOP) titled '*Soil Sampling and Logging*' (Robson reference EAR-SOP003, 2012) and the SOP *'Soil Sampling for Asbestos' (Robson reference* EAR-SOP009 2012) (refer **Appendix H**).

Sample design was undertaken in accordance with the SAQP by Robson Environmental Pty Ltd (September 2014) '*Sample Analysis Quality Plan – Canberra Brickworks Remediation Project'* (Robson Reference: 9623_EAR_SAQP_20140916. docx) which had been reviewed and endorsed by the NSW EPA accredited contaminated land Auditor.

In accordance with Table A of NSW EPA (1995) '*Sampling Design Guidelines*' a minimum of approximately thirteen (13) systematic sample points would be required for a site covering the combined site area of 4,500 m^2 to identify a hotspot of around 23.1 m diameter with 95 % confidence. In this case 16 locations were selected within the boundary of the area of impact and an additional six (6) locations were selected down gradient within the drainage line and three (3) up gradient on the east side of the dump outside the vegetated area.

In addition, the test pits were connected with north-south trenches to determine whether there was a significant difference in fill between the test pits. Where significant changes were observed it was expected that additional samples would be taken (refer to **Figure 4**). The location of the trenches was designed to be representative with the aim of characterising the waste.

As asbestos is one (1) of the contaminants of concern the Western Australia Department of Health (2009) "*Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia*" (herein referred

to as WA Guidelines) which have been adopted by the ASC NEPM (2013) was also considered. The WA guideline recommends the sampling density to be double the sampling density of what is set out in the NSW EPA (1995) '*Sampling Design Guidelines*'. However, considering the fact that asbestos is known to be present in significant quantities and the objective of this assessment is to characterise and delineate the extent of the waste, the additional sample points were considered unlikely to add value to the assessment. Therefore, the sample design as described above is considered to be satisfactory.

7.1 Sampling Methods

Soil samples that were collected were screened in the field with a portable PID to assess the potential for ionisable volatile compounds in soil. The sensitivity of the PID is dependent on the organic compound and varies for different mixtures of hydrocarbons. The PID was calibrated daily prior to use with a standard reference gas of known concentration (Isobutylene 100 parts per million (ppm)) and fresh air. Calibration records for the PID are presented in **Appendix B**.

Each sample was collected with a clean disposable nitrile glove and was placed in laboratory prepared sample containers and labelled with unique sample identification. Collected samples were placed in an ice cooled esky immediately after collection and during transport to a NATA accredited laboratory. Chain of Custody (COC) documentation was completed at the time of sample collection and accompanied the samples to the laboratory.

Specific soil sampling methods are briefly described below.

7.1.1 Test Pits

The samples were taken from targeted soil horizons from within the test pit using an excavator. Approximately, 0.1 - 0.2 m is removed at that soil horizon and sub-sampled from the excavator bucket.

7.1.2 Asbestos Materials

Suspect asbestos containing materials were moistened with a fine water spray prior to being sampled with a clean disposable nitrile glove.

7.1.3 Asbestos in Soil

Soil samples collected for asbestos analysis were collected in general accordance with the method outlined in the WA Guideline as described below;

A 10 litre (L) sample were collected and sieved through a 7 mm sieve. Identified ACM was collected and weighed, and the asbestos concentration in soil at each location was then calculated using the formula:

$$\% \text{ Soil Asbestos} = \frac{\% \text{ Asbestos Content} \times \text{ACM (kg)}}{\text{Soil Volume (L)} \times \text{Soil Density (kg/L)}}$$

To assess for Asbestos Fines (AF) at each sample location one (1) wetted 500 mL volume sample was also be collected. These samples were dispatched to a NATA accredited laboratory for analysis for asbestos in accordance with procedures outlined in Section 4.1.8 of the WA Guideline;

On a number of occasions the soil was not be suitable for sieving and the material was manually broken up in the field to ensure ACM was not present within soil clods etc and sieved where possible. The sample taken for Fibrous Asbestos (FA) and Asbestos Fines (AF) analysis included combination of sieved and manual inspected soil/rock.

Where the soil conditions resulted in the generation of dust (that is, in the presence of loose, dry soil) during the sampling process, the sampling location and samples were moistened with water applied as a fine mist to minimise the potential for dust generation during the sampling process;

7.1.4 Airborne Fibre Monitoring

Based on information from previous assessments, the site was known to contain ACM in the form of non-friable sheet materials. Furthermore, data collected in June 2007 by Robson indicated the presence of asbestos fibres.

Where bonded asbestos materials are considered to be potentially friable when removed, airborne fibre monitoring is recommended as it is good occupational hygiene practice as stipulated in the Safe Work Australia Code of Practice (2011) *How to Safely Remove Asbestos.*

Therefore, airborne asbestos fibre monitoring was implemented to assess whether respirable asbestos fibres were detectable during the removal of asbestos materials from the site. During the removal works representative airborne fibre monitoring locations were chosen adjacent to the removal works. Fibre monitoring pumps were generally located in common areas (lunch room, the site office), the decontamination unit and on the north, east, south and south boundaries of the work area and in the cabin of one of the operational excavators or bobcat.

Airborne fibre monitoring was conducted daily during all site activities including background monitoring prior to the commencement of site works from 13 November through to 18 December 2014).

The monitoring was undertaken using the following sampling equipment:

- Battery powered pump;
- Clean connecting hose;
- Membrane filters (mixed ester of cellulose) with a 0.8 micro millimetre (µm) pore size;
- Open face plastic filter holders.

The filter membranes were analysed at Robson's in-house NATA endorsed laboratory in accordance with '*Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust*' (NOHSC: 3003, 2005) for both exposure and control sampling. Certified laboratory reports for the airborne fibre monitoring are provided in **Appendix G.**

7.2 The Sampling and Analytical Plan

The Sample and Analytical Plan as proposed in the SAQP is presented below in **Table J.**

Table J: Sample and Analytical Plan.

Location	Rate or Number of Samples Proposed	Analytes
Asbestos Dump 0.45 ha	Fifteen (15) test pits within the presumed dump footprint Three (3) samples per test pit – two (2) in fill and one (1) in natural	Eight (8) metals and asbestos (all samples); TRH, BTEX, PAH, Phenols, OCP, PCB (1 per test pit) Pathogens: E coli, Faecal Coliforms and Total Coliforms (to be included adjacent the Septic Tank).
	Seven (7) test pits down gradient within the drainage line and three (3) test pits up gradient from the dump. Two (2) samples per test pit – one (1) surface and one (1) in natural (additional samples to be taken if extensive fill is observed	Eight (8) metals and asbestos (all samples); TRH, BTEX, PAH, Phenols, OCP, PCB (1 per test pit)
	2 per every second test pit (one(1) of fill material and one (1) of natural soil)	CEC, organic carbon, clay content, iron and pH
QA/QC Samples	Duplicate samples One (1) duplicate per 10 primary samples and one (1) triplicate per 20 primary samples and one (1) rinsate per field day. One (1) trip spike and one (1) trip blank per sample batch	PAHs, eight (8) metals and asbestos Trip blank and trip spike – BTEX and TRH C_6-C_9 only.

Notes:

- **TRH**: Total Recoverable Hydrocarbons; **BTEX**: Benzene, Toluene, Ethylbenzene, Xylenes; **PAH**: Polycyclic Aromatic Hydrocarbons; **PCB**: Polychlorinated biphenyls; **OCP**: Organochlorine Pesticides; **Heavy Metals**: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc;
- Cation Exchange Capacity (CEC), pH and clay content analyses are required for the derivation of EILs in accordance with the ASC NEPM (2013).
- If other contaminant sources are identified the analytical suite may need to be altered e.g. evidence of sludge from the septic tank, municipal waste etc.
- Based on what is observed in the trenches connecting test pits additional samples may be warranted.

8 VEGETATION AND ASBESTOS REMOVAL

The following section is specific to the removal of the vegetation cover, the broken asbestos sheeting (a non-friable asbestos containing material (ACM)), from the soil surface that included fill soil where the asbestos sheet could not be easily separated.

Site photographs are presented in **Appendix D** of this report.

A chronological summary of the vegetation and asbestos removal and subsequent ESA works is presented in **Table K** below and are described in detail in the subsequent pages in this section and **Section 9.**

In accordance with the RAP the work area (the site) was set up as an asbestos removal area in accordance with NOHSC (2002, 2005) *'Code of Practice for the Safe Removal of Asbestos – 2nd Edition'.* And during the remedial works airborne fibre monitoring was undertaken on daily basis in accordance with NOHSC (3003, 2005) '*Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust*'.

Table K. Summary of Field and Remedial Works

Stage	Date	Activity / Fieldwork	Contamination Summary
1-1 – Site Setup	October – 21 November 2014	Clear vegetation to establish site access road and the site compound.	None identified
1-1A – Site Setup and background airborne fibre monitoring	13 – 19 November 2014	Background airborne fibre monitoring prior to the commencement of remedial works to establish baseline with regard to fibre concentrations.	All results less than 0.01 F/ml)
1-2 and 1-3 Removal of blackberry and other vegetation and ACM as required	21 November – 1 December 2014	Remove vegetation and stockpile on site. **Note:** All vegetation removed with roots was stockpiled together to be treated as contaminated.	Surface ACM identified

Stage	Date	Activity / Fieldwork	Contamination Summary
1-3 - Removal of the ACM as required	21 November – 8 December 2014	Remove ACM sheet material and ACM impacted soil.	Surface ACM identified
1-4 – Environmental Site Assessment	4 December 2014; and 8 December -12 December 2014.	Soil sampling from test pits and trenching for the purpose of determining fill type between test pits locations	Asbestos sheet fragments were identified in Test Pits 3, 5, 6, 8 and 13. Low level hydrocarbon contamination was identified in TP 8 (negligible), TP 11 and TP13. Lead concentrations exceed the Solid Waste Criteria without leachability data: TP3, TP4, TP5, TP12, TP13 and TP15. Nickel concentrations exceed the Solid Waste Criteria without leachability data: TP1, TP9, and TP10.
1-4A – Temporary site shutdown	15 December -18 December 2014	Remove roots from the stockpiled and place within the 'AD' vegetation and wood chip the remaining waste for on site use. Seal disturbed soils, compound gravels and access road with a bituminous sealant.	ACM remains below the surface within the 'AD' boundary.

8.1 Vegetation Removal

The vegetation removal included the removal and stockpiling of blackberry vine, small and mature trees as required to enable the removal of surface ACM where found. The vegetation removal works were undertaken in accordance with the ACTPLA approved *Tree Management Plan Landscape Plan* (DSB Landscape Architects 24 March 2014) for the site. Therefore, apart from a few large trees in the centre and toward the west side of the site all of the vegetation cover was removed.

The vegetation removal was undertaken by the AAC and Irwin and Hartshorn between 21 November and 1 December 2014. A suitably qualified and experienced environmental scientist and ACT Licensed Class A Assessor from Robson was also on site to undertake airborne fibre monitoring during the removal works to monitor the removal and stockpiling of the vegetation.

Vegetation that had significant amounts of soil bound to the roots was deemed to have a significant risk of asbestos in soil and was therefore stockpiled separately. A bobcat was used to remove the blackberry vine while a 30 tonne excavator was used to remove trees as required. All vegetation was stockpiled on the grassed area on the east side of the work site.

The soil below vegetation was moist which helped to limit the dust emissions during the removal process and therefore while water was available at all times as a mechanism for dust suppression it was only used as required. As the vegetation was removed the asbestos sheet material as it was found on the surface was kept wet until it could be removed by the ACT licensed Asbestos Removalist.

The majority of the asbestos found was non-friable broken asbestos corrugated roof sheet and it was located in the central east part of the 'AD' and is described in the following sections.

8.2 Surface ACM Removal

Surface ACM removal commenced on 21 November and was completed on 8 December.

During and following the vegetation removal all visually identifiable ACM was handpicked and placed in asbestos waste bags by the ACT licensed asbestos waste contractor AAC. The volume of ACM removed in this way was minimal as there were large quantity of fragments and it was determined that it would be more efficient to remove the ACM with an excavator and load it directly into a leak proof truck for transport to the Mugga Lane Resource Management Centre (MLRMC). The majority of the ACM was removed in this way and is described in the next section.

8.2.1 Asbestos in Soil Removal

The direct loading of ACM fill material into trucks commenced on 28 November 2014 with the last load recorded as being transported to the Mugga Lane Resource Management Centre (MLRMC) on 9 December 2014 (Refer **Appendix C**).

The ACM impacted fill also included brick, tile, ash, metal, glass and plastic and depending on the transport vehicle it was either loaded into a double plastic lined truck tray and wrapped so that the ACM was sealed during transport to the landfill or placed directly into a leaked proof covered truck. Both methods were considered suitable and in accordance with ACT ESDD (2014) '*Information Sheet 5 Requirements for the transport and disposal of asbestos contaminated wastes'.*

Based on the tip dockets provided to Robson by Capcorp and AAC, 328.38 tonnes (t) of asbestos impacted soil was disposed to MLRMC. All truck movement and estimated volumes based on truck capacity reconciles with Robson field tracking records. Robson estimated that 174 m^3 which equates to 323.6 t using a clay density of 1.86 t/m^3 as referenced from the Australasian Institute of Mining and Metallurgy (1995) '*Field Geologist Manual'* was removed from the site.

9 FIELD WORK OBSERVATIONS

The ESA field work observations are described below. Refer to **Figure 4** at the rear of this report for the soil sample location plans related to this assessment.

The PID results and soil descriptions of samples taken are shown in the test pit logs presented in **Appendix E** of this report.

9.1 Test Pits

A suitably qualified and experienced environmental scientist and an ACT Licensed Class A Assessor from Robson supervised the excavation and sampling of the 25 test pits and four (4) trenches across the site. The field work was undertaken between 4 and 12 December 2014. The aim of the test pit work was to excavate 0.5 mbgl into the natural substrate where possible to characterise the fill across the site. Each test pit location was surveyed prior to undertaking the investigative works on 2 December 2014 by 4D Surveying. During the excavation of each test pit the surface was surveyed prior to the start of excavation and then the relative levels (RLs) were recorded for each sample horizon to assist with calculating the sample depth (provided it was safe to do so) (refer to **Figure 4** for Test Pit and Trench locations).

In general asbestos cement sheet fragments from broken corrugated roof sheet were observed in the soil at varying concentrations and depths in TP3, TP5, T6, TP8 and TP13. Where the asbestos was observed the fill was also noted to contain metal, glass, plastic, brick, tile, slag, ash and wood fragments. In test pits where the fill was dominated by brick, tile, minor ash and slag asbestos material was not observed.

Based on observations made during test pitting ACM appears to be primarily to be present within the top metre of fill. Pockets of ACM were found to be concentrated in particular locations for example TP13 and TP 6 where it was found to be at 3 mbgl.

The fill ranged in depth from no fill being present on the west side of the site to as deep as 5.5 mbgl at TP14 which is located on the northeast side of the site. The fill in the centre of the site ranges in depth from 0.5 mbgl to 4.5 mbgl.

A pocket of fill was also identified off site down gradient from the site wiithin Block 1 of Section 127 but no ACM was observed at this location.

Water inflows were observed in test pits TP8 and TP10. Based on the observed sudden inflow of water into the test pit, particularly TP10 at 4.6 mbgl and as the site had received a recent significant rainfall the water is thought to be seepage water/ a perched lens and not regional groundwater. With regard to contamination odours or staining on the surface of the water was not observed therefore samples were not deemed to be necessary. If significant water is identified during Stage 2 remediation works the water will be sampled and analysed for the site specific contaminants of concern and the data assessed against the relevant criteria specific to the receiving waters as defined in the Stage 2 RAP and/ or for off site disposal (if required).

During the sampling a duplicate of each sample was screened in the field with a hand-held MiniRae® 2000 Photoionisation Detector (PID) for Volatile Organic Compounds (VOCs). The PID results ranged from 0.0 ppm – 4.7 ppm (TP21) which suggests that the likelihood of significant concentrations of VOCs is low.

The natural soils may be described generally as either a sandy Clay, orange to red, exhibiting medium plasticity with minor medium grained gravels or a yellow

weathered granite. Based on a previous investigation (Robson reference 3144_ CL_EI Final_20061018) the natural soil on the east side of the 'AD' was described as either a yellow, brown silty clay or a yellow weathered siltstone.

9.2 Trench Observations

In accordance with SAQP following the completion of the test pit and sampling work four (4) north – south oriented trenches were excavated with the aim of joining the test pits to assess the heterogeneity of fill between the test pits.

The trench excavation work was undertaken on 12 December 2014. On average the trenches were one (1) metre wide, between two (2) and three (3) metres deep and their length varied from While survey points were recorded along the sides of the trenches the base of the trenches were not surveyed as access was not possible for safety reasons (Refer **Figure 4**).

Trench 1

Trench 1 connected test pits TP6, TP4, and TP5 and was approximately 42 m long. Natural soil was observed at the southern end near TP6. A high concentration of brick was observed adjacent the Septic Tank. Natural soil was observed at approximately 1 mbgl in the creek. Minor ACM was observed in the surface soil within the trench.

Trench 2

Trench 2 connected test pits TP6, TP7, TP8, TP9 and TP10 and was approximately 80 m long. Natural soil was observed at the southern end near TP6. Brick and ash was observed between TP6 and TP7. High brick content with a natural organic clay base near TP8. High brick content between TP8 and TP9. Between TP9 and 10 the substrate is dry with some ash and was considered to be consistent with the test pits. Brick and ash was observed on the north side of TP10. In summary Trench 2 did not exhibit signs of significant contamination. No ACM was observed in the walls or the base of the trench however some fragments were observed on the surface of the spoil but these were not thought to have come from below ground but are thought to have been material left following the surface removal of ACM.

Trench 3

Trench 3 connected test pits TP11, TP12 and TP13 and was approximately 57 m long. Natural soil was observed at the southern end and continued to be observed between and near TP11 and TP12. ACM and brick were observed between TP12 and TP13. The ACM mostly present in the upper layers with brick and minor ACM and the natural soil horizon below. ACM and Brick continued to be observed near TP13 and north of TP13. Other than the ACM observed near and north of TP13 no other indicators of significant contamination was observed.

Trench 4

Trench 4 connected test pits TP16, TP15 and TP17 and was approximately 55 m long. Ash was observed in the surface layer at the south end but for the soil was found to be mostly natural across the transect while one (1) piece of ACM was observed on the surface at the north end likely to have been transported from the high ACM area to he southeast during the general site works.

Further, no odours or visual observations related to putrescible waste were made. Therefore the likelihood of landfill gases to be present in the AD is considered to be low.

10 LABORATORY ANALYSIS AND ANALYTICAL RESULTS

10.1 Laboratory Analysis

Soil samples (including field QA/QC samples) were submitted to SGS Laboratories (SGS), Alexandria, NSW (primary laboratory) and Envirolab Services Pty Ltd (Envirolab), Chatswood, NSW (secondary laboratory). Both SGS and Envirolab are NATA accredited for the analysis performed and are able to provide results that are below the selected assessment criteria.

The limits of laboratory reporting (LOR) for the analytical methods used by the primary laboratory were compared with the proposed assessment criteria. This was to ensure that the assessment criteria values exceeded the laboratory LOR. The results of the comparison are presented in Section 5 in **Table E** and **Table F.**

Certified laboratory reports, sample receipt advice and COC documentation are included in **Appendix F** while the airborne fibre monitoring results are included in **Appendix G**. The laboratory analysis undertaken comprised the following:

Primary soil samples

In accordance with the SAQP the follow sample analysis was undertaken. The proposed analytical plan was varied slightly (refer **Table K** in **Section 7.2**) to accommodate the field conditions and are presented in **Table L** below:

Table L: Analytical Plan.

Location	Number of Soil Samples	Analytes
Asbestos Dump Approximately 0.45 ha	23	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn) and asbestos.
	19	Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn) and asbestos.
	4	Asbestos
	4	TRH and PAH
	4	PAH, Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn) and asbestos only;
	15	Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), asbestos and CEC, organic carbon, clay content, iron and pH.

Location	Number of Soil Samples	Analytes
	1	E.coli, Faecal Coliforms and Total Coliforms, Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn) and asbestos.
	1	TRH, BTEX, PAH, Phenols, OCP, PCB, Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), asbestos and CEC, organic carbon, clay content, iron and pH.
QA/QC Samples	Duplicate samples Five (5) Intra – lab Five (5) Inter - lab	Duplicates: PAHs, eight (8) metals and asbestos
	Four (4) trip spike and four (4) trip blank per sample batch	Trip blank and trip spike – BTEX and TRH C_6-C_9 only.

Notes:

- **TRH**: Total Recoverable Hydrocarbons; **BTEX**: Benzene, Toluene, Ethylbenzene, Xylenes; **PAH**: Polycyclic Aromatic Hydrocarbons; **PCB**: Polychlorinated biphenyls; **OCP**: Organochlorine Pesticides; **Heavy Metals**: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc;
- Cation Exchange Capacity (CEC), pH and clay content analyses are required for the derivation of EILs in accordance with the ASC NEPM (2013).

In summary, soil samples were taken from a total of 25 grid based sample locations from the site which was in general accordance with the sample design as set out in the SAQP.

Sample locations were located across the footprint of the 'AD' based on systematic sampling pattern. In accordance with Table A of NSW EPA (1995) '*Sampling Design Guidelines*' a minimum of approximately thirteen (13) systematic sample points would be required for a site covering the combined site area of 4,500 m^2 to identify a hotspot of approximately 23.1 m diameter with 95 % confidence. In this case 16 locations were located within the area of presumed impact, while six (6) sample locations were located down gradient within the drainage line and three (3) up-gradient on the east side of the 'AD'. This number of sample locations achieved for this investigation was deemed to satisfy the proposed required sample density for the site.

Duplicates Samples

- Ten (10) duplicate samples (QC1 – QC10) were taken during the course of the project. Of the ten (10) duplicate samples five (5) were inter-lab duplicates and five (5) were intra-lab duplicates. The analytes selected for these samples were

dependent on the parent sample and represented some or a representative of the analytes selected;

- 71 primary samples were taken from the 25 test pits locations across the site between 4 December and 12 December 2014. In that time period there were a total of four (4) sampling days. Based on the proposed QA/QC program an intra-duplicate lab duplicate was to be taken 1 per 10 samples and an inter-lab duplicate was to be taken 1 per 20 samples. Therefore, the number of inter-lab duplicates is one (1) above the required number samples which is four (4) while the number of intra-lab duplicates is two (2) below the required number. Based on this outcome Robson considers the numbers of duplicates taken for this project to be satisfactory and will provide adequate information with regard to the project reliance on the laboratories analytical methodologies. Further, the number of duplicates taken meets the Australian Standard AS4482.1 which requires an inter-lab and an intra-lab duplicate to be taken every 20 samples.

Trip Blanks and Trip Spikes

- Four (4) trip blanks (laboratory supplied water in BTEX vial) and were analysed for BTEX and TRH fraction $C_6 – C_9$.
- Four (4) trip spikes (laboratory supplied BTEX spiked water in a BTEX vial) and were analysed for BTEX and TRH fraction $C_6 – C_9$.

The QA/QC program required a Trip Spike (TS) and Trip Blank (TB) to be taken with each sample event (per field day). On this project there were a total of four (4) sampling days and a total of three (3) sample transport events. Therefore, the number of TS and TB samples meets the QA/QC program. Therefore Robson concludes this is adequate to enable the assessment for the potential of cross contamination in the field and during transport and to measure the potential for volatile loss in transport.

Rinsate

- Two (2) rinsate samples were taken over the course of the project. The analytes selected for analysis were dependent on the potential contaminants of concern specific to that sampling event.

The QA/QC program required a Rinsate (R) to be taken with each sample event (per field day). On this project there were a total of four (4) sampling days and a total of two (2) sample transport events. Therefore, the number of rinsate samples does not meet the QA/QC program. However, it is noted as the majority of samples were taken with a clean disposable glove from the centre of the excavator bucket and therefore Rinsate samples were only taken when deemed necessary. As Rinsates samples were taken on at least two (2) of the four (4) sampling days Robson concludes this is adequate to assess the effectiveness of the decontamination procedures used for re-usable equipment including disposable gloves.

In general all Quality control (QC) samples were labelled with no reference to the primary sample on the sample container or COCs to ensure analytical results were not biased by the laboratory. In addition, all samples were clearly labelled with a unique identifier and were placed in an ice cooled esky with COC documentation for transport to a NATA accredited laboratory.

10.2 Comparison of Analytical Results to the Site Assessment Criteria

10.2.1 Land Use

Laboratory analytical results for the primary soil samples, the calculation of ACM concentrations and the EIL criteria for metals calculation work sheet are provided in specific tables, **Table 1** to **5** in the rear of this report. Samples where the contaminants of concern exceed the assessment criteria or are of significance are summarised below and the implications of these results are discussed in more detail in **Section 10.**

Asbestos

Suspect asbestos sheet fragments were either presumed and / or determined to be positive for asbestos by laboratory analysis in Test Pits, TP3, TP5, TP6, TP8 and TP13. The concentration of asbestos sheet materials in these test pits based on field analysis ranged from 0.06 weight percent per weight (% w/w) in TP6 (3 m) to 1.17 (% w/w) in TP13 (0.0-0.1 m) which exceeded the site assessment criteria of 0.04 % w/w. Asbestos fragments greater than (>) two (2) millimetres (mm) and less than (<) 7 mm was identified in sample TP8 (0.9 - 1.0m) at a concentration of (0.028 % w/w); TP13 (0.0 - 0.1 m : 5.7 % w/w) and TP13 (1.9-2.0 m: 0.046 % w/w). These also exceeded the assessment criteria of 0.04 % w/w with the exception of TP8 (0.9 - 1.0m). Fibrous Asbestos (FA) and Asbestos Fibre (AF) (<2 mm) was also detected in TP13 (0.0-0.1 m : 0.37 % w/w) and TP13 (1.9-2.0 m : 0.053 % w/w) which exceeds the assessment criteria of 0.001 % w/w. While soil samples were not taken during the trenching work the trenching confirmed the presence of ACM around test pits as identified above.

Airborne Fibre Monitoring

Airborne asbestos fibre monitoring was implemented to assess whether respirable asbestos fibres were produced during the onsite works and whether they were leaving the site boundary. During the assessment works airborne fibre monitoring locations where chosen in common areas (lunch room, the site office), the decontamination unit located at the entry and exit to the site, on the north, east, south and south boundaries of the work area and in the cabin of one (1) of the operational excavators or bobcat. In addition, a field blank was also collected.

In summary, the airborne fibre results were below the minimum practical detection limits of 0.01 fibre per millilitre of air (f/ml). The results of the airborne fibre monitoring indicate that during the assessment works undertaken at the site, it is considered unlikely that asbestos fibres have become airborne at significant concentrations.

Copies of the NATA endorsed laboratory report for the analysis of the airborne fibre monitoring samples are provided in **Appendix G**.

TRH, BTEX and PAHs

All samples returned results below the laboratory limit of reporting (LOR) apart from samples TP8 (0.0-0.1m), TP11 (0.0-0.1 m) and TP13 (0.0-0.1 m); (0.9-1.0 m); (1.9-2.0 m) and (2.9-3.0 m). TP8 and TP13 were located in the central part of the ‘AD’, while TP11 was located on the south boundary of the ‘AD’.

TP8 (0.0-0.1 m) returned a very low concentration of 47 mg/kg for TRH (C_{15} – C_{28}) and 46 mg/kg for TRH (C_{29} – C_{36}) which do not exceed any of the assessment criteria for hydrocarbons and therefore these results are not of concern.

TP11 (0.0-0.1 m) returned a concentration of 200 mg/kg for TRH F3 (C_{16} – C_{34}) which is below the assessment criteria of 1,300 mg/kg and a TRH sum total of 250 mg/kg (C_{10} – C_{36}) which is not of concern.

Four (4) soil tests down the profile in TP13 (0.0-3.0 m) returned a concentration range of below the laboratory limit of detection (<90 mg/kg) to 630 mg/kg for TRH F3 (C_{16} – C_{34}) which is below the assessment criteria of 1300 mg/kg and a TRH sum total range of < 110 mg/kg to 630 mg/kg (C_{10} – C_{36}) which is not of concern.

TP13 (0.0-0.1) returned a concentration of 9.5 mg/kg for Benzo (a) Pyrene and 170 mg/kg for the sum total of Polycyclic Aromatic Hydrocarbons (PAHs). While the total concentration of 170 mg/kg for PAHs does not exceed the assessment criteria of 400 mg/kg for HIL B the concentration of 9.5 mg/kg does exceed the assessment criteria of 4 mg/kg for HIL B and the ESL criteria of 0.7 mg/kg. The elevated concentration of Benzo (a) Pyrene was not identified down the profile of TP13 nor was it identified at other test pit locations. The implications of this result are discussed further in **Section 10.**

Heavy Metals (As, Cd, Cu, Cr, Hg, Pb, Ni and Zn)

Concentrations of heavy metals were detected in all samples analysed. The concentrations did not exceed the HIL B assessment criteria while the EIL assessment criteria was exceeded for Zinc (451 mg/kg) in two (2) of the soil samples analysed returning concentrations of 520 mg/kg (TP6 – 1.9 – 2.0 m) and 470 mg/kg (TP8 - 0.9 -1.0 m). The implications of these results are discussed further in **Section 10.**

Speciated Phenols, OCP and PCB

TP13 (0.0-0.1 m) returned a concentration of 1 mg/kg for the OCP Dieldrin which is well below the assessment criteria of 10 mg/kg for Aldrin and Dieldrin.

All other samples returned concentrations of speciated phenols, OCP and PCB that were either below the laboratory limit of detection (LOR) or well below the assessment criteria.

10.2.2 Waste Criteria

TRH, BTEX and PAHs

The samples returned concentrations of TRH, BTEX and PAHs that were either below the laboratory limit of detection (LOR) or where concentrations of these contaminates were identified the concentrations did not exceed the Inert Waste Classification Criteria.

Speciated Phenols, OCP and PCB

The samples returned concentrations of Speciated Phenols, OCP and PCB that were either below the laboratory limit of detection (LOR) or where concentrations of these contaminates were identified the concentrations did not exceed the Inert Waste Classification Criteria.

Asbestos

Asbestos was detected in Test Pits TP3, TP5, TP6, TP8 and TP13 at the surface and to a depth of 3.2 m at Test Pit 13. As a concentration threshold has not been established with regard to waste where asbestos has been detected the asbestos and related soil or fill if it cannot be separated from the asbestos must be treated as asbestos waste. In accordance with the ACT Waste Classification Guidelines (Environment ACT (2000) '*Environmental Guidelines: Assessment & Classification of Liquid & Non-Liquid Wastes*';) asbestos waste is classified as Industrial Waste in the ACT but it may be disposed of to the MLRMC. Alternatively, asbestos waste may be disposed of at WBRMC provided there are no potential contaminants that exceed the assessment criteria for commercial / industrial sites.

Heavy Metals (As, Cd, Cu, Cr, Hg, Pb, Ni and Zn)

Of the heavy metals tested only lead (Pb) and/or nickel (Ni) concentrations exceeded the Solid Waste Classification Criteria without leachability data for soil samples taken from TP1, TP4, TP5, TP9, TP10, TP12, TP13 and TP15. Therefore, if the waste was to be disposed of to a licensed landfill in the ACT further sampling and leachate analysis for lead and nickel prior to disposal would be required.

10.2.3 BRU Criteria

Apart from asbestos the concentrations of the contaminants of potential concern did not exceed the BRU assessment criteria specific for Commercial and Industrial land use HIL 'D' (ASC NEPM 2013) (from a chemical contamination perspective only). Aesthetic and Geotechnical considerations would also need to be taken into account. For example, brick or concrete is not considered to be BRU but provided it is not contaminated it could be recycled.

10.3 Quality Control Results

10.3.1 Field QA/QC

Duplicates

As highlighted previously, five (5) intra-lab duplicate (triplicates) samples and five (5) inter-lab duplicates (triplicates) sample were collected and analysed to assess the reproducibility of the sampling procedures and the laboratory analytical methods used. This was assessed via calculation of the Relative Percentage Difference (RPD) for a primary soil sample and the corresponding field duplicate / triplicate samples. The calculation of the RPDs is a method of normalising two (2) values and allows a comparison between values and represents the differences between the primary and QC sample, divided by the average of the two (2) results expressed as a percentage. The RPD is calculated using the following formula:

$$\frac{\text{RPD = Result No. 1 – Result No. 2 x 100}}{\text{Mean result}}$$

Calculated RPD results would be considered acceptable when the value is less than 50 % (if the result is five (5) times greater than the LOR)). Should the RPD value exceed 50 %, then further investigation to the cause of the difference between the primary and QC results would be undertaken.

The analytical results and calculation of the RPDs for the duplicate pairs are presented in **Table 2** with the data tables at the rear of this report. In summary, the calculated RPD values for the soil samples were all within the acceptable range with the exception of the following paired samples:

- QC2 (Triplicate) and TP23 (0.0-0.1) (Parent) returned an RPD of 58 % for nickel, while all other analytes for this pair were equal to or below the acceptable RPD of 50 %;
- QC3 (Duplicate) and TP5 (0.0-0.1) (Parent) returned an RPD of 53 % for lead while all other analytes for this pair were below the acceptable RPD of 50 %;
- QC7 (Duplicate) and TP14 (0.9-1.0) (Parent) returned an RPD of 141 % for Zinc and 64 % for lead while all other analytes for this pair were below the acceptable RPD of 50 %;
- QC8 (Triplicate) and TP14 (0.9-1.0) (Parent) returned an RPD of 147 % for Zinc and 57 % for nickel while all other analytes for this pair were below the acceptable RPD of 50 %;

The analytical results for QC5 (Duplicate) were compared to QC6 (Triplicate) to generate RPD results as the parent sample (TP 7(0.0-0.1)) was not analysed. The RPD of 50 % for the analytes tested was not exceeded for this pair.

These RPD exceedences above have occurred for one (1) or two (2) metals from a suite of eight (8) metals analysed. These exceedences may have occurred due to the heterogeneity of soil as all soil samples where the exceedences occurred were taken in the fill layer. In summary as these RPD exceedences only occurred with a small range of analytes within the sample, and based on the above explanations these exceedences are not considered to be of concern and the quality of the laboratory data is considered to be acceptable.

Rinsate, Trip Spike and Trip Blank

The analytical results for the rinsate samples, the trip spikes and the trip blanks samples are provided in **Table 3** with the data tables at the rear of this report. In summary, the results for the rinsate sample and the trip blank sample were all below the laboratory limit of reporting (LOR) for all analytes apart from concentrations of Mercury (0.0002 mg/L), Copper (0.003 mg/L) and Zinc (0.014 mg/L) in R1 and Copper (0.004 mg/L) and Zinc (0.02 mg/L) in R2. There are two (2) possible reasons for detectable concentrations in the rinsates:

a) the Rinsate water used as provided by the primary lab was contaminated (note based on our internal records (December 2014) SGS rinsate water exhibited detectable concentrations of copper, nickel and zinc above the concentrations recorded in both R1 and R2).

b) there may have been minimal cross contamination between samples during sample collection;

Further, based on discussion with a representative from the SGS (29 January 2015) low concentrations of metals are sometimes recorded in rinsate water that has been prepared specifically for low organic sampling which is a result of the preparation process (boiling). However, in this case there is no evidence that this type of rinsate water was used in this project.

In conclusion these concentrations of metals in the rinsate water are below site assessment criteria and are unlikely to have impacted on the analytical results for the project.

Concentrations of volatiles in the Trip Blanks and Trip Spikes were all below the laboratory detection limit therefore cross contamination whilst the samples were in transit between the site and the laboratory is assessed as unlikely.

The Trip Spike 1 (TS-1) was above 90 %, while TS-2 to TS-4 were greater than 100 % for the volatiles indicating that volatile loss was not significant during transport.

10.3.2 Laboratory Quality Control

The results of the laboratory internal quality control program are included along with the laboratory reports in **Appendix F**. The acceptable limits for the laboratory QA/QC are presented **Table M** below.

Table M: Summary of Acceptable Laboratory QA/QC Limits

Sample Type	Acceptable Limits
Surrogate Spikes	60% - 130%
Duplicate Sample	0% - 200% (if result is 5 times greater than the LOR)
Duplicate Sample	Any RPD is acceptable (if result is 5 times less than the LOR)
Laboratory Control Samples	60% - 140%
Matrix Spikes	70% - 130% (metals)
Method Blanks	Less than the LOR

In summary, the laboratory QA / QC results indicate the following:

- The laboratory duplicate sample analyses were within the acceptable limits with exception of the following:

  SE134169 – 1 Sample – SGS explanation: The result was less than five (5) LOR.

  SE134376 – 1 Sample – SGS explanation: Recovery failed acceptance criteria due to matrix interference.

  SE 134376 – 1 Sample - SGS explanation: Duplicate failed acceptance criteria due to sample heterogeneity.

  SE 134396 - 1 Sample - SGS explanation: Duplicate failed acceptance criteria due to sample heterogeneity.

- The spike and surrogate recovery results were within the laboratories acceptable range with the exception of the following:

  SE134169 – 2 Samples - Recovery failed acceptance criteria due to matrix interference.

  SE134376 - 2 Samples - Recovery failed acceptance criteria due to matrix interference and sample heterogeneity.

  SE134396 – 2 Samples - Recovery failed acceptance criteria due to matrix interference.

- The laboratory control samples, which were run with each batch of samples analysed, were within acceptable QC limits set by the laboratory;

- The concentrations of the laboratory blanks, which were run with each batch of samples analysed, were below the practical quantitation limits (PQL).

- Analysis of all samples was undertaken within sample holding times except for the following:

  SE134376 – Analyte pH – Samples TP7 (0.9-1.0) and TP7 (4.8-4.9) – Explanation: Laboratory error.

  SE134396 – Analyte pH – Samples TP9 (1.1-1.2); TP9 (3.9-4.0); TP11 (0.4-0.5); TP13 (1.9-2.0); TP13 (3.5-3.6); TP15 (0.9-1.0); TP17 (0.0-0.1) and TP17 (2.9-3.0) – Explanation: Laboratory error.

  SE134396A – Analytes TRH and PAH – Samples – TP11 (0.4-0.5); TP13 (0.9-1.0); TP13 (1.9-2.0) and TP13 (2.9-3.0) – Explanation: Requested analysis by Robson after the holding time had expired.

Based on the results of the implemented field quality control (calculation of the RPDs for the sample duplicate, triplicate pairs and the analytical results recorded for the rinsate, trip blank and trip spike samples) and the results of the internal quality control implemented by the laboratory, Robson considers the analytical results

provided in the laboratory reports to be acceptable for the purposes of this assessment.

11 DISCUSSION

11.1 Soil

Soil samples were analysed for a range of contaminants of potential concern (COPC) as identified in the SAQP. The COPCs include TRH, BTEX, PAHs, Speciated Phenols, OCP, PCB and Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn) and asbestos.

Asbestos, heavy metals, TRH and PAH and asbestos were the COPCs detected in the fill soils across the site and the significance of these are discussed below.

Twenty five (25) grid based sample locations were excavated with an excavator to a target depth of 0.5 m into the natural soil horizon where possible across the site ('AD'). Of the 25, 16 locations were within the understood boundary of the 'AD' while six (6) were located down gradient within the drainage line and three (3) up gradient on the east side of the 'AD' outside the mounded vegetated area.

Site Soils

The results of the laboratory analysis for the site identified asbestos sheet materials in the test pits TP3, TP5, TP6, TP8 and TP13. Friable asbestos, FA and AF were identified in test pits TP8 and TP13.

Low concentrations of TRH and PAH were detected at test pit locations TP8, TP11 and TP13. Concentrations only exceeded the assessment criteria for Benzo (a) Pyrene (BaP = BaP TEQ) (4 mg/kg) at TP13 (0.0 - 0.1m) exhibiting a concentration of 15 mg/kg.

Due to the detection of TRH and PAH at these locations additional analysis of soil samples taken at depth which were held by the laboratory were submitted for analysis. The samples submitted included TP11 (0.4-0.5), TP13 (0.9-1.0), TP13 (1.9-2.0) and TP13 (2.9-3.0). Although these samples exceeded the NATA prescribed holding times and therefore the results would be technically unreliable, the aim of the analysis was to determine whether there was evidence of gross contamination. Further consideration was also given to the fact that the contaminants detected in the initial round of testing were the heavier fraction hydrocarbons (C_{16} – C_{36}) and BaP and the degradation of these hydrocarbon fractions and BaP is significantly slower than the lighter fractions (TRH C_6 - C_9). Therefore, it was considered useful to run these analyses despite the samples being analysed outside of the laboratory holding times.

Given this, similar concentrations of BaP were not detected at depth at TP13 and although low concentrations (below the assessment criteria) of TRH were detected to a depth of 3 m in this location these concentration are not considered to be of concern. The BaP TEQ concentration of 15 mg/kg is considered to be confined to the surface soils at this location. The extent of the elevated BaP TEQ has been delineated and does not warrant further investigation. Further, due to the presence ACM in this location and that the soils are likely be removed and disposed of asbestos waste which would be acceptable provided the waste went to WBMRC as the BaP concentration is well below the Commercial and Industrial land use criteria (HIL D) of 40 mg/kg. However, if the material was to be disposed of at an ACT licensed landfill as Solid Waste, leachability data of the BaP would be required.

All other contaminants of concern returned concentrations below the assessment criteria. However, when considering the site specific EILs for metals exceedences for zinc (451 mg/kg) were recorded in the fill soil at two (2) locations TP6 (1.9 - 2.0: 520 mg/kg) and TP8 (0.9-1.0: 470 mg/kg). As this is fill soil and is likely to be removed as part of the Stage 2 remediation works (to landfill) these exceedences are not considered to be of concern.

With regard to waste classification, lead and nickel concentrations were elevated in some locations and would require leachate analysis if the waste materials were to be disposed of to an ACT licensed landfill. However, if all material was to be disposed of to the West Belconnen Resource Management Centre (WBRMC) as asbestos waste leachate analysis would not be required as the metal concentrations do not exceed the Commercial and Industrial land use assessment criteria HIL D (ASC NEPM 2013) which is the appropriate land use criteria for the WBRMC site.

The principal contaminant of the concern is asbestos. Based on the assessment the asbestos is concentrated in the central and southeast portion of the dump. The asbestos where it was located ranged in depth from 0.5 mbgl at TP3 to a depth of 3.2 mbgl at TP13. Based on this information the asbestos impacted fill is confined to the upper layer within this area and is expected to occur at varying concentrations within the fill. The fill across the site covers a greater area than the asbestos contamination. Based on field observations the fill that is asbestos impacted has a high concentration of mixed-waste that includes soil, brick, tile, metal, glass, wood, ash and slag while the fill that does not appear to contain asbestos is dominated by brick, ceramic tile with some ash and slag. Based on these observations the asbestos is confined to the surface layer of the fill within a 1,260 square metre (m^2) area of the 'AD' while the fill covers a much larger area and is likely to extend beyond the visible boundary of the 'AD' toward the north and east of the site toward a Lane Poole Place and the Brickwork buildings. Therefore, based on the survey data collected during the assessment (Refer to **Figures 7 and 8**) the estimated volumes specific to the 'AD' of asbestos waste is approximately 2,610.1 m^3 while the estimated total volume of fill soil (soil, brick, tile, glass, metal ash and slag) including the asbestos is 8,732 m^3. These figures equate to a 4,854.8 t and 16,242 t respectively when using a clay density of 1.86 t/m^3 as referenced from the Australasian Institute of Mining and Metallurgy (1995) '*Field Geologist Manual'* and do not include the fill identified around TP22 and TP23 primarily because these locations are considered to be outside the 'AD' (the area to be remediated).

However, it must be noted that the derivation of these figures is based on field observations and interpolation between data points so a degree of uncertainty must be considered. If one extends the ACM fill boundary half way between the outlying unimpacted test pits the approximate area is 2,700 m^2 and assuming an average depth of 1.5 mbgl the volume of ACM fill could be as high as 4,050 m^3 which equates to approximately 7,533 t.

Extent of fill material

Fill consisting predominantly of brick and tile with ash and slag without ACM was also not only identified on Public Land down gradient (west) from the main concentration of the ACM but also to the north and the east of the site.

The fill to west of the 'AD' is either very shallow or not present (TP16, TP19, TP20 and TP21) and then is present again at TP22 and TP23 up to depths of 2.2 m (TP22). Therefore fill has encroached from the site onto Public Land Block 20 Section 102 and Block 1 Section 127. Further, while the boundary of the ACM impacted fill has been delineated, the boundary of the fill has only been partially delineated along the southern boundary of the site and fill exists to the north and east of the outer test pits within the site. It must be noted that while no ACM or other contaminants of concern were detected in these locations aesthetic and geotechnical considerations must be considered when assessing the suitability of the site for the proposed land use.

11.2 Asbestos Materials

As part of the Stage 1 Remedial Works Program on completion of the removal of the vegetation from the surface visible asbestos sheet materials were removed. Where the asbestos was severely fragmented and intermixed with the site's fill materials it was removed as asbestos contaminated waste. The aim of the removal was to reduce the risk of worker exposure to ACM during the investigative Phase of the project. This objective was largely met and resulted in the removal of 328 t by AAC the ACT licensed Asbestos Removal Contractor to the Mugga Lane Resource Management Centre (MLRMC) in Symonston ACT.

To limit the volume of ACM removed during Stage 1 works in locations where the fragmented ACM continued to be present below surface (greater than 0.5 mbgl) on completion of removal, these areas were made safe by covering them with approximately 200 mm of unimpacted soil from other sections of the site. As these high impact areas were small, the works to cover the ACM to 'make safe' was not significant and was done as part of the site reinstatement following the removal of the vegetation.

Airborne Fibre Monitoring

As part of the remediation monitoring, asbestos airborne fibre monitoring was undertaken on a daily basis during all site works and in summary, the airborne fibre results were below the minimum practical detection limits of 0.01 fibre per millilitre of air (f/ml). The results of the airborne fibre monitoring indicate that during the assessment works undertaken at the site, it is considered unlikely that asbestos fibres have become airborne at significant concentrations and there the dust controls measures implemented for the site were considered to be appropriate for the site works.

11.3 Groundwater

Depth to groundwater is unknown however what is believed to be seepage water/ perched water lens was observed in TP10 at 4.6 mbgl and water but to a lesser extent was also observed in TP8 at approximately 1.9 mbgl.

Based on the observed sudden inflow of water into the test pit, particularly TP10 at 4.6 mbgl and as the site had received a recent significant rainfall (53.6 mm between 1 and 7 December 2014 with 29.6 mm falling on 7 December 2014 was recorded at the Tuggeranong weather station by the Bureau of Meteorology) the water is thought to be seepage water/ a perched lens and not regional groundwater.

With regard to contamination odours or staining on the surface of the water was not observed.

12 CONCLUSIONS AND RECOMMENDATIONS

In summary, based on the results of the ESA the following conclusions and recommendations are made:

- The vegetation cover was successfully removed and stockpiled on the east side of the site
- During and following the vegetation removal 328.38 t of ACM was removed from site by an ACT licensed removalist (AAC) and disposed at the Mugga Lane Resource Management Centre;
- Airborne fibre monitoring was undertaken prior to and during all stages of activity undertaken within the work area. All airborne fibre results were below the minimum practical detection limits of 0.01 fibre per millilitre of air (f/ml). The results of the airborne fibre monitoring indicate that during the removal and the assessment works undertaken at the site, it is considered unlikely that asbestos fibres have become airborne at significant concentrations.
- While no odours or visual observations related to putrescible waste were made, the likelihood of landfill gases to be present in the 'AD' still remains a possibility until the waste has been removed.
- Water inflows were observed in test pits TP8 and TP10. Based on the observed sudden inflow of water into the test pit, particularly TP10 at 4.6 mbgl and as the site had received a recent significant rainfall the water is thought to be seepage water/ a perched lens and not regional groundwater.

  Note: if significant water is identified during Stage 2 remediation works, the water will be sampled and analysed for the site specific contaminants of concern and the data assessed against the relevant criteria specific to the receiving waters as defined in the Stage 2 RAP and/ or for off site disposal (if required).
- Non – friable asbestos containing material (ACM) is the principal contaminant of concern (intermixed with fill) and is present in the centre and southeast section of the 'AD' in the surface layer of the fill and appears to range in depth and concentration.
- Based on survey data the ACM impacted fill is estimated to cover an area of 1,260 m^2 while fill does not contain significant quantities of ACM covers an area of approximately 3,722 m^2. Based on depth horizons recorded for each of the 25 test pits these figures equate to approximately 2,610.1 cubic metres (m^3) (4,854.8 t) and 8,732 m^3 (16,242 t) respectively.

  However, it must be noted that the derivation of these figures is based on field observations and interpolation between data points so a degree of uncertainty must be considered. If one extends the ACM fill boundary half way between the outlying unimpacted test pits the approximate area is 2,700 m^2 and assuming an average depth of 1.5 mbgl the volume of ACM fill could be as high as 4,050 m^3 which equates to approximately 7,533 t;
- Low concentrations of other potential contaminants of concern were detected in the fill materials and these included TRH, PAHs: principally BaP TEQ and Heavy Metals. However, BaP TEQ was the only contaminant that exceeded the assessment criteria (BaP TEQ: 4mg/kg) at TP13 (0.0 - 0.1m) exhibiting a concentration of 15 mg/kg. As similar concentrations of BaP TEQ were not

detected at depth in this location or in other locations the exceedence was considered to be isolated and not of concern;

- The ACM impacted material would be suitable for disposal at the West Belconnen Waste Management Centre pending receipt of approval from ACT Environmental Standards (ES);
- The ACM impacted material would be suitable for disposal as asbestos waste at the Mugga Lane Resource Management Centre pending the receipt of leachate data specific to heavy metals (principally lead and nickel) and BaP and receipt of approval from Remondis (the landfill operator);
- The fill material that does not contain ACM does not exhibit contaminant concentrations that exceed the proposed land use criteria HIL B (high density residential land use) (ASC NEPM 2013). Therefore, if the ACM impacted fill can be successfully removed then the remaining fill would be suitable to remain on site. However, other considerations may need to be given to geotechnical and aesthetic requirements specific to the site. Therefore, if the remediation option is to leave clean fill (brick, tile with minor ash and slag) on site, it must be clear how this material is going to be managed from aesthetic point of view in the Stage 2 RAP. For example, this could include the installation of a marker layer (geo-fabric) and covering the material with EPA approved imported fill.

Based on this information Robson recommends that the data collected and assessed in this report is suitable for the refinement of the proposed Stage 2 remedial works as proposed in the current Remediation Action Plan (RAP) with the objective of rendering the site suitable for high density residential land use as defined by the '*National Environment Protection (Assessment of Site Contamination) Measure'* (NEPM as amended, May 2013).

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14 ABBREVIATIONS

Abbreviations	
ACL	Added Contaminant Limits
ACM	Asbestos Containing Material
ADWG	Australian Drinking Water Quality Guidelines
AEC	Area of Environmental Concern
AF	Asbestos Fines
AGST	Aboveground Storage Tank
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environmental and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AS	Australian Standard
ASC	Assessment of Site Contamination
AWQG	Australian Water Quality Guidelines
B(a)P	Benzo(a)Pyrene
BH	Bore Hole
BTEX	Benzene – Toluene – Ethylbenzene – Xylene
CMP	Contaminant Management Plan
COC	Chain Of Custody
CSM	Conceptual Site Model
CT	Contaminant Threshold
DBYD	Dial Before You Dig
DEC	Department of Environment and Conservation
DECCEW	Department of Environment, Climate Change, Energy and Water
DQO	Data Quality Objectives
EIL	Ecological Investigation Level

Abbreviations	
EPA	Environmental Protection Authority
EPP	Environmental Protection Policy
EPU	Environmental Protection Unit
ESA	Environmental Site Assessment
ESL	Ecological Screening Level
FA	Fibrous Asbestos
g/kg	Grams per kilogram
GIL	Groundwater Investigation Levels
GMRRW	Guidelines for Managing Risk in Recreational Waters
HIL	Health Investigation Level
HM	Heavy Metal
HSL	Health Screening Level
ILs	Investigation Levels
Km	Kilometres
L	Litres
L/s	Litres per second
LOR	Laboratory limit of reporting
m	Metres
m^2	Metres square
mbgl	Metres Below Ground Level
mg/kg	Milligrams per kilogram
mg/L	Milligrams per Litre
MW	Monitoring Well
NA	Not available
NATA	National Association of Testing Authorities
NE	Not established

Abbreviations	
NEPC	National Environmental Protection Council
NEPM	National Environmental Protection Measure
NHMRC	National Health and Medical Research Council
NRMMC	National Resource Management Ministerial Research Council
NSW	New South Wales
OH&S	Occupational Health and Safety
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated biphenyls
pH	A measure of the acidity or basicity of an aqueous solution.
PID	Photoionisation Detector
PPE	Personal Protective Equipment
ppm	Parts per million
QA	Quality Assurance
QC	Quality Control
RAP	Remediation Action Plan
RPD	Relative Percentage Difference
SSMP	Site Safety Management Plan
TBD	To be determined
TDS	Total Dissolved Solids
TEQ	Toxicity Equivalence Quotient
TRH	Total Recoverable Hydrocarbon
ug/L	Micrograms per litre
UCL	Upper Confidence Limit
USEPA	United Stated Environmental Protection Agency
(% w/w)	Percent weight per weight

15 STATEMENT OF LIMITATIONS

The ESA was undertaken in order to part remediate and assess the Site located at Denman Street Yarralumla ACT - 'Asbestos Dump' Canberra Brickworks west side of Block 1 Section 102 Yarralumla following removal of vegetation cover, surface ACM / ACM impacted soil and separation of building materials miscellaneous concrete.

To the best of Robson's knowledge, our assessment of the data represents a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the entire site. In addition, the assessment did not include the direct sampling and analysis of soil vapour.

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TABLES

Tables 1 - 5

9623 - Table 1
TP1 - TP25
Soil Analytical Restults
Stage 1 ESA - Canberra Brickworks Remediation Project

Chem_Group	ChemName	output unit	EQL	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)	Field ID	TP1 0.0-0.1	TP1 0.4-0.5	TP1 1.1-1.2	TP2 0.0-0.1	TP2 0.9-1.0	TP2 2.9-3.0	TP3 0.0-0.1	TP3 0.4-0.5	TP3 1.4-1.5	TP4 0.0-0.1
									Testpit Number	TP1	TP1	TP1	TP2	TP2	TP2	TP3	TP3	TP3	TP4
									Sample Depth	0.0-0.1	0.4-0.5	1.1-1.2	0-0.1	0.9-1	2.9-3	0-0.1	0.4-0.5	1.4-1.5	0-0.1
									Sample Date	9/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	10/12/2014
									Lab Sample Number	SE134376.000	SE134376.001	SE134376.002	SE134376.004	SE134376.005	SE134376.006	SE134376.007	SE134376.008	SE134376.009	SE134376.018
	2346&2356-Tetrachlorophenol	mg/kg	1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<1	-	<1	-	-	<1	-	-	-
	3/4-Methylphenol (m/p-cresol)	mg/kg	1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<1	-	<1	-	-	<1	-	-	-
	Exchangeable Calcium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	80.7	65.4	-	-	-	-
	Exchangeable Magnesium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	13.4	28.2	-	-	-	-
	Exchangeable Potassium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	4.8	5.5	-	-	-	-
	Exchangeable Magnesium, Mg	meq/100g	0.02	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	0.98	3.8	-	-	-	-
Halogenated Benzenes	Hexachlorobenzene	mg/kg	0.1	**15[1]**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
Halogenated Phenols	2,4,5-trichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**800|8000|8000|32000**	-	<0.5	-	<0.5	-	-	<0.5	-	-	-
	2,4,6-trichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**4|40|40|160**	-	<0.5	-	<0.5	-	-	<0.5	-	-	-
	2,4-dichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.5	-	<0.5	-	-	<0.5	-	-	-
	2,6-dichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.5	-	<0.5	-	-	<0.5	-	-	-
	2-chlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.5	-	<0.5	-	-	<0.5	-	-	-
	Pentachlorophenol	mg/kg	0.5	**130[1]**	**NE**	**NE**	**NE**	**NE**	-	<0.5	-	<0.5	-	-	<0.5	-	-	-
Inorganics	Exchangeable Calcium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	1200	1800	-	-	-	-
	Exchangeable Magnesium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	120	460	-	-	-	-
	Exchangeable Potassium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	140	290	-	-	-	-
	Exchangeable Sodium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	18	29	-	-	-	-
	pH (Lab)	pH_Units	0	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	7.5	6.4	-	-	-	-
	TOC	mg/kg	500	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	6100	2400	-	-	-	-
Asbestos AF/FA	Asbestos in soil (>2mm to <7mm AF/FA)	%w/w	0.001	**0.001[3]**	**NE**	**NE**	**NE**	**NE**	-	<0.001	<0.001	<0.001	<0.001	<0.001	N.A.	<0.001	<0.001	<0.001
Asbestos AF/FA	Asbestos in soil (<2mm AF/FA)	%w/w	0.001	**0.001[3]**	**NE**	**NE**	**NE**	**NE**	-	<0.001	<0.001	<0.001	<0.001	<0.001	N.A.	<0.001	<0.001	<0.001
Metals	Arsenic	mg/kg	3	**500[1]**	**NE**	**104**	**NE**	**NE**	11	10	9	7	8	3	7	9	12	5
	Cadmium	mg/kg	0.3	**150[1]**	**NE**	**NE**	**NE**	**NE**	<0.3	<0.3	0.5	<0.3	<0.3	0.3	<0.3	0.5	0.4	<0.3
	Chromium (III+VI)	mg/kg	0.3	**500[1]**	**NE**	**630**	**NE**	**NE**	11	10	23	19	15	40	17	21	21	26
	Copper	mg/kg	v	**30000[1]**	**NE**	**86**	**NE**	**NE**	28	27	72	16	19	22	30	23	69	9.4
	Iron	mg/kg	50	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	15,000	40,000	-	-	-	-
	Lead	mg/kg	1	**1200[1]**	**NE**	**1131**	**NE**	**10|100|100|400**	25	24	57	60	24	59	24	58	470	50
	Mercury	mg/kg	0.01	**120[1]**	**NE**	**NE**	**NE**	**0.4|4|4|16**	<0.01	<0.01	0.4	0.03	0.03	0.02	0.01	<0.01	<0.01	0.02
	Nickel	mg/kg	0.5	**1200[1]**	**NE**	**169**	**NE**	**4|40|40|160**	44	34	18	14	19	13	19	12	11	6.3
	Zinc	mg/kg	0.5	**60000[1]**	**NE**	**451**	**NE**	**NE**	160	75	230	94	130	290	82	290	330	43
Organochlorine Pesticides (OCPs)	2,4-DDT	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	4,4-DDE	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	a-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Aldrin	mg/kg	0.1	**10[1]**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	b-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Chlordane (cis)	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	gamma-Chlordane	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	d-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	DDD	mg/kg	0.1	**600**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	DDT	mg/kg	0.1	**600**	**NE**	**180**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Dieldrin	mg/kg	0.2	**10[1]**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Endosulfan I	mg/kg	0.2	**400**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Endosulfan II	mg/kg	0.2	**400**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Endosulfan sulphate	mg/kg	0.1	**400**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Endrin	mg/kg	0.2	**20[1]**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Endrin aldehyde	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Endrin ketone	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	g-BHC (Lindane)	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Heptachlor	mg/kg	0.1	**10[1]**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Heptachlor epoxide	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Methoxychlor	mg/kg	0.1	**500[1]**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	o,p-DDD	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	o,p'-DDE	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	trans-Nonachlor	mg/kg	0.1	**0.01[1]**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
Pesticides	Isodrin	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Mirex	mg/kg	0.1	**20[1]**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-

9623 - Table 1
TP1 - TP25
Soil Analytical Results
Stage 1 ESA - Canberra Brickworks Remediation Project

									Field ID	TP1 0.0-0.1	TP1 0.4-0.5	TP1 1.1-1.2	TP2 0.0-0.1	TP2 0.9-1.0	TP2 2.9-3.0	TP3 0.0-0.1	TP3 0.4-0.5	TP3 1.4-1.5	TP4 0.0-0.1
									Testpit Number	TP1	TP1	TP1	TP2	TP2	TP2	TP3	TP3	TP3	TP4
									Sample Depth	0.0-0.1	0.4-0.5	1.1-1.2	0-0.1	0.9-1	2.9-3	0-0.1	0.4-0.5	1.4-1.5	0-0.1
									Sample Date	9/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	10/12/2014
									Lab Sample Number	SE134376.000	SE134376.001	SE134376.002	SE134376.004	SE134376.005	SE134376.006	SE134376.007	SE134376.008	SE134376.009	SE134376.018
Chem_Group	**ChemName**	**output unit**	**EQL**	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)											
Polycyclic Aromatic Hydrocarbons (PAH) & Phenols	Benzo[b+j]fluoranthene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	1-Methylnaphthalene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	0.4	-	-	<0.1	-	-	-
	2,4-dimethylphenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.5	-	<0.5	-	-	<0.5	-	-	-
	2,4-dinitrophenol	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	<2	-	<2	-	-	<2	-	-	-
	2-methylnaphthalene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	0.6	-	-	<0.1	-	-	-
	2-methylphenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**400|4000|4000|16000**	-	<0.5	-	<0.5	-	-	<0.5	-	-	-
	2-nitrophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.5	-	<0.5	-	-	<0.5	-	-	-
	3-&4-methylphenol	mg/kg	1	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	-	-	-	-	-	-
	4-chloro-3-methylphenol	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	<2	-	<2	-	-	<2	-	-	-
	4-nitrophenol	mg/kg	1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<1	-	<1	-	-	<1	-	-	-
	Acenaphthene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Acenaphthylene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Anthracene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Benz(a)anthracene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Benzo(a) pyrene	mg/kg	0.1	**4[1]**	**0.7**	**NE**	**NE**	**0.08|0.8|0.8|3.2**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Benzo(g,h,i)perylene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Benzo(k)fluoranthene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Chrysene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Cresol Total	mg/kg	1.5	**4700[1]**	**NE**	**NE**	**NE**	**400|4000|4000|16000**	-	<1.5	-	<1.5	-	-	<1.5	-	-	-
	Dibenz(a,h)anthracene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Fluoranthene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Fluorene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Naphthalene	mg/kg	0.1	**5[2]**	**NE**	**170**	**NE**	**NE**	-	<0.1	-	<0.1 - 0.2	-	-	<0.1	-	-	-
	Carcinogenic PAH's (As BaP TEQ)	mg/kg	0.1	**4[1]**	**0.7**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	<0.2
	PAHs (Sum of total)	mg/kg	0.8	**400[1]**	**NE**	**NE**	**NE**	**NE**	-	<0.8	-	1.5	-	-	<0.8	-	-	-
	Phenanthrene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	0.1	-	-	<0.1	-	-	-
	Phenol	mg/kg	0.5	**45000[1]**	**NE**	**NE**	**NE**	**28.8|288|288|1152**	-	<0.5	-	<0.5	-	-	<0.5	-	-	-
	Pyrene	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
Polychlorinated Biphenyls (PCBs)	Arochlor 1016	mg/kg	0.2	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1221	mg/kg	0.2	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1232	mg/kg	0.2	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1242	mg/kg	0.2	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1248	mg/kg	0.2	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1254	mg/kg	0.2	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1260	mg/kg	0.2	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1268	mg/kg	0.2	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Aroclor 1262	mg/kg	0.2	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	PCBs (Sum of total)	mg/kg	1	**1[1]**	**NE**	**NE**	**NE**	**NE**	-	<1	-	<1	-	-	<1	-	-	-
Total Recoverable Hydrocarbons (TRH)	C10-C16	mg/kg	25	**NE**	**NE**	**NE**	**1000**	**NE**	-	<25	-	<25	-	-	<25	-	-	-
	C16-C34	mg/kg	90	**NE**	**1300**	**1300**	**2500**	**NE**	-	<90	-	<90	-	-	<90	-	-	-
	C34-C40	mg/kg	120	**NE**	**5600**	**5600**	**10,000**	**NE**	-	<120	-	<120	-	-	<120	-	-	-
	C6 - C9	mg/kg	20	**NE**	**NE**	**NE**	**NE**	**NE**	-	<20	-	<20	-	-	<20	-	-	-
	C10 - C14	mg/kg	20	**NE**	**NE**	**NE**	**NE**	**NE**	-	<20	-	<20	-	-	<20	-	-	-
	C15 - C28	mg/kg	45	**NE**	**NE**	**NE**	**NE**	**NE**	-	<45	-	<45	-	-	<45	-	-	-
	C29-C36	mg/kg	45	**NE**	**NE**	**NE**	**NE**	**NE**	-	<45	-	<45	-	-	<45	-	-	-
	+C10 - C36 (Sum of total)	mg/kg	110	**NE**	**NE**	**NE**	**NE**	**NE**	-	<110	-	<110	-	-	<110	-	-	-
	C10 - C40 (Sum of total)	mg/kg	210	**NE**	**NE**	**NE**	**NE**	**NE**	-	<210	-	<210	-	-	<210	-	-	-
	C6-C10	mg/kg	25	**NE**	**NE**	**NE**	**NE**	**NE**	-	<25	-	<25	-	-	<25	-	-	-
	TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	**280[2]**	**120**	**120**	**NE**	**NE**	-	<25	-	<25	-	-	<25	-	-	-
	TRH C37-C40	mg/kg	100	**NE**	**NE**	**NE**	**NE**	**NE**	-	<100	-	<100	-	-	<100	-	-	-
Benzne Toluene Ethylbenzne Xylene(BTEX)	Benzene	mg/kg	0.1	**0.7[2]**	**65**	**65**	**NE**	**1|10|10|40**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Ethylbenzene	mg/kg	0.1	**NE**	**125**	**125**	**NE**	**60|600|600|2400**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Toluene	mg/kg	0.1	**480**	**105**	**105**	**NE**	**28.8|288|288|1152**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Total BTEX	mg/kg	0.6	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.6	-	<0.6	-	-	<0.6	-	-	-
	Xylene (m & p)	mg/kg	0.2	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.2	-	<0.2	-	-	<0.2	-	-	-
	Xylene (o)	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	<0.1	-	<0.1	-	-	<0.1	-	-	-
	Xylene Total	mg/kg	0.3	**110[2]**	**45**	**45**	**NE**	**100|1000|1000|4000**	-	<0.3	-	<0.3	-	-	<0.3	-	-	-
	C6-C10 less BTEX (F1)	mg/kg	25	**50[2]**	**180**	**180**	**700**	**NE**	-	<25	-	<25	-	-	<25	-	-	-
Faecal Coliforms	Faecal Coliform Count	Counts	200	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	-	-	-	-	-	-
	Escherichia Coli Count	Counts	200	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	-	-	-	-	-	-
	Total Coliform Count	Counts	200	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	-	-	-	-	-	-

1. NEPM (1999, amended 2013) - Table 1A(1) 'Health investigation levels for soil contaminants of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater'*HIL B Residential with minimal opportunities for soil access including dwellings with fully and permanently paved yard space such as high rise buildings and flats*'..

2. NEPM (1999, amended 2013) - Table 1A(3) 'Soil HSLs for vapour intrusion of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater', HSL B Exposure Setting: Low to High Density Residential. Adopted value is for a clay soil at a depth of 0 m to <1 m.

3. NEPM (1999 amended 2013) - Table 1B (6) ESLs for TPH fractions F1-F4, BTEX and Benzo(a)Pyrene in soil of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater ', ESL setting urban residential and public open space.

4. NEPM (1999, amended 2013) - Table 1B (5) 'Generic EILs for aged As, Pb, fresh DDT and fresh napthalene in soil irrespective of the pyhysicochemical properties'.

5. NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil

6. Environment ACT (2000) 'ACT's Environmental Standards Table A4: Assessment & Classification of Liquid & Non-liquid Waste'.

NE = Not established; NA = Not applicable; mg/kg = milligrams per kilogram; TEQ = Toxicity equivelant quotient.

Cell Shading = Exceedance of adopted assessment criteria.

9623 - Table 1
TP1 - TP25
Soil Analytical Restults
Stage 1 ESA - Canberra Brickworks Remediation Project

Chem_Group	ChemName	output unit	EQL	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)	Field ID	TP4 0.9-1.0	TP4 1.9-2.0	TP4 3.6-3.7	TP5 0.0-0.1	TP5 1.1-1.2	TP5 1.9-2.0	TP5 4.1-4.2	TP6 0.0-0.1	TP6 1.9-2.0	TP6 3.4-3.5
									Testpit Number	TP4	TP4	TP4	TP5	TP5	TP5	TP5	TP6	TP6	TP6
									Sample Depth	0.9-1	1.9-2	3.6-3.7	0-0.1	1.1-1.2	1.9-2	4.1-4.2	0-0.1	1.9-2	3.4-3.5
									Sample Date	10/12/2014	10/12/2014	10/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	10/12/2014	10/12/2014	10/12/2014
									Lab Sample Number	SE134376.019	SE134376.020	SE134376.021	SE134376.010	SE134376.011	SE134376.012	SE134376.013	SE134376.022	SE134376.023	SE134376.024
	2346&2356-Tetrachlorophenol	mg/kg	1	**NE**	**NE**	**NE**	**NE**	**NE**	<1	-	-	<1	-	-	-	<1	-	-
	3/4-Methylphenol (m/p-cresol)	mg/kg	1	**NE**	**NE**	**NE**	**NE**	**NE**	<1	-	-	<1	-	-	-	<1	-	-
	Exchangeable Calcium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	80	-	52	-	-	-
	Exchangeable Magnesium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	14.2	-	44.4	-	-	-
	Exchangeable Potassium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	4.8	-	2.5	-	-	-
	Exchangeable Magnesium, Mg	meq/100g	0.02	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	1.5	-	5.3	-	-	-
Halogenated Benzenes	Hexachlorobenzene	mg/kg	0.1	**15[3]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
Halogenated Phenols	2,4,5-trichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**800|8000|8000|32000**	<0.5	-	-	<0.5	-	-	-	<0.5	-	-
	2,4,6-trichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**4|40|40|160**	<0.5	-	-	<0.5	-	-	-	<0.5	-	-
	2,4-dichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	<0.5	-	-	<0.5	-	-	-	<0.5	-	-
	2,6-dichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	<0.5	-	-	<0.5	-	-	-	<0.5	-	-
	2-chlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	<0.5	-	-	<0.5	-	-	-	<0.5	-	-
	Pentachlorophenol	mg/kg	0.5	**130[3]**	**NE**	**NE**	**NE**	**NE**	<0.5	-	-	<0.5	-	-	-	<0.5	-	-
Inorganics	Exchangeable Calcium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	1700	-	1200	-	-	-
	Exchangeable Magnesium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	180	-	640	-	-	-
	Exchangeable Potassium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	200	-	120	-	-	-
	Exchangeable Sodium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	24	-	27	-	-	-
	pH (Lab)	pH_Units	0	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	6	-	6.5	-	-	-
	TOC	mg/kg	500	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	15,000	-	500	-	-	-
Asbestos AF/FA	Asbestos in soil (>2mm to <7mm AF/FA)	%w/w	0.001	**0.001[3]**	**NE**	**NE**	**NE**	**NE**	<0.001	<0.001	<0.001	<0.001	N.A.	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos AF/FA	Asbestos in soil (<2mm AF/FA)	%w/w	0.001	**0.001[3]**	**NE**	**NE**	**NE**	**NE**	<0.001	<0.001	<0.001	<0.001	N.A.	<0.001	<0.001	<0.001	<0.001	<0.001
Metals	Arsenic	mg/kg	3	**500[1]**	**NE**	**104**	**NE**	**NE**	3	10	4	7	9	8	3	5	5	6
	Cadmium	mg/kg	0.3	**150[1]**	**NE**	**NE**	**NE**	**NE**	0.7	<0.3	<0.3	0.4	0.5	<0.3	<0.3	<0.3	<0.3	0.4
	Chromium (III+VI)	mg/kg	0.3	**500[1]**	**NE**	**630**	**NE**	**NE**	9.2	21	15	18	21	18	30	22	21	18
	Copper	mg/kg	v	**30000[1]**	**NE**	**86**	**NE**	**NE**	8	25	14	25	51	35	13	14	12	42
	Iron	mg/kg	50	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	-	-	30,000	-	-	-
	Lead	mg/kg	1	**1200[1]**	**NE**	**1131**	**NE**	**10|100|100|400**	250	110	11	170	70	34	22	28	26	89
	Mercury	mg/kg	0.01	**120[1]**	**NE**	**NE**	**NE**	**0.4|4|4|16**	0.04	0.02	<0.01	0.04	0.19	0.16	0.01	0.03	0.01	<0.01
	Nickel	mg/kg	0.5	**1200[1]**	**NE**	**169**	**NE**	**4|40|40|160**	4.8	16	7.5	18	18	16	12	14	9.3	11
	Zinc	mg/kg	0.5	**60000[1]**	**NE**	**451**	**NE**	**NE**	110	120	83	260	250	270	93	26	**520**	260
Organochlorine Pesticides (OCPs)	2,4-DDT	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	4,4-DDE	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	a-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Aldrin	mg/kg	0.1	**10[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	b-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Chlordane (cis)	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	gamma-Chlordane	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	d-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	DDD	mg/kg	0.1	**600**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	DDT	mg/kg	0.1	**600**	**NE**	**180**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Dieldrin	mg/kg	0.2	**10[1]**	**NE**	**NE**	**NE**	**NE**	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Endosulfan I	mg/kg	0.2	**400**	**NE**	**NE**	**NE**	**NE**	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Endosulfan II	mg/kg	0.2	**400**	**NE**	**NE**	**NE**	**NE**	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Endosulfan sulphate	mg/kg	0.1	**400**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Endrin	mg/kg	0.2	**20[1]**	**NE**	**NE**	**NE**	**NE**	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Endrin aldehyde	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Endrin ketone	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	g-BHC (Lindane)	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Heptachlor	mg/kg	0.1	**10[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Heptachlor epoxide	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Methoxychlor	mg/kg	0.1	**500[3]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	o,p-DDD	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	o,p'-DDE	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	trans-Nonachlor	mg/kg	0.1	**0.01[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
Pesticides	Isodrin	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Mirex	mg/kg	0.1	**20[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	-	<0.1	-	-

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Chem_Group	ChemName	output unit	EQL	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)	Field ID	TP4 0.9-1.0	TP4 1.9-2.0	TP4 3.6-3.7	TP5 0.0-0.1	TP5 1.1-1.2	TP5 1.9-2.0	TP5 4.1-4.2	TP6 0.0-0.1	TP6 1.9-2.0	TP6 3.4-3.5
								Testpit Number	TP4	TP4	TP4	TP5	TP5	TP5	TP5	TP6	TP6	TP6
								Sample Depth	0.9-1	1.9-2	3.6-3.7	0-0.1	1.1-1.2	1.9-2	4.1-4.2	0-0.1	1.9-2	3.4-3.5
								Sample Date	10/12/2014	10/12/2014	10/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	10/12/2014	10/12/2014	10/12/2014
								Lab Sample Number	SE134376.019	SE134376.020	SE134376.021	SE134376.010	SE134376.011	SE134376.012	SE134376.013	SE134376.022	SE134376.023	SE134376.024
Polycyclic Aromatic Hydrocarbons (PAH) & Phenols	Benzo[b+j]fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	0.2	-	<0.1	-	<0.1	-	-
	1-Methylnaphthalene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-	-
	2,4-dimethylphenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	-	<0.5	-	-	-	<0.5	-	-
	2,4-dinitrophenol	mg/kg	2	NE	NE	NE	NE	NE	<2	-	-	<2	-	-	-	<2	-	-
	2-methylnaphthalene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-	-
	2-methylphenol	mg/kg	0.5	NE	NE	NE	NE	400|4000|4000|16000	<0.5	-	-	<0.5	-	-	-	<0.5	-	-
	2-nitrophenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	-	<0.5	-	-	-	<0.5	-	-
	3-&4-methylphenol	mg/kg	1	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-	-
	4-chloro-3-methylphenol	mg/kg	2	NE	NE	NE	NE	NE	<2	-	-	<2	-	-	-	<2	-	-
	4-nitrophenol	mg/kg	1	NE	NE	NE	NE	NE	<1	-	-	<1	-	-	-	<1	-	-
	Acenaphthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-	-
	Acenaphthylene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-	-
	Anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-	-
	Benz(a)anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	0.2	-	<0.1	-	<0.1	-	-
	Benzo(a) pyrene	mg/kg	0.1	4[1]	0.7	NE	NE	0.08|0.8|0.8|3.2	<0.1	-	-	0.1	-	<0.1	-	<0.1	-	-
	Benzo(g,h,i)perylene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-	-
	Benzo(k)fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-	-
	Chrysene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	0.1	-	<0.1	-	<0.1	-	-
	Cresol Total	mg/kg	1.5	4700[1]	NE	NE	NE	400|4000|4000|16000	<1.5	-	-	<1.5	-	-	-	<1.5	-	-
	Dibenz(a,h)anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-	-
	Fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	0.4	-	<0.1	-	<0.1	-	-
	Fluorene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-	-
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-	-
	Naphthalene	mg/kg	0.1	5[2]	NE	170	NE	NE	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-	-
	Carcinogenic PAH's (As BaP TEQ)	mg/kg	0.1	4[1]	0.7	NE	NE	NE	<0.2	-	-	-	-	-	-	0.2	<0.2	
	PAHs (Sum of total)	mg/kg	0.8	400[1]	NE	NE	NE	NE	<0.8	-	-	2	-	<0.8	-	<0.8	-	-
	Phenanthrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	0.3	-	0.1	-	<0.1	-	-
	Phenol	mg/kg	0.5	45000[1]	NE	NE	NE	28.8|288|288|1152	<0.5	-	-	<0.5	-	-	-	<0.5	-	-
	Pyrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	0.3	-	<0.1	-	<0.1	-	-
Polychlorinated Biphenyls (PCBs)	Arochlor 1016	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Arochlor 1221	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Arochlor 1232	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Arochlor 1242	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Arochlor 1248	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Arochlor 1254	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Arochlor 1260	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Arochlor 1268	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Aroclor 1262	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	PCBs (Sum of total)	mg/kg	1	1[1]	NE	NE	NE	NE	<1	-	-	<1	-	-	-	<1	-	-
Total Recoverable Hydrocarbons (TRH)	C10-C16	mg/kg	25	NE	NE	NE	1000	NE	<25	-	-	<25	-	-	-	<25	-	-
	C16-C34	mg/kg	90	NE	1300	1300	2500	NE	<90	-	-	<90	-	-	-	<90	-	-
	C34-C40	mg/kg	120	NE	5600	5600	10,000	NE	<120	-	-	<120	-	-	-	<120	-	-
	C6 - C9	mg/kg	20	NE	NE	NE	NE	NE	<20	-	-	<20	-	-	-	<20	-	-
	C10 - C14	mg/kg	20	NE	NE	NE	NE	NE	<20	-	-	<20	-	-	-	<20	-	-
	C15 - C28	mg/kg	45	NE	NE	NE	NE	NE	<45	-	-	<45	-	-	-	<45	-	-
	C29-C36	mg/kg	45	NE	NE	NE	NE	NE	<45	-	-	<45	-	-	-	<45	-	-
	+C10 - C36 (Sum of total)	mg/kg	110	NE	NE	NE	NE	NE	<110	-	-	<110	-	-	-	<110	-	-
	C10 - C40 (Sum of total)	mg/kg	210	NE	NE	NE	NE	NE	<210	-	-	<210	-	-	-	<210	-	-
	C6-C10	mg/kg	25	NE	NE	NE	NE	NE	<25	-	-	<25	-	-	-	<25	-	-
	TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	280[2]	120	120	NE	NE	<25	-	-	<25	-	-	-	<25	-	-
	TRH C37-C40	mg/kg	100	NE	NE	NE	NE	NE	<100	-	-	<100	-	-	-	<100	-	-
Benzne Toluene Ethylbenzne Xylene(BTEX)	Benzene	mg/kg	0.1	0.7[2]	65	65	NE	1|10|10|40	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Ethylbenzene	mg/kg	0.1	NE	125	125	NE	60|600|600|2400	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Toluene	mg/kg	0.1	480	105	105	NE	28.8|288|288|1152	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Total BTEX	mg/kg	0.6	NE	NE	NE	NE	NE	<0.6	-	-	<0.6	-	-	-	<0.6	-	-
	Xylene (m & p)	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	-	<0.2	-	-
	Xylene (o)	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	-	<0.1	-	-
	Xylene Total	mg/kg	0.3	110[2]	45	45	NE	100|1000|1000|4000	<0.3	-	-	<0.3	-	-	-	<0.3	-	-
	C6-C10 less BTEX (F1)	mg/kg	25	50[2]	180	180	700	NE	<25	-	-	<25	-	-	-	<25	-	-
Faecal Coliforms	Faecal Coliform Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-	-
	Escherichia Coli Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-	-
	Total Coliform Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-	-

1. NEPM (1999, amended 2013) - Table 1A(1) 'Health investigation levels for soil contaminants of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater'*HIL B Residential with minimal opportunities for soil access including dwellings with fully and permanently paved yard space such as high rise buildings and flats*'..

2. NEPM (1999, amended 2013) - Table 1A(3) 'Soil HSLs for vapour intrusion of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater', HSL B Exposure Setting: Low to High Density Residential. Adopted value is for a clay soil at a depth of 0 m to <1 m.

3. NEPM (1999 amended 2013) - Table 1B (6) ESLs for TPH fractions F1-F4, BTEX and Benzo(a)Pyrene in soil of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater ', ESL setting urban residential and public open space.

4. NEPM (1999, amended 2013) - Table 1B (5) 'Generic EILs for aged As, Pb, fresh DDT and fresh napthalene in soil irrespective of the pyhysicochemical properties'.

5. NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil

6. Environment ACT (2000) 'ACT's Environmental Standards Table A4: Assessment & Classification of Liquid & Non-liquid Waste'.

NE = Not established; NA = Not applicable; mg/kg = milligrams per kilogram; TEQ = Toxicity equivelant quotient.

Cell Shading = Exceedance of adopted assessment criteria.

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Chem_Group	ChemName	output unit	EQL	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)	Field ID	TP7 0.4-0.5	TP7 0.9-1.0	TP7 4.8-4.9	TP8 0.0-0.1	TP8 0.9-1.0	TP8 2.8-2.9	TP9 0.0-0.1	TP9 1.1-1.2	TP9 2.9-3.0	TP9 3.9-4.0
									Testpit Number	TP7	TP7	TP7	TP8	TP8	TP8	TP9	TP9	TP9	TP9
									Sample Depth	0.4-0.5	0.9-1	4.8-4.9	0-0.1	0.9-1	2.8-2.9	0-0.1	1.1-1.2	2.9-3	3.9-4
									Sample Date	10/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014
									Lab Sample Number	SE134376.025	SE134376.026	SE134376.029	SE134396.001	SE134396.002	SE134396.004	SE134396.005	SE134396.006	SE134396.007	SE134396.008
	2346&2356-Tetrachlorophenol	mg/kg	1	**NE**	**NE**	**NE**	**NE**	**NE**	<1	-	-	<1	-	-	<1	-	-	-
	3/4-Methylphenol (m/p-cresol)	mg/kg	1	**NE**	**NE**	**NE**	**NE**	**NE**	<1	-	-	-	-	-	-	-	-	-
	Exchangeable Calcium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	55.3	49.9	-	-	-	-	90.4	-	67.5
	Exchangeable Magnesium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	36.9	47.5	-	-	-	-	7.4	-	24.2
	Exchangeable Potassium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	2.7	1.6	-	-	-	-	2	-	7
	Exchangeable Magnesium, Mg	meq/100g	0.02	**NE**	**NE**	**NE**	**NE**	**NE**	-	4.3	5.4	-	-	-	-	1.8	-	2.1
Halogenated Benzenes	Hexachlorobenzene	mg/kg	0.1	**15[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
Halogenated Phenols	2,4,5-trichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**800|8000|8000|32000**	<0.5	-	-	<0.5	-	-	<0.5	-	-	-
	2,4,6-trichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**4|40|40|160**	<0.5	-	-	<0.5	-	-	<0.5	-	-	-
	2,4-dichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	<0.5	-	-	<0.5	-	-	<0.5	-	-	-
	2,6-dichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	<0.5	-	-	<0.5	-	-	<0.5	-	-	-
	2-chlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	<0.5	-	-	<0.5	-	-	<0.5	-	-	-
	Pentachlorophenol	mg/kg	0.5	**130[1]**	**NE**	**NE**	**NE**	**NE**	<0.5	-	-	<0.5	-	-	<0.5	-	-	-
Inorganics	Exchangeable Calcium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	1300	1100	-	-	-	-	4400	-	1200
	Exchangeable Magnesium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	520	660	-	-	-	-	220	-	250
	Exchangeable Potassium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	120	73	-	-	-	-	190	-	240
	Exchangeable Sodium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	140	25	-	-	-	-	16	-	27
	pH (Lab)	pH_Units	0	**NE**	**NE**	**NE**	**NE**	**NE**	-	7.3	6.5	-	-	-	-	6.2	-	6
	TOC	mg/kg	500	**NE**	**NE**	**NE**	**NE**	**NE**	-	5100	1200	-	-	-	-	14,000	-	3200
Asbestos AF/FA	Asbestos in soil (>2mm to <7mm AF/FA)	%w/w	0.001	**0.001[3]**	**NE**	**NE**	**NE**	**NE**	<0.001	<0.001	<0.001	<0.001	**0.028**	<0.001	N.A.	<0.001	<0.001	<0.001
Asbestos AF/FA	Asbestos in soil (<2mm AF/FA)	%w/w	0.001	**0.001[3]**	**NE**	**NE**	**NE**	**NE**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	N.A.	<0.001	<0.001	<0.001
Metals	Arsenic	mg/kg	3	**500[1]**	**NE**	**104**	**NE**	**NE**	4	4	<3	6	7	5	7	18	12	6
	Cadmium	mg/kg	0.3	**150[1]**	**NE**	**NE**	**NE**	**NE**	<0.3	<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	**500[1]**	**NE**	**630**	**NE**	**NE**	24	18	20	18	18	13	19	11	11	25
	Copper	mg/kg	v	**30000[1]**	**NE**	**86**	**NE**	**NE**	11	7.1	11	18	21	6.9	14	21	21	16
	Iron	mg/kg	50	**NE**	**NE**	**NE**	**NE**	**NE**	-	7600	12,000	-	-	-	-	34,000	-	15,000
	Lead	mg/kg	1	**1200[1]**	**NE**	**1131**	**NE**	**10|100|100|400**	19	22	8	47	130	16	17	10	15	35
	Mercury	mg/kg	0.01	**120[1]**	**NE**	**NE**	**NE**	**0.4|4|4|16**	0.02	0.02	<0.01	0.04	0.04	<0.01	0.01	<0.01	0.02	0.01
	Nickel	mg/kg	0.5	**1200[1]**	**NE**	**169**	**NE**	**4|40|40|160**	7.1	5.9	10	13	15	8.7	15	59	24	8.8
	Zinc	mg/kg	0.5	**60000[1]**	**NE**	**451**	**NE**	**NE**	21	22	150	290	**470**	170	41	31	110	58
Organochlorine Pesticides (OCPs)	2,4-DDT	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	4,4-DDE	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	a-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Aldrin	mg/kg	0.1	**10[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	b-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Chlordane (cis)	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	gamma-Chlordane	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	d-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	DDD	mg/kg	0.1	**600**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	DDT	mg/kg	0.1	**600**	**NE**	**180**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Dieldrin	mg/kg	0.2	**10[1]**	**NE**	**NE**	**NE**	**NE**	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Endosulfan I	mg/kg	0.2	**400**	**NE**	**NE**	**NE**	**NE**	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Endosulfan II	mg/kg	0.2	**400**	**NE**	**NE**	**NE**	**NE**	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Endosulfan sulphate	mg/kg	0.1	**400**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Endrin	mg/kg	0.2	**20[1]**	**NE**	**NE**	**NE**	**NE**	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Endrin aldehyde	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Endrin ketone	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	g-BHC (Lindane)	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Heptachlor	mg/kg	0.1	**10[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Heptachlor epoxide	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Methoxychlor	mg/kg	0.1	**500[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	o,p-DDD	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	o,p'-DDE	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	trans-Nonachlor	mg/kg	0.1	**0.01[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
Pesticides	Isodrin	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Mirex	mg/kg	0.1	**20[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	-	<0.1	-	-	-

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Chem_Group	ChemName	output unit	EQL	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)	Field ID	TP7 0.4-0.5	TP7 0.9-1.0	TP7 4.8-4.9	TP8 0.0-0.1	TP8 0.9-1.0	TP8 2.8-2.9	TP9 0.0-0.1	TP9 1.1-1.2	TP9 2.9-3.0	TP9 3.9-4.0
								Testpit Number	TP7	TP7	TP7	TP8	TP8	TP8	TP9	TP9	TP9	TP9
								Sample Depth	0.4-0.5	0.9-1	4.8-4.9	0-0.1	0.9-1	2.8-2.9	0-0.1	1.1-1.2	2.9-3	3.9-4
								Sample Date	10/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014
								Lab Sample Number	SE134376.025	SE134376.026	SE134376.029	SE134396.001	SE134396.002	SE134396.004	SE134396.005	SE134396.006	SE134396.007	SE134396.008
Polycyclic Aromatic Hydrocarbons (PAH) & Phenols	Benzo[b+j]fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	1-Methylnaphthalene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	2,4-dimethylphenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	-	<0.5	-	-	<0.5	-	-	-
	2,4-dinitrophenol	mg/kg	2	NE	NE	NE	NE	NE	<2	-	-	<2	-	-	<2	-	-	-
	2-methylnaphthalene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	2-methylphenol	mg/kg	0.5	NE	NE	NE	NE	400|4000|4000|16000	<0.5	-	-	<0.5	-	-	<0.5	-	-	-
	2-nitrophenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	-	<0.5	-	-	<0.5	-	-	-
	3-&4-methylphenol	mg/kg	1	NE	NE	NE	NE	NE	-	-	-	<1	-	-	<1	-	-	-
	4-chloro-3-methylphenol	mg/kg	2	NE	NE	NE	NE	NE	<2	-	-	<2	-	-	<2	-	-	-
	4-nitrophenol	mg/kg	1	NE	NE	NE	NE	NE	<1	-	-	<1	-	-	<1	-	-	-
	Acenaphthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Acenaphthylene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Benz(a)anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Benzo(a) pyrene	mg/kg	0.1	4[1]	0.7	NE	NE	0.08|0.8|0.8|3.2	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Benzo(g,h,i)perylene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Benzo(k)fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Chrysene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Cresol Total	mg/kg	1.5	4700[1]	NE	NE	NE	400|4000|4000|16000	<1.5	-	-	<1.5	-	-	<1.5	-	-	-
	Dibenz(a,h)anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Fluorene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Naphthalene	mg/kg	0.1	5[2]	NE	170	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
	Carcinogenic PAH's (As BaP TEQ)	mg/kg	0.1	4[1]	0.7	NE	NE	NE	<0.2	-	-	<0.2	-	-	<0.2	-	<0.2	-
	PAHs (Sum of total)	mg/kg	0.8	400[1]	NE	NE	NE	NE	<0.8	-	-	<0.8	-	-	<0.8	-	<0.8	-
	Phenanthrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	0.1	-
	Phenol	mg/kg	0.5	45000[1]	NE	NE	NE	28.8|288|288|1152	<0.5	-	-	<0.5	-	-	<0.5	-	-	-
	Pyrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	<0.1	-
Polychlorinated Biphenyls (PCBs)	Arochlor 1016	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1221	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1232	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1242	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1248	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1254	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1260	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Arochlor 1268	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Aroclor 1262	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	PCBs (Sum of total)	mg/kg	1	1[1]	NE	NE	NE	NE	<1	-	-	<1	-	-	<1	-	-	-
Total Recoverable Hydrocarbons (TRH)	C10-C16	mg/kg	25	NE	NE	NE	1000	NE	<25	-	-	<25	-	-	<25	-	-	-
	C16-C34	mg/kg	90	NE	1300	1300	2500	NE	<90	-	-	<90	-	-	<90	-	-	-
	C34-C40	mg/kg	120	NE	5600	5600	10,000	NE	<120	-	-	<120	-	-	<120	-	-	-
	C6 - C9	mg/kg	20	NE	NE	NE	NE	NE	<20	-	-	<20	-	-	<20	-	-	-
	C10 - C14	mg/kg	20	NE	NE	NE	NE	NE	<20	-	-	<20	-	-	<20	-	-	-
	C15 - C28	mg/kg	45	NE	NE	NE	NE	NE	<45	-	-	47	-	-	<45	-	-	-
	C29-C36	mg/kg	45	NE	NE	NE	NE	NE	<45	-	-	46	-	-	<45	-	-	-
	+C10 - C36 (Sum of total)	mg/kg	110	NE	NE	NE	NE	NE	<110	-	-	<110	-	-	<110	-	-	-
	C10 - C40 (Sum of total)	mg/kg	210	NE	NE	NE	NE	NE	<210	-	-	<210	-	-	<210	-	-	-
	C6-C10	mg/kg	25	NE	NE	NE	NE	NE	<25	-	-	<25	-	-	<25	-	-	-
	TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	280[2]	120	120	NE	NE	<25	-	-	<25	-	-	<25	-	-	-
	TRH C37-C40	mg/kg	100	NE	NE	NE	NE	NE	<100	-	-	<100	-	-	<100	-	-	-
Benzne Toluene Ethylbenzne Xylene(BTEX)	Benzene	mg/kg	0.1	0.7[2]	65	65	NE	1|10|10|40	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Ethylbenzene	mg/kg	0.1	NE	125	125	NE	60|600|600|2400	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Toluene	mg/kg	0.1	480	105	105	NE	28.8|288|288|1152	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Total BTEX	mg/kg	0.6	NE	NE	NE	NE	NE	<0.6	-	-	<0.6	-	-	<0.6	-	-	-
	Xylene (m & p)	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	-	<0.2	-	-	-
	Xylene (o)	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	-	<0.1	-	-	-
	Xylene Total	mg/kg	0.3	110[2]	45	45	NE	100|1000|1000|4000	<0.3	-	-	<0.3	-	-	<0.3	-	-	-
	C6-C10 less BTEX (F1)	mg/kg	25	50[2]	180	180	700	NE	<25	-	-	<25	-	-	<25	-	-	-
Faecal Coliforms	Faecal Coliform Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	<200	-	-	-	-
	Escherichia Coli Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	<200	-	-	-	-
	Total Coliform Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	200	-	-	-	-

1. NEPM (1999, amended 2013) - Table 1A(1) 'Health investigation levels for soil contaminants of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater'*HIL B Residential with minimal opportunities for soil access including dwellings with fully and permanently paved yard space such as high rise buildings and flats*'..

2. NEPM (1999, amended 2013) - Table 1A(3) 'Soil HSLs for vapour intrusion of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater', HSL B Exposure Setting: Low to High Density Residential. Adopted value is for a clay soil at a depth of 0 m to <1 m.

3. NEPM (1999 amended 2013) - Table 1B (6) ESLs for TPH fractions F1-F4, BTEX and Benzo(a)Pyrene in soil of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater ', ESL setting urban residential and public open space.

4. NEPM (1999, amended 2013) - Table 1B (5) 'Generic EILs for aged As, Pb, fresh DDT and fresh napthalene in soil irrespective of the pyhysicochemical properties'.

5. NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil

6. Environment ACT (2000) 'ACT's Environmental Standards Table A4: Assessment & Classification of Liquid & Non-liquid Waste'.

NE = Not established; NA = Not applicable; mg/kg = milligrams per kilogram; TEQ = Toxicity equivelant quotient.

Cell Shading = Exceedance of adopted assessment criteria.

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TP1 - TP25
Soil Analytical Restults
Stage 1 ESA - Canberra Brickworks Remediation Project

Chem_Group	ChemName	output unit	EQL	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)	Field ID	TP10 0.4-0.5	TP10 1.9-2.0	TP10 3.9-4.0	TP11 0.0-0.1	TP11 0.4-0.5	TP12 0.0-0.1	TP12 0.4-0.5	TP13 0.0-0.1	TP13 0.9-1.0
								Testpit Number	TP10	TP10	TP10	TP11	TP11	TP12	TP12	TP13	TP13
								Sample Depth	0.4-0.5	1.9-2	3.9-4	0-0.1	0.4-0.5	0-0.1	0.4-0.5	0-0.1	0.9-1
								Sample Date	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	10/12/2014	10/12/2014	11/12/2014	11/12/2014
								Lab Sample Number	SE134396.009	SE134396.010	SE134396.011	SE134396.012	SE134396.013	SE134396.014	SE134396.015	SE134396.016	SE134396A.039
	2346&2356-Tetrachlorophenol	mg/kg	1	**NE**	**NE**	**NE**	**NE**	**NE**	<1	-	-	<1	-	<1	-	<1	-
	3/4-Methylphenol (m/p-cresol)	mg/kg	1	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	-	-	-	-	-
	Exchangeable Calcium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	51.8	-	-	-	-
	Exchangeable Magnesium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	38.1	-	-	-	-
	Exchangeable Potassium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	7	-	-	-	-
	Exchangeable Magnesium, Mg	meq/100g	0.02	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	2.1	-	-	-	-
Halogenated Benzenes	Hexachlorobenzene	mg/kg	0.1	**15[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
Halogenated Phenols	2,4,5-trichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**800|8000|8000|32000**	<0.5	-	-	<0.5	-	<0.5	-	<0.5	-
	2,4,6-trichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**4|40|40|160**	<0.5	-	-	<0.5	-	<0.5	-	<0.5	-
	2,4-dichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	<0.5	-	-	<0.5	-	<0.5	-	<0.5	-
	2,6-dichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	<0.5	-	-	<0.5	-	<0.5	-	<0.5	-
	2-chlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	<0.5	-	-	<0.5	-	<0.5	-	<0.5	-
	Pentachlorophenol	mg/kg	0.5	**130[1]**	**NE**	**NE**	**NE**	**NE**	<0.5	-	-	<0.5	-	<0.5	-	<0.5	-
Inorganics	Exchangeable Calcium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	580	-	-	-	-
	Exchangeable Magnesium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	260	-	-	-	-
	Exchangeable Potassium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	150	-	-	-	-
	Exchangeable Sodium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	41	-	-	-	-
	pH (Lab)	pH_Units	0	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	5.5	-	-	-	-
	TOC	mg/kg	500	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	4700	-	-	-	-
Asbestos AF/FA	Asbestos in soil (>2mm to <7mm AF/FA)	%w/w	0.001	**0.001[3]**	**NE**	**NE**	**NE**	**NE**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**5.7**	**0.046**
Asbestos AF/FA	Asbestos in soil (<2mm AF/FA)	%w/w	0.001	**0.001[3]**	**NE**	**NE**	**NE**	**NE**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.37**	**0.053**
Metals	Arsenic	mg/kg	3	**500[1]**	**NE**	**104**	**NE**	**NE**	11	14	11	6	6	7	6	9	-
	Cadmium	mg/kg	0.3	**150[1]**	**NE**	**NE**	**NE**	**NE**	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	2.3	-
	Chromium (III+VI)	mg/kg	0.3	**500[1]**	**NE**	**630**	**NE**	**NE**	12	14	14	16	32	22	15	39	-
	Copper	mg/kg	v	**30000[1]**	**NE**	**86**	**NE**	**NE**	29	18	38	9.9	12	47	46	35	-
	Iron	mg/kg	50	**NE**	**NE**	**NE**	**NE**	**NE**	-	-	-	-	21,000	-	-	-	-
	Lead	mg/kg	1	**1200[1]**	**NE**	**1131**	**NE**	**10|100|100|400**	23	15	22	38	38	480	500	140	-
	Mercury	mg/kg	0.01	**120[1]**	**NE**	**NE**	**NE**	**0.4|4|4|16**	<0.01	<0.01	0.01	0.03	0.02	<0.01	<0.01	0.06	-
	Nickel	mg/kg	0.5	**1200[1]**	**NE**	**169**	**NE**	**4|40|40|160**	30	46	25	8.8	10	8.2	10	23	-
	Zinc	mg/kg	0.5	**60000[1]**	**NE**	**451**	**NE**	**NE**	84	45	91	160	30	160	150	440	-
Organochlorine Pesticides (OCPs)	2,4-DDT	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	4,4-DDE	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	a-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	Aldrin	mg/kg	0.1	**10[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	b-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	Chlordane (cis)	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	gamma-Chlordane	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	d-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	DDD	mg/kg	0.1	**600**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	DDT	mg/kg	0.1	**600**	**NE**	**180**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	Dieldrin	mg/kg	0.2	**10[1]**	**NE**	**NE**	**NE**	**NE**	<0.2	-	-	<0.2	-	<0.2	-	1	-
	Endosulfan I	mg/kg	0.2	**400**	**NE**	**NE**	**NE**	**NE**	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	Endosulfan II	mg/kg	0.2	**400**	**NE**	**NE**	**NE**	**NE**	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	Endosulfan sulphate	mg/kg	0.1	**400**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	Endrin	mg/kg	0.2	**20[1]**	**NE**	**NE**	**NE**	**NE**	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	Endrin aldehyde	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	Endrin ketone	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	g-BHC (Lindane)	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	Heptachlor	mg/kg	0.1	**10[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	Heptachlor epoxide	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	Methoxychlor	mg/kg	0.1	**500[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	o,p-DDD	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	o,p'-DDE	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	trans-Nonachlor	mg/kg	0.1	**0.01[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
Pesticides	Isodrin	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	Mirex	mg/kg	0.1	**20[1]**	**NE**	**NE**	**NE**	**NE**	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-

9623 - Table 1
TP1 - TP25
Soil Analytical Results
Stage 1 ESA - Canberra Brickworks Remediation Project

Chem_Group	ChemName	output unit	EQL	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)	Field ID	TP10 0.4-0.5	TP10 1.9-2.0	TP10 3.9-4.0	TP11 0.0-0.1	TP11 0.4-0.5	TP12 0.0-0.1	TP12 0.4-0.5	TP13 0.0-0.1	TP13 0.9-1.0
								Testpit Number	TP10	TP10	TP10	TP11	TP11	TP12	TP12	TP13	TP13
								Sample Depth	0.4-0.5	1.9-2	3.9-4	0-0.1	0.4-0.5	0-0.1	0.4-0.5	0-0.1	0.9-1
								Sample Date	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	10/12/2014	10/12/2014	11/12/2014	11/12/2014
								Lab Sample Number	SE134396.009	SE134396.010	SE134396.011	SE134396.012	SE134396.013	SE134396.014	SE134396.015	SE134396.016	SE134396A.039
Polycyclic Aromatic Hydrocarbons (PAH) & Phenols	Benzo[b+j]fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	18	<0.1
	1-Methylnaphthalene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	<0.1	<0.1
	2,4-dimethylphenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	-	<0.5	-	<0.5	-	<0.5	-
	2,4-dinitrophenol	mg/kg	2	NE	NE	NE	NE	NE	<2	-	-	<2	-	<2	-	<2	-
	2-methylnaphthalene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	<0.1	<0.1
	2-methylphenol	mg/kg	0.5	NE	NE	NE	NE	400|4000|4000|16000	<0.5	-	-	<0.5	-	<0.5	-	<0.5	-
	2-nitrophenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	-	<0.5	-	<0.5	-	<0.5	-
	3-&4-methylphenol	mg/kg	1	NE	NE	NE	NE	NE	<1	-	-	<1	-	<1	-	<1	-
	4-chloro-3-methylphenol	mg/kg	2	NE	NE	NE	NE	NE	<2	-	-	<2	-	<2	-	<2	-
	4-nitrophenol	mg/kg	1	NE	NE	NE	NE	NE	<1	-	-	<1	-	<1	-	<1	-
	Acenaphthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	0.9	<0.1
	Acenaphthylene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	0.2	<0.1
	Anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	4.1	<0.1
	Benz(a)anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	14	<0.1
	Benzo(a) pyrene	mg/kg	0.1	4[1]	0.7	NE	NE	0.08|0.8|0.8|3.2	<0.1	-	-	<0.1	<0.1	<0.1	-	9.5	<0.1
	Benzo(g,h,i)perylene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	5.9	<0.1
	Benzo(k)fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	5.1	<0.1
	Chrysene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	8.7	<0.1
	Cresol Total	mg/kg	1.5	4700[1]	NE	NE	NE	400|4000|4000|16000	<1.5	-	-	<1.5	-	<1.5	-	<1.5	-
	Dibenz(a,h)anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	0.8	<0.1
	Fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	41	<0.1
	Fluorene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	1.6	<0.1
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	7.3	<0.1
	Naphthalene	mg/kg	0.1	5[2]	NE	170	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	<0.1	<0.1
	Carcinogenic PAH's (As BaP TEQ)	mg/kg	0.1	4[1]	0.7	NE	NE	NE	<0.2	-	-	<0.2	-	<0.2	-	15	-
	PAHs (Sum of total)	mg/kg	0.8	400[1]	NE	NE	NE	NE	<0.8	-	-	<0.8	<0.8	<0.8	-	170	<0.8
	Phenanthrene	mg/kg	0.1	NE	NE	NE	NE	NE	0.2	-	-	<0.1	<0.1	<0.1	-	28	<0.1
	Phenol	mg/kg	0.5	45000[1]	NE	NE	NE	28.8|288|288|1152	<0.5	-	-	<0.5	-	<0.5	-	<0.5	-
	Pyrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	<0.1	<0.1	-	29	<0.1
Polychlorinated Biphenyls (PCBs)	Arochlor 1016	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	Arochlor 1221	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	Arochlor 1232	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	Arochlor 1242	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	Arochlor 1248	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	Arochlor 1254	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	Arochlor 1260	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	Arochlor 1268	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	Aroclor 1262	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	PCBs (Sum of total)	mg/kg	1	1[1]	NE	NE	NE	NE	<1	-	-	<1	-	<1	-	<1	-
Total Recoverable Hydrocarbons (TRH)	C10-C16	mg/kg	25	NE	NE	NE	1000	NE	<25	-	-	<25	<25	<25	-	<25	<25
	C16-C34	mg/kg	90	NE	1300	1300	2500	NE	<90	-	-	200	<90	<90	-	630	<90
	C34-C40	mg/kg	120	NE	5600	5600	10,000	NE	<120	-	-	<120	<120	<120	-	<120	<120
	C6 - C9	mg/kg	20	NE	NE	NE	NE	NE	<20	-	-	<20	<20	<20	-	<20	<20
	C10 - C14	mg/kg	20	NE	NE	NE	NE	NE	<20	-	-	<20	<20	<20	-	<20	<20
	C15 - C28	mg/kg	45	NE	NE	NE	NE	NE	<45	-	-	99	<45	<45	-	420	67
	C29-C36	mg/kg	45	NE	NE	NE	NE	NE	<45	-	-	150	<45	<45	-	270	<45
	+C10 - C36 (Sum of total)	mg/kg	110	NE	NE	NE	NE	NE	<110	-	-	250	<110	<110	-	690	<110
	C10 - C40 (Sum of total)	mg/kg	210	NE	NE	NE	NE	NE	<210	-	-	250	<210	<210	-	690	<210
	C6-C10	mg/kg	25	NE	NE	NE	NE	NE	<25	-	-	<25	<25	<25	-	<25	<25
	TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	280[2]	120	120	NE	NE	<25	-	-	<25	-	<25	-	<25	-
	TRH C37-C40	mg/kg	100	NE	NE	NE	NE	NE	<100	-	-	<100	<100	<100	-	<100	<100
Benzne Toluene Ethylbenzne Xylene(BTEX)	Benzene	mg/kg	0.1	0.7[2]	65	65	NE	1|10|10|40	<0.1	-	-	<0.1	<0.1	<0.1	-	<0.1	<0.1
	Ethylbenzene	mg/kg	0.1	NE	125	125	NE	60|600|600|2400	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	Toluene	mg/kg	0.1	480	105	105	NE	28.8|288|288|1152	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	Total BTEX	mg/kg	0.6	NE	NE	NE	NE	NE	<0.6	-	-	<0.6	-	<0.6	-	<0.6	-
	Xylene (m & p)	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	-	<0.2	-	<0.2	-	<0.2	-
	Xylene (o)	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	-	<0.1	-	<0.1	-	<0.1	-
	Xylene Total	mg/kg	0.3	110[2]	45	45	NE	100|1000|1000|4000	<0.3	-	-	<0.3	-	<0.3	-	<0.3	-
	C6-C10 less BTEX (F1)	mg/kg	25	50[2]	180	180	700	NE	<25	-	-	<25	<25	<25	-	<25	<25
Faecal Coliforms	Faecal Coliform Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-
	Escherichia Coli Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-
	Total Coliform Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-

1. NEPM (1999, amended 2013) - Table 1A(1) 'Health investigation levels for soil contaminants of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater'*HIL B Residential with minimal opportunities for soil access including dwellings with fully and permanently paved yard space such as high rise buildings and flats'*..

2. NEPM (1999, amended 2013) - Table 1A(3) 'Soil HSLs for vapour intrusion of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater', HSL B Exposure Setting: Low to High Density Residential. Adopted value is for a clay soil at a depth of 0 m to <1 m.

3. NEPM (1999 amended 2013) - Table 1B (6) ESLs for TPH fractions F1-F4, BTEX and Benzo(a)Pyrene in soil of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater ', ESL setting urban residential and public open space.

4. NEPM (1999, amended 2013) - Table 1B (5) 'Generic EILs for aged As, Pb, fresh DDT and fresh napthalene in soil irrespective of the pyhysicochemical properties'.

5. NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil

6. Environment ACT (2000) 'ACT's Environmental Standards Table A4: Assessment & Classification of Liquid & Non-liquid Waste'.

NE = Not established; NA = Not applicable; mg/kg = milligrams per kilogram; TEQ = Toxicity equivelant quotient.

Cell Shading = Exceedance of adopted assessment criteria.

Chem_Group	ChemName	output unit	EQL	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)	Field ID	TP13 1.9-2.0	TP13 2.9-3.0	TP13 3.5-3.6	TP14 0.0-0.1	TP 14 0.9-1.0	TP14 2.9-3.0	TP14 5.4-5.5	TP15 0.0-0.1	TP15 0.9-1.0
									Testpit Number	TP13	TP13	TP13	TP14	TP14	TP14	TP14	TP15	TP15
									Sample Depth	1.9-2	2.9-3	3.5-3.6	0-0.1	0.9-1	2.9-3	5.4-5.5	0-0.1	0.9-1
									Sample Date	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	10/12/2014	10/12/2014
									Lab Sample Number	SE134396.017	SE134396.018	SE134396.019	SE134396.020	SE134396.021	SE134396.021	SE134396.022	SE134396.023	SE134396.024
	2346&2356-Tetrachlorophenol	mg/kg	1	NE	NE	NE	NE	NE	-	-	-	<1	-	-	-	<1	-
	3/4-Methylphenol (m/p-cresol)	mg/kg	1	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-
	Exchangeable Calcium Percentage	%	0.1	NE	NE	NE	NE	NE	91.2	-	53.7	-	-	-	-	-	32.4
	Exchangeable Magnesium Percentage	%	0.1	NE	NE	NE	NE	NE	6.9	-	40.6	-	-	-	-	-	57.6
	Exchangeable Potassium Percentage	%	0.1	NE	NE	NE	NE	NE	1.6	-	3.9	-	-	-	-	-	5.1
	Exchangeable Magnesium, Mg	meq/100g	0.02	NE	NE	NE	NE	NE	1	-	2.8	-	-	-	-	-	3.9
Halogenated Benzenes	Hexachlorobenzene	mg/kg	0.1	15[1]	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
Halogenated Phenols	2,4,5-trichlorophenol	mg/kg	0.5	NE	NE	NE	NE	800|8000|8000|32000	-	-	-	<0.5	-	-	-	<0.5	-
	2,4,6-trichlorophenol	mg/kg	0.5	NE	NE	NE	NE	4|40|40|160	-	-	-	<0.5	-	-	-	<0.5	-
	2,4-dichlorophenol	mg/kg	0.5	NE	NE	NE	NE	NE	-	-	-	<0.5	-	-	-	<0.5	-
	2,6-dichlorophenol	mg/kg	0.5	NE	NE	NE	NE	NE	-	-	-	<0.5	-	-	-	<0.5	-
	2-chlorophenol	mg/kg	0.5	NE	NE	NE	NE	NE	-	-	-	<0.5	-	-	-	<0.5	-
	Pentachlorophenol	mg/kg	0.5	130[1]	NE	NE	NE	NE	-	-	-	<0.5	-	-	-	<0.5	-
Inorganics	Exchangeable Calcium	mg/kg	2	NE	NE	NE	NE	NE	2700	-	740	-	-	-	-	-	430
	Exchangeable Magnesium	mg/kg	2	NE	NE	NE	NE	NE	130	-	340	-	-	-	-	-	470
	Exchangeable Potassium	mg/kg	2	NE	NE	NE	NE	NE	95	-	100	-	-	-	-	-	130
	Exchangeable Sodium	mg/kg	2	NE	NE	NE	NE	NE	8	-	28	-	-	-	-	-	75
	pH (Lab)	pH_Units	0	NE	NE	NE	NE	NE	5.2	-	4.8	-	-	-	-	-	6.2
	TOC	mg/kg	500	NE	NE	NE	NE	NE	2000	-	4300	-	-	-	-	-	1100
Asbestos AF/FA	Asbestos in soil (>2mm to <7mm AF/FA)	%w/w	0.001	0.001[3]	NE	NE	NE	NE	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos AF/FA	Asbestos in soil (<2mm AF/FA)	%w/w	0.001	0.001[3]	NE	NE	NE	NE	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Metals	Arsenic	mg/kg	3	500[1]	NE	104	NE	NE	13	-	4	5	6	10	11	6	15
	Cadmium	mg/kg	0.3	150[1]	NE	NE	NE	NE	0.5	-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
	Chromium (III+VI)	mg/kg	0.3	500[1]	NE	630	NE	NE	28	-	28	36	24	13	9.7	24	20
	Copper	mg/kg	v	30000[1]	NE	86	NE	NE	45	-	15	16	12	16	28	11	16
	Iron	mg/kg	50	NE	NE	NE	NE	NE	36,000	-	28,000	-	-	-	-	-	28,000
	Lead	mg/kg	1	1200[1]	NE	1131	NE	10|100|100|400	110	-	32	20	31	20	67	35	110
	Mercury	mg/kg	0.01	120[1]	NE	NE	NE	0.4|4|4|16	0.04	-	<0.01	<0.01	0.04	0.02	<0.01	0.01	<0.01
	Nickel	mg/kg	0.5	1200[1]	NE	169	NE	4|40|40|160	23	-	11	13	8.9	26	30	8.2	7.2
	Zinc	mg/kg	0.5	60000[1]	NE	451	NE	NE	450	-	240	43	38	55	90	47	70
Organochlorine Pesticides (OCPs)	2,4-DDT	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	4,4-DDE	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	a-BHC	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	Aldrin	mg/kg	0.1	10[1]	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	b-BHC	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	Chlordane (cis)	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	gamma-Chlordane	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	d-BHC	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	DDD	mg/kg	0.1	600	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	DDT	mg/kg	0.1	600	NE	180	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	Dieldrin	mg/kg	0.2	10[1]	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Endosulfan I	mg/kg	0.2	400	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Endosulfan II	mg/kg	0.2	400	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Endosulfan sulphate	mg/kg	0.1	400	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	Endrin	mg/kg	0.2	20[1]	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Endrin aldehyde	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	Endrin ketone	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	g-BHC (Lindane)	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	Heptachlor	mg/kg	0.1	10[1]	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	Heptachlor epoxide	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	Methoxychlor	mg/kg	0.1	500[1]	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	o,p-DDD	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	o,p'-DDE	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	trans-Nonachlor	mg/kg	0.1	0.01[1]	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
Pesticides	Isodrin	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	Mirex	mg/kg	0.1	20[1]	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-

9623 - Table 1
TP1 - TP25
Soil Analytical Results
Stage 1 ESA - Canberra Brickworks Remediation Project

								Field ID	TP13 1.9-2.0	TP13 2.9-3.0	TP13 3.5-3.6	TP14 0.0-0.1	TP 14 0.9-1.0	TP14 2.9-3.0	TP14 5.4-5.5	TP15 0.0-0.1	TP15 0.9-1.0
								Testpit Number	TP13	TP13	TP13	TP14	TP14	TP14	TP14	TP15	TP15
								Sample Depth	1.9-2	2.9-3	3.5-3.6	0-0.1	0.9-1	2.9-3	5.4-5.5	0-0.1	0.9-1
								Sample Date	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	10/12/2014	10/12/2014
								Lab Sample Number	SE134396.017	SE134396.018	SE134396.019	SE134396.020	SE134396.021	SE134396.021	SE134396.022	SE134396.023	SE134396.024
Chem_Group	**ChemName**	**output unit**	**EQL**	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)									
Polycyclic Aromatic Hydrocarbons (PAH) & Phenols	Benzo[b+j]fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	1-Methylnaphthalene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	2,4-dimethylphenol	mg/kg	0.5	NE	NE	NE	NE	NE	-	-	-	<0.5	-	-	-	<0.5	-
	2,4-dinitrophenol	mg/kg	2	NE	NE	NE	NE	NE	-	-	-	<2	-	-	-	<2	-
	2-methylnaphthalene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	2-methylphenol	mg/kg	0.5	NE	NE	NE	NE	**400|4000|4000|16000**	-	-	-	<0.5	-	-	-	1	-
	2-nitrophenol	mg/kg	0.5	NE	NE	NE	NE	NE	-	-	-	<0.5	-	-	-	<0.5	-
	3-&4-methylphenol	mg/kg	1	NE	NE	NE	NE	NE	-	-	-	<1	-	-	-	<1	-
	4-chloro-3-methylphenol	mg/kg	2	NE	NE	NE	NE	NE	-	-	-	<2	-	-	-	<2	-
	4-nitrophenol	mg/kg	1	NE	NE	NE	NE	NE	-	-	-	<1	-	-	-	<1	-
	Acenaphthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Acenaphthylene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Benz(a)anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Benzo(a) pyrene	mg/kg	0.1	4[1]	0.7	NE	NE	**0.08|0.8|0.8|3.2**	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Benzo(g,h,i)perylene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Benzo(k)fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Chrysene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Cresol Total	mg/kg	1.5	4700[1]	NE	NE	NE	**400|4000|4000|16000**	-	-	-	<1.5	-	-	-	<1.5	-
	Dibenz(a,h)anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Fluorene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Naphthalene	mg/kg	0.1	5[2]	NE	170	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Carcinogenic PAH's (As BaP TEQ)	mg/kg	0.1	4[1]	0.7	NE	NE	NE	-	-	-	<0.2	<0.2	<0.2	-	<0.2	-
	PAHs (Sum of total)	mg/kg	0.8	400[1]	NE	NE	NE	NE	<0.8	<0.8	-	<0.8	<0.8	<0.8	-	<0.8	-
	Phenanthrene	mg/kg	0.1	NE	NE	NE	NE	NE	0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
	Phenol	mg/kg	0.5	45000[1]	NE	NE	NE	**28.8|288|288|1152**	-	-	-	<0.5	-	-	-	<0.5	-
	Pyrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
Polychlorinated Biphenyls (PCBs)	Arochlor 1016	mg/kg	0.2	NE	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Arochlor 1221	mg/kg	0.2	NE	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Arochlor 1232	mg/kg	0.2	NE	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Arochlor 1242	mg/kg	0.2	NE	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Arochlor 1248	mg/kg	0.2	NE	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Arochlor 1254	mg/kg	0.2	NE	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Arochlor 1260	mg/kg	0.2	NE	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Arochlor 1268	mg/kg	0.2	NE	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Aroclor 1262	mg/kg	0.2	NE	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	PCBs (Sum of total)	mg/kg	1	1[1]	NE	NE	NE	NE	-	-	-	<1	-	-	-	<1	-
Total Recoverable Hydrocarbons (TRH)	C10-C16	mg/kg	25	NE	NE	NE	1000	NE	<25	<25	-	<25	-	-	-	<25	-
	C16-C34	mg/kg	90	NE	1300	1300	2500	NE	460	230	-	<90	-	-	-	<90	-
	C34-C40	mg/kg	120	NE	5600	5600	10,000	NE	<120	<120	-	<120	-	-	-	<120	-
	C6 - C9	mg/kg	20	NE	NE	NE	NE	NE	<20	<20	-	<20	-	-	-	<20	-
	C10 - C14	mg/kg	20	NE	NE	NE	NE	NE	<20	<20	-	<20	-	-	-	<20	-
	C15 - C28	mg/kg	45	NE	NE	NE	NE	NE	310	150	-	<45	-	-	-	<45	-
	C29-C36	mg/kg	45	NE	NE	NE	NE	NE	200	85	-	<45	-	-	-	<45	-
	+C10 - C36 (Sum of total)	mg/kg	110	NE	NE	NE	NE	NE	510	240	-	<110	-	-	-	<110	-
	C10 - C40 (Sum of total)	mg/kg	210	NE	NE	NE	NE	NE	510	240	-	<210	-	-	-	<210	-
	C6-C10	mg/kg	25	NE	NE	NE	NE	NE	<25	<25	-	<25	-	-	-	<25	-
	TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	280[2]	120	120	NE	NE	-	-	-	<25	-	-	-	<25	-
	TRH C37-C40	mg/kg	100	NE	NE	NE	NE	NE	<100	<100	-	<100	-	-	-	<100	-
Benzne Toluene Ethylbenzne Xylene(BTEX)	Benzene	mg/kg	0.1	0.7[2]	65	65	NE	**1|10|10|40**	<0.1	<0.1	-	<0.1	-	-	-	<0.1	-
	Ethylbenzene	mg/kg	0.1	NE	125	125	NE	**60|600|600|2400**	-	-	-	<0.1	-	-	-	<0.1	-
	Toluene	mg/kg	0.1	480	105	105	NE	**28.8|288|288|1152**	-	-	-	<0.1	-	-	-	<0.1	-
	Total BTEX	mg/kg	0.6	NE	NE	NE	NE	NE	-	-	-	<0.6	-	-	-	<0.6	-
	Xylene (m & p)	mg/kg	0.2	NE	NE	NE	NE	NE	-	-	-	<0.2	-	-	-	<0.2	-
	Xylene (o)	mg/kg	0.1	NE	NE	NE	NE	NE	-	-	-	<0.1	-	-	-	<0.1	-
	Xylene Total	mg/kg	0.3	110[2]	45	45	NE	**100|1000|1000|4000**	-	-	-	<0.3	-	-	-	<0.3	-
	C6-C10 less BTEX (F1)	mg/kg	25	50[2]	180	180	700	NE	<25	<25	-	<25	-	-	-	<25	-
Faecal Coliforms	Faecal Coliform Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-
	Escherichia Coli Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-
	Total Coliform Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-

1. NEPM (1999, amended 2013) - Table 1A(1) 'Health investigation levels for soil contaminants of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater'*HIL B Residential with minimal opportunities for soil access including dwellings with fully and permanently paved yard space such as high rise buildings and flats*'..

2. NEPM (1999, amended 2013) - Table 1A(3) 'Soil HSLs for vapour intrusion of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater', HSL B Exposure Setting: Low to High Density Residential. Adopted value is for a clay soil at a depth of 0 m to <1 m.

3. NEPM (1999 amended 2013) - Table 1B (6) ESLs for TPH fractions F1-F4, BTEX and Benzo(a)Pyrene in soil of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater ', ESL setting urban residential and public open space.

4. NEPM (1999, amended 2013) - Table 1B (5) 'Generic EILs for aged As, Pb, fresh DDT and fresh napthalene in soil irrespective of the pyhysicochemical properties'.

5. NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil

6. Environment ACT (2000) 'ACT's Environmental Standards Table A4: Assessment & Classification of Liquid & Non-liquid Waste'.

NE = Not established; NA = Not applicable; mg/kg = milligrams per kilogram; TEQ = Toxicity equivelant quotient.

Cell Shading = Exceedance of adopted assessment criteria.

9623 - Table 1
TP1 - TP25
Soil Analytical Restults
Stage 1 ESA - Canberra Brickworks Remediation Project

Chem_Group	ChemName	output unit	EQL	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)								
Field ID									TP16 0.0-0.1	TP16 0.6-0.7	TP17 0.0-0.1	TP17 0.9-1.0	TP17 2.9-3.0	TP18 0.0-0.1	TP18 0.6-0.7	TP19 0.0-0.1	TP19 0.6-0.7
Testpit Number									TP16	TP16	TP17	TP17	TP17	TP18	TP18	TP19	TP19
Sample Depth									0-0.1	0.6-0.7	0-0.1	0.9-1	2.9-3	0-0.1	0.6-0.7	0-0.1	0.6-0.7
Sample Date									11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014
Lab Sample Number									SE134396.025	SE134396.026	SE134396.027	SE134396.028	SE134396.029	SE134396.030	SE134396.031	SE134396.032	SE134396.033
	2346&2356-Tetrachlorophenol	mg/kg	1	NE	NE	NE	NE	NE	<1	-	<1	-	-	<1	-	<1	-
	3/4-Methylphenol (m/p-cresol)	mg/kg	1	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-
	Exchangeable Calcium Percentage	%	0.1	NE	NE	NE	NE	NE	-	-	76.8	-	45.4	-	-	-	-
	Exchangeable Magnesium Percentage	%	0.1	NE	NE	NE	NE	NE	-	-	16.8	-	48.7	-	-	-	-
	Exchangeable Potassium Percentage	%	0.1	NE	NE	NE	NE	NE	-	-	6.2	-	3.5	-	-	-	-
	Exchangeable Magnesium, Mg	meq/100g	0.02	NE	NE	NE	NE	NE	-	-	5.3	-	6.7	-	-	-	-
Halogenated Benzenes	Hexachlorobenzene	mg/kg	0.1	15[1]	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
Halogenated Phenols	2,4,5-trichlorophenol	mg/kg	0.5	NE	NE	NE	NE	800|8000|8000|32000	<0.5	-	<0.5	-	-	<0.5	-	<0.5	-
	2,4,6-trichlorophenol	mg/kg	0.5	NE	NE	NE	NE	4|40|40|160	<0.5	-	<0.5	-	-	<0.5	-	<0.5	-
	2,4-dichlorophenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	<0.5	-	-	<0.5	-	<0.5	-
	2,6-dichlorophenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	<0.5	-	-	<0.5	-	<0.5	-
	2-chlorophenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	<0.5	-	-	<0.5	-	<0.5	-
	Pentachlorophenol	mg/kg	0.5	130[1]	NE	NE	NE	NE	<0.5	-	<0.5	-	-	<0.5	-	<0.5	-
Inorganics	Exchangeable Calcium	mg/kg	2	NE	NE	NE	NE	NE	-	-	4900	-	1300	-	-	-	-
	Exchangeable Magnesium	mg/kg	2	NE	NE	NE	NE	NE	-	-	650	-	820	-	-	-	-
	Exchangeable Potassium	mg/kg	2	NE	NE	NE	NE	NE	-	-	770	-	190	-	-	-	-
	Exchangeable Sodium	mg/kg	2	NE	NE	NE	NE	NE	-	-	15	-	75	-	-	-	-
	pH (Lab)	pH_Units	0	NE	NE	NE	NE	NE	-	-	7.2	-	6.7	-	-	-	-
	TOC	mg/kg	500	NE	NE	NE	NE	NE	-	-	44,000	-	1800	-	-	-	-
Asbestos AF/FA	Asbestos in soil (>2mm to <7mm AF/FA)	%w/w	0.001	0.001[3]	NE	NE	NE	NE	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos AF/FA	Asbestos in soil (<2mm AF/FA)	%w/w	0.001	0.001[3]	NE	NE	NE	NE	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Metals	Arsenic	mg/kg	3	500[1]	NE	104	NE	NE	5	5	8	5	<3	4	5	4	5
	Cadmium	mg/kg	0.3	150[1]	NE	NE	NE	NE	<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	500[1]	NE	630	NE	NE	23	20	17	18	19	24	23	29	24
	Copper	mg/kg	v	30000[1]	NE	86	NE	NE	10	9.2	16	15	9.7	8.6	13	6.4	15
	Iron	mg/kg	50	NE	NE	NE	NE	NE	-	-	20,000	-	28,000	-	-	-	-
	Lead	mg/kg	1	1200[1]	NE	1131	NE	10|100|100|400	41	41	29	27	11	33	43	24	16
	Mercury	mg/kg	0.01	120[1]	NE	NE	NE	0.4|4|4|16	<0.01	<0.01	0.06	0.02	0.01	0.02	<0.01	0.01	0.05
	Nickel	mg/kg	0.5	1200[1]	NE	169	NE	4|40|40|160	7.6	5.8	13	9.9	12	7.8	9.4	6.8	9.2
	Zinc	mg/kg	0.5	60000[1]	NE	451	NE	NE	68	36	70	42	97	73	36	40	29
Organochlorine Pesticides (OCPs)	2,4-DDT	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	4,4-DDE	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	a-BHC	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Aldrin	mg/kg	0.1	10[1]	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	b-BHC	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Chlordane (cis)	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	gamma-Chlordane	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	d-BHC	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	DDD	mg/kg	0.1	600	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	DDT	mg/kg	0.1	600	NE	180	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Dieldrin	mg/kg	0.2	10[1]	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Endosulfan I	mg/kg	0.2	400	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Endosulfan II	mg/kg	0.2	400	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Endosulfan sulphate	mg/kg	0.1	400	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Endrin	mg/kg	0.2	20[1]	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Endrin aldehyde	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Endrin ketone	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	g-BHC (Lindane)	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Heptachlor	mg/kg	0.1	10[1]	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Heptachlor epoxide	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Methoxychlor	mg/kg	0.1	500[1]	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	o,p-DDD	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	o,p'-DDE	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	trans-Nonachlor	mg/kg	0.1	0.01[1]	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
Pesticides	Isodrin	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Mirex	mg/kg	0.1	20[1]	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-

9623 - Table 1
TP1 - TP25
Soil Analytical Restults
Stage 1 ESA - Canberra Brickworks Remediation Project

Chem_Group	ChemName	output unit	EQL	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)	Field ID	TP16 0.0-0.1	TP16 0.6-0.7	TP17 0.0-0.1	TP17 0.9-1.0	TP17 2.9-3.0	TP18 0.0-0.1	TP18 0.6-0.7	TP19 0.0-0.1	TP19 0.6-0.7
								Testpit Number	TP16	TP16	TP17	TP17	TP17	TP18	TP18	TP19	TP19
								Sample Depth	0-0.1	0.6-0.7	0-0.1	0.9-1	2.9-3	0-0.1	0.6-0.7	0-0.1	0.6-0.7
								Sample Date	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014
								Lab Sample Number	SE134396.025	SE134396.026	SE134396.027	SE134396.028	SE134396.029	SE134396.030	SE134396.031	SE134396.032	SE134396.033
Polycyclic Aromatic Hydrocarbons (PAH) & Phenols	Benzo[b+j]fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	0.1	-	-	<0.1	-	<0.1	-
	1-Methylnaphthalene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	2,4-dimethylphenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	<0.5	-	-	<0.5	-	<0.5	-
	2,4-dinitrophenol	mg/kg	2	NE	NE	NE	NE	NE	<2	-	<2	-	-	<2	-	<2	-
	2-methylnaphthalene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	2-methylphenol	mg/kg	0.5	NE	NE	NE	NE	400|4000|4000|16000	<0.5	-	<0.5	-	-	<0.5	-	<0.5	-
	2-nitrophenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	<0.5	-	-	<0.5	-	<0.5	-
	3-&4-methylphenol	mg/kg	1	NE	NE	NE	NE	NE	<1	-	<1	-	-	<1	-	<1	-
	4-chloro-3-methylphenol	mg/kg	2	NE	NE	NE	NE	NE	<2	-	<2	-	-	<2	-	<2	-
	4-nitrophenol	mg/kg	1	NE	NE	NE	NE	NE	<1	-	<1	-	-	<1	-	<1	-
	Acenaphthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Acenaphthylene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Benz(a)anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Benzo(a) pyrene	mg/kg	0.1	4[1]	0.7	NE	NE	0.08|0.8|0.8|3.2	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Benzo(g,h,i)perylene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Benzo(k)fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Chrysene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	0.1	-	-	<0.1	-	<0.1	-
	Cresol Total	mg/kg	1.5	4700[1]	NE	NE	NE	400|4000|4000|16000	<1.5	-	<1.5	-	-	<1.5	-	<1.5	-
	Dibenz(a,h)anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	0.2	-	-	<0.1	-	<0.1	-
	Fluorene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Naphthalene	mg/kg	0.1	5[2]	NE	170	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Carcinogenic PAH's (As BaP TEQ)	mg/kg	0.1	4[1]	0.7	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	
	PAHs (Sum of total)	mg/kg	0.8	400[1]	NE	NE	NE	NE	<0.8	-	<0.8	-	-	<0.8	-	<0.8	-
	Phenanthrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	0.2	-	-	<0.1	-	<0.1	-
	Phenol	mg/kg	0.5	45000[1]	NE	NE	NE	28.8|288|288|1152	<0.5	-	<0.5	-	-	<0.5	-	<0.5	-
	Pyrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	0.2	-	-	<0.1	-	<0.1	-
Polychlorinated Biphenyls (PCBs)	Arochlor 1016	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Arochlor 1221	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Arochlor 1232	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Arochlor 1242	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Arochlor 1248	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Arochlor 1254	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Arochlor 1260	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Arochlor 1268	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Aroclor 1262	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	PCBs (Sum of total)	mg/kg	1	1[1]	NE	NE	NE	NE	<1	-	<1	-	-	<1	-	<1	-
Total Recoverable Hydrocarbons (TRH)	C10-C16	mg/kg	25	NE	NE	NE	1000	NE	<25	-	<25	-	-	<25	-	<25	-
	C16-C34	mg/kg	90	NE	1300	1300	2500	NE	<90	-	<90	-	-	<90	-	<90	-
	C34-C40	mg/kg	120	NE	5600	5600	10,000	NE	<120	-	<120	-	-	<120	-	<120	-
	C6 - C9	mg/kg	20	NE	NE	NE	NE	NE	<20	-	<20	-	-	<20	-	<20	-
	C10 - C14	mg/kg	20	NE	NE	NE	NE	NE	<20	-	<20	-	-	<20	-	<20	-
	C15 - C28	mg/kg	45	NE	NE	NE	NE	NE	<45	-	<45	-	-	<45	-	<45	-
	C29-C36	mg/kg	45	NE	NE	NE	NE	NE	<45	-	100	-	-	<45	-	<45	-
	+C10 - C36 (Sum of total)	mg/kg	110	NE	NE	NE	NE	NE	<110	-	<110	-	-	<110	-	<110	-
	C10 - C40 (Sum of total)	mg/kg	210	NE	NE	NE	NE	NE	<210	-	<210	-	-	<210	-	<210	-
	C6-C10	mg/kg	25	NE	NE	NE	NE	NE	<25	-	<25	-	-	<25	-	<25	-
	TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	280[2]	120	120	NE	NE	<25	-	<25	-	-	<25	-	<25	-
	TRH C37-C40	mg/kg	100	NE	NE	NE	NE	NE	<100	-	<100	-	-	<100	-	<100	-
Benzne Toluene Ethylbenzne Xylene(BTEX)	Benzene	mg/kg	0.1	0.7[2]	65	65	NE	1|10|10|40	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Ethylbenzene	mg/kg	0.1	NE	125	125	NE	60|600|600|2400	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Toluene	mg/kg	0.1	480	105	105	NE	28.8|288|288|1152	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Total BTEX	mg/kg	0.6	NE	NE	NE	NE	NE	<0.6	-	<0.6	-	-	<0.6	-	<0.6	-
	Xylene (m & p)	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	-	<0.2	-	<0.2	-
	Xylene (o)	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	-	<0.1	-	<0.1	-
	Xylene Total	mg/kg	0.3	110[2]	45	45	NE	100|1000|1000|4000	<0.3	-	<0.3	-	-	<0.3	-	<0.3	-
	C6-C10 less BTEX (F1)	mg/kg	25	50[2]	180	180	700	NE	<25	-	<25	-	-	<25	-	<25	-
Faecal Coliforms	Faecal Coliform Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-
	Escherichia Coli Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-
	Total Coliform Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-

1. NEPM (1999, amended 2013) - Table 1A(1) 'Health investigation levels for soil contaminants of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater'*HIL B Residential with minimal opportunities for soil access including dwellings with fully and permanently paved yard space such as high rise buildings and flats'*..

2. NEPM (1999, amended 2013) - Table 1A(3) 'Soil HSLs for vapour intrusion of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater', HSL B Exposure Setting: Low to High Density Residential. Adopted value is for a clay soil at a depth of 0 m to <1 m.

3. NEPM (1999 amended 2013) - Table 1B (6) ESLs for TPH fractions F1-F4, BTEX and Benzo(a)Pyrene in soil of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater ', ESL setting urban residential and public open space.

4. NEPM (1999, amended 2013) - Table 1B (5) 'Generic EILs for aged As, Pb, fresh DDT and fresh napthalene in soil irrespective of the pyhysicochemical properties'.

5. NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil

6. Environment ACT (2000) 'ACT's Environmental Standards Table A4: Assessment & Classification of Liquid & Non-liquid Waste'.

NE = Not established; NA = Not applicable; mg/kg = milligrams per kilogram; TEQ = Toxicity equivelant quotient.

Cell Shading = Exceedance of adopted assessment criteria.

								Field ID	TP20 0.0-0.1	TP20 0.5-0.6	TP21 0.0-0.11	TP21 0.5-0.6	TP22 0.0-0.1	TP22 0.4-0.5	TP23 0.0-0.1	TP23 0.9-1.0	TP24 0.0-0.1	TP25 0.0-0.1
								Testpit Number	TP20	TP20	TP21	TP21	TP22	TP22	TP23	TP23	TP24	TP25
								Sample Depth	0-0.1	0.5-0.6	0-0.11	0.5-0.6	0-0.1	0.4-0.5	0-0.1	0.9-1	0-0.1	0-0.1
								Sample Date	4/12/2014	4/12/2014	4/12/2014	4/12/2014	4/12/2014	4/12/2014	4/12/2014	4/12/2014	4/12/2014	4/12/2014
								Lab Sample Number	SE134169.001	SE134169.002	SE134169.003	SE134169.004	SE134169.005	SE134169.006	SE134169.007	SE134169.008	SE134169.009	SE134169.010
Chem_Group	**ChemName**	**output unit**	**EQL**	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)											
	2346&2356-Tetrachlorophenol	mg/kg	1	**NE**	**NE**	**NE**	**NE**	**NE**	<1	-	<1	-	<1	-	<1	-	<1	<1
	3/4-Methylphenol (m/p-cresol)	mg/kg	1	**NE**	**NE**	**NE**	**NE**	**NE**	<1	-	<1	-	<1	-	<1	-	<1	<1
	Exchangeable Calcium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	52.7	-	-	-	87.4	-	64.7	-	-
	Exchangeable Magnesium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	39.2	-	-	-	10.8	-	32.7	-	-
	Exchangeable Potassium Percentage	%	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	-	6.6	-	-	-	1.5	-	2.1	-	-
	Exchangeable Magnesium, Mg	meq/100g	0.02	**NE**	**NE**	**NE**	**NE**	**NE**	-	2.5	-	-	-	2.1	-	4.5	-	-
Halogenated Benzenes	Hexachlorobenzene	mg/kg	0.1	**15**[1]	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
Halogenated Phenols	2,4,5-trichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**800|8000|8000|32000**	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5
	2,4,6-trichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**4|40|40|160**	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5
	2,4-dichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5
	2,6-dichlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5
	2-chlorophenol	mg/kg	0.5	**NE**	**NE**	**NE**	**NE**	**NE**	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5
	Pentachlorophenol	mg/kg	0.5	**130**[1]	**NE**	**NE**	**NE**	**NE**	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5
Inorganics	Exchangeable Calcium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	680	-	-	-	3500	-	1800	-	-
	Exchangeable Magnesium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	310	-	-	-	260	-	550	-	-
	Exchangeable Potassium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	170	-	-	-	120	-	110	-	-
	Exchangeable Sodium	mg/kg	2	**NE**	**NE**	**NE**	**NE**	**NE**	-	23	-	-	-	15	-	15	-	-
	pH (Lab)	pH_Units	0	**NE**	**NE**	**NE**	**NE**	**NE**	-	7	-	-	-	8.4	-	7.7	-	-
	TOC	mg/kg	500	**NE**	**NE**	**NE**	**NE**	**NE**	-	5600	-	-	-	9100	-	13,000	-	-
Asbestos AF/FA	Asbestos in soil (>2mm to <7mm AF/FA)	%w/w	0.001	**0.001**[3]	**NE**	**NE**	**NE**	**NE**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos AF/FA	Asbestos in soil (<2mm AF/FA)	%w/w	0.001	**0.001**[3]	**NE**	**NE**	**NE**	**NE**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Metals	Arsenic	mg/kg	3	**500**[1]	**NE**	**104**	**NE**	**NE**	3	3	<3	4	5	8	6	7	6	6
	Cadmium	mg/kg	0.3	**150**[1]	**NE**	**NE**	**NE**	**NE**	<0.3	<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	**500**[1]	**NE**	**630**	**NE**	**NE**	30	33	26	30	22	18	20	16	37	32
	Copper	mg/kg	v	**30000**[3]	**NE**	**86**	**NE**	**NE**	6.8	13	7.1	15	14	19	17	20	8.8	7.1
	Iron	mg/kg	50	**NE**	**NE**	**NE**	**NE**	**NE**	-	24,000	-	-	-	22,000	-	24,000	-	-
	Lead	mg/kg	1	**1200**[1]	**NE**	**1131**	**NE**	**10|100|100|400**	22	17	19	67	34	25	27	25	34	29
	Mercury	mg/kg	0.01	**120**[1]	**NE**	**NE**	**NE**	**0.4|4|4|16**	0.03	0.03	0.04	0.02	0.02	0.03	0.02	0.03	0.03	0.04
	Nickel	mg/kg	0.5	**1200**[1]	**NE**	**169**	**NE**	**4|40|40|160**	7.7	8.6	6.4	12	10	17	11	18	6.4	7
	Zinc	mg/kg	0.5	**60000**[3]	**NE**	**451**	**NE**	**NE**	27	28	28	25	45	63	49	77	50	33
Organochlorine Pesticides (OCPs)	2,4-DDT	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	4,4-DDE	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	a-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Aldrin	mg/kg	0.1	**10**[1]	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	b-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Chlordane (cis)	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	gamma-Chlordane	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	d-BHC	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	DDD	mg/kg	0.1	**600**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	DDT	mg/kg	0.1	**600**	**NE**	**180**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Dieldrin	mg/kg	0.2	**10**[1]	**NE**	**NE**	**NE**	**NE**	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Endosulfan I	mg/kg	0.2	**400**	**NE**	**NE**	**NE**	**NE**	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Endosulfan II	mg/kg	0.2	**400**	**NE**	**NE**	**NE**	**NE**	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Endosulfan sulphate	mg/kg	0.1	**400**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Endrin	mg/kg	0.2	**20**[1]	**NE**	**NE**	**NE**	**NE**	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Endrin aldehyde	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Endrin ketone	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	g-BHC (Lindane)	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Heptachlor	mg/kg	0.1	**10**[1]	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Heptachlor epoxide	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Methoxychlor	mg/kg	0.1	**500**[1]	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	o,p-DDD	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	o,p'-DDE	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	trans-Nonachlor	mg/kg	0.1	**0.01**[1]	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
Pesticides	Isodrin	mg/kg	0.1	**NE**	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Mirex	mg/kg	0.1	**20**[1]	**NE**	**NE**	**NE**	**NE**	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1

9623 - Table 1
TP1 - TP25
Soil Analytical Restults
Stage 1 ESA - Canberra Brickworks Remediation Project

								Field ID	TP20 0.0-0.1	TP20 0.5-0.6	TP21 0.0-0.11	TP21 0.5-0.6	TP22 0.0-0.1	TP22 0.4-0.5	TP23 0.0-0.1	TP23 0.9-1.0	TP24 0.0-0.1	TP25 0.0-0.1
								Testpit Number	TP20	TP20	TP21	TP21	TP22	TP22	TP23	TP23	TP24	TP25
								Sample Depth	0-0.1	0.5-0.6	0-0.11	0.5-0.6	0-0.1	0.4-0.5	0-0.1	0.9-1	0-0.1	0-0.1
								Sample Date	4/12/2014	4/12/2014	4/12/2014	4/12/2014	4/12/2014	4/12/2014	4/12/2014	4/12/2014	4/12/2014	4/12/2014
								Lab Sample Number	SE134169.001	SE134169.002	SE134169.003	SE134169.004	SE134169.005	SE134169.006	SE134169.007	SE134169.008	SE134169.009	SE134169.010
Chem_Group	ChemName	output unit	EQL	1:NEPM 2013 Table 1A(1) HILs Res B Soil (1) & NEPM 2013 Table 1A(3) 2:Soil HSL for Vapour Intrusion (mg/kg) HSL B & NEPM 2013 Table 7 HSLs for asbestos contamination in soil - Residential B.	3: NEPM 2013 Table 1B(6) ESL's for Urban Residential Fine Soil	4: NEPM 2013 Table 1B (3) EIL's for Urban Residential Fine Soil	5: NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil	6: ACT Waste Classification Non-Liquid Waste Inert (4)										
Polycyclic Aromatic Hydrocarbons (PAH) & Phenols	Benzo[b+j]fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	1-Methylnaphthalene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	2,4-dimethylphenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5
	2,4-dinitrophenol	mg/kg	2	NE	NE	NE	NE	NE	<2	-	<2	-	<2	-	<2	-	<2	<2
	2-methylnaphthalene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	2-methylphenol	mg/kg	0.5	NE	NE	NE	NE	400|4000|4000|16000	<0.5	-	1	-	<0.5	-	<0.5	-	<0.5	<0.5
	2-nitrophenol	mg/kg	0.5	NE	NE	NE	NE	NE	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5
	3-&4-methylphenol	mg/kg	1	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-	-
	4-chloro-3-methylphenol	mg/kg	2	NE	NE	NE	NE	NE	<2	-	<2	-	<2	-	<2	-	<2	<2
	4-nitrophenol	mg/kg	1	NE	NE	NE	NE	NE	<1	-	<1	-	<1	-	<1	-	<1	<1
	Acenaphthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Acenaphthylene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Benz(a)anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Benzo(a) pyrene	mg/kg	0.1	4[1]	0.7	NE	NE	0.08|0.8|0.8|3.2	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Benzo(g,h,i)perylene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Benzo(k)fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Chrysene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Cresol Total	mg/kg	1.5	4700[1]	NE	NE	NE	400|4000|4000|16000	<1.5	-	<1.5	-	<1.5	-	<1.5	-	<1.5	<1.5
	Dibenz(a,h)anthracene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Fluoranthene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Fluorene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Naphthalene	mg/kg	0.1	5[2]	NE	170	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Carcinogenic PAH's (As BaP TEQ)	mg/kg	0.1	4[1]	0.7	NE	NE	NE	<0.2	-	<0.2	-	<0.2		<0.2		<0.2	<0.2
	PAHs (Sum of total)	mg/kg	0.8	400[1]	NE	NE	NE	NE	<0.8	-	<0.8	-	<0.8	-	<0.8	-	<0.8	<0.8
	Phenanthrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Phenol	mg/kg	0.5	45000[1]	NE	NE	NE	28.8|288|288|1152	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5
	Pyrene	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
Polychlorinated Biphenyls (PCBs)	Arochlor 1016	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Arochlor 1221	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Arochlor 1232	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Arochlor 1242	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Arochlor 1248	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Arochlor 1254	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Arochlor 1260	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Arochlor 1268	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Aroclor 1262	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	PCBs (Sum of total)	mg/kg	1	1[1]	NE	NE	NE	NE	<1	-	<1	-	<1	-	<1	-	<1	<1
Total Recoverable Hydrocarbons (TRH)	C10-C16	mg/kg	25	NE	NE	NE	1000	NE	<25	-	<25	-	<25	-	<25	-	<25	<25
	C16-C34	mg/kg	90	NE	1300	1300	2500	NE	<90	-	<90	-	<90	-	<90	-	<90	210
	C34-C40	mg/kg	120	NE	5600	5600	10,000	NE	<120	-	<120	-	<120	-	<120	-	<120	<120
	C6 - C9	mg/kg	20	NE	NE	NE	NE	NE	<20	-	<20	-	<20	-	<20	-	<20	<20
	C10 - C14	mg/kg	20	NE	NE	NE	NE	NE	<20	-	<20	-	<20	-	<20	-	<20	<20
	C15 - C28	mg/kg	45	NE	NE	NE	NE	NE	<45	-	<45	-	<45	-	<45	-	<45	160
	C29-C36	mg/kg	45	NE	NE	NE	NE	NE	<45	-	<45	-	<45	-	<45	-	<45	92
	+C10 - C36 (Sum of total)	mg/kg	110	NE	NE	NE	NE	NE	<110	-	<110	-	<110	-	<110	-	<110	250
	C10 - C40 (Sum of total)	mg/kg	210	NE	NE	NE	NE	NE	<210	-	<210	-	<210	-	<210	-	<210	250
	C6-C10	mg/kg	25	NE	NE	NE	NE	NE	<25	-	<25	-	<25	-	<25	-	<25	<25
	TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	280[2]	120	120	NE	NE	<25	-	<25	-	<25	-	<25	-	<25	<25
	TRH C37-C40	mg/kg	100	NE	NE	NE	NE	NE	<100	-	<100	-	<100	-	<100	-	<100	<100
Benzne Toluene Ethylbenzne Xylene(BTEX)	Benzene	mg/kg	0.1	0.7[2]	65	65	NE	1|10|10|40	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Ethylbenzene	mg/kg	0.1	NE	125	125	NE	60|600|600|2400	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Toluene	mg/kg	0.1	480	105	105	NE	28.8|288|288|1152	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Total BTEX	mg/kg	0.6	NE	NE	NE	NE	NE	<0.6	-	<0.6	-	<0.6	-	<0.6	-	<0.6	<0.6
	Xylene (m & p)	mg/kg	0.2	NE	NE	NE	NE	NE	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2
	Xylene (o)	mg/kg	0.1	NE	NE	NE	NE	NE	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1
	Xylene Total	mg/kg	0.3	110[3]	45	45	NE	100|1000|1000|4000	<0.3	-	<0.3	-	<0.3	-	<0.3	-	<0.3	<0.3
	C6-C10 less BTEX (F1)	mg/kg	25	50[3]	180	180	700	NE	<25	-	<25	-	<25	-	<25	-	<25	<25
Faecal Coliforms	Faecal Coliform Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-	-
	Escherichia Coli Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-	-
	Total Coliform Count	Counts	200	NE	NE	NE	NE	NE	-	-	-	-	-	-	-	-	-	-

1. NEPM (1999, amended 2013) - Table 1A(1) 'Health investigation levels for soil contaminants of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater'*HIL B Residential with minimal opportunities for soil access including dwellings with fully and permanently paved yard space such as high rise buildings and flats*'..

2. NEPM (1999, amended 2013) - Table 1A(3) 'Soil HSLs for vapour intrusion of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater', HSL B Exposure Setting: Low to High Density Residential. Adopted value is for a clay soil at a depth of 0 m to <1 m.

3. NEPM (1999 amended 2013) - Table 1B (6) ESLs for TPH fractions F1-F4, BTEX and Benzo(a)Pyrene in soil of Schedule B1 'Guideline on Investigation Levels for Soil and Groundwater ', ESL setting urban residential and public open space.

4. NEPM (1999, amended 2013) - Table 1B (5) 'Generic EILs for aged As, Pb, fresh DDT and fresh napthalene in soil irrespective of the pyhysicochemical properties'.

5. NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Fine Soil

6. Environment ACT (2000) 'ACT's Environmental Standards Table A4: Assessment & Classification of Liquid & Non-liquid Waste'.

NE = Not established; NA = Not applicable; mg/kg = milligrams per kilogram; TEQ = Toxicity equivelant quotient.

Cell Shading = Exceedance of adopted assessment criteria.

Capezio, Canberra Brickworks

9623 - Table 2
Soil QA/QC Restults
Stage 1 RESA - Canberra Brickworks Remediation Project

SDG					120574					120901									
Field_ID					QC2														
Sampled_Date-Time					4/12/2014														
Chem_Group	**ChemName**	**Units**	**EQL**																
Metals	Arsenic	mg/kg	3	6	7	15	8	29	7	8	13	6	15	6	<4	NC	6	5	18	6	0
	Cadmium	mg/kg	0.3	<0.3	<0.3	NC	<0.4	NC	0.4	0.4	0	<0.4	0	<0.3	<0.4	NC	<0.3	<0.3	NC	<0.4	29
	Chromium (III+VI)	mg/kg	0.3	20	19	5	25	22	18	19	5	19	5	25	23	8	24	17	34	28	15
	Copper	mg/kg	0.5	17	19	11	23	30	25	22	13	24	4	10	11	10	12	8.3	36	17	34
	Lead	mg/kg	1	27	26	4	28	4	170	99	**53**	120	34	28	23	20	31	16	**64**	21	38
	Mercury	mg/kg	0.01	0.02	0.02	0	<0.1	NC	0.04	0.04	0	<0.1	**NC**	0.03	<0.1	NC	0.04	<0.01	NC	<0.1	NC
	Nickel	mg/kg	0.5	11	13	17	20	**58**	18	18	0	20	11	7.8	13	50	8.9	9.4	5	16	**57**
	Zinc	mg/kg	0.5	49	53	8	62	23	260	250	4	250	4	25	26	4	38	220	**141**	250	**147**
PAH	Benzo[b+j]fluoranthene	mg/kg	0.1	<0.1	<0.1	0	-	-	0.2	<0.1	67	-	-	<0.1	-	0	<0.1	<0.1	0	-	0
	1-Methylnaphthalene	mg/kg	0.1	<0.1	<0.1	0	-	-	<0.1	<0.1	0	-	-	<0.1	-	0	<0.1	<0.1	0	-	0
	2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	0	-	-	<0.1	<0.1	0	-	-	<0.1	-	0	<0.1	<0.1	0	-	0
	Acenaphthene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
	Acenaphthylene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
	Anthracene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
	Benz(a)anthracene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	0.2	<0.1	67	<0.1	67	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
	Benzo(a) pyrene	mg/kg	0.1	<0.1	<0.1	0	<0.05	0	0.1	<0.1	0	<0.05	0	<0.1	<0.05	0	<0.1	<0.1	0	<0.05	0
	Benzo(g,h,i)perylene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
	Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	0	<0.2	0	<0.1	<0.1	0	<0.2	0	<0.1	<0.2	0	<0.1	<0.1	0	<0.2	0
	Chrysene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
	Dibenz(a,h)anthracene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
	Fluoranthene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	0.4	<0.1	NC	<0.1	NC	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
	Fluorene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
	Naphthalene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
	PAHs (Sum of total)	mg/kg	0.8	<0.8	<0.8	0	<0.1	0	2	<0.8	NC	<0.1	NC	<0.8	<0.1	0	<0.8	<0.8	0	<0.1	0
	Phenanthrene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	0.3	<0.1	NC	<0.1	NC	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
	Pyrene	mg/kg	0.1	<0.1	<0.1	0	<0.1	0	0.3	<0.1	NC	<0.1	NC	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	0
Asbestos AF/FA	Asbestos in soil (>2mm to <7mm AF/FA)	0.001	<0.01	<0.01	0	<0.01	0	<0.01	<0.01	0	<0.01	0	<0.01	<0.01	0	<0.01	<0.01	0	<0.01	0
	Asbestos in soil (<2mm AF/FA)	0.001	<0.001	<0.001	0	<0.001	0	<0.001	0.010	18	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	0

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 80 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory.
NC: Not Calculable.

[Filter]

Lab Sample Number	SE134169.013	SE134376.0	SE134169.014	SE134376.016	SE134376.031	SE134396.036	SE134169.015	SE134376.017	SE134376.032	SE134396.037
Field_ID	R1	R2	Trip Blank 1	Trip Blank 2	Trip Blank 3	Trip Blank 4	Trip Spike 1	Trip Spike 2	Trip Spike 3	Trip Spike 4
Sampled_Date_Time	4/12/2014	9/12/2014	4/12/2014	9/12/2014	10/12/2014	11/12/2014	4/12/2014	8/12/2014	8/12/2014	11/12/2014

Method_Type	ChemName	output unit	EQL										
Metals	Mercury (Filtered)	mg/L	0.0001	0.0002	<0.0001	-	-	-	-	-	-	-	-
	Arsenic (Filtered)	mg/L	0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
	Cadmium (Filtered)	mg/L	0.0001	<0.0001	<0.0001	-	-	-	-	-	-	-	-
	Chromium (III+VI) (Filtered)	mg/L	0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
	Copper (Filtered)	mg/L	0.001	0.003	0.004	-	-	-	-	-	-	-	-
	Lead (Filtered)	mg/L	0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
	Nickel (Filtered)	mg/L	0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
	Zinc (Filtered)	mg/L	0.005	0.014	0.02	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons (PAH)/Phenols	Benzo[b+j]fluoranthene	mg/L	0.0001	<0.0001	<0.0001	-	-	-	-	-	-	-	-
	1-Methylnaphthalene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	2-methylnaphthalene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Acenaphthene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Acenaphthylene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Anthracene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Benz(a)anthracene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Benzo(a) pyrene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Benzo(g,h,i)perylene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Benzo(k)fluoranthene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Chrysene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Dibenz(a,h)anthracene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Fluoranthene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Fluorene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Indeno(1,2,3-c,d)pyrene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Naphthalene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	PAHs (Sum of total)	µg/L	1	<1	<1	-	-	-	-	-	-	-	-
	Phenanthrene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
	Pyrene	µg/L	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
BTEX	Benzene	µg/L	0.5	-	-	<0.5	<0.5	<0.5	<0.5	[91%]	[104%]	[105%]	[112%]
	Ethylbenzene	µg/L	0.5	-	-	<0.5	<0.5	<0.5	<0.5	[94%]	[113%]	[116%]	[111%]
	Naphthalene	µg/L	0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-
	Toluene	µg/L	0.5	-	-	<0.5	<0.5	<0.5	<0.5	[93%]	[113%]	[111%]	[105%]
	Total BTEX	mg/L	0.003	-	-	<0.003	<0.003	<0.003	<0.003	-	-	-	-
	Xylene (m & p)	µg/L	1	-	-	<1	<1	<1	<1	[96%]	[104%]	[106%]	[114%]
	Xylene (o)	µg/L	0.5	-	-	<0.5	<0.5	<0.5	<0.5	[97%]	[111%]	[113%]	[113%]
	Xylene Total	µg/L	1.5	-	-	<1.5	<1.5	<1.5	<1.5	-	-	-	-
	C6 - C9	µg/L	40	-	-	<40	<40	<40	<40	-	-	-	-
	C6-C10 less BTEX (F1)	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	-	-	-	-
	C6-C10	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	-	-	-	-
	Dibromofluoromethane (Surrogate)	%	-	-	-	-	-	-	-	**94**	**95**	**94**	**115**
	d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-	-	-	**91**	**94**	**93**	**118**
	d8-toluene (Surrogate)	%	-	-	-	-	-	-	-	**91**	**96**	**97**	**85**
	Bromofluorobenzene (Surrogate)	%	-	-	-	-	-	-	-	**111**	**106**	**108**	**103**

TABLE 4
ASBESTOS CONTENT IN SOIL

Project # : 9623	Date: December 2015
Project Name: Stage 1 Remediation and ESA - Canberra Brickworks Remediation Project	Field Personnel: AR and AM
Client: Capcorp Constrcutions Pty Ltd	Project Manager: BK

*WA (2009)Guidelines Soil Volume = 10 Litres

Location	**Weight of Soil** (kg)	**ACM (Y/N)** (Note the average fragment size and type of ACM ie lagging, asbestos cement)	**Weight of ACM** (kg)	**Density** (kg/L)	**% Asbestos Content** (for ACM unless a specific product is identified use 40%)	**% Soil Asbestos Site Criteria - HIL'B';0.04% w/w**
TP5 (1.9-2.0)	13.214		0.052	1.3214	40	0.12
TP6 (0.9-1.0)	14.7		0.034	1.47	40	0.06
TP13 (0.0-0.0)	11.97		0.42	1.197	40	1.17
TP13 (0.4-0.5)	13.78		0.2	1.378	40	0.42
TP13 (1.9-2.0)	13.45		0.288	1.345	40	0.64
TP13 (2.9-3.0)	12.826		0.122	1.2826	40	0.30

$$\% \text{ Soil in asbestos} = \frac{\% \text{ Asbestos Content} \times \text{ACM (kg)}}{\text{Soil Volume (L)} \times \text{Soil Density (kg/L)}}$$

General Guide to Asbestos Content of Common Building Materials

Product		**Approximate % Asbestos**
Cement Products		10-15%
Asbestos Millboard		15-40%
Asbestos Ropes and Cloth		100%
Lagging		6-85%

*Western Australia Department of Health (2009) 'Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia' (WA (2009)Guidelines)

9623 - TABLE 5
SITE SPECIFIC CRITERIA CALCULATIONS
Metals
Asbestos Dump - Canberra Remediation Project
(December 2014)

Laboratory Identification												**95% UCL**
Sample Identification		TP2	TP5	TP7	TP9	TP11	TP13	TP15	TP17	TP20	TP23	
Sample Depth		2.9-3.0	4.1-4.2	4.8-4.9	3.9-4.0	0.4-0.5	3.5-3.6	0.9-1.0	2.9-3.0	0.5-0.6	0.9-1.0	
Lithology		Sandy Clay	Sandy Clay	Weathered Granite	Sandy Clay	Sandy Clay	Sandy Clay	Gravelly Clay	Sandy Clay	Clayey Sand	Low Fill: Clayey Sand	
Sample Collection Date		9/012/2014	9/12/2014	10/12/2014	10/12/2014	11/12/2014	11/12/2014	10/12/2014	11/12/2014	4/12/2014	4/12/2014	
	Physicochemical Properties											
	CEC	13	12	11	8.8	5.6	6.9	6.7	14	6.4	14	
	Clay %	69	50	35	81	61	67	66	69	53	55	
	pH	6.5	6.5	6.5	6	5.5	4.8	6.2	6.7	7.0	7.7	
	Iron %	3.00	4.00	1.20	1.50	2.10	2.60	2.80	2.80	2.40	2.40	
	TOC %	0.24	0.05	0.12	0.32	0.47	0.43	0.11	0.18	0.56	1.30	
ABC mg/kg	**Analyte Criteria**											
21.13	Copper (mg/Kg)	85	35	50	80	80	55	45	75	140	220	**86**
8	Nickel (mg/Kg)	210	200	190	130	50	75	75	220	65	220	**169**
31.3	Cr(III) (mg/Kg)	790	710	630	830	760	780	770	790	720	730	***630**
31.8	Zinc (mg/Kg)	530	500	470	400	230	180	320	560	310	560	**451**

Additional Calculation Parameters/Information:

NSW — Clay % = < 75um

Low traffic volume — ABC: Ambient background concetrations derived from natural soils in Test Pits 20, 21, 24 and 25

Aged

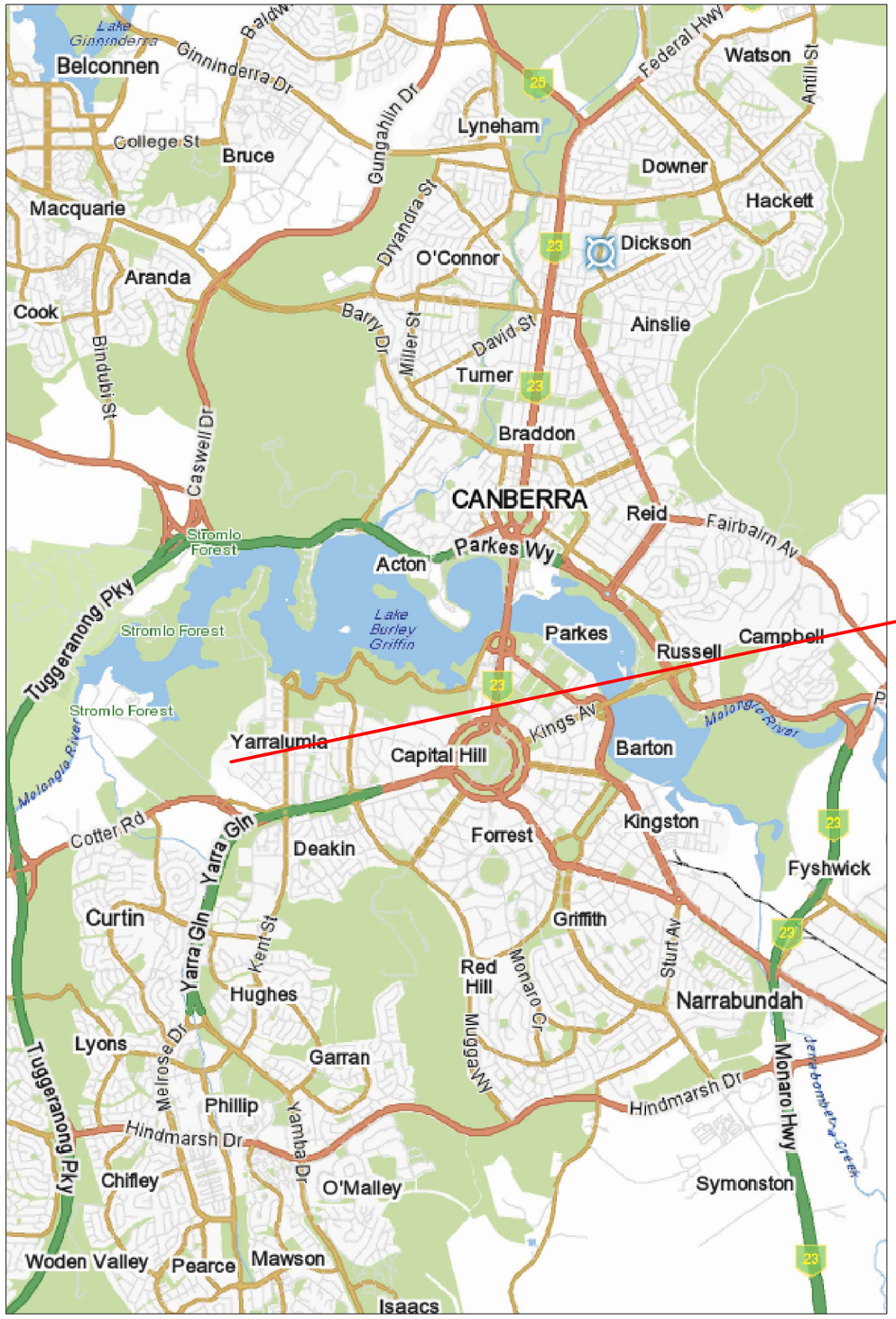
Urban Residential and Open Public Spaces; — Data derived from natural soil horizons

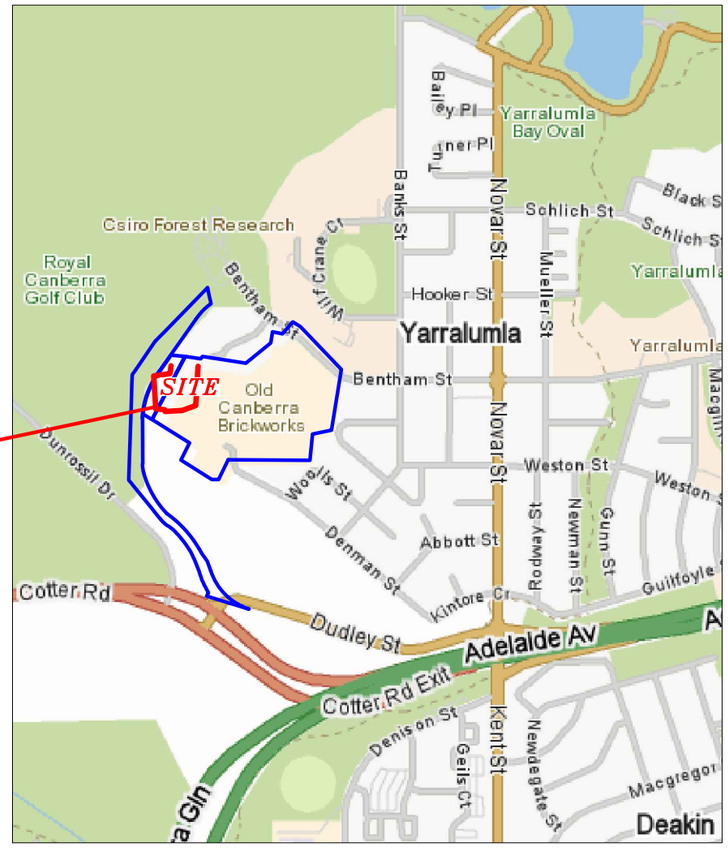
BOLD: Criteria derived from calculating 95% Upper Confidence Limit (UCL) of the calculated ACLs,

* 95%^UCL could not be calculated therefore the lowest concentration was selected as the site speciifc criterion.

FIGURES

Figures 1 to 6





LEGEND

BLOCK BOUNDARIES

SITE FENCE BOUNDARY

Note: Scale, locations, and boundaries are approximate only.
Images courtesy of Google Maps

Robson ENVIRONMENTAL
Environmental Excellence through Experience, Endeavour and Evaluation

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Client:

CAPCORP CONSTRUCTIONS PTY LTD

Project:

CANBERRA BRICKWORKS STAGE 1 ESA

Location:

CANBERRA BRICKWORKS
(BLOCK 1 & 20 SECTION 102 AND BLOCK 1 SECTION 127)
YARRALUMLA ACT 2600

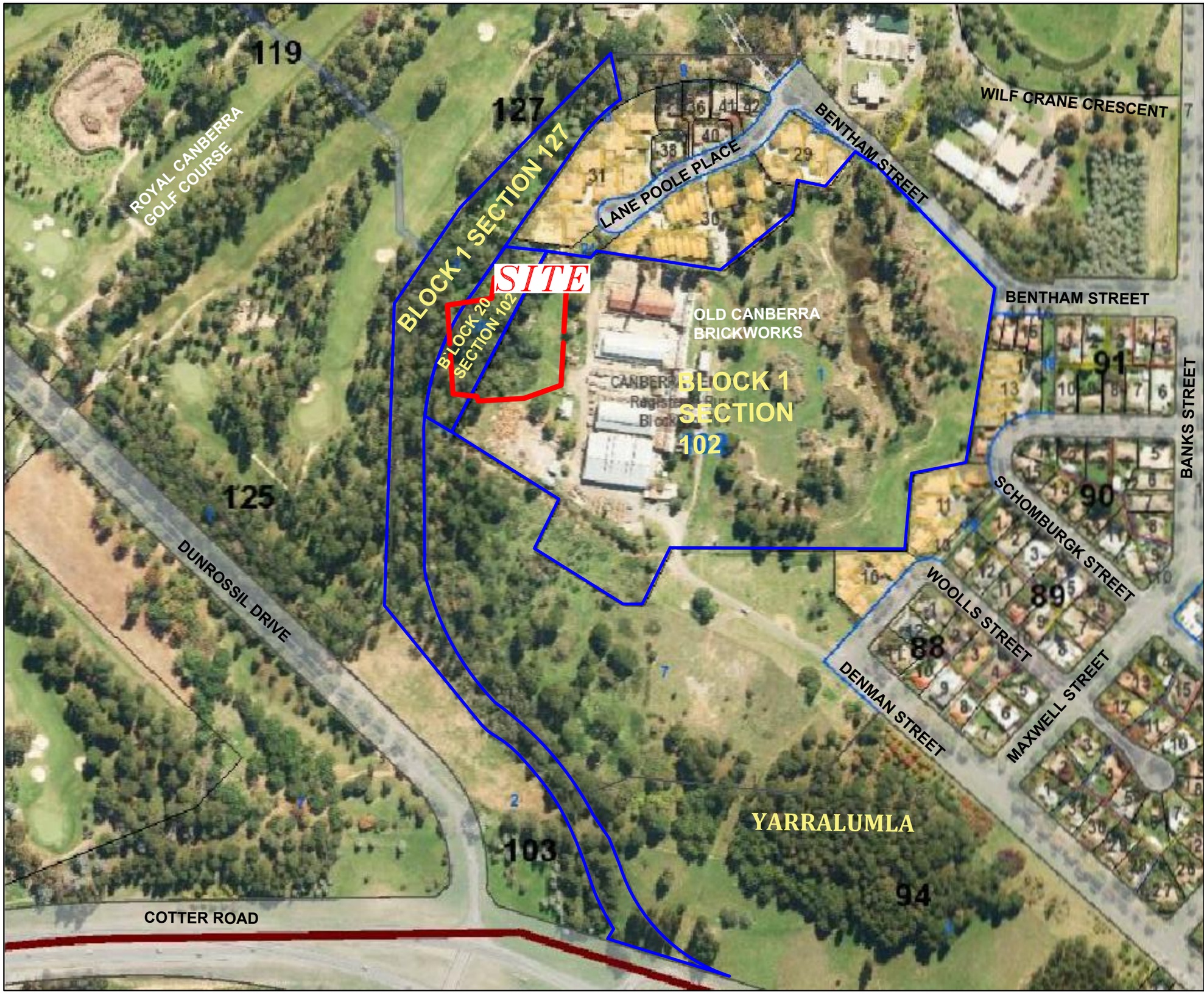
Drawing Title:

SITE LOCATION PLAN

Drawn S.W.	Signed	Date 02.02.15	
Checked B.K.	Signed	Date 02.02.15	

Rev	Date	Revision Details	Drn
A	02.02.15		S.W.

Project - Drawing No.	Figure No.	Rev.
9623	1	A



LEGEND

BLOCK BOUNDARIES

SITE FENCE BOUNDARY

0 30 60 90 120 150

APPROXIMATE SCALE METRES

Note: Scale, locations, and boundaries are approximate only.

Image courtesy of ACTMapi

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Client:

CAPCORP CONSTRUCTIONS PTY LTD

Project:

CANBERRA BRICKWORKS STAGE 1 ESA

Location:

CANBERRA BRICKWORKS
(BLOCK 1 & 20 SECTION 102 AND BLOCK 1 SECTION 127)
YARRALUMLA ACT 2600

Drawing Title:

GENERAL SITE PLAN

Drawn S.W.	Signed	Date 02.02.15	
Checked B.K.	Signed	Date 02.02.15	

Rev	Date	Revision Details	Drn
A	02.02.15		S.W.

Project - Drawing No.	Figure No.	Rev.
9623	2	A

LEGEND

- BLOCK BOUNDARIES
- SITE FENCE BOUNDARY
- APPROXIMATE FILL BOUNDARY
- APPROXIMATE FILL AND ACM BOUNDARY
- FILL LIKELY BEYOND BOUNDARY

0 12 24 36 48 60

APPROXIMATE SCALE METRES

Note: Scale, locations, and boundaries are approximate only.
Image courtesy of Nearmap 17.01.15

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www.robsonenviro.com.au
ABN: 55 008 660 900

Client:
ACT PROPERTY GROUP

Project:
CANBERRA BRICKWORKS
STAGE 1 ESA

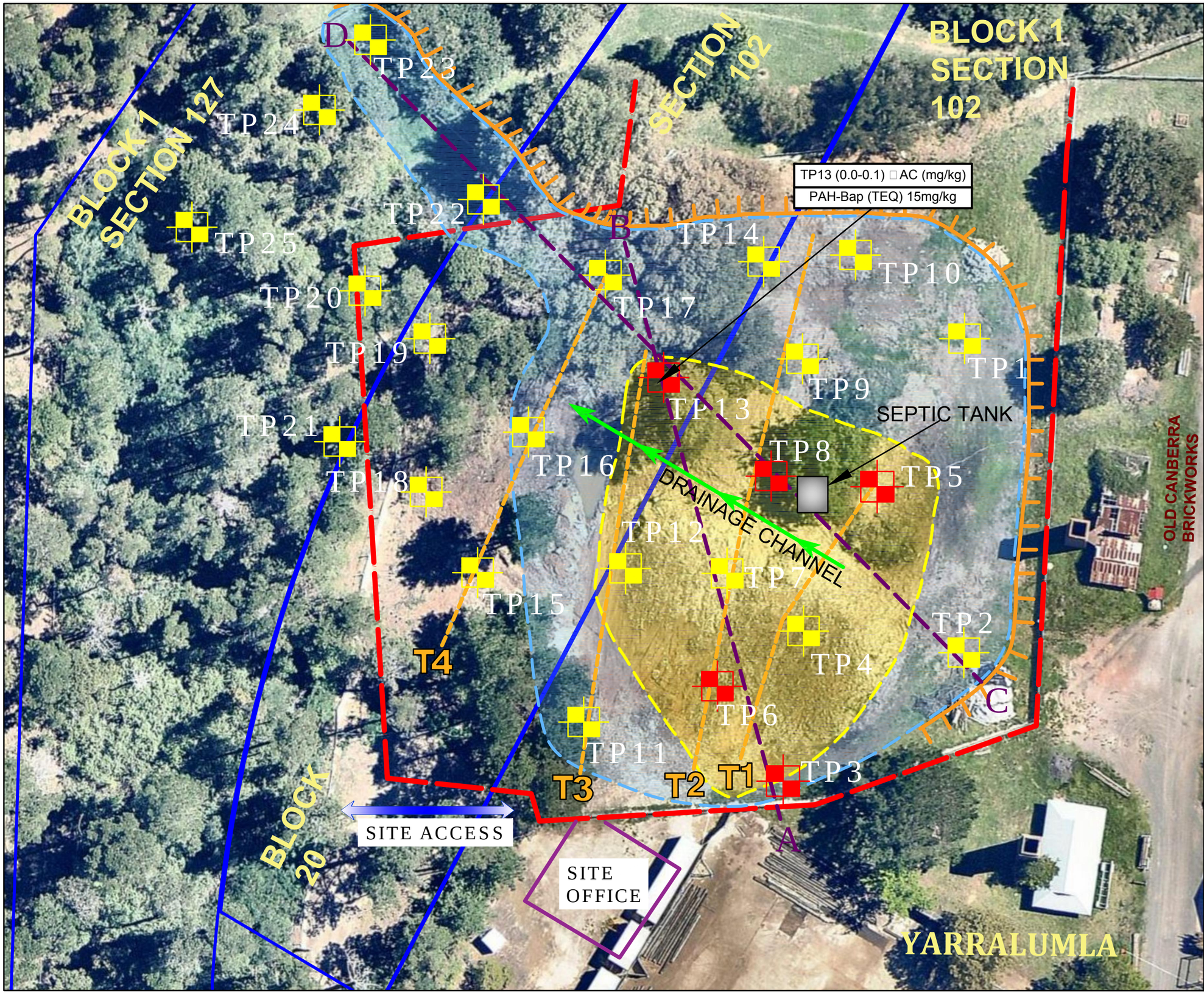
Location:
CANBERRA BRICKWORKS
(BLOCKS 1 & 20 SECTION 102 AND BLOCK 1 SECTION 127)
YARRALUMLA ACT 2600

Drawing Title:
SAMPLE LOCATION PLAN

Drawn S.W.	Signed	Date 12.03.15	
Checked B.K.	Signed	Date 12.03.15	

Rev	Date	Revision Details	Drn
A	12.03.15		S.W.

Project - Drawing No.	Figure No.	Rev.
9623	3	A



TP13 (0.0-0.1) AC (mg/kg)
PAH-Bap (TEQ) 15mg/kg

LEGEND

- BLOCK BOUNDARIES
- SITE FENCE BOUNDARY
- TP5 — TESTPIT (TP) ASBESTOS CONTAINING MATERIAL (ACM) DETECTED
- TP2 — TEST PIT (TP) SAMPLE LOCATIONS
- T4 — TRENCH LOCATIONS
- A—B — CROSS SECTION
- APPROXIMATE FILL BOUNDARY
- APPROXIMATE FILL AND ACM BOUNDARY
- FILL LIKELY BEYOND BOUNDARY

0 6 12 18 24 30
APPROXIMATE SCALE METRES

Note: Scale, locations, and boundaries are approximate only.
Image courtesy of Nearmap 17.01.15

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Client:
CAPCORP CONSTRUCTIONS PTY LTD

Project:
CANBERRA BRICKWORKS STAGE 1 ESA

Location:
CANBERRA BRICKWORKS
(BLOCKS 1 & 20 SECTION 102 AND BLOCK 1 SECTION 127)
YARRALUMLA ACT 2600

Drawing Title:
SAMPLE LOCATION PLAN

Drawn S.W.	Signed	Date 12.03.15	
Checked B.K.	Signed	Date 12.03.15	

Rev	Date	Revision Details	Drn
A	12.03.15		S.W.

Project - Drawing No.	Figure No.	Rev.
9623	4	A

BLOCK 1 SECTION 102

SENSITIVE RECEPTORS

Nearby Residential Area
Lane Poole Place North of site

Royal Golf Course / Visitors

Yarralumla Brickworks Workers / Visitors

N
W
E
S

Site Office / Workers

BLOCK 20 SECTION 102

Wind direction

Landfill Gases

Wind direction

S

TP3
577 m AHD

TP6
577.6

TP7
578.1

N

TP17
574

TP13
576.4

Fill: Brick, concrete, ash, metal (car body parts), plastic and asbestos as sheet fragments

DRAINAGE CHANNEL

PERCHED WATER LENS

Fill: Brick, tile no ACM

Natural

1 m
2 m
3 m
4 m

A

approximately 80 m

B

DEPTH TO GROUNDWATER IS UNKNOWN

NTH-STH CROSS-SECTION OF ASBESTOS DUMP

LEGEND

TP6 Test Pit ACM observed

TP7 Test Pit no ACM observed

Block Boundary

Note: Not to Scale

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Client:
CAPCORP CONSTRUCTIONS PTY LTD

Project:
CANBERRA BRICKWORKS STAGE 1 ESA

Location:
CANBERRA BRICKWORKS
(BLOCKS 1 & 20 SECTION 102 AND BLOCK 1 SECTION 127)
YARRALUMLA ACT 2600

Drawing Title:
CONCEPTUAL SITE MODEL
CROSS SECTION A - B

Drawn S.W.	Signed	Date 18.03.15	
Checked B.K.	Signed	Date 18.03.15	

Rev	Date	Revision Details	Drn
A	18.03.15		S.W.

Project - Drawing No.	Figure No.	Rev.
9623	5	A

BLOCK 1 SECTION 102

BLOCK 20 SECTION 102

BLOCK 1 SECTION 127

SENSITIVE RECEPTORS

Nearby Residential Area
Lane Poole Place North of site

Royal Golf Course / Visitors

Yarralumla Brickworks Workers / Visitors

N

W

E

S

Site Office / Workers

Wind direction

SE

TP2

576.6 m AHD

TP5

576.4

TP8

575.8

Landfill Gases

TP13

576.9

Wind direction

TP17

575.4

TP22

TP23

SW

1 m

2 m

3 m

4 m

Fill: Brick, tile, no ACM

Fill: Brick, concrete, ash, metal (car body parts), plastic and asbestos as sheet fragments

SEPTIC TANK

POSSIBLE SEEPAGE

PERCHED WATER LENS

Natural

C

D

approximately 115 m

STH EAST TO STH WEST CROSS-SECTION OF ASBESTOS DUMP

LEGEND

TP5 Test Pit ACM observed

TP2 Test Pit no ACM observed

Block Boundary

Note: Not to Scale

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Client:
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Project:
CANBERRA BRICKWORKS STAGE 1 ESA

Location:
CANBERRA BRICKWORKS
(BLOCKS 1 & 20 SECTION 102 AND BLOCK 1 SECTION 127)
YARRALUMLA ACT 2600

Drawing Title:
CONCEPTUAL SITE MODEL
CROSS SECTION C - D

Drawn S.W.	Signed	Date 18.03.15	
Checked B.K.	Signed	Date 18.03.15	

Rev	Date	Revision Details	Drn
A	18.0315		S.W.

Project - Drawing No.	Figure No.	Rev.
9623	5A	A

A3

ROYAL CANBERRA GOLF COURSE

BLOCK 20 SECTION 102

BLOCK 1 SECTION 127

BLOCK 1 SECTION 102

SEDIMENT CONTROL FENCE

DRAINAGE LINE

FORKLIFT SHED

COAL AND OIL STORAGE

SEPTIC TANK

BH5 (2006)

SAMPLED AREA JUNE 2007

BH4 (2006)

ACCESS GATE

STORAGE AREA

SITE OFFICE

EXPLOSIVE STORE

STORAGE AREA

GRAVEL ACCESS ROAD

GRAVEL ACCESS ROAD

MAIN ENTRANCE

TO DENMAN STREET

CONCRETE FORECOURT

THIS IS ONE INTERPRETATION ONLY
OTHER INTERPRETATIONS ARE POSSIBLE

LEGEND

- BLOCK BOUNDARY
- BUILDINGS
- APPROXIMATE EXTENT OF ASBESTOS DUMP
- WORK AREA FENCELINE
- TREE / SHRUB / VEGETATION
- AREA IMPACTED BY SURFACE WATER DISPERSION OF ASBESTOS DUMP
- SEDIMENT CONTROL FENCE
- AEC'S (Connell Wagner 2001)
- BOREHOLE (2006)

0 5 10 15 20 25
SCALE METRES

NOTE: ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE ONLY

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ABN: 55 008 660 900

Client:

CAPCORP CONSTRUCTIONS PTY LTD

Project:

CANBERRA BRICKWORKS STAGE 1 ESA

Location: CANBERRA BRICKWORKS (AREA OF CONCERN) (BLOCKS 1 & 20 SECTION 102 AND BLOCK 1 SECTION 127) YARRALUMLA ACT 2600

Drawing Title:

SAMPLE LOCATION EDITED PLAN (2006 Environmental Audit) and 2007 RAP

Drawn S.W.	Signed	Date 02.02.2015
Checked B.K.	Signed	Date 02.02.2015

Rev	Date	Revision Details	Drn
A	02.02.2015		S.W.

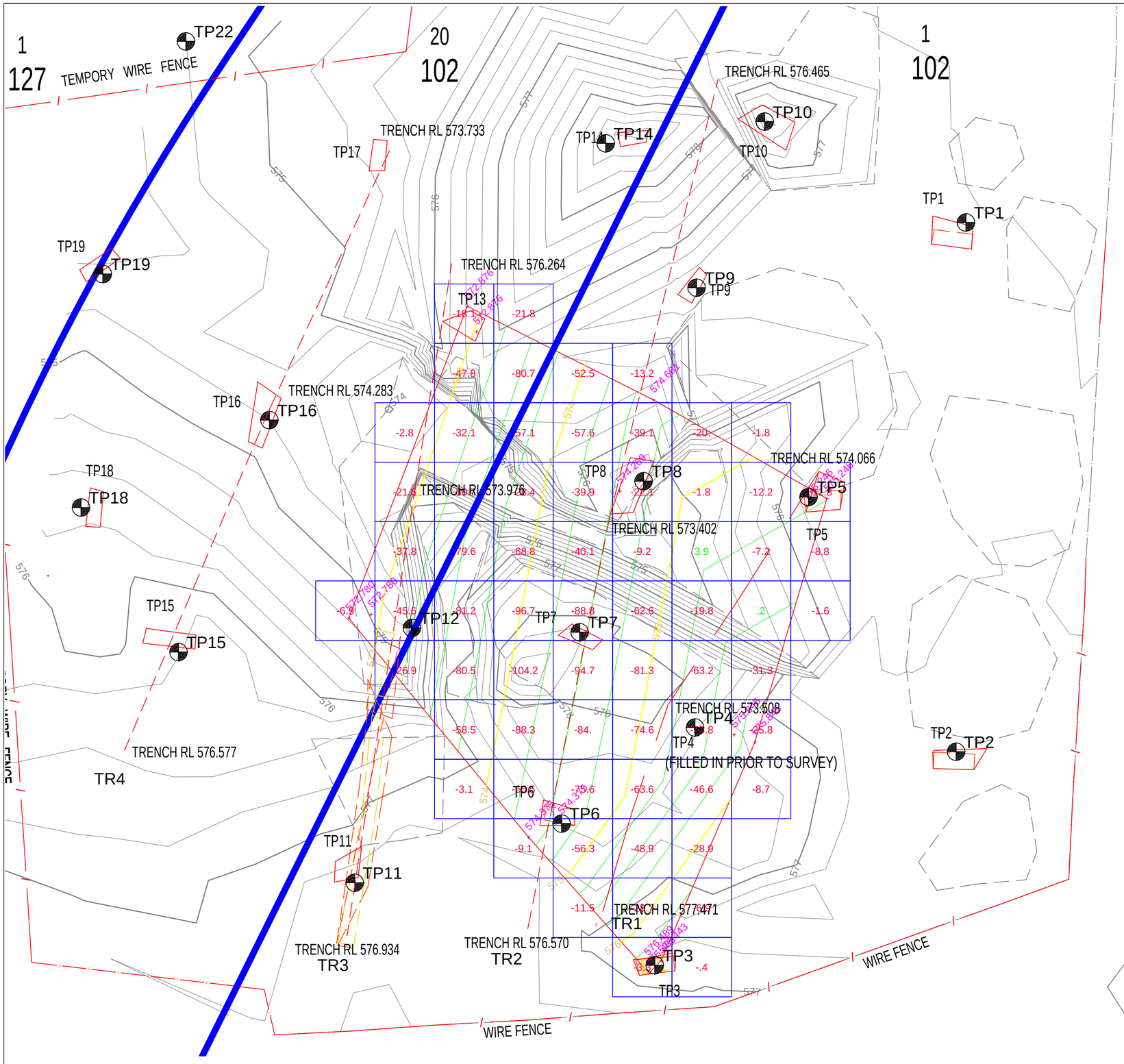
Project - Drawing No.	Figure No.	Rev.
9623	6	A

Figures 7 and 8

Source: 4D Surveying

(Figure 7: Volume A (Asbestos fill) Layer v Existing Surface – Plan No 18294_05_A.dwg)

(Figure 8: Volume B (Fill) Layer v Existing Surface – Plan No 18294_05_B.dwg)




```
                                05_AGC Surface Layer Volumes -
SURFACE TO SURFACE VOLUMES
==========================

PROJECT         : 05_AGC Surface Layer Volumes
DATE            : 27/01/2015
TIME            : 11:04:27 AM

================================

REGION          : Canberra Brickworks
--------------------------------

START SURFACE : 1 EXISTING SURFACE
FINISH SURFACE: 2 A LAYER SURFACE
MATERIAL      :
GRID INTERVAL : 1.000m
AREA          : 1260.00m²
CUT FACTOR    : 1.00
FILL FACTOR   : 1.00

CUT VOLUME    :     2619.5m³
FILL VOLUME   :        9.3m³

NET VOLUME    :     2610.1m³ CUT
--------------------------------
```

-2.2 5 metre x 5 metre GRID with NET Volume

EXISTING SURFACE CONTOURS BLOCK

DENOTES TEST PIT SURVEY 02.12.2014

IMPORTANT NOTE

This plan is prepared for CAPCORP from a combination of field survey and existing records for the purpose of designing new constructions on the land and should not be used for any other purpose. The title boundaries shown hereon were not marked by the author at the time of survey.

Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services. This note is an integral part of the plan.

Peter Williams
Registered Surveyor

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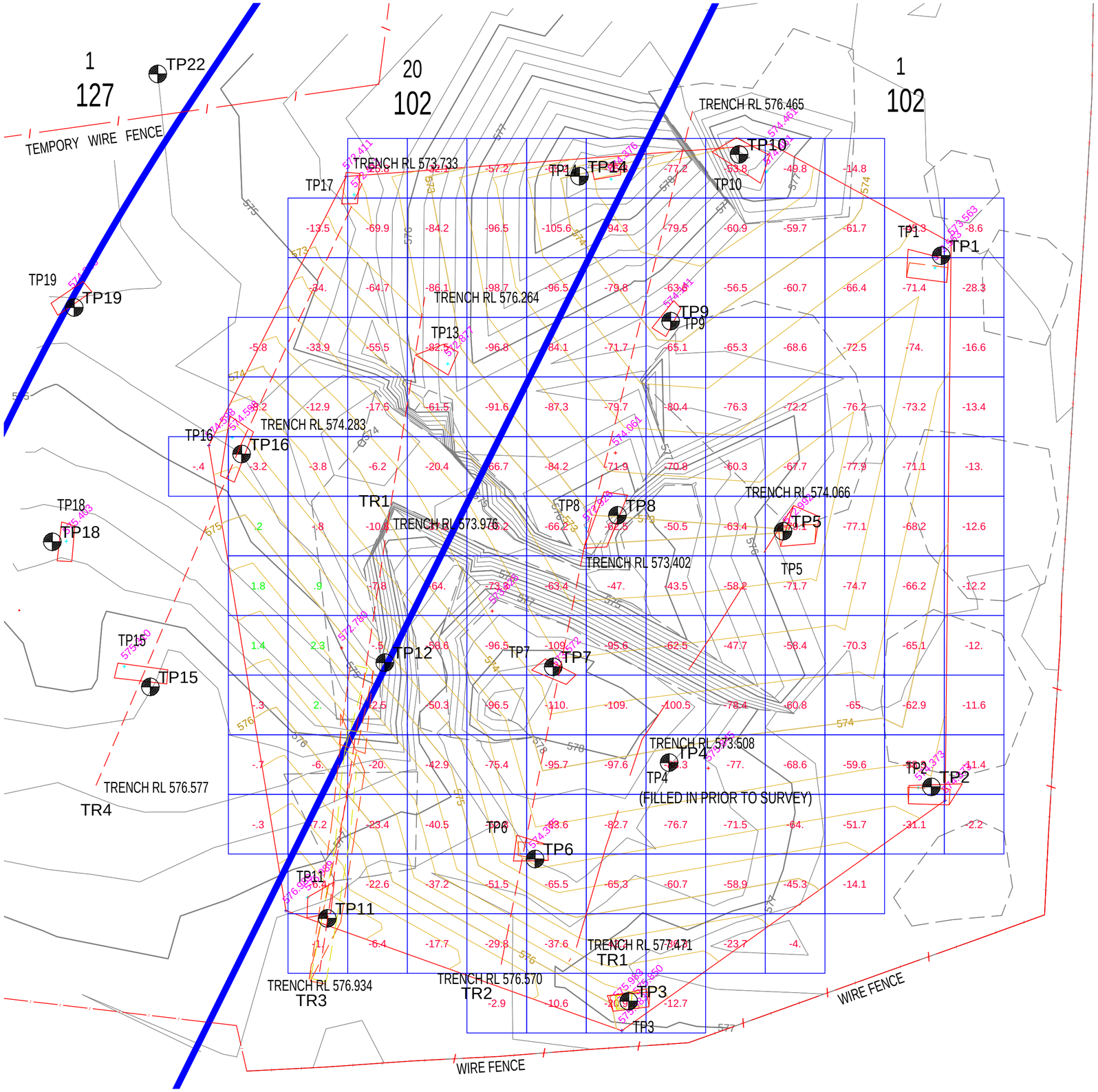
REDUCTION RATIO 1:250 A2	REVISIONS & AMENDMENTS		CLIENT: CAPCORP	SHEET No. 1
ORIGIN OF LEVELS SR 863 RL589.12 Contour Interval: 0.25m	Test Pit & Trenches added 29.01.2015		VOLUME A LAYER v EXISTING SURFACE CANBERRA BRICKWORKS DENHAM STREET YARRALUMLA	No. OF SHEETS:1
				DATE: 27.01.2015
DATUM: AHD & AGC	DRWN BY: PW	SUR BY:		PLAN No. 18294_05_A.dwg



05_AGC Surface Layer Volumes - B LAYER
SURFACE TO SURFACE VOLUMES

PROJECT : 05_AGC Surface Layer Volumes
DATE : 27/01/2015
TIME : 11:09:48 AM

REGION : Canberra Brickworks

START SURFACE : 1 EXISTING SURFACE
FINISH SURFACE: 3 B LAYER SURFACE
MATERIAL :
GRID INTERVAL : 1.000m
AREA : 3722.00m²
CUT FACTOR : 1.00
FILL FACTOR : 1.00

CUT VOLUME : 8748.9m³
FILL VOLUME : 16.3m³

NET VOLUME : 8732.6m³ CUT

-2.2 5 metre x 5 metre GRID with NET Volume

EXISTING SURFACE CONTOURS BLOCK

DENOTES TEST PIT SURVEY 02.12.2014

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REDUCTION RATIO 1:250 A2	REVISIONS & AMENDMENTS	CLIENT: CAPCORP	SHEET No. 1
ORIGIN OF LEVELS SR 863 RL589.12 Contour Interval: 0.25m		VOLUME B LAYER v EXISTING SURFACE CANBERRA BRICKWORKS DENMAN STREET YARRALUMLA	No. OF SHEETS: 1 DATE: 27.01.2015
DATUM: AHD & AGC	DRWN BY: PW SUR BY:		PLAN No. 18294_05_B.dwg

APPENDICES

Appendices A to H

Appendix A

Data Quality Objectives

(Sourced from RAP- *Robson Reference* 9623_EAR_SAQP_20140916.docx*)*

4. DATA QUALITY OBJECTIVES

Assessment of the Data Quality Objectives (DQOs) is a process used to aid the planning of environmental investigations and remedial works by providing a structured methodology for assessing the environmental data collection processes, identification of sample locations, number of samples required, sampling techniques and defining acceptable assessment criteria.

The DQO process used to aid the development of this SAQP has been prepared in general accordance with Appendix C of the Australian Standard AS4482.1-2005 '*Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil – Part 1: Non-Volatile and Semi-Volatile Compounds*' and the US EPA (2000) '*Data Quality Objectives Process for Hazardous Waste Site Investigation*' (US EPA QA/G-4HW).

4.1 Define the Study Boundaries

The assessment area applicable to this SAQP is located within and adjacent to the foot print of the 'AD' on the western boundary of the Brickworks. The site is identified as parts of Blocks 1, 20 Section 102 Yarralumla and part of Block 1 Section 127 Yarralumla. The boundary of the waste has not been surveyed but is shown generally in **Figure 2**. The combined area is approximately 0.45 ha.

The vertical boundary is estimated to be approximately 3 metres below ground level (mbgl) (at its deepest point).

4.2 State the Problem

Previous assessments on the site have identified asbestos containing materials in the building rubble within the dump and asbestos concentrations in soil (in the form of asbestos fibre) at levels which are unacceptable for the proposed land use. In addition to the asbestos, low concentrations of Total Petroleum Hydrocarbons (TPH) (110mg/kg TPH - C_{29}-C_{36}) were identified in the soil sample taken from a test pit location in June 2007. Therefore, awareness for the potential of other contaminants of concern must be maintained and may require further assessment or remediation to manage this risk.

However, these assessments have not adequately characterised the dump to permit the development of an appropriate remediation strategy for the impacted land. Therefore the ESA is necessary as it will provide data specific to lateral and vertical extent of impact and allow further characterisation of the waste stream.

Project Team and Communication Plan

The project team is known in part and will generally include the following entities:

- Representatives from the ACT Property Group who are the custodians of the site and the primary decision makers;
- The Remediation contractor AAC Environmental Pty Ltd(AAC) who are responsible for the set-up of the site, for the remedial works (for example, site access and sediment control measures), provide plant and operators to

excavate the impacted soil, provide trucks for off-site haulage of impacted soil and undertake site reinstatement work;

- Contaminated land consultants from Robson, including a project manager and field staff who would provide on-site environmental consultancy advice during remedial and investigative works, including material tracking, airborne fibre monitoring, collection of samples from test pits and trenches;
- An ACT licensed asbestos removalist to be confirmed by AAC, will set up decontamination zones and supervise the loading and removal works;
- A NSW EPA accredited site Auditor who will be responsible for the review of the works undertaken by the consultant and effectively represents the ACT EPA to ensure the suitability of the site for the proposed land use;
- The ACT EPA who would be responsible for reviewing applications for the removal of soil from the dump location and final review of the Site Audit Statement to be provided by the Auditor on completion.

A summary of the team members involved is presented in **Table A** below.

Table A: Project Team and Communication Plan

Organisation / Role	Name / Title	Contact Details	
		Phone	Email
TAMS (ACTPG)	Mike Brown Senior Manager	02 6231 0700	Mike.brown@act.gov.au
	Katie Burrows Assistant Manager	02 6231 0700	Katie.burrows@act.gov.au
SSP Principal Representative for the Territory	Steve Hayden	02 6205 4651 0458 161 616	Steven.Hayden@act.gov.au
	Barry Ingham	02 62070037	barry.ingram@act.gov.au
	Michael Whitehouse	02 6205 3164	michael.whitehouse@act.gov.au
Capezio & Co P/L - Project Manager	Don Capezio Project Director	02 6239 1113	don@capezioandco.com.au
	Dylan Hughes Construction Manager	02 6239 1113	dylan@capezioandco.com.au

Organisation / Role	Name / Title	Contact Details	
		Phone	Email
	Ben Da Pozzo Site Manager Admin	02 6239 1113	ben@capezioandco.au
GeoSyntec/ NSW EPA Accredited Auditor	Lange Jorstad – Auditor	0447 249 250	LJorstad@Geosyntec.com
Earthworks and Construction (Remediation Contractor)	Arthur Watson - AAC Environmental Pty Ltd	02 6248 4326 M: 0419 629 864	awatson@aacenviro.com.au
Licensed Asbestos Removalist	TBA	TBA	TBA
Heritage / Archaeological Consultant	Shelley James Principal Consultant	(02) 6253 6888 (02) 6253 6804	Shelley.james@erm.com
Robson Environmental Pty Ltd – Environmental Consultant	Ben Kendon – Project Manager	(02) 6171 4623	0437 008 278
	Chris Gunton – Associate Environmental Scientist	(02) 6171 4619	0447 033 232
	Andrew Roberts – Site Manager	(02) 6171 4621	0437 009 369

Conceptual Site Model

Based upon the results of the previous assessments, it is assessed that all fill material within the footprint of the 'AD' which contains building waste should, until demonstrated otherwise, be considered to be impacted with unacceptable levels of ACM.

The 'AD' is an area that was used as a dump by both on-site personnel and may have also been used for illegal dumping activities. The bulk of the asbestos material is thought to have come from the site buildings during periods of renovation.

The potential on-site sensitive receptors of the COPCs include: on-site workers, visitors and trespassers while the off-site sensitive receptors include residents to the north of the 'AD' and the public who may access the adjacent public land or the adjacent Royal Canberra Golf course. Depending on the depth to groundwater, the water table is also considered to be a potential pathway for contamination as is surface water.

It is estimated that the volume of fill containing builders waste is in the order of 9,000 m^3 (in-situ, based upon an average depth of 2 m by the area of the dump (0.45 ha)) (refer **Figure 4**).

Future Exposure Scenarios

Potential receptors that may be exposed to contamination would include the following if remediation is not achieved:

- Construction and maintenance workers present during the construction works and ongoing maintenance of the site;
- Users / occupants of surrounding properties during the construction works and ongoing maintenance of the site;
- Future users and visitors to the site; and
- The potential for terrestrial organisms to be receptors is also considered and accounted for on the basis of the proposed site assessment criteria.

Potential exposure routes include via direct contact with contaminated soil, and by inhalation and / or ingestion of dust. Should contamination be migrating from the site, then neighbouring site users may be exposed to contaminants, particularly via inhalation and / or ingestion of dust.

4.3 Identify the Decision

Based on the previous assessments, it is understood that asbestos and low concentrations of hydrocarbon impacted soil is present on the site and that much of this material (potentially all) may require disposal off-site or reused. Assuming that the proposed soil assessment works are undertaken, the principal study questions are:

- "*Has the waste been adequately characterised and delineated both vertically and horizontally to give confidence that the remediation goals can be achieved*"

Soil Assessment for Site Use

- "*Does the soil on the site contain contaminant concentrations and / or other indicators of potential contamination that may pose an unacceptable risk to human health and / or the environment, thereby affecting the suitability of the site ('AD') for the proposed potential residential land use (HIL 'B' – High density residential)"?*

4.4 Identify Inputs to the Decision

A variety of data inputs have been identified to allow an informed and measured decision regarding the development of the SAQP. The inputs required are summarised in **Table B** below.

Table B: Identified Data Inputs for the SAQP

Data Input	Adequacy of Information
Historical Land Use	**Adequate** – Information is presented in the previous reports by Robson, particularly: • Connell and Wagner 2001 - *Appendix F-Brickworks Contamination Report* • Robson Laboratories Pty Ltd (October 2006) '*Environmental Investigation – Audit Report Yarralumla Brickworks Block 1 Section 102 Yarralumla Canberra Central ACT* (Robson reference 3144_ CL_EI Final_20061018). • Robson Laboratories Pty Ltd (2007) *'Remediation Action Plan - Asbestos Dump Yarralumla Brickworks Block 1 Section 102 Yarralumla Canberra Central ACT'* (Robson reference 3144_ CL_RAP_20070612).
Identification of Areas Requiring Assessment	**Generally Adequate** – The areas to be investigated include asbestos sheet materials and the associated impacted soil (fill containing building rubble) and the potential for hydrocarbons which has not been delineated laterally or vertically.
Identification of Contaminants	**Generally Adequate** – Appropriate contaminants of concern are defined in the previous Robson assessment reports. Specifically this includes asbestos and hydrocarbons.

Data Input	Adequacy of Information
Quantification of Contaminants in Soil	**Generally Adequate** – The concentrations of asbestos in soil have been broadly assessed, with all fill material containing building rubble assumed to be asbestos impacted. The lateral and vertical extent of the hydrocarbons and other potential contaminants of concern to be assessed during the ESA.

4.5 Develop a Decision Rule

4.5.1 Assessment Criteria for Soil

Investigation and screening level criteria as defined in the ASC NEPM (2013) are the concentrations of contaminants above which further assessment and /or appropriate remediation may be required.

Robson understands that the site is to be redeveloped for mixed-use high density residential and commercial land use. The assessment criteria applicable to this exposure scenario and sourced from the ASC NEPM (2013) are the Health-based Investigation Level (HIL) 'B'- *'Residential with minimal opportunities for soil access including dwellings with fully and permanently paved yard space such as high-rise buildings and flats'*.

The ASC NEPM 2013 also provides health screening levels (HSLs) for petroleum hydrocarbon compounds. It is considered that the dominant exposure pathway to petroleum hydrocarbon compounds would likely be via vapour inhalation, and therefore criteria sourced from Table 1A (3) have been adopted for the purpose of screening during this assessment.

In addition to the above, the ASC NEPM 2013 also provides ecological investigation levels (EILs) for common contaminants (including arsenic, copper, chromium (III), DDT, naphthalene, nickel, lead and zinc), and ecological screening levels (ESLs) for petroleum hydrocarbons (including benzene, toluene, ethylbenzene and xylene (BTEX), benzo(a)pyrene (B(a)P), and total recoverable hydrocarbon (TRH) fractions. The EILs and ESL should generally be applied to soil that will remain on the site and within the top two (2) metres (m) of the finished surface / ground level for generic land use. This generally corresponds to the root zone and habitation zone of many plant species.

For the purposes of this ESA it may not be necessary to assess the results against the EILs and ESLs as the material if assessed as unsuitable for site use which is expected, will either be assessed as suitable for BRU in a commercial/industrial setting or it will be disposed directly to land fill. However, the criteria have been included as possible assessment criteria in the event they are applicable.

EIL Ambient Background Concentrations (ABCs)

The Environmental Investigation Levels ambient background concentrations (ABCs) for copper, chromium (III), nickel, lead and zinc will be determined in the following manner.

In the first instance the EIL land use setting for the site is considered to be 'urban residential and public open space' therefore the protection level for this land use setting is 80%.

It is assumed that the ecosystem is adapted to the ABC for the locality and it adding the contaminants over and above the background concentration which has an adverse affect on the environment.

For this assessment samples are expected to be taken in natural soils in the dump, to the east and west (down gradient) of the dump (refer **Figure 6**). Robson considers these locations to be representative with regard to the ABCs for arsenic, copper, chromium (III), DDT, naphthalene, nickel, lead and zinc. If the assessment demonstrates exceedences with regard to the site specific EILs (using the ASC NEPM Toolbox) then additional testing may be required to derive the ABCs for the site.

Robson will also use historic soil data from across the Canberra Brickworks site which is available from the following 2006 Robson report:

- Robson Laboratories Pty Ltd (October 2006) '*Environmental Investigation – Audit Report Yarralumla Brickworks Block 1 Section 102 Yarralumla Canberra Central ACT.* (Robson reference 3144_ CL_EI Final_20061018).

The data will be used to compare with the results from the data collected in this investigation which will give confidence with regard to the derived ABCs.

HSLs, ESLs and TRH Management Limits

Based on the field observations (which are presented in **Section 3**) the soil sampled from the bore holes east of the dump and from the test pits within the dump were silty clay.

To assess the suitability of the soil in the vicinity of the dump, the HSL criteria for clay has been applied while the suitability of the soil with regards to ecological considerations has been assessed against the ESL criteria for fine soil texture. For the purpose of this assessment, the depth applied to establish the HSL criteria was 0 m to < 1 m which is considered appropriate as there is a high likelihood that soil will occur within this depth range.

Following the assessment of TRH (fractions F1 – F4) impacts with consideration given to the ESL and HSLs, the TRH Management Limits may also need to be considered and these shall be sourced (when required) from Table 1(B)7 *'Management Limits for TRH Fractions F1 – F4) in Soil'* of the ASC NEPM (2013). As the proposed land use includes a residential component, the residential, parkland and open space category with a 'fine' soil texture has been used to determine the TRH Management Limits criteria.

A summary of the adopted HILs and HSLs for the 'AD' assessment are presented below in **Table C**, and the adopted EILs and ESLs are summarised in the following **Table D** overleaf.

Table C: Proposed Soil Assessment Criteria (HILs and HSLs)

Contaminant	HIL B [1] (mg/kg)	HSL B[2](Clay) (mg/kg)
ACM	0.04 % w/w	NE
Fibrous Asbestos (FA)	0.001 % w/w	NE
Asbestos Fines (AF)	0.001 % w/w	NE
Benzene	NE	0.7
Ethylbenzene	NE	NL
Toluene	NE	480
Xylene (m & p)	NE	NE
Xylene (o)	NE	NE
Xylene Total	NE	110
F1 (TPH C_6 – C_{10} minus BTEX)	NE	50
F2 (TPH greater than (>) C_{10} - C_{16} minus naphthalene)	NE	280
Carcinogenic PAHs (as B(a)P TEQ)	4	NE
Napthalene	NE	5
PAHs (Sum of total)	400	NE
Phenol	45,000	NE
DDT+DDE+DDD	600	NE
Aldrin and dieldrin	10	NE
Chlordane	90	NE
Endosulfan	400	NE
Endrin	20	NE
HCB	15	NE
Heptachlor	10	NE
Methoxychlor	500	NE
Mirex	20	NE
Toxaphene	30	NE
PCBs (Sum of total)	1	NE
Arsenic (total)	500	NE
Cadmium	20	NE
Chromium (VI)	500	NE
Copper	30,000	NE
Lead	1,200	NE
Mercury (inorganic)	120	NE
Nickel	1200	NE
Zinc	60,000	NE

Notes:

1. ASC NEPM (2013) – Table 1A(1) '*Health investigation levels for soil contaminants*' of Schedule B1 '*Guideline on Investigation Levels for Soil and Groundwater*', HIL B Exposure

Setting: *'Residential with minimal opportunities for soil access including dwellings with fully and permanently paved yard space such as high-rise buildings and flats'*.

2. ASC NEPM (2013) – Table 1A (3) '*Soil HSLs for vapour intrusion*' of Schedule B1 '*Guideline on Investigation Levels for Soil and Groundwater*', HSL A & HSL B Exposure Setting: Low to high density residential. Adopted value is for a clay soil at a depth of 0 m to < 1 m.
NE = Not established, mg/kg = milligrams per kilogram, TEQ = toxicity equivalent quotient, PAH = Polycyclic Aromatic Hydrocarbons

Table D: Proposed Soil Assessment Criteria (EILs and ESLs)

Contaminant	EIL[1] (mg/kg)	ESL[2] (Fine) (mg/kg)
Benzene	NE	65
Ethylbenzene	NE	125
Toluene	NE	105
Xylene (m & p)	NE	NE
Xylene (o)	NE	NE
Xylene Total	NE	45
F1 (TPH C_6 – C_{10} minus BTEX)	NE	180 (800[4])
F2 (TPH greater than (>) C_{10} - C_{16})	NE	120 (1,000[4])
F3 (TPH > C_{16} - C_{34})	NE	1,300 (3,500[4])
F4 (TPH > C_{34} - C_{40})	NE	5,600 (10,000[4])
Carcinogenic PAHs (as B(a)P)	NE	0.7
Napthalene	170	NE
PAHs (Sum of total)	NE	NE
Phenol	NE	NE
DDT	180	NE
Aldrin and dieldrin	NE	NE
Chlordane	NE	NE
Endosulfan	NE	NE
Endrin	NE	NE
HCB	NE	NE
Heptachlor	NE	NE
Methoxychlor	NE	NE
Mirex	NE	NE
Toxaphene	NE	NE
PCBs (Sum of total)	NE	NE
Arsenic (total)	100	NE
Cadmium	NE	NE
Chromium (III)	190 – 400 (TBD)	NE
Copper	60 – 800 (TBD)	NE
Lead	1,100	NE
Mercury (inorganic)	NE	NE
Nickel	30 – 560 (TBD)	NE
Zinc	70 – 1300 (TBD)	NE

Notes:

1. ASC NEPM (2013) – Table 1B (5) '*Generic EILs for aged As, Pb, fresh DDT and fresh naphthalene in soil irrespective of their physicochemical properties*'.
2. ASC NEPM (2013) – Table 1B(6) *'ESLs for TPH fractions F1 – F4, BTEX and Benzo(a)Pyrene in soil*' of Schedule B1 *'Guideline on Investigation Levels for Soil and Groundwater*', ESL setting urban residential and public open space.
3. ASC NEPM (2013) – ASC NEPM Toolbox, '*Ecological Investigation Levels – Interactive (Excel) Calculation Spreadsheet*'. Assuming the heavy metals are aged, that is, greater than two (2) years old. Soil physiochemical properties required to calculate EILs for Cu, Ni, CrIII and Zn (refer TBD below).
4. ASC NEPM (2013) Table 1B(7) *'Management Limits for TPH fractions F1-F4 in soils';* Soil texture 'fine', residential, parkland and open public space exposure setting.

NE: Not established, mg/kg = milligrams per kilogram.

TBD: **TBD:** To be determined**. Note:** These concentration ranges are Added Contaminant Limits (ACLs) and the Ambient Background Concentrations (ABCs) when determined must be added to determine the EIL.

The standard laboratory analysis for chromium provides a total concentration (that is, the result is unspeciated for chromium (III) and chromium (VI)). As the HIL 'B' assessment criteria for chromium (VI) is 500 mg/kg, it was considered that should the measured concentration of total chromium exceed this, then the sample would be re-analysed and speciated to measure the chromium (VI) concentration.

Statistical Evaluation

Statistical evaluation of soil analytical results may be necessary in the event of exceedences of the adopted assessment criteria. Statistical analysis should adhere to the following criteria:

- No single analytical result is to be greater than 250 % of the site criterion;
- The arithmetic mean of sample analytical results must be below the site criterion;
- The standard deviation must be less than 50 % of the site criterion.

It must also be emphasised that in the NSW EPA (1995) '*Sampling Design Guidelines*' that a site or sampling area cannot be considered to be uncontaminated or successfully remediated if the 95 % Upper Confidence Limit (UCL) of the arithmetic average concentration exceeds the assessment criterion. The 95 % UCL will therefore be considered as a primary tool to establish the efficacy of future remedial works.

Evaluation of Soil Assessment Criteria

Envirolab Pty Ltd (Envirolab) is the proposed primary laboratory, while SGS Services Pty Ltd (SGS) is the proposed secondary laboratory. Both laboratories are NATA endorsed for the proposed analytical suite.

The limits of laboratory reporting (LOR) for the analytical methods used by the primary laboratory were compared with the proposed assessment criteria. This was to ensure that the assessment criteria values exceeded the laboratory LOR. The results of the comparison are presented overleaf in **Tables E and F.**

Table E. Comparison of the Laboratory LOR with the Proposed Soil Assessment Criteria (HILs and HSLs)

Contaminant	HIL B [1] (mg/kg)	HSL B[2](Clay) (mg/kg)	Laboratory LOR (mg/kg)
Asbestos			
ACM	0.04 % w/w	NE	**0.1 g/kg (0.01 % w/w)**
Fibrous Asbestos (FA)	0.001 % w/w	NE	**0.1 g/kg (0.01 % w/w)**
Asbestos Fines (AF)	0.001 % w/w	NE	**0.1 g/kg (0.01 % w/w)**
Hydrocarbons			
Benzene	NE	0.7	0.2
Ethylbenzene	NE	NL	1
Toluene	NE	480	0.5
Xylene (m & p)	NE	NE	2
Xylene (o)	NE	NE	1
Xylene Total	NE	110	3
F1 (TPH C_6 – C_{10} minus BTEX)	NE	50	25
F2 (TPH greater than (>) C_{10} - C_{16} minus naphthalene)	NE	280	50
Polycyclic Aromatic Hydrocarbons (PAHs)			
Carcinogenic PAHs (as B(a)P TEQ)	4	NE	0.05
Napthalene	NE	5	0.1
PAHs (Sum of total)	400	NE	1.55
Phenol	45,000	NE	0.2
Organochlorine Pesticides			
DDT+DDE+DDD	600	NE	0.3
Aldrin and dieldrin	10	NE	0.2
Chlordane	90	NE	0.1
Endosulfan	400	NE	0.1
Endrin	20	NE	0.1
HCB	15	NE	0.1
Heptachlor	10	NE	0.1
Methoxychlor	500	NE	0.1
Mirex	20	NE	0.5
Toxaphene	30	NE	NA
PCBs (Sum of total)	1	NE	0.7
Metals			
Arsenic (total)	500	NE	4
Cadmium	20	NE	0.4
Chromium (VI)	500	NE	1
Copper	30,000	NE	1
Lead	1,200	NE	1
Mercury (inorganic)	120	NE	0.1
Nickel	1200	NE	1
Zinc	60,000	NE	1

Notes:

Bold: LOR is greater than the assessment criteria.

Table F. Comparison of the Laboratory LOR with the Proposed Soil Assessment Criteria (EILs and ESLs)

Contaminant	EIL[1] (mg/kg)	ESL[2] (Fine) (mg/kg)	Laboratory LOR (mg/kg)
Hydrocarbons			
Benzene	NE	65	0.2
Ethylbenzene	NE	125	1
Toluene	NE	105	0.5
Xylene (m & p)	NE	NE	2
Xylene (o)	NE	NE	1
Xylene Total	NE	45	3
F1 (TPH C_6 – C_{10} minus BTEX)	NE	180	25
F2 (TPH greater than (>) C_{10} - C_{16})	NE	120	50
F3 (TPH > C_{16} - C_{34})	NE	1300	100
F4 (TPH > C_{34} - C_{40})	NE	5600	100
Polycyclic Aromatic Hydrocarbons (PAHs)			
Carcinogenic PAHs (as B(a)P)	NE	0.7	0.05
Napthalene	170	NE	0.1
PAHs (Sum of total)	NE	NE	1.55
Phenol	NE	NE	0.2
Organochlorine Pesticides			
DDT	180	NE	0.3
Aldrin and dieldrin	NE	NE	0.2
Chlordane	NE	NE	0.1
Endosulfan	NE	NE	0.1
Endrin	NE	NE	0.1
HCB	NE	NE	0.1
Heptachlor	NE	NE	0.1
Methoxychlor	NE	NE	0.1
Mirex	NE	NE	0.5
Toxaphene	NE	NE	NA
PCBs (Sum of total)	NE	NE	0.7
Metals			
Arsenic (total)	100	NE	4
Cadmium	NE	NE	0.4
Chromium (III)	190 – 400 (TBD)	NE	1
Copper	60 – 800 (TBD)	NE	1
Lead	1,100	NE	1
Mercury (inorganic)	NE	NE	0.1
Nickel	30 – 560 (TBD)	NE	1
Zinc	70 – 1300 (TBD)	NE	1

Notes:
Bold: LOR is greater than the assessment criteria.
TBD: To be determined**. Note:** These concentration ranges are Added Contaminant Limits (ACLs) and the Ambient Background Concentrations (ABCs) when determined must be added to determine the EIL.

With regards to the asbestos criteria and laboratory LORs, it is noted from the Australian Standard AS4964-2004 '*Method for the Qualitative Identification of Asbestos in Bulk Samples*', which is a NATA accredited method for qualitative identification of asbestos in bulk samples, that the limit of reporting (LOR) of asbestos by the laboratory is 0.1 g/kg, which is equivalent to 0.01 % weight per weight (% w/w). That is, the assessment criteria for FA and AF are therefore below the laboratory LOR. Other analytical methods for the detection of asbestos which can achieve the required FA and AF criteria are not NATA accredited methods but should be considered appropriate if required.

In the interim it is noted that the laboratories used do report in their comments section of the analytical report whether asbestos was detected but at concentrations below the LOR. If such a comment is made a precautionary approach will be adopted and the sample will be considered to exceed the assessment criteria. On the other hand, if the result is reported as being below the LOR and no additional comment is provided then the sample result will be considered to be below the assessment criteria.

Based on the review, the laboratory LOR for each analyte is considered suitable for the purpose of this SAQP.

4.5.2 Classification of Soil for Off-Site Beneficial Re-Use

To permit flexibility with regard to the assessment of data collected during the ESA it may be possible to consider Beneficial Re-Use (BRU) of soil on a commercial/industrial site based on the results of the assessment.

Material assessed as unsuitable for on-site use may be suitable for BRU on other properties within the ACT (most likely day cover at the West Belconnen Resource Management Centre (WBRMC) or commercial / industrial properties).

The criteria considered to be applicable for the assessment of the material for BRU on commercial / industrial properties are the NEPM HIL 'D' which includes premises such as shops and offices as well as factories and industrial sites. HSL 'D' and ESL 'Fine' would be applied to assess hydrocarbon impacts when required. The proposed soil criteria for assessment for off-site BRU are summarised below in **Tables G and H**.

Table G: Proposed Assessment Criteria for Off-Site Beneficial Re-Use (HIL and HSL)

Contaminant	HIL D [1] (mg/kg)	HSL D[2](Clay) (mg/kg)	WA Guideline[2] (% w/w)
ACM	NE	NE	0.05
Fibrous Asbestos (FA)	NE	NE	0.001
Asbestos Fines (AF)	NE	NE	0.001
Benzene	NE	4	NA
Ethylbenzene	NE	NE	NA
Toluene	NE	NE	NA

Contaminant	HIL D [1] (mg/kg)	HSL D[2](Clay) (mg/kg)	WA Guideline[2] (% w/w)
Xylene (m & p)	NE	NE	NA
Xylene (o)	NE	NE	NA
Xylene Total	NE	NL	NA
F1 (TPH C_6 – C_{10} minus BTEX)	NE	310	NA
F2 (TPH greater than (>) C_{10} - C_{16} minus naphthalene)	NE	NE	NA
Carcinogenic PAHs (as B(a)P TEQ)	40	NE	NA
Napthalene	NE	NL	NA
PAHs (Sum of total)	4000	NE	NA
Phenol	240000	NE	NA
DDT+DDE+DDD	3600	NE	NA
Aldrin and dieldrin	45	NE	NA
Chlordane	530	NE	NA
Endosulfan	2000	NE	NA
Endrin	100	NE	NA
HCB	80	NE	NA
Heptachlor	50	NE	NA
Methoxychlor	2500	NE	NA
Mirex	100	NE	NA
Toxaphene	150	NE	NA
PCBs (Sum of total)	7	NE	NA
Arsenic (total)	3000	NE	NA
Cadmium	900	NE	NA
Chromium (VI)	3600	NE	NA
Copper	240000	NE	NA
Lead	1500	NE	NA
Mercury (inorganic)	730	NE	NA
Nickel	6000	NE	NA
Zinc	400000	NE	NA

Notes:

1. NEPM (1999, amended 2013) – Table 1A(1) '*Health investigation levels for soil contaminants*' of Schedule B1 '*Guideline on Investigation Levels for Soil and Groundwater*', HIL D commercial/industrial such as shops, offices, factories and industrial sites
2. NEPM (1999, amended 2013) – Table 1A(3) '*Soil HSLs for vapour intrusion*' of Schedule B1 '*Guideline on Investigation Levels for Soil and Groundwater*', HSL D Exposure Setting: Commercial and Industrial. Adopted value is for a clay soil at a depth of 0 m to < 1 m.

NE = Not established; NA = Not Applicable; mg/kg = milligrams per kilogram; TEQ = toxicity equivalent quotient;
PAH = Polycyclic Aromatic Hydrocarbons

Table H: Proposed Assessment Criteria for Off-Site Beneficial Re-Use (EIL and ESL)

Contaminant	EIL[1] (mg/kg)	ESL[2] (Fine) (mg/kg)
Benzene	NE	95
Ethylbenzene	NE	185
Toluene	NE	135
Xylene (m & p)	NE	NE
Xylene (o)	NE	NE
Xylene Total	NE	95
F1 (TPH C_6 – C_{10} minus BTEX)	NE	215
F2 (TPH greater than (>) C_{10} - C_{16})	NE	170
F3 (TPH > C_{16} - C_{34})	NE	2500
F4 (TPH > C_{34} - C_{40})	NE	6600
Carcinogenic PAHs (as B(a)P)	NE	1.4
Napthalene	370	NE
PAHs (Sum of total)	NE	NE
Phenol	NE	NE
DDT	640	NE
Aldrin and dieldrin	NE	NE
Chlordane	NE	NE
Endosulfan	NE	NE
Endrin	NE	NE
HCB	NE	NE
Heptachlor	NE	NE
Methoxychlor	NE	NE
Mirex	NE	NE
Toxaphene	NE	NE
PCBs (Sum of total)	NE	NE
Arsenic (total)	160	NE
Cadmium	NE	NE
Chromium (III)	190 – 400 (TBD)	NE
Copper	60 – 800 (TBD)	NE
Lead	1800	NE
Mercury (inorganic)	NE	NE
Nickel	30 – 560 (TBD)	NE
Zinc	70 – 1300 (TBD)	NE

Notes:

1. NEPM (1999, amended 2013) – Table 1B (5) '*Generic EILs for aged As, Pb, fresh DDT and fresh naphthalene in soil irrespective of their physicochemical properties*'.
2. NEPM (1999, amended 2013) – Table 1B (6) *'ESLs for TPH fractions F1 – F4, BTEX and Benzo(a)Pyrene in soil*' of Schedule B1 *'Guideline on Investigation Levels for Soil and Groundwater*', ESL setting commercial and industrial.
3. NEPM (1999, amended 2013) – ASC NEPM Toolbox, '*Ecological Investigation Levels – Interactive (Excel) Calculation Spreadsheet*'. Assuming the heavy metals are aged, that is, greater than two (2) years old. Soil physiochemical properties required to calculate EILs for CrIII, Cu, Ni, and Zn (refer TBD below).

NE: Not established.
mg/kg = milligrams per kilogram.

NL: Non-limiting.
TBD: To be determined**. Note:** These concentration ranges are Added Contaminant Limits (ACLs) and the Ambient Background Concentrations (ABCs) when determined must be added to determine the EIL.

4.5.3 Classification of Waste Soil for Off-Site Disposal

To permit flexibility with regard to the assessment of data collected during the ESA it may be possible to consider Waste Classification from this in-situ assessment and is therefore discussed in this section.

Soil material that is considered to be unsuitable for off-site BRU at a commercial and industrial site would be disposed at a licensed waste facility in the ACT in accordance with the criteria presented in Environment ACT (2000) '*ACT's Environmental Standards: Assessment & Classification of Liquid & Non-liquid Waste*', a summary of which is provided below in **Table I**. It is also noted that soil potentially impacted with asbestos is to be classified as an '*asbestos contaminated waste*' and would therefore require removal in accordance with ACT EPA Contaminated Sites Information Sheet No. 5 (2011) '*Requirements for the Transport and Disposal of Asbestos Contaminated Wastes*'.

Table I: Soil Waste Assessment Criteria

Contaminant	Waste Classification (Environment ACT Table A3)[1] (mg/kg)		
	Inert	Solid	Industrial
Hydrocarbons (BTEX and TPH)			
Benzene	1	10	40
Ethylbenzene	60	600	2400
Toluene	28	288	1152
Xylene (m & p)	NE	NE	NE
Xylene (o)	NE	NE	NE
Xylene Total	100	1000	4000
TPH (C_6 – C_{10})	650	650	2600
TPH (C_{10} – C_{40})	5000	10000	40000
Polycyclic Aromatic Hydrocarbons (PAHs)			
Naphthalene	NE	NE	NE
Carcinogenic PAHs (as B(a)P TEQ)	0.08	0.8	3.2
PAHs (Sum of total)	200	200	800
Total Phenolics			
Phenol (non-halogenated)	28	288	1152
Organochlorine Pesticides			
DDT	NE	NE	NE

Contaminant	Waste Classification (Environment ACT Table A3)[1] (mg/kg)		
	Inert	Solid	Industrial
Aldrin and dieldrin	NE	NE	NE
Chlordane	NE	NE	NE
Endosulfan	NE	NE	NE
Endrin	NE	NE	NE
HCB	NE	NE	NE
Heptachlor	NE	NE	NE
Methoxychlor	NE	NE	NE
Mirex	NE	NE	NE
Toxaphene	NE	NE	NE
Polychlorinated Biphenyls			
PCBs (Sum of total)	2	<50	<50
Metals			
Arsenic	10	100	400
Cadmium	2	20	80
Chromium (III)	NE	NE	NE
Chromium (VI)	10	100	400
Copper	NE	NE	NE
Lead	10	100	400
Mercury (inorganic)	0.4	4	16
Nickel	4	40	160
Zinc	NE	NE	NE

Notes to Table M:
NE: Not established
[1] CT: Contaminant Threshold values for waste classification without doing the leachate test.

With regards to the above, it is noted that if exceedences of the Solid Waste Classification criteria of Table A3 are recorded, then additional laboratory analysis to determine the leachability of samples (using the Toxicity Characteristic Leaching Procedure (TCLP) may be undertaken, with the results then being compared against criteria sourced from Table A4 of Environment ACT (2000) '*ACT's Environmental Standards: Assessment & Classification of Liquid & Non-liquid Waste*'.

4.5.4 Water Assessment Criteria

In the event water is encountered during the investigation water samples will be taken. To assess the water for site use purposes assessment criteria must be established and are discussed and presented below.

Consideration has been given to the potential uses of water in the surrounding area (the golf course) and to the nearest receiving water body, the Warrina Inlet of Lake Burley Griffin located approximately 600m northwest of the site, in determining the groundwater investigation levels (GIL). The potential contamination risks related to the groundwater are considered in general accordance with the ACT Ambient Environmental Standards presented in the ACT *Environment Protection Regulation 2005*, with consideration also given to the NSW DEC (2007) '*Guidelines for the Assessment and Management of Groundwater Contamination*' for ecological protection.

Figure 1 of the ACTPLA Territory Plan (2009) '*Water Use and Catchment General Code*' indicates that the site is located within the Yarralumla Catchment area designated as 'Urban Area'. Purposes for which water may be used and the prescribed environmental values for this catchment area only include discharge to stormwater which is the most applicable for the site. However, as Warrina Inlet of Lake Burley Griffin is the nearest receiving water body, its catchment designation has also been considered when setting the assessment criteria.

Warrina Inlet is near Yarramundi Reach at the west end of the lake which is designated as a Conservation Catchment within Molonglo. Therefore, the following values must be considered which include recreational use (REC/2), waterscape (VIEW), aquatic habitat – mountain streams (AQUA/1), and discharge (diverted stormwater).

However, with consideration given to the location of the site, the likelihood of discharge from the site entering Warrina Inlet is considered to be low and more likely to impact the down gradient public land and the adjacent golf course. Therefore, Robson considers AQUA/4(urban streams and stormwater) is the more appropriate the setting and has adopted these criteria as set out in the ACT *Environment Protection Regulation 2005*.

The Australian and New Zealand Environment and Conservation Council (ANZECC, 2000) '*Australian and New Zealand Guidelines for Fresh and Marine Water Quality*' state that for physical and chemical stressor triggers, where a state or territory has established regional guideline trigger values, such as the VIEW and AQUA/4 criteria, those values should be used in preference to the default values provided in the ANZECC (2000) Guidelines. Based on the above it is proposed that the GILs to be adopted will be the lower of the following:

- VIEW and AQUA/4 (urban streams and stormwater) sourced from the ACT *Environment Protection Regulation 2005*;
- Assessment criteria for the protection of 95 % of species in freshwater aquatic ecosystems sourced from the ANZECC (2000) Guidelines.

It is noted that the ACTPLA Territory Plan (2009) '*Water Use and Catchment General Code*' does not include domestic water supply as a purpose for which water may be used in urban and conservation catchments. As such, GILs for the protection of human health have not been considered in this assessment.

A summary of the adopted GILs for the assessment of risk to ecological values are presented below in **Table J**.

Table J: Groundwater Investigation Levels

Contaminant	ANZECC (2000)[1] (µg/L)	ACT AQUA/4[2] (µg/L)	Adopted GIL (µg/L)
Asbestos[4]	NE	NE	NE
Organics			
TPH C_6-C_9	NE	NE	NE
TPH C_{10}-C_{40}	NE	NE	NE
Benzene	950	300	300
Toluene	ID	300	300
Ethylbenzene	ID	140	140
m-xylene	ID	NE	NE
o-xylene	350	NE	350
p-xylene	200	NE	200
Xylene	NE	NE	NE
Naphthalene	16	NE	16
Polychlorinated Biphenyls (PCB)			
Arochlor 1242	0.3	NE	0.3
Arochlor 1254	0.01	NE	0.01
Total PCB	NE	1	1
Organochlorine Pesticides (OCP)			
Aldrin	NI	0.01	0.01
Chlordane	0.03	NI	0.03
DDE	NE	0.14	0.14
DDT	0.006	0.001	0.001
Dieldrin	NI	0.002	0.002

Contaminant	ANZECC (2000)[1] (µg/L)	ACT AQUA/4[2] (µg/L)	Adopted GIL (µg/L)
Endosulfan	0.03	0.1	0.1
Endrin	0.01	0.0023	0.0023
Heptachlor	0.01	0.003	0.003
Lindane	0.2	0.003	0.003
Methoxychlor	NE	0.04	0.04
Mirex	NE	0.001	0.001
Metals			
Arsenic	NI	50	50
Cadmium	0.2	0.2	0.2
Chromium	1	2	2
Copper	1.4	2	2
Lead	3.4	1	1
Mercury	0.6	0.1	0.1
Nickel	11	25	25
Zinc	8	5	5
Polycyclic Aromatic Hydrocarbons (PAH)			
Total PAH	NE	3	3
Nutrients			
Ammonia	900	2,200[3]	2,200
Nitrite	NE	60	60
Phosphorous (total)	100	≤100[2]	≤100[2]
Physio-chemical parametres			
Acidity	8	6.5-9.0[2]	6.5-9.0[2]

Notes:

1. ANZECC (2000) '*Australian and New Zealand Guidelines for Fresh and Marine Water Quality*'. Trigger values for freshwater aquatic ecosystems, 95 % level of protection (% species)/Freshwater lakes and reservoirs (Physical and chemical stressors).
2. ACT *Environment Protection Regulation 2005* – AQUA/4 Urban Streams and Stormwater
3. The most sensitive value as calculated from the parameters of the current assessment.
4. Asbestos in water is not considered to be harmful to natural ecosystems therefore a guideline has not been established. Further, as the water on site is not used as a potable source the '*2004 Australian Drinking Water Guidelines*' (ADWG 2004) have not been considered. However, it should be noted that a guideline for asbestos in drinking water has not been established and the National Health and Medical Research Council (NHMRC) support this with a fact sheet that states "There is insufficient data to set a guideline value", "as the weight of evidence indicates that ingested asbestos is not hazardous to health". Also the World Health Organization (WHO) has concluded that establishing a guideline for asbestos in drinking-water is unnecessary, given the absence of evidence that the ingested asbestos is hazardous to health.

µg/L – Micrograms per litre
NE – Not established
ID – Insufficient data to derive a reliable trigger value.

Evaluation of Water Assessment Criteria

Envirolab Pty Ltd (Envirolab) is the proposed primary laboratory, while SGS Services Pty Ltd (SGS) is the proposed secondary laboratory. Both laboratories are NATA endorsed for the proposed analytical suite.

The limits of laboratory reporting (LOR) for the analytical methods used by the primary laboratory were compared with the proposed assessment criteria. This was to ensure that the assessment criteria values exceeded the laboratory LOR. The results of the comparison are presented below in **Table K.**

Table K: Comparison of Laboratory LOR with the Adopted GILs

Contaminant	Adopted GIL (µg/L)	Laboratory LOR[1] (µg/L)
Organics		
TPH C_6-C_9	NE	10
TPH C_{10}-C_{40}	NE	NA
Benzene	300	1
Toluene	300	1
Ethylbenzene	140	1
m-Xylene	NE	NA
o-Xylene	350	1
p-Xylene	200	NA

Contaminant	Adopted GIL (µg/L)	Laboratory LOR[1] (µg/L)
m&p-Xylene	NE	2
Xylene	NE	3[2]
Naphthalene	16	1
Polychlorinated Biphenyls		
Arochlor 1242	0.3	0.1
Arochlor 1254	0.01	**0.1**
Total PCB	1	0.1
Organochlorine Pesticides (OCP)		
Aldrin	0.01	0.01
Chlordane	0.03	0.01
DDE	0.14	0.01
DDT	0.001	**0.006**
Dieldrin	0.002	**0.01**
Endosulfan	0.1	0.01
Endrin	0.0023	**0.01**
Heptachlor	0.003	**0.01**
Lindane	0.003	NA
Methoxychlor	0.04	0.02
Mirex	0.001	NA
Metals		
Arsenic	50	1
Cadmium	0.2	0.1
Chromium	2	1
Copper	2	1

Contaminant	Adopted GIL (µg/L)	Laboratory LOR[1] (µg/L)
Lead	1	1
Mercury	0.1	0.05
Nickel	25	1
Zinc	5	1
Polycyclic Aromatic Hydrocarbons (PAH)		
Total PAH	3	2

Notes:

1. Only the LORs of the primary laboratory are considered.
2. Combined LORs of m&p–xylene and o–xylene.

BOLD – LOR exceeds the adopted GIL.
µg/L – Micrograms per litre
NA – Not analysed
NE – Not established

Based on the review the laboratory LOR a number of analytes, primarily in the PCB and OCP groups, exceed the adopted GILs. Considering, the site setting is not likely to discharge waters directly into adjacent receiving waters any analyte concentrations below the LOR is unlikely to have a significant impact on the environment. Therefore analysis to the standard LOR is considered appropriate for the purposes of this assessment.

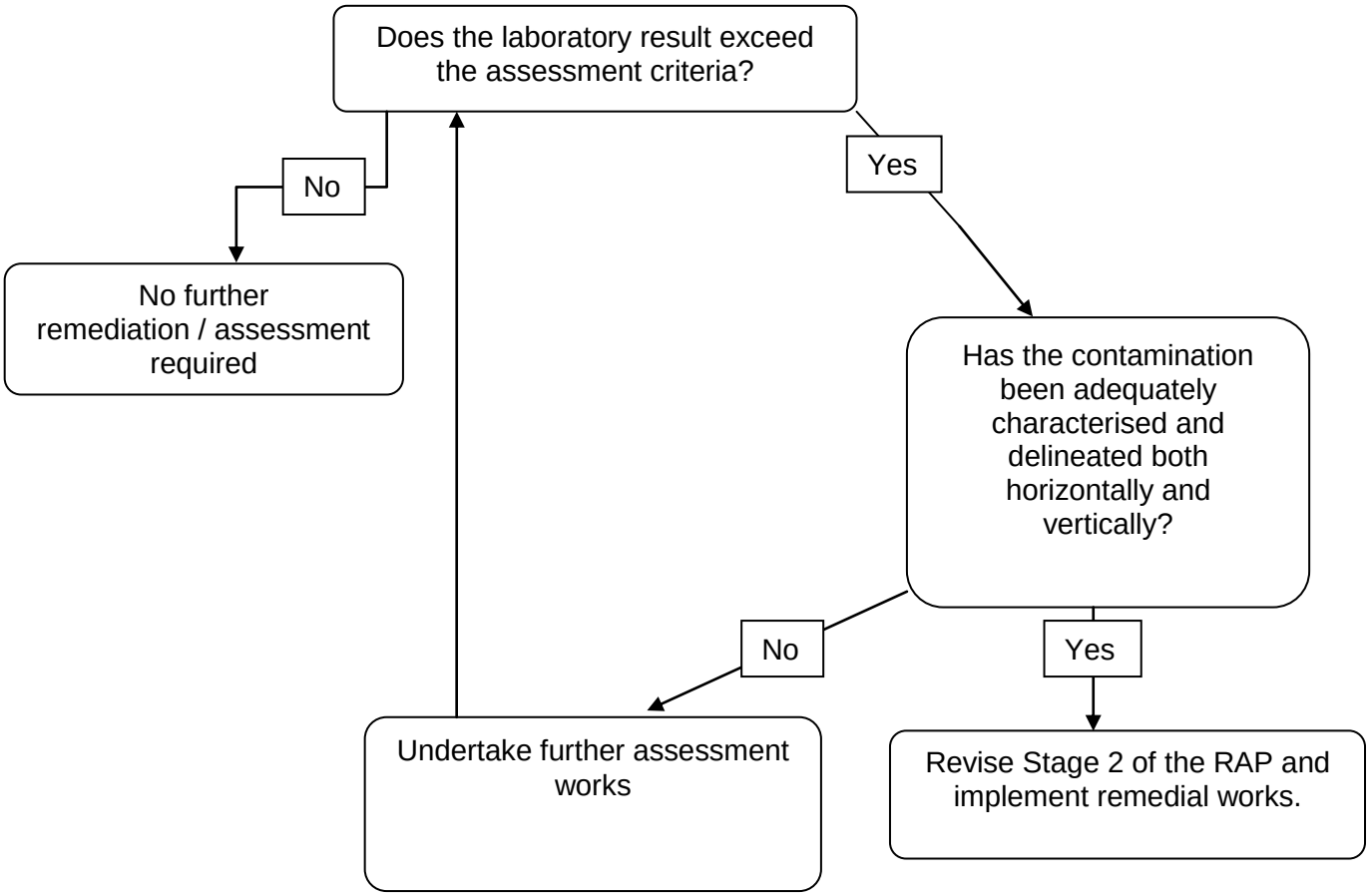
With regards to the laboratory not providing individual analytical results for either m-Xylene or p-Xylene, it was considered that the analysis which would be undertaken (m & p- Xylene) would be adequate as the LOR for this analysis is well below the criteria for either m-Xylene and p-Xylene.

4.5.5 Airborne Fibre Monitoring Criteria

The control level for airborne fibre concentrations recorded during air monitoring will be 0.01 fibres/mL, as required by National Occupational Health and Safety Commission (NOHSC): 2002 (2005) '*Safe Removal of Asbestos, 2nd Edition*'. It is further noted that 0.01 fibres/mL represents a concentration that is 1/10th of the WorkSafe Australia's recommended Exposure Standard for all forms of asbestos of 0.1 fibres/mL, as documented in the guideline NOHSC:1003 (1995, amended 2003) '*Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment*'.

4.6 Develop a Decision Rule

Should analytical results of soil samples indicate contaminant concentrations at levels which exceed the adopted assessment criteria, then the significance of the exceedences and appropriate course of actions would be assessed in liaison with the Site Auditor and then discussed within the ESA report. The decision rule for the comparison of laboratory results with the assessment criteria is presented in the following flow chart.



4.7 Specify Tolerable Limits on Decision Errors

Two (2) primary decision errors may occur which would affect the outcome of the assessment of the suitability of the site for the proposed land use. The errors and their associated consequences are presented in **Table L** below.

Table L: Identified Decision Errors and Associated Consequences for the Site

Error	Consequences
The site is assessed as suitable for the proposed residential use (HIL 'B') when it is actually unsuitable.	Contamination remains on site that may pose a risk to human health and / or the environment.
The site is assessed as unsuitable for the proposed residential use when the site is actually suitable.	Financial consequences associated with unnecessary assessment and / or remedial works.

The consequence of assessing the site as suitable when it is in fact unsuitable is considered to be more significant than the consequence of assessing the site as unsuitable.

Similar, there are also two (2) primary decision errors which may occur which would affect the outcome of the assessment of the suitability of the material proposed to be bulk excavated and beneficially re-used and / or disposed of off-site. The errors and their associated consequences are presented in **Table M** below.

Table M: Identified Decision Errors and Associated Consequences for Off-Site Beneficial Re-Use and / or Waste Disposal

Error	Consequences
The material in the dump is assessed as being suitable for BRU and / or disposal when it is actually unsuitable.	Contamination is transported to the recipient site and may pose a risk to human health and / or the environment.
The material to be bulk excavated (or part thereof) is assessed as being unsuitable for BRU and / or disposal when it is actually suitable.	Financial consequences associated with unnecessary remediation and associated management.

Factors that may contribute to the above decision errors include:

- Sampling design errors – may be attributed to too few sample locations, high variability of the contaminant dispersion or volatile loss due to the disturbed nature of the sample;
- Measurement errors – may be attributed to poor sampling methods, sample collection techniques, poor sample handling, poor sample preparation or analytical errors;
- Interpretive error – data is interpreted incorrectly.

The strategy to minimise the risk of a decision error from occurring is presented below in **Table N**.

Table N: Strategy for Minimising the Risk of a Decision Error from Occurring.

Factor Contributing to Error	Type of Error	Actions to Minimise Risk of Occurring
Sample Design Error	Insufficient Sampling	Validation sampling to be conducted in general accordance with the WA Guidelines and NSW EPA (1995) '*Sampling Design Guidelines*'.
	Contaminant Variability	Appropriate number of duplicate / triplicate samples to be collected in accordance with AS4482.1-2005.
Measurement Errors	Inappropriate Sample Methods	Selection of appropriate sample method to allow sampling of the required locations.
	Sample Collection Techniques	Sampling to be completed in accordance with Robson Standard Operating Procedures (SOP) '*Soil Sampling and Logging*' (EAR-SOP003).
	Volatile Loss	Soil samples will be immediately placed into clean laboratory supplied glass jars, sealed with teflon-lined lids and stored in an ice cooled container.
	Poor Sample Handling	Samples to be stored and transported in ice cooled eskies under Chain of Custody (COC) conditions.
	Poor sample preparation and analytical error	Field quality assurance / quality control (QA / QC) duplicates, triplicates, rinsates, trip blanks and trip spikes to be collected in accordance with AS4482.1-2005 to assess reproducibility of sample results, decontamination procedures and potential volatile loss during transport. Laboratory QA / QC to be reviewed to assess laboratory quality.
Misidentification of ACM	Incorrect identification of contaminant	A licensed ACT Class 'A' Asbestos Assessor will be responsible for providing clearance of the site to ensure that there is no visible ACM at the surface of the remedial excavations prior to the reinstatement of clean soil.

Factor Contributing to Error	Type of Error	Actions to Minimise Risk of Occurring
	Removal of uncontaminated material	A licensed ACT Class 'A' Asbestos Assessor will be present on site to assess that the material known to contain ACM is removed from the site.
Interpretive Error	Incorrect interpretation leading to error	All reports and correspondence to be peer reviewed within Robson and final report to be reviewed by third party NSW EPA accredited Site Auditor.

Duplicate samples will be used to assess the reproducibility of the sampling and analytical methods used. Calculation of the Relative Percentage Difference (RPD) is a method of normalising two (2) values, and allows a comparison between values and represents the difference between the primary and QC sample, divided by the average of the two results expressed as a percentage.

The RPD is calculated with the formula provided below.

$$RPD = \frac{\text{Result No. 1} - \text{Result No.2}}{\text{Mean Result}} \times 100$$

Calculated RPD results would be considered acceptable when the value is less than 50 %. Should the RPD value exceed 50 %, then further investigation to the cause of the difference between the primary and QC results would be undertaken.

The tolerances for the evaluation of the internal laboratory quality control samples are based on the laboratory's acceptance criteria. The tolerances for the laboratory quality control samples are summarised below in **Table O**.

Table O: Limits for the Assessment of Internal Laboratory Quality Control Samples.

Sample Type	Acceptable Limits
Surrogate Spikes	60% - 140%
Duplicate Sample	0% - 50% (if result is 5 times greater than the LOR)
Duplicate Sample	Any RPD is acceptable (if result is 5 times less than the LOR)
Matrix Spikes	70% - 130% (metals)
Method Blanks	Less than the LOR

Should the results of the internal laboratory QA / QC exceed the acceptable limits, then investigation of the laboratory methods would be undertaken to assess

whether the reliability of laboratory results is compromised and how the laboratory results may affect the decision making process outcomes of the assessment.

4.8 Optimise the Design for Obtaining Data

This assessment relates to the characterisation of the 'AD'. The following sections outline the proposed assessment and sampling strategy for the collection of information to assess the effectiveness of ESA.

4.9 Data Quality Indicators

Data quality indicators (DQI's) will be used to assess the performance in achieving the DQO's, and to assess whether the data obtained is reliable and useful for the assessment purposes. In summary, DQI's include the following:

- Accuracy – Accuracy is a quantitative measure of the closeness of a reported result against the true value;
- Precision – Precision is a quantitative measure of the reproducibility of a result;
- Representativeness – Representativeness is an expression of the confidence (expressed qualitatively) that data are representative of each media present on the site.
- Completeness – Completeness is a measure of the useable data from a sampling event;
- Comparability – Comparability is the confidence (expressed qualitatively) that data can be considered equivalent for each sampling and analytical event;

A summary of the proposed methods to be employed to ensure that the DQO's are met include the following:

<u>Data Accuracy and Precision</u>

- A suitably qualified and experienced Robson environmental scientist will undertake sampling and screening activities in accordance with Robson's SOPs. Where applicable, a licensed ACT Class 'A' asbestos assessor from Robson would also be utilised;
- The scientist / asbestos assessor will employ appropriate sampling methods to minimise the opportunities for cross-contamination to occur between samples;
- Laboratory analysis would be undertaken only at analytical laboratories NATA accredited for the analysis to be undertaken;
- The scientist / asbestos assessor will implement the field based QA/QC program through the collection of field based blind duplicates, by carrying field blanks with the daily samples and forwarding trip spikes with the samples to the lab.
- The analytical laboratory will employ their own internal quality control program which will include at least laboratory control samples, blanks, duplicates,

matrix spikes and surrogate spikes. The allowable tolerance for internal laboratory QA is provided in **Section 4.7**.

Data Comparability

- The Robson environmental scientist / asbestos assessor will be suitably qualified and experienced and employ appropriate sampling methods in accordance with the SOPs;
- The Robson environmental scientist/ asbestos assessor will record field conditions at the time of sampling and will ensure samples are taken in the same way specific to the media being sampled;
- Appropriate sample storage and transportation methods will be employed, including transportation under COC conditions;
- Laboratory analysis would be undertaken only at analytical laboratories NATA accredited for the analysis to be undertaken;
- Where possible, consistent analytical methods would be employed for laboratory analysis.

Data Completeness and Representativeness

- Implementation of appropriate sampling design, with appropriate sampling density and sampling depths;
- The media sampled and the analytes selected for analysis is in accordance with the SAQP;
- Preparation of field notes including daily sites activities register, logs, sample plans, COC sheets, field equipment calibration registers, PID screening register, field QA / QC sample register, photographic log register, site sketches and notes, sample registers, and soil tracking records;
- Confirmation that laboratories have received samples in good order (sample receipt acknowledgement);
- Ensuring that laboratory certificates received are signed by authorised signatories and bear the NATA stamp;
- Confirmation that the laboratories have analysed as per the COC request.

Appendix B

PID Calibration Records and Certificates

Field Calibration Register

Issued Date 5/11/13
Doc No: EAR-F005
Printed: 23/07/2014 2:25 PM

Electronic version current
Uncontrolled copy valid only at time of printing

Project Number and Name: 9623 - Soil Assessment
Client: Capezio and Co
Location: Yarralumla Brickworks
Project Manager: BK
Field Personnel: AR
Date: 4/12/14
Work Description (ESA, TEA, GME): Test pitting

Photoionisation Detector (PID)

Equipment Serial/ID Number:
Equipment Description: mini RAE2000

Calibration and Service Details

Frequency required by manufacturer: Six monthly
Date last calibration (by qualified technician):
Calibrated by (personnel and company name):
Calibration (Fresh Air): 0ppm
Calibration (Span Gas - Isobutylene): 100ppm

Field Challenge Details

Date	Time	Zero-Fresh Air	Span-Isobutylene
4/12/14	10:10 am	0ppm	100ppm
9/12/14	8 Am	0ppm	100ppm
10/12/14	7:30 AM	0ppm	100ppm

Date	Time	Zero-Fresh Air	Span-Isobutylene
11/12/14	8 Am	0	100ppm

Water Quality Meter (WQM)

Equipment Serial/ID Number:
Equipment Description:

Calibration and Service Details

Frequency required by manufacturer:
Date last calibration (by qualified technician):
Calibrated by (personnel and company name):
Calibration standard / Comments:

Field Challenge Details

Date	Time	pH	EC (ms/cm)(µScm)	DO (%) (ppm)	Redox - ORP (mV)

Interface Probe (IP)

Equipment Serial/ID Number:
Equipment Description:

Maintenance Details

Frequency required by manufacturer:
Date last maintained (by qualified technician):
Maintained by (personnel and company name):
Comments:

Field Maintenance Details

Date	Time	Cleaning Method

Gas Monitor (CO_2, H_2S, LEL, O_2)

Equipment Serial/ID Number:
Equipment Description:

Calibration and Service Details

Frequency required by manufacturer:
Date last calibration (by qualified technician):
Calibrated by (personnel and company name):
Calibration standard / Comments:

Field Challenge Details

Date	Time	CO	H_2S	LEL	O_2

Appendix C

Asbestos Waste Disposal Dockets

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151
MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET

Docket: MWI283712\1
Date: 9/12/2014 8:27 AM
Printed: 9/12/2014 8:27 AM
Operator: ISS3

Customer: AAC ENVIRONMENTAL PTY LT
Customer ABN: 83108729737
Address: 10 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
Vehicle: YIK11K
Carrier:
Order No:

S3-ASBESTOS Product Charges
15.96t @ $151.70/t $2421.13

Subtotal $2421.13
Rounding $0.00
Total including GST $2421.13
GST $220.10

Gross 27.40t
Tare 11.44t

Net 15.96t

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET

Docket: MWI283614\1
Date: 8/12/2014 3:09 PM
Printed: 8/12/2014 3:09 PM
Operator: ISS7

Customer: AAC ENVIRONMENTAL PTY LT
Customer ABN: 83108729737
Address: 10 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
Vehicle: YIK11K
Carrier:
Order No:

S3-ASBESTOS Product Charges
18.98t @ $151.70/t $2879.27

Subtotal $2879.27
Rounding $0.00
Total including GST $2879.27
GST $261.75

Gross 30.32t
Tare 11.34t

Net 18.98t

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET

Docket: MWI283756\1
Date: 9/12/2014 11:02 AM
Printed: 9/12/2014 11:02 AM
Operator: ISS3

Customer: AAC ENVIRONMENTAL PTY LT
Customer ABN: 83108729737
Address: 10 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
Vehicle: YIK11K
Carrier:
Order No:

S3-ASBESTOS Product Charges
14.06t @ $151.70/t $2132.90

Subtotal $2132.90
Rounding $0.00
Total including GST $2132.90
GST $193.90

Gross 25.48t
Tare 11.42t

Net 14.06t

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET

Docket: MWI283767\1
Date: 9/12/2014 11:26 AM
Printed: 9/12/2014 11:26 AM
Operator: IS83

Customer: AAC ENVIRONMENTAL PTY LT
Customer ABN: 83108729737
Address: 10 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
Vehicle: YHY70F
Carrier:
Order No:

S3-ASBESTOS Product Charges	
18.68t @ $151.70/t	$2864.10
Subtotal	$2864.10
Rounding	$0.00
Total including GST	$2864.10
GST	$260.37

Gross	30.40t
Tare	11.52t
Net	18.68t

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET

Docket: MWI283737\1
Date: 9/12/2014 10:08 AM
Printed: 9/12/2014 10:09 AM
Operator: IS83

Customer: AAC ENVIRONMENTAL PTY LT
Customer ABN: 83108729737
Address: 10 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
Vehicle: YHY70F
Carrier:
Order No:

S3-ASBESTOS Product Charges	
16.52t @ $151.70/t	$2506.08
Subtotal	$2506.08
Rounding	$0.00
Total including GST	$2506.08
GST	$227.83

Gross	28.06t
Tare	11.54t
Net	16.52t

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET

Docket: MWI283715\1
Date: 9/12/2014 8:37 AM
Printed: 9/12/2014 8:37 AM
Operator: IS83

Customer: AAC ENVIRONMENTAL PTY LT
Customer ABN: 83108729737
Address: 10 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
Vehicle: YHY70F
Carrier:
Order No:

S3-ASBESTOS Product Charges	
15.74t @ $151.70/t	$2387.76
Subtotal	$2387.76
Rounding	$0.00
Total including GST	$2387.76
GST	$217.07

Gross	27.30t
Tare	11.56t
Net	15.74t

Mugga Lane
ACT NOW/STE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET

Docket: MW283609\1
Date: 8/12/2014 3:05 PM
Printed: 8/12/2014 3:06 PM
Operator: ISS7

Customer: AAC ENVIRONMENTAL PTY LT
Customer ABN: 33108729737
Address: 40 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
Vehicle: YHY70F
Carrier:
Order No:

53-ASBESTOS Product Charges	
19.66t @ $151.70/t	$2982.42
Subtotal	$2982.42
Rounding	$0.00
Total including GST	$2982.42
GST	$271.13

Gross	31.14t
Tare	11.48t
Net	19.66t

Irwin&Hartshorn pty ltd
abn 69 074 330 082
12 alderson place
hume act 2620
phone 02 6260 1588
fax 02 6260 1236

demolitionexcavationplanthirebulkhaulage
generalhaulageheavyhaulagetilttrayhireoverdimensiontransport

Customer: AAC (Brad Archer)

Date: 8/12/14
Driver: STORK
Rego No. YHY70F

Job Description:

	$	¢
Asbestos 1283573	17.6	
MW 02816 M\1	13.22	
MW 02853 M\1	17.98	
* MWI 283609	14.66	

From: Yarralumla Brick Works

To: Mugga Asbestos P.t

Start Time: 0730 AM / PM (INC. TRAVEL)

Finish Time: 1530 AM / PM (INC. TRAVEL)

Total: .....

Docket No. 36463

IH/MP 004 10-07

Total

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN [illegible]

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET

Docket: MWI283558\1
[illegible]
Printed: 9/12/2014 9:48 AM
[illegible]

[illegible]
Customer ABN: [illegible]
Address: 10 A RAILWAY STREET
[illegible]: OAKS ESTATE
[illegible]
Vehicle: YIK13Y
[illegible]
[illegible]

[illegible] Product Charges
[illegible] $2336.18
[illegible] $0.00
Rounding $0.00
Total including GST $2336.18
[illegible] $212.38

Gross 26.80t
Tare 11.40t
Net 15.40t

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN [illegible]

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET Manual

Docket: MWD2778M\1
[illegible]: 9/12/2014 10:46 AM
[illegible]: 9/12/2014 10:41 AM
Operator: ISST

Customer: AAC ENVIRONMENTAL P/L
[illegible] ABN: [illegible]
Address: 10 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
[illegible]
[illegible]

[illegible] Product Charges
[illegible] $2669.92
[illegible] $2669.92
[illegible] $0.00
Total including GST $2669.92
[illegible] $242.72

Gross 29.10t
Tare 11.50t
Net 17.60t

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN [illegible]

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET

[illegible]

[illegible] MW02790M\1

[illegible]

[illegible]

[illegible]

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN [illegible]

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET
Manual

Docket: MW0283OM\1
Date: [illegible]
Printed: [illegible]
Operator: [illegible]

Customer: ARC ENVIRONMENTAL PTY LT
Customer ABN: [illegible]
Address: 10 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
Vehicle: [illegible]
Carrier:
Order No:

[illegible]	[illegible]	[illegible]
Subtotal		[illegible]
[illegible]		[illegible]
Total including GST		$2069.19
[illegible]		[illegible]

Gross 25.02t
Tare 11.38t

Net 13.64t

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN [illegible]

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET
Manual

Docket: MW0285OM\1
Date: [illegible]
Printed: 8/12/2014 [illegible]
Operator: [illegible]

Customer: ARC ENVIRONMENTAL PTY LT
Customer ABN: [illegible]
Address: 10 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
Vehicle: [illegible]
Carrier:
Order No:

[illegible]	[illegible]	[illegible]
17.98t @ $151.70/t		$2727.57
[illegible]		[illegible]
Total including GST		$2727.57
[illegible]		[illegible]

Gross 29.46t
Tare 11.48t

Net 17.98t

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN

MUGGA LANE
SYMONSTON ACT 260[illegible]

DELIVERY DOCKET

Docket: MW02859M\1

Operator:

Customer:
Address:
Suburb: OAKS ESTATE

Vehicle:

Order No:

Charges

18.72t @ $151.70/t $2839.82

$2839.82
Rounding
Total including GST $2839.82

Gross 30.04t
Tare 11.32t

Net 18.72t

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET

Docket: MWI282680\1
Date: 2/12/2014 9:49 AM
Printed: 2/12/2014 9:49 AM
Operator: ISS7

Customer: AAC ENVIRONMENTAL PTY LT
Customer ABN: 83108729737
Address: 10 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
Vehicle: YHY70F
Carrier:
Order No:

S3-ASBESTOS	Product Charges	
15.84t @ $151.70/t		$2402.93
Subtotal		$2402.93
Rounding		$0.00
Total including GST		$2402.93
GST		$218.45

Gross	27.36t
Tare	11.52t
Net	15.84t

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET

Docket: MWI282709\1
Date: 2/12/2014 11:10 AM
Printed: 2/12/2014 11:10 AM
Operator: ISS7

Customer: AAC ENVIRONMENTAL PTY LT
Customer ABN: 83108729737
Address: 10 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
Vehicle: YHY70F
Carrier:
Order No:

S3-ASBESTOS	Product Charges	
16.90t @ $151.70/t		$2563.73
Subtotal		$2563.73
Rounding		$0.00
Total including GST		$2563.73
GST		$233.07

Gross	28.40t
Tare	11.50t
Net	16.90t

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

DELIVERY DOCKET

Docket: MWI282758\1
Date: 2/12/2014 12:34 PM
Printed: 2/12/2014 12:34 PM
Operator: ISS7

Customer: AAC ENVIRONMENTAL PTY LT
Customer ABN: 83108729737
Address: 10 A RAILWAY STREET
Suburb: OAKS ESTATE
Destination:
Vehicle: YHY70F
Carrier:
Order No:

S3-ASBESTOS	Product Charges	
14.34t @ $151.70/t		$2175.38
Subtotal		$2175.38
Rounding		$0.00
Total including GST		$2175.38
GST		$197.76

Gross	25.84t
Tare	11.50t
Net	14.34t

[illegible]

[illegible]

[illegible]

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

TAX INVOICE

Docket: MWI282486\1
Date: 1/12/2014 11:43 AM
Printed: 1/12/2014 11:44 AM
Operator: ISS1

Customer: Cash Customers
Vehicle: YKD603

S3-ASBESTOS Product Charges	
4.32t @ $151.70/t	$655.34
Subtotal	$655.34
Rounding	$0.00
Total including GST	**$655.34**
GST	$59.58

Gross	9.00t
Tare	4.68t
Net	4.32t

Payment/Refund $655.34
Paid By Credit Card
Ref No 266288031198

Detail 1:
Detail 2:
Detail 3:

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

TAX INVOICE

Docket: MWI282447\1
Date: 1/12/2014 9:33 AM
Printed: 1/12/2014 9:34 AM
Operator: ISS1

Customer: Cash Customers
Vehicle: YKD603

S3-ASBESTOS Product Charges	
4.98t @ $151.70/t	$755.47
Subtotal	$755.47
Rounding	$0.00
Total including GST	**$755.47**
GST	$68.68

Gross	9.66t
Tare	4.68t
Net	4.98t

Payment/Refund $755.47
Paid By Credit Card
Ref No 266288031107

Detail 1:
Detail 2:
Detail 3:

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

TAX INVOICE

Docket: MWI282194\1
Date: 28/11/2014 2:02 PM
Printed: 28/11/2014 2:03 PM
Operator: ISSC

Customer: Cash Customers
Vehicle: YK0603

53-ASBESTOS Product Charges
5.74t @ $151.70/t $870.76

Subtotal $870.76
Rounding $0.00
Total including GST $870.76
GST $77.16

Gross 10.40t
Tare 4.66t
Net 5.74t

Payment/Refund $870.76
Paid By Credit Card
Ref No 266286029973

Detail 1:
Detail 2:
Detail 3:

Mugga Lane
ACT NOWASTE MUGGA LANE
ABN 52 427 642 151

MUGGA LANE
SYMONSTON ACT 2609

TAX INVOICE

Docket: MWI282158\1
Date: 28/11/2014 12:27 PM
Printed: 28/11/2014 12:28 PM
Operator: ISSC

Customer: Cash Customers
Vehicle: YK0603

53-ASBESTOS Product Charges
4.48t @ $151.70/t $679.62

Subtotal $679.62
Rounding $0.00
Total including GST $679.62
GST $61.78

Gross 9.22t
Tare 4.74t
Net 4.48t

Payment/Refund $679.62
Paid By Credit Card
Ref No 266286029961

Detail 1:
Detail 2:
Detail 3:

ACT Government
Territory and Municipal Services

Pd $6400. 13/1/15
$5000. 2/1/15
$5000. 2/1/15
$10000. 15/1/15
$10,000. 16/1/15 JPX8LC
$5,000 16/1/15 FHGRCV
5605.27 16/1/15

Tax Invoice

ABN: 52 427 642 151

Invoice To	Details
AAC ENVIRONMENTAL PTY LTD (LANDFILL & RECYCLING) 17 Capital Terrace QUEANBEYAN NSW 2620	**Customer Number:** 144758 **Invoice Number:** NWT014051 **Invoice Date:** 18-DEC-2014 **Payment Terms:** 30 DAYS NET **Due Date:** 17-JAN-2015 **Amount Payable:** **$47,005.77**

Line	Description	Qty	Unit	Unit Price	Total exc GST	GST	Total inc GST
001	2/12/2014 MWI282663\\1 YKO603 S3-ASBESTOS 5.18t	1		$785.81	$714.37	$71.44	785.81
002	2/12/2014 MWI282680\\1 YHY70F S3-ASBESTOS 15.84t	1		$2,402.93	$2,184.48	$218.45	2,402.93
003	2/12/2014 MWI282709\\1 YHY70F S3-ASBESTOS 16.9t	1		$2,563.73	$2,330.66	$233.07	2,563.73
004	2/12/2014 MWI282728\\1 YKO603 S3-ASBESTOS 5.52t	1		$837.38	$761.25	$76.13	837.38
005	2/12/2014 MWI282758\\1 YHY70F S3-ASBESTOS 14.34t	1		$2,175.38	$1,977.62	$197.76	2,175.38
	total 57.78t						
006	3/12/2014 MWI282903\\1 YKO603 S3-ASBESTOS 1t	1		$151.70	$137.91	$13.79	151.70
007	8/12/2014 MWI283558\\1 YIK11K S3-ASBESTOS 15.4t	1		$2,336.18	$2,123.80	$212.38	2,336.18
008	8/12/2014 MWI283609\\1 YHY70F S3-ASBESTOS 19.66t	1		$2,982.42	$2,711.29	$271.13	2,982.42
009	8/12/2014 MWI283614\\1 YIK11K S3-ASBESTOS 18.98t	1		$2,879.27	$2,617.52	$261.75	2,879.27
010	8/12/2014 MWO2778M\\1 YHY70F S3-ASBESTOS 17.6t	1		$2,669.92	$2,427.20	$242.72	2,669.92
011	8/12/2014 MWO2790M\\1 YIK11K S3-ASBESTOS 18.54t	1		$2,812.52	$2,556.84	$255.68	2,812.52
				Invoice Totals:	$42,732.50	$4,273.27	$47,005.77

ACT NOWASTE AR

Payment enquiries should be directed to: NOWaste Accounts Receivable 132281

EFT payments can be made to:

BSB Number: 037-843

Account Number: 540144758

Reference: NWT014051

Account Name: ACT Government Account

Please return this section with your payment to:

Shared Services Accounts Receivable
GPO BOX 158
CANBERRA CITY ACT 2601

Fax: (02) 620 53202
Email: SharedServicesAccountsReceivable@act.gov.au

Customer Number: 144758
Invoice Number: NWT014051
Invoice Date: 18-DEC-2014
Due Date: 17-JAN-2015
Amount Payable: **$47,005.77**
No receipt mailed unless requested

ACT Government

Territory and Municipal Services

Tax Invoice

ABN: 52 427 642 151

Invoice To	Details
AAC ENVIRONMENTAL PTY LTD (LANDFILL & RECYCLING) 17 Capital Terrace QUEANBEYAN NSW 2620	**Customer Number:** 144758 **Invoice Number:** NWT014051 **Invoice Date:** 18-DEC-2014 **Payment Terms:** 30 DAYS NET **Due Date:** 17-JAN-2015 **Amount Payable:** **$47,005.77**

Line	Description	Qty	Unit	Unit Price	Total exc GST	GST	Total inc GST
012	8/12/2014 MWO2816M\\1 YHY70F S3-ASBESTOS 13.22t	1		$2,005.47	$1,823.15	$182.32	2,005.47
013	9/12/2014 MWI283756\\1 YIK11K S3-ASBESTOS 14.06t	1		$2,132.90	$1,939.00	$193.90	2,132.90
014	8/12/2014 MWO2830M\\1 YIK11K S3-ASBESTOS 13.64t	1		$2,069.19	$1,881.08	$188.11	2,069.19
015	8/12/2014 MWO2853M\\1 YHY70F S3-ASBESTOS 17.98t	1		$2,727.57	$2,479.61	$247.96	2,727.57
016	9/12/2014 MWI283767\\1 YHY70F S3-ASBESTOS 18.88t	1		$2,864.10	$2,603.73	$260.37	2,864.10
017	8/12/2014 MWO2859M\\1 YIK11K S3-ASBESTOS 18.72t	1		$2,839.82	$2,581.65	$258.17	2,839.82
018	9/12/2014 MWI283712\\1 YIK11K S3-ASBESTOS 15.96t	1		$2,421.13	$2,201.03	$220.10	2,421.13
019	9/12/2014 MWI283715\\1 YHY70F S3-ASBESTOS 15.74t	1		$2,387.76	$2,170.69	$217.07	2,387.76
020	9/12/2014 MWI283734\\1 YIK11K S3-ASBESTOS 16.18t	1		$2,454.51	$2,231.37	$223.14	2,454.51
021	9/12/2014 MWI283737\\1 YHY70F S3-ASBESTOS 16.52t	1		$2,506.08	$2,278.25	$227.83	2,506.08
	3rd of Dec: 1 tow 2nd of Dec 57.78t 8th of Dec: 153.74t 9th of Dec: 97.34t						
ACT NOWASTE AR				**Invoice Totals:**	$42,732.50	$4,273.27	$47,005.77

Payment enquiries should be directed to: NOWaste Accounts Receivable 132281

EFT payments can be made to:

BSB Number: 037-843

Account Number: 540144758

Reference: NWT014051

Account Name: ACT Government Account

Please return this section with your payment to:

Shared Services Accounts Receivable
GPO BOX 158
CANBERRA CITY ACT 2601

Customer Number: 144758
Invoice Number: NWT014051
Invoice Date: 18-DEC-2014
Due Date: 17-JAN-2015
Amount Payable: **$47,005.77**
No receipt mailed unless requested

Fax: (02) 620 53202
Email: SharedServicesAccountsReceivable@act.gov.au

Appendix D

Site Photographs

Photograph 1: Site entry prior to the commencement of works – view to the west – 14/11/2014

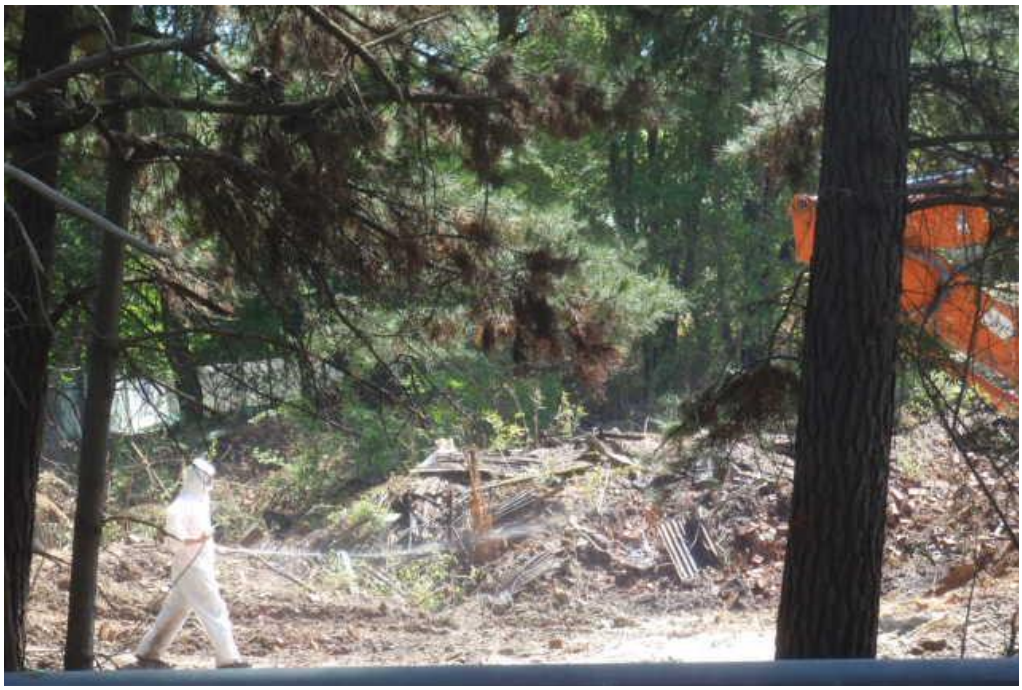
Photograph 2: View of site compound to the northeast – 14/11/2014

Photograph 3: View of built entry to the site – 21/11/2014

Photograph 4: Removal of blackberry vine with Bobcat – 21/11/2014

Photograph 5: AAC undertaking vegetation removal (view to the north from site compound) – 24/11/2014

Photograph 6: View of exposed ACM following vegetation removal – 28/11/2014



Photograph 7: View of ACM removal – 2/12/2014

Photograph 8: Vegetation removal – 1/12/2014

Photograph 9: View of ACM finds following vegetation removal – 1/12/2014

Photograph 10: Loading surface ACM – 28/11/2014

Photograph 11: Covered ACM load for transport to MLRMC – 28/11/2014

Photograph 12: Loading ACM (final day of ACM removal) – 8/12/2014

Photograph 12: View of Decontamination Unit - 5/12/2014

Photograph 14: View of TP22 with brick and glass fragments (no ACM observed) – 4/12/2014

Photograph 15: View of TP23 with fill (brick and ash/ slag fragments) – no ACM observed) - 4/12/14

Photograph 16: View of TP25 with natural soil (no fill observed – surface sample only) - 4/12/14

Photograph 17: View of TP1 with fill (brick and tile) – no ACM observed) - 9/12/14

Photograph 18: View of TP3 with fill (brick and tile) – ACM observed on surface) - 9/12/14

Photograph 19: View of TP2 with natural soil at the base – no ACM observed) - 9/12/14

Photograph 20: View of TP11 with natural soil at the base – no ACM observed) - 10/12/14

Photograph 21: View of TP8 with fill (brick, metal, wood surface ACM) – 10/12/14

Photograph 22: View of TP8 with water and possibly natural soil its base - 10/12/14

Photograph 23: View of TP10 with fill (No ACM observed) – 11/12/2014

Photograph 24: View of TP10 with fill (brick and tile) – 12/12/2014

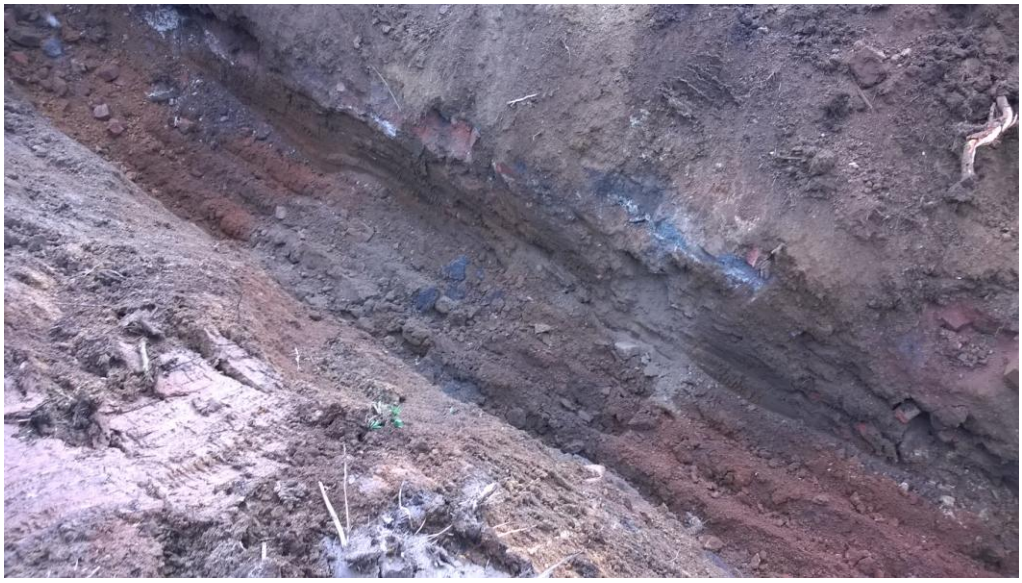
Photograph 25: View of TP10 with water (perched seepage water and not the water table) – 11/12/2014

Photograph 26: View of TP13 with fill (brick, plastic metal and ACM) – 11/12/2014

Photograph 27: View of TP16 with minor surface fill – 11/12/2014

Photograph 28: View of TP18 with no fill observed – 11/12/2014

Photograph 29: Trench 1 with view of natural soil in the profile at the south end – 12/12/2014



Photograph 30: Trench 1 with view of brick, ash and slag in the profile – 12/12/2014

Photograph 31: Trench 1 with view of high brick concentration on the north side of the drainage channel – 12/12/2014

Photograph 32: Trench 1 view to the south – 12/12/2014

Photograph 33: Trench 2 - View of natural soil intermixed with fill (no ACM observed) – 12/12/2014

Photograph 34: Trench 2 - View of fill between TP 6 and TP 7 (no ACM observed) – 12/12/2014

Photograph 35: Trench 2 - View of fill between TP 7 and TP8; note pocket of as and brick at base on trench (no ACM observed)– 12/12/2014

Photograph 36: Trench 2 - View of fill between near TP8 with Septic on the right (no ACM observed) – 12/12/2014

Photograph 37: Trench 2 between TP 9 and TP10 – 12/12/2014.

Photograph 38: Trench 2 – View to the north (no ACM observed except on the surface) – 12/12/2014.

Photograph 39: Trench 3 - View from the south end near TP11 and TP12 (no (ACM observed) – 12/12/2014

Photograph 40: Trench 3 - View to the north between TP12 and TP13 (ACM observed in fill) – 12/12/2014

Photograph 41: Trench 3 – North of TP13 (high ACM observed in fill) – 12/12/2014

Photograph 42: Trench 4 – with a view of ash at the south end (no ACM observed) - 12/12/2014

Photograph 43. View to the north of the TP13 Area following the test pit and trenching assessment works – 12/12/2014.

Photograph 44. View to the east from the TP13 Area following the test pit and trenching assessment works with mixed demo waste in the foreground – 12/12/2014.

Photograph 45. View to the north of mulching the stockpiled vegetation – 15/12/2014.

Photograph 46. View of site sealing activity with a bituminous sealant in the southwest corner of the site – 17/12/2014.

Photograph 47. View to the south following mulching and sealing activities – 18/12/2014.

Photograph 48. View to the north following mulching and sealing activities – 18/12/2014.

Appendix E

Test Pit Logs (1 - 25)

TEST PIT NUMBER TP1

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 9/12/14 **COMPLETED** 9/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Silty SAND, brown, medium to fine grained, minor gravel, igneous and shale.	PID: 0.0 PPM	Brick fragments, grass, and rootlets.
			0.5				PID: 0.0 PPM 0 PPM	Ash, and slag, up to 80% brick.
			1.0				PID: 0.0 PPM 0 PPM	
			1.5					
			2.0		FILL	FILL: Up to 100% brick and tile.		Up to 100% brick.
			2.5					
			3.0					
			3.5			Borehole TP1 terminated at 3.2m		
			4.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

TEST PIT NUMBER TP2

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 9/12/14 **COMPLETED** 9/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Gravelly, Clayey, SAND, brown, medium to fine grained, medium plasticity. Igneous rock fragments.		Bricks and brick fragments.
					FILL	FILL: Gravelly, Clayey, SAND, brown, medium to fine grained, medium plasticity.	PID: 0.0 PPM	Ash, and slag, up to 50% brick.
			0.5				PID: 0.0 PPM	
			1.0				PID: 0.0 PPM	
								Metal fragments.
			1.5					
			2.0				PID: 0.0 PPM	Glass fragments
			2.5					
					CL	Natural: Sandy CLAY, orange-red with yellow and grey mottling, medium to fine grained, medium plasticity.		
			3.0				PID: 0.0 PPM	
						Borehole TP2 terminated at 3.2m		
			3.5					
			4.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

TEST PIT NUMBER TP3

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 9/12/14 **COMPLETED** 9/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Sandy CLAY, orange to brown, medium plasticity, with rootlets.	PID: 0.7 PPM	Glass, brick, ACM.
			0.5		FILL	FILL: Sandy CLAY, medium plasticity, orange-brown to yellow, granite gravel and cobbles.	PID: 1.2 PPM 0 PPM	Upto 50% brick.
			1.0		SC	Natural: Clayey SAND, orange-red, fine to medium grained, medium plasticity.	PID: 0.0 PPM 0 PPM	
			1.5			Borehole TP3 terminated at 1.5m	PID: 0.0 PPM	
			2.0					
			2.5					
			3.0					
			3.5					
			4.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

TEST PIT NUMBER TP4

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 10/12/14 **COMPLETED** 10/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Silty SAND, brown, fine to medium grained, minor granite gravel.	PID: 0.0 PPM	
			0.5				PID: 0.0 PPM	
			1.0				PID: 0.0 PPM	Brick fragments, ash and slag.
			1.5					
			2.0				PID: 0.0 PPM	
					FILL	FILL: Sandy CLAY, brown-red, medium to fine grained, medium plasticity,		
			2.5					
			3.0				PID: 0.0 PPM	
					CL	NATURAL: Sandy CLAY, orange-red, granite pebbles.		
			3.5				PID: 0.0 PPM	
						Borehole TP4 terminated at 3.7m		
			4.0					
			4.5					

TEST PIT NUMBER TP5

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 9/12/14 **COMPLETED** 9/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Silty SAND, brown, fine to medium grained.	PID: 0.0 PPM	Grass, root fibres, tree roots.
								Brick, glass, plastic, metal, organic matter, ash and slag.
			0.5				PID: 0.0 PPM	
			1.0					1 ACM fragment observed.
							PID: 0.0 PPM	
			1.5					
			2.0				PID: 0.0 PPM	
			2.5					
			3.0					
			3.5				PID: 0.0 PPM	
			4.0		CL	NATURAL: Sandy CLAY, orange-red, grey mottling, fine to medium grained, medium plasticity.		

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

TEST PIT NUMBER TP5

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 9/12/14 **COMPLETED** 9/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E							PID: 0.0 PPM	
						Borehole TP5 terminated at 4.2m		
			4.5					
			5.0					
			5.5					
			6.0					
			6.5					
			7.0					
			7.5					
			8.0					

TEST PIT NUMBER TP6

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 10/12/14 **COMPLETED** 10/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Sandy CLAY, brown, some gravel.	PID: 0.0 PPM	
			0.5				PID: 0.0 PPM	Brick, metal, fibreglass sheeting, concrete fragments.
			1.0				PID: 0.0 PPM	ACM.
			1.5					
			2.0				PID: 0.0 PPM	
			2.5					
			3.0				PID: 0.0 PPM	
					FILL	FILL: Sandy CLAY, brown-yellow, mediumt o fine grained, some gravel.		
					GR	NATURAL: Highly weathered granite, yellow, very hard.		
			3.5				PID: 0.0 PPM	
						Borehole TP6 terminated at 3.5m		
			4.0					

TEST PIT NUMBER TP7

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 10/12/14 **COMPLETED** 10/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Silty, SAND, brown, medium to fine grained.	PID: 0.0 PPM	
			0.5				PID: 0.0 PPM	Some brick and metal.
			1.0				PID: 0.0 PPM	
			1.5					
			2.0				PID: 0.0 PPM	Plastic pipe.
			2.5					
			3.0				PID: 0.0 PPM	
			3.5					Increase of brick upto 25%
					FILL	FILL: Sandy CLAY, dark brown, medium plasticity, fine grained.		Increased moisture.
			4.0				PID: 0.0 PPM	

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

TEST PIT NUMBER TP7

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 10/12/14 **COMPLETED** 10/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			4.5		FILL	FILL: Sandy CLAY, dark brown, medium plasticity, fine grained. *(continued)*		
				+ + + + + +	GR	NATURAL: Weathered Granite, yellow, hard, medium grained.	PID: 0.0 PPM	
			5.0			Borehole TP7 terminated at 4.9m		
			5.5					
			6.0					
			6.5					
			7.0					
			7.5					
			8.0					

TEST PIT NUMBER TP8

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 10/12/14 **COMPLETED** 10/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Sandy CLAY, brown, moderate plasticity.	PID: 0.0	Brick, metal, ACM, wood.
			0.5				PID: 0.0	
								Up to 80% brick.
			1.0				PID: 0.0	
			1.5					
			2.0				PID: 0.0	
			2.5		SC	NATURAL: Clayey SAND, grey-green-yellow, medium-coarse grained, some gravel.	PID: 0.0	
			3.0			Borehole TP8 terminated at 2.9m		
			3.5					
			4.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

TEST PIT NUMBER TP9

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 10/12/14 **COMPLETED** 10/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Sandy CLAY, brown, medium plasticity, medium-fine grained.	PID: 0.0	Ash, charcoal, brick fragments, slag.
			0.5		FILL	FILL: Clayey SAND, brown, medium-fine grained, medium plasticity.	PID: 0.0	
			1.0				PID: 0.0	
			1.5					
			2.0				PID: 0.0	
			2.5		FILL	FILL: Sandy CLAY, red-orange medium plasticity, some gravel.		
			3.0		FILL	FILL: Gravelly SAND, dark grey-brown, gravelly sand, coarse grained.	PID: 0.0	Increase of Brick at 2.5 upto 50%
			3.5		CL	NATURAL: Sandy CLAY, orange-red, grey mottling, fine to medium grained, medium plasticity.		
			4.0				PID: 0.0	

Borehole TP9 terminated at 4m

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

TEST PIT NUMBER TP10

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 11/12/14 **COMPLETED** 11/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Gravelly, Sandy, CLAY, red-brown, medium plasticity.	PID: 0.0	Slag, brick, organic matter, roots grass.
			0.5		FILL	FILL: Silty SAND, grey, fine to medium grained, minor gravel.	PID: 0.0	Slag, brick, tiles, ash.
			1.0				PID: 0.0	
			1.5					
			2.0				PID: 0.0	
			2.5					
			3.0				PID: 0.0	
			3.5					Upto 90% brick.
			4.0				PID: 0.0	

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TEST PIT NUMBER TP10

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 11/12/14 **COMPLETED** 11/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			4.5		FILL	FILL: Silty SAND, grey, fine to medium grained, minor gravel. *(continued)*		Water Inflow.
			5.0		SHALE	Possible Natural: Shale Bedrock. Borehole TP10 terminated at 5.2m		
			5.5					
			6.0					
			6.5					
			7.0					
			7.5					
			8.0					

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TEST PIT NUMBER TP11

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 11/12/14 **COMPLETED** 11/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E					FILL	FILL: Silty SAND, brown, medium-fine grained, minor gravel, organic matter, roots, pine needles.	PID: 1.0 PPM	Brick, ash, slag/
					CL	NATURAL: Sandy CLAY, red-brown, medium plasticity, with silt stone cobbles.		
			0.5				PID: 0.1 PPM	
						Borehole TP11 terminated at 0.5m		
			1.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

Robson Environmental Pty Ltd
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Fyshwick ACT 2609

TEST PIT NUMBER TP12

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 11/12/14 **COMPLETED** 11/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E					FILL	FILL: Silty, Sandy, CLAY, brown, medium-fine grained, ironstone gravel, roots.	PID: 0.0 PPM	Brick
					CL	NATURAL: Sandy CLAY, red-orange, medium plasticity, coarse-fine grained sand, and large cobbles of heavily weathered granite.		
			0.5				PID: 0.0 PPM	
						Borehole TP12 terminated at 0.5m		
			1.0					

TEST PIT NUMBER TP13

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 11/12/14 **COMPLETED** 11/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Sandy CLAY, brown, medium plasticity, minor siltstone gravel and cobbles.	PID: 0.0 PPM	Brick, plastic, metal, 20% ACM.
			0.5				PID: 0.0 PPM	Decrease of ACM at 0.5
					FILL	FILL: Silty SAND, brown, medium to fine grained.		Glass, metal, brick, concrete fragments, ash, and slag.
			1.0				PID: 0.0 PPM	
			1.5					
			2.0				PID: 0.0 PPM	Upto 50% glass, metal, brick concrete fragments, ash and slag.
			2.5					
			3.0				PID: 0.0 PPM	
					CL	NATURAL: Sandy CLAY, yellow-orange mottled, medium plasticity, with ironstone gravel.		
			3.5				PID: 0.0 PPM	
						Borehole TP13 terminated at 3.6m		
			4.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

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TEST PIT NUMBER TP14

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 11/12/14 **COMPLETED** 11/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Silty CLAY, red-brown, medium plasticity, with siltstone cobbles and gravel.	PID: 0.0 PPM	Organic matter, brick, concrete fragments, and tile.
			0.5				PID: 0.0 PPM	
					FILL	FILL: Silty Clayey SAND, red-brown, medium grained.		
			1.0				PID: 0.0 PPM	Brick, concrete fragments, ash and slag.
			1.5					
			2.0				PID: 0.0 PPM	
			2.5					
			3.0				PID: 0.0 PPM	
								Increase in ash and slag.
			3.5					
			4.0					

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TEST PIT NUMBER TP14

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 11/12/14 **COMPLETED** 11/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			4.5		FILL	FILL: Silty Clayey SAND, red-brown, medium grained. *(continued)*	PID: 0.0 PPM	
			5.0					
			5.5				PID: 0.0 PPM	
						Borehole TP14 terminated at 5.5m		
			6.0					
			6.5					
			7.0					
			7.5					
			8.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

TEST PIT NUMBER TP15

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140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 10/12/14 **COMPLETED** 10/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E					FILL	FILL: Silty Sandy CLAY, brown, medium plasticity, siltstone fragments	PID: 0.0 PPM	Charcoal, roots.
			0.5		CL	NATURAL: Gravelly CLAY, orange-grey mottled, cobbles of weathered granite.	PID: 1.5 PPM	
			1.0				PID: 0.0 PPM	
						Borehole TP15 terminated at 1m		
			1.5					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

TEST PIT NUMBER TP16

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 11/12/14 **COMPLETED** 11/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E					FILL	FILL: Silty Sandy CLAY, brown, medium plasticity. with minor organic matter, and ironstone accretions.	PID: 0.6 PPM	
			0.5		CL	NATURAL: Sandy CLAY, red-orange, medium plasticity, quartz gravel and granite cobbles.		
			1.0			Borehole TP16 terminated at 0.7m		
			1.5					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

TEST PIT NUMBER TP17

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 11/12/14 **COMPLETED** 11/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Silty Sandy CLAY, medium plasticity, quartz gravel and cobbles, siltstone cobbles, with minor organic matter.	PID: 0.0 PPM	Charcoal, and brick fragments.
					FILL	FILL: Clayey SAND, yellow, weathered granite cobbles.		
			0.5				PID: 0.0 PPM	
			1.0				PID: 0.0 PPM	
					FILL	FILL: Sandy CLAY, bark brown, medium plasticity.		
			1.5					
			2.0				PID: 0.0 PPM	
			2.5		CL	NATURAL: Sandy CLAY, red-orange mottled, high plasticity.		
			3.0				PID: 0.0 PPM	
						Borehole TP17 terminated at 3m		
			3.5					
			4.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

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TEST PIT NUMBER TP18

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 11/12/14 **COMPLETED** 11/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E					Topsoil	Silty Sandy CLAY, medium plasticity, with roots and rootlets.	PID: 0.0 PPM	
			0.5		CL	NATURAL: Sandy CLAY, red-orange, quartz gravel, weathered granite cobbles.	PID: 1.0 PPM	Very Hard
			1.0			Borehole TP18 terminated at 0.7m		

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

TEST PIT NUMBER TP19

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 11/12/14 **COMPLETED** 11/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AM **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E					FILL	FILL: Silty Sandy CLAY, brown, medium plasticity, with organic matter and roots.	PID: 0.2 PPM	Roots.
					FILL	FILL: Silty CLAY, yellow, medium plasticity.		
					CL	NATURAL: Sandy CLAY, red-orange, medium plasticity, medium plasticity.		
			0.5				PID: 0.0 PPM	
						Borehole TP19 terminated at 0.5m		
			1.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

TEST PIT NUMBER TP20

Robson Environmental Pty Ltd
140 Gladstone Street
Fyshwick ACT 2609

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 4/12/14 **COMPLETED** 4/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AR **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E					Topsoil	Silty Clayey SAND, brown, fine grained, with roots, rootlets and organic matter.	PID: 3.1 PPM	
					SC	NATURAL: Clayey SAND, yellow-orange, medium grained.		
			0.5				PID: 1.6 PPM	
						Borehole TP20 terminated at 0.6m		
			1.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

Robson Environmental Pty Ltd
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TEST PIT NUMBER TP21

CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 4/12/14 **COMPLETED** 4/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 3m by 1m **LOGGED BY** AR **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E					Topsoil	Silty Clayey SAND, brown, fine grained, root fibres, and tree roots.	PID: 4.5 PPM	
					SC	NATURAL: Clayey SAND, brown, medium grained, with igneous gravel, and tree roots.		
			0.5				PID: 4.7 PPM	
						Borehole TP21 terminated at 0.6m		
			1.0					

TEST PIT NUMBER TP22

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CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 4/12/14 **COMPLETED** 4/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 2m by 0.6m **LOGGED BY** AR **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Sandy, Gravelly, CLAY, brown, low plasticity, siltstone gravel, and cobbles.	PID: 0.4 PPM	Ash, slag, metal, and brick. No ACM Observed.
			0.5				PID: 0.5 PPM	
			1.0		FILL	FILL: Clayey SAND, brown, medium grained.	PID: 0.2 PPM	Metal fragments. No ACM Observed.
			1.5					
			2.0				PID: 0.0 PPM	Metal and timber fragments. No ACM Observed.
			2.5		SC	Natural: Clayey SAND, yellow-orange, medium grained.		
			3.0			Borehole TP22 terminated at 2.7m		
			3.5					
			4.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

TEST PIT NUMBER TP23

Robson Environmental Pty Ltd
140 Gladstone Street
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CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 4/12/14 **COMPLETED** 4/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR Irwin & Hartshorn **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator **TEST PIT LOCATION** ---

TEST PIT SIZE 2m by 0.6m **LOGGED BY** AR **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.0		FILL	FILL: Clayey SAND, brown, medium grained, siltstone gravel and cobbles, and roots and rootlets.	PID: 0.5 PPM	Minor brick, ash, and slag. No ACM Observed.
			0.5				PID: 0.0 PPM	
			1.0				PID: 1.5 PPM	
			1.5		SC	NATURAL: Clayey SAND, yellow-orange, medium grained.		
			2.0				PID: 0.5 PPM	
						Borehole TP23 terminated at 2m		
			2.5					
			3.0					
			3.5					
			4.0					

TEST PIT NUMBER TP24

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CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 4/12/14 **COMPLETED** 4/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR NA **SLOPE** --- **BEARING** ---

EQUIPMENT Shovel **TEST PIT LOCATION** ---

TEST PIT SIZE Surface Sample **LOGGED BY** AR **CHECKED BY** BK

NOTES ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Shovel					Topsoil	Clayey SAND, dark brown, fine to medium grained, with organic matter, and pine needles.	PID: 0.1 PPM	
			0.5			Borehole TP24 terminated at 0.1m		
			1.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

TEST PIT NUMBER TP25

Robson Environmental Pty Ltd
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CLIENT Capcorp Constructions Pty Ltd **PROJECT NAME** Canberra Brickworks Remediation Project

PROJECT NUMBER 9623 **PROJECT LOCATION** Canberra Brickworks

DATE STARTED 4/12/14 **COMPLETED** 4/12/14 **R.L. SURFACE** --- **DATUM** ---

EXCAVATION CONTRACTOR NA **SLOPE** --- **BEARING** ---

EQUIPMENT Shovel **TEST PIT LOCATION**

TEST PIT SIZE Surface Sample **LOGGED BY** AR **CHECKED BY** BK

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Shovel					Topsoil	Clayey SAND, dark brown, fine to medium grained, with organic matter, and pine needles.	PID: 0.7 PPM	
			0.5			Borehole TP25 terminated at 0.1m		
			1.0					

BOREHOLE / TEST PIT ESDAT_GINT.GPJ GINT STD AUSTRALIA.GDT 4/2/15

Appendix F

Sample Receipts, COC Documentation and Laboratory Reports

ANALYTICAL REPORT

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Ben Kendon	Manager	Huong Crawford
Client	Robson Environmental Pty Ltd	Laboratory	SGS Alexandria Environmental
Address	140 Gladstone Street, FYSHWICK PO Box 112, FYSHWICK ACT 2609	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	(02) 6239 5656	Telephone	+61 2 8594 0400
Facsimile	(02) 6239 5669	Facsimile	+61 2 8594 0499
Email	ben@robsonlabs.com.au	Email	au.environmental.sydney@sgs.com
Project	**9623 - ESA - Old Canberra Brickworks**	SGS Reference	**SE134169 R0**
Order Number	(Not specified)	Report Number	0000098771
Samples	15	Date Reported	17 Dec 2014
Date Started	09 Dec 2014	Date Received	05 Dec 2014

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

No respirable fibres detected in all samples using trace analysis technique as per AS 4964-2004.
FA+AF measured gravimatically (excluding free fibres).
Asbestos weight is approximate.
Asbestos analysed by Approved Identifier Ravee Sivasubramaniam .

SIGNATORIES

Andy Sutton
Senior Organic Chemist

Deanne Norris
Organic Chemist

Dong Liang
Metals/Inorganics Team Leader

Huong Crawford
Production Manager

Kamrul Ahsan
Senior Chemist

Ly Kim Ha
Organic Section Head

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134169.001 Soil 04 Dec 2014 TP20 0.0-0.1	SE134169.002 Soil 04 Dec 2014 TP20 0.5-0.6	SE134169.003 Soil 04 Dec 2014 TP21 0.0-0.11	SE134169.004 Soil 04 Dec 2014 TP21 0.5-0.6
VOC's in Soil Method: AN433/AN434						
Monocyclic Aromatic Hydrocarbons						
Benzene	mg/kg	0.1	<0.1	-	<0.1	-
Toluene	mg/kg	0.1	<0.1	-	<0.1	-
Ethylbenzene	mg/kg	0.1	<0.1	-	<0.1	-
m/p-xylene	mg/kg	0.2	<0.2	-	<0.2	-
o-xylene	mg/kg	0.1	<0.1	-	<0.1	-
Polycyclic VOCs						
Naphthalene	mg/kg	0.1	<0.1	-	<0.1	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	**70**	-	**73**	-
d4-1,2-dichloroethane (Surrogate)	%	-	**85**	-	**84**	-
d8-toluene (Surrogate)	%	-	**85**	-	**88**	-
Bromofluorobenzene (Surrogate)	%	-	**75**	-	**76**	-
Totals						
Total Xylenes*	mg/kg	0.3	<0.3	-	<0.3	-
Total BTEX*	mg/kg	0.6	<0.6	-	<0.6	-
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410						
TRH C6-C10	mg/kg	25	<25	-	<25	-
TRH C6-C9	mg/kg	20	<20	-	<20	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	**70**	-	**73**	-
d4-1,2-dichloroethane (Surrogate)	%	-	**85**	-	**84**	-
d8-toluene (Surrogate)	%	-	**85**	-	**88**	-
Bromofluorobenzene (Surrogate)	%	-	**75**	-	**76**	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134169.001 Soil 04 Dec 2014 TP20 0.0-0.1	SE134169.002 Soil 04 Dec 2014 TP20 0.5-0.6	SE134169.003 Soil 04 Dec 2014 TP21 0.0-0.11	SE134169.004 Soil 04 Dec 2014 TP21 0.5-0.6
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410 (continued)						
VPH F Bands						
Benzene (F0)	mg/kg	0.1	<0.1	-	<0.1	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	-	<25	-
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403						
TRH C10-C14	mg/kg	20	<20	-	<20	-
TRH C15-C28	mg/kg	45	<45	-	<45	-
TRH C29-C36	mg/kg	45	<45	-	<45	-
TRH C37-C40	mg/kg	100	<100	-	<100	-
TRH C10-C36 Total	mg/kg	110	<110	-	<110	-
TRH C10-C40 Total	mg/kg	210	<210	-	<210	-
TRH F Bands						
TRH >C10-C16 (F2)	mg/kg	25	<25	-	<25	-
TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	<25	-	<25	-
TRH >C16-C34 (F3)	mg/kg	90	<90	-	<90	-
TRH >C34-C40 (F4)	mg/kg	120	<120	-	<120	-
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420						
Naphthalene	mg/kg	0.1	<0.1	-	<0.1	-
2-methylnaphthalene	mg/kg	0.1	<0.1	-	<0.1	-
1-methylnaphthalene	mg/kg	0.1	<0.1	-	<0.1	-
Acenaphthylene	mg/kg	0.1	<0.1	-	<0.1	-
Acenaphthene	mg/kg	0.1	<0.1	-	<0.1	-
Fluorene	mg/kg	0.1	<0.1	-	<0.1	-
Phenanthrene	mg/kg	0.1	<0.1	-	<0.1	-
Anthracene	mg/kg	0.1	<0.1	-	<0.1	-
Fluoranthene	mg/kg	0.1	<0.1	-	<0.1	-
Pyrene	mg/kg	0.1	<0.1	-	<0.1	-
Benzo(a)anthracene	mg/kg	0.1	<0.1	-	<0.1	-
Chrysene	mg/kg	0.1	<0.1	-	<0.1	-
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	-	<0.1	-
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	-	<0.1	-
Benzo(a)pyrene	mg/kg	0.1	<0.1	-	<0.1	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	-	<0.1	-
Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	-	<0.1	-
Benzo(ghi)perylene	mg/kg	0.1	<0.1	-	<0.1	-
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=0*	TEQ	0.2	<0.2	-	<0.2	-
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=LOR*	TEQ (mg/kg)	0.3	<0.3	-	<0.3	-
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=LOR/2*	TEQ (mg/kg)	0.2	<0.2	-	<0.2	-
Total PAH	mg/kg	0.8	<0.8	-	<0.8	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.001 Soil 04 Dec 2014 TP20 0.0-0.1	SE134169.002 Soil 04 Dec 2014 TP20 0.5-0.6	SE134169.003 Soil 04 Dec 2014 TP21 0.0-0.11	SE134169.004 Soil 04 Dec 2014 TP21 0.5-0.6
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)							
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		**116**	-	**102**	-
2-fluorobiphenyl (Surrogate)	%	-		**98**	-	**86**	-
d14-p-terphenyl (Surrogate)	%	-		**106**	-	**88**	-
Speciated Phenols in Soil Method: AN420							
Phenol	mg/kg	0.5		<0.5	-	<0.5	-
2-methyl phenol (o-cresol)	mg/kg	0.5		<0.5	-	**1.0**	-
3/4-methyl phenol (m/p-cresol)	mg/kg	1		<1	-	<1	-
Total Cresol	mg/kg	1.5		<1.5	-	<1.5	-
2-chlorophenol	mg/kg	0.5		<0.5	-	<0.5	-
2,4-dimethylphenol	mg/kg	0.5		<0.5	-	<0.5	-
2,6-dichlorophenol	mg/kg	0.5		<0.5	-	<0.5	-
2,4-dichlorophenol	mg/kg	0.5		<0.5	-	<0.5	-
2,4,6-trichlorophenol	mg/kg	0.5		<0.5	-	<0.5	-
2-nitrophenol	mg/kg	0.5		<0.5	-	<0.5	-
4-nitrophenol	mg/kg	1		<1	-	<1	-
2,4,5-trichlorophenol	mg/kg	0.5		<0.5	-	<0.5	-
2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1		<1	-	<1	-
Pentachlorophenol	mg/kg	0.5		<0.5	-	<0.5	-
2,4-dinitrophenol	mg/kg	2		<2	-	<2	-
4-chloro-3-methylphenol	mg/kg	2		<2	-	<2	-
Surrogates							
2,4,6-Tribromophenol (Surrogate)	%	-		**83**	-	**84**	-
d5-phenol (Surrogate)	%	-		**70**	-	**73**	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.001 Soil 04 Dec 2014 TP20 0.0-0.1	SE134169.002 Soil 04 Dec 2014 TP20 0.5-0.6	SE134169.003 Soil 04 Dec 2014 TP21 0.0-0.11	SE134169.004 Soil 04 Dec 2014 TP21 0.5-0.6
OC Pesticides in Soil Method: AN400/AN420							
Hexachlorobenzene (HCB)	mg/kg	0.1		<0.1	-	<0.1	-
Alpha BHC	mg/kg	0.1		<0.1	-	<0.1	-
Lindane	mg/kg	0.1		<0.1	-	<0.1	-
Heptachlor	mg/kg	0.1		<0.1	-	<0.1	-
Aldrin	mg/kg	0.1		<0.1	-	<0.1	-
Beta BHC	mg/kg	0.1		<0.1	-	<0.1	-
Delta BHC	mg/kg	0.1		<0.1	-	<0.1	-
Heptachlor epoxide	mg/kg	0.1		<0.1	-	<0.1	-
o,p'-DDE	mg/kg	0.1		<0.1	-	<0.1	-
Alpha Endosulfan	mg/kg	0.2		<0.2	-	<0.2	-
Gamma Chlordane	mg/kg	0.1		<0.1	-	<0.1	-
Alpha Chlordane	mg/kg	0.1		<0.1	-	<0.1	-
trans-Nonachlor	mg/kg	0.1		<0.1	-	<0.1	-
p,p'-DDE	mg/kg	0.1		<0.1	-	<0.1	-
Dieldrin	mg/kg	0.2		<0.2	-	<0.2	-
Endrin	mg/kg	0.2		<0.2	-	<0.2	-
o,p'-DDD	mg/kg	0.1		<0.1	-	<0.1	-
o,p'-DDT	mg/kg	0.1		<0.1	-	<0.1	-
Beta Endosulfan	mg/kg	0.2		<0.2	-	<0.2	-
p,p'-DDD	mg/kg	0.1		<0.1	-	<0.1	-
p,p'-DDT	mg/kg	0.1		<0.1	-	<0.1	-
Endosulfan sulphate	mg/kg	0.1		<0.1	-	<0.1	-
Endrin Aldehyde	mg/kg	0.1		<0.1	-	<0.1	-
Methoxychlor	mg/kg	0.1		<0.1	-	<0.1	-
Endrin Ketone	mg/kg	0.1		<0.1	-	<0.1	-
Isodrin	mg/kg	0.1		<0.1	-	<0.1	-
Mirex	mg/kg	0.1		<0.1	-	<0.1	-
Surrogates							
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-		**100**	-	**98**	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134169.001 Soil 04 Dec 2014 TP20 0.0-0.1	SE134169.002 Soil 04 Dec 2014 TP20 0.5-0.6	SE134169.003 Soil 04 Dec 2014 TP21 0.0-0.11	SE134169.004 Soil 04 Dec 2014 TP21 0.5-0.6
PCBs in Soil Method: AN400/AN420						
Arochlor 1016	mg/kg	0.2	<0.2	-	<0.2	-
Arochlor 1221	mg/kg	0.2	<0.2	-	<0.2	-
Arochlor 1232	mg/kg	0.2	<0.2	-	<0.2	-
Arochlor 1242	mg/kg	0.2	<0.2	-	<0.2	-
Arochlor 1248	mg/kg	0.2	<0.2	-	<0.2	-
Arochlor 1254	mg/kg	0.2	<0.2	-	<0.2	-
Arochlor 1260	mg/kg	0.2	<0.2	-	<0.2	-
Arochlor 1262	mg/kg	0.2	<0.2	-	<0.2	-
Arochlor 1268	mg/kg	0.2	<0.2	-	<0.2	-
Total PCBs (Arochlors)	mg/kg	1	<1	-	<1	-
Surrogates						
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	**100**	-	**98**	-
pH in soil (1:5) Method: AN101						
pH	pH Units	-	-	**7.0**	-	-
Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) Method: AN122						
Exchangeable Sodium, Na	mg/kg	2	-	**23**	-	-
Exchangeable Sodium, Na	meq/100g	0.01	-	**0.10**	-	-
Exchangeable Sodium Percentage*	%	0.1	-	**1.5**	-	-
Exchangeable Potassium, K	mg/kg	2	-	**170**	-	-
Exchangeable Potassium, K	meq/100g	0.01	-	**0.43**	-	-
Exchangeable Potassium Percentage*	%	0.1	-	**6.6**	-	-
Exchangeable Calcium, Ca	mg/kg	2	-	**680**	-	-
Exchangeable Calcium, Ca	meq/100g	0.01	-	**3.4**	-	-
Exchangeable Calcium Percentage*	%	0.1	-	**52.7**	-	-
Exchangeable Magnesium, Mg	mg/kg	2	-	**310**	-	-
Exchangeable Magnesium, Mg	meq/100g	0.02	-	**2.5**	-	-
Exchangeable Magnesium Percentage*	%	0.1	-	**39.2**	-	-
Cation Exchange Capacity	meq/100g	0.02	-	**6.4**	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.001 Soil 04 Dec 2014 TP20 0.0-0.1	SE134169.002 Soil 04 Dec 2014 TP20 0.5-0.6	SE134169.003 Soil 04 Dec 2014 TP21 0.0-0.11	SE134169.004 Soil 04 Dec 2014 TP21 0.5-0.6
TOC in Soil Method: AN188							
Total Organic Carbon	%w/w	0.05		-	**0.56**	-	-
Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest Method: AN040/AN320							
Arsenic, As	mg/kg	3		**3**	**3**	<3	**4**
Cadmium, Cd	mg/kg	0.3		<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.3		**30**	**33**	**26**	**30**
Copper, Cu	mg/kg	0.5		**6.8**	**13**	**7.1**	**15**
Lead, Pb	mg/kg	1		**22**	**17**	**19**	**67**
Iron, Fe	mg/kg	50		-	**24000**	-	-
Nickel, Ni	mg/kg	0.5		**7.7**	**8.6**	**6.4**	**12**
Zinc, Zn	mg/kg	0.5		**27**	**28**	**28**	**25**
Particle sizing of soils <75µm by hydrometer Method: AN005							
Sedimentation Diameter 1	mm	0.0001		-	**0.0540**	-	-
Passing Sedimentation Diameter 1	%w/w	1		-	**53**	-	-
Retained Sedimentation Diameter 1	%w/w	1		-	**6**	-	-
Sedimentation Diameter 2	mm	0.0001		-	**0.0384**	-	-
Passing Sedimentation Diameter 2	%w/w	1		-	**51**	-	-
Retained Sedimentation Diameter 2	%w/w	1		-	**2**	-	-
Sedimentation Diameter 3	mm	0.0001		-	**0.0275**	-	-
Passing Sedimentation Diameter 3	%w/w	1		-	**46**	-	-
Retained Sedimentation Diameter 3	%w/w	1		-	**5**	-	-
Sedimentation Diameter 4	mm	0.0001		-	**0.0197**	-	-
Passing Sedimentation Diameter 4	%w/w	1		-	**41**	-	-
Retained Sedimentation Diameter 4	%w/w	1		-	**5**	-	-
Sedimentation Diameter 5	mm	0.0001		-	**0.0146**	-	-
Passing Sedimentation Diameter 5	%w/w	1		-	**37**	-	-
Retained Sedimentation Diameter 5	%w/w	1		-	**5**	-	-
Sedimentation Diameter 6	mm	0.0001		-	**0.0104**	-	-
Passing Sedimentation Diameter 6	%w/w	1		-	**34**	-	-
Retained Sedimentation Diameter 6	%w/w	1		-	**2**	-	-
Sedimentation Diameter 7	mm	0.0001		-	**0.0074**	-	-
Passing Sedimentation Diameter 7	%w/w	1		-	**32**	-	-
Retained Sedimentation Diameter 7	%w/w	1		-	**2**	-	-
Sedimentation Diameter 8	mm	0.0001		-	**0.0052**	-	-
Passing Sedimentation Diameter 8	%w/w	1		-	**32**	-	-
Retained Sedimentation Diameter 8	%w/w	1		-	<1	-	-
Sedimentation Diameter 9	mm	0.0001		-	**0.0037**	-	-
Passing Sedimentation Diameter 9	%w/w	1		-	**32**	-	-
Retained Sedimentation Diameter 9	%w/w	1		-	<1	-	-
Sedimentation Diameter 10	mm	0.0001		-	**0.0015**	-	-
Passing Sedimentation Diameter 10	%w/w	1		-	**29**	-	-
Retained Sedimentation Diameter 10	%w/w	1		-	**2**	-	-
Sedimentation Diameter 11	mm	0.0001		-	**0.0011**	-	-
Passing Sedimentation Diameter 11	%w/w	1		-	**29**	-	-
Retained Sedimentation Diameter 11	%w/w	1		-	<1	-	-
Mercury in Soil Method: AN312							
Mercury	mg/kg	0.01		**0.03**	**0.03**	**0.04**	**0.02**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.001 Soil 04 Dec 2014 TP20 0.0-0.1	SE134169.002 Soil 04 Dec 2014 TP20 0.5-0.6	SE134169.003 Soil 04 Dec 2014 TP21 0.0-0.11	SE134169.004 Soil 04 Dec 2014 TP21 0.5-0.6
Gravimetric Determination of Asbestos in Soil Method: AN605							
Total Sample Weight*	g	1		**643**	**670**	**571**	**769**
Asbestos in soil (>7mm ACM)*	%w/w	0.01		<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm AF/FA)*	%w/w	0.001		<0.001	<0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001		<0.001	<0.001	<0.001	<0.001
Fibre Type*	No unit	-		-	-	-	-
Moisture Content Method: AN002							
% Moisture	%	0.5		**16**	**9.5**	**20**	**7.4**
VOCs in Water Method: AN433/AN434							
Monocyclic Aromatic Hydrocarbons							
Benzene	µg/L	0.5		-	-	-	-
Toluene	µg/L	0.5		-	-	-	-
Ethylbenzene	µg/L	0.5		-	-	-	-
m/p-xylene	µg/L	1		-	-	-	-
o-xylene	µg/L	0.5		-	-	-	-
Polycyclic VOCs							
Naphthalene	µg/L	0.5		-	-	-	-
Surrogates							
Dibromofluoromethane (Surrogate)	%	-		-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-		-	-	-	-
d8-toluene (Surrogate)	%	-		-	-	-	-
Bromofluorobenzene (Surrogate)	%	-		-	-	-	-
Totals							
Total Xylenes	µg/L	1.5		-	-	-	-
Total BTEX	µg/L	3		-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134169.001 Soil 04 Dec 2014 TP20 0.0-0.1	SE134169.002 Soil 04 Dec 2014 TP20 0.5-0.6	SE134169.003 Soil 04 Dec 2014 TP21 0.0-0.11	SE134169.004 Soil 04 Dec 2014 TP21 0.5-0.6
Volatile Petroleum Hydrocarbons in Water Method: AN433/AN434/AN410						
TRH C6-C10	µg/L	50	-	-	-	-
TRH C6-C9	µg/L	40	-	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-	-
VPH F Bands						
Benzene (F0)	µg/L	0.5	-	-	-	-
TRH C6-C10 minus BTEX (F1)	µg/L	50	-	-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420						
Naphthalene	µg/L	0.1	-	-	-	-
2-methylnaphthalene	µg/L	0.1	-	-	-	-
1-methylnaphthalene	µg/L	0.1	-	-	-	-
Acenaphthylene	µg/L	0.1	-	-	-	-
Acenaphthene	µg/L	0.1	-	-	-	-
Fluorene	µg/L	0.1	-	-	-	-
Phenanthrene	µg/L	0.1	-	-	-	-
Anthracene	µg/L	0.1	-	-	-	-
Fluoranthene	µg/L	0.1	-	-	-	-
Pyrene	µg/L	0.1	-	-	-	-
Benzo(a)anthracene	µg/L	0.1	-	-	-	-
Chrysene	µg/L	0.1	-	-	-	-
Benzo(b&j)fluoranthene	µg/L	0.1	-	-	-	-
Benzo(k)fluoranthene	µg/L	0.1	-	-	-	-
Benzo(a)pyrene	µg/L	0.1	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/L	0.1	-	-	-	-
Dibenzo(a&h)anthracene	µg/L	0.1	-	-	-	-
Benzo(ghi)perylene	µg/L	0.1	-	-	-	-
Total PAH (18)	µg/L	1	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.001 Soil 04 Dec 2014 TP20 0.0-0.1	SE134169.002 Soil 04 Dec 2014 TP20 0.5-0.6	SE134169.003 Soil 04 Dec 2014 TP21 0.0-0.11	SE134169.004 Soil 04 Dec 2014 TP21 0.5-0.6
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420 (continued)							
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		-	-	-	-
2-fluorobiphenyl (Surrogate)	%	-		-	-	-	-
d14-p-terphenyl (Surrogate)	%	-		-	-	-	-
Trace Metals (Dissolved) in Water by ICPMS Method: AN318							
Arsenic, As	µg/L	1		-	-	-	-
Cadmium, Cd	µg/L	0.1		-	-	-	-
Chromium, Cr	µg/L	1		-	-	-	-
Copper, Cu	µg/L	1		-	-	-	-
Lead, Pb	µg/L	1		-	-	-	-
Nickel, Ni	µg/L	1		-	-	-	-
Zinc, Zn	µg/L	5		-	-	-	-
Mercury (dissolved) in Water Method: AN311/AN312							
Mercury	mg/L	0.0001		-	-	-	-

Parameter	Units	LOR	Sample Number: SE134169.005 Sample Matrix: Soil Sample Date: 04 Dec 2014 Sample Name: TP22 0.0-0.1	SE134169.006 Soil 04 Dec 2014 TP22 0.4-0.5	SE134169.007 Soil 04 Dec 2014 TP22 1.9-2.0	SE134169.008 Soil 04 Dec 2014 TP23 0.0-0.1
VOC's in Soil Method: AN433/AN434						
Monocyclic Aromatic Hydrocarbons						
Benzene	mg/kg	0.1	<0.1	-	-	<0.1
Toluene	mg/kg	0.1	<0.1	-	-	<0.1
Ethylbenzene	mg/kg	0.1	<0.1	-	-	<0.1
m/p-xylene	mg/kg	0.2	<0.2	-	-	<0.2
o-xylene	mg/kg	0.1	<0.1	-	-	<0.1
Polycyclic VOCs						
Naphthalene	mg/kg	0.1	<0.1	-	-	<0.1
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	**79**	-	-	**72**
d4-1,2-dichloroethane (Surrogate)	%	-	**92**	-	-	**84**
d8-toluene (Surrogate)	%	-	**97**	-	-	**86**
Bromofluorobenzene (Surrogate)	%	-	**87**	-	-	**73**
Totals						
Total Xylenes*	mg/kg	0.3	<0.3	-	-	<0.3
Total BTEX*	mg/kg	0.6	<0.6	-	-	<0.6
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410						
TRH C6-C10	mg/kg	25	<25	-	-	<25
TRH C6-C9	mg/kg	20	<20	-	-	<20
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	**79**	-	-	**72**
d4-1,2-dichloroethane (Surrogate)	%	-	**92**	-	-	**84**
d8-toluene (Surrogate)	%	-	**97**	-	-	**86**
Bromofluorobenzene (Surrogate)	%	-	**87**	-	-	**73**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134169.005 Soil 04 Dec 2014 TP22 0.0-0.1	SE134169.006 Soil 04 Dec 2014 TP22 0.4-0.5	SE134169.007 Soil 04 Dec 2014 TP22 1.9-2.0	SE134169.008 Soil 04 Dec 2014 TP23 0.0-0.1
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410 (continued)						
VPH F Bands						
Benzene (F0)	mg/kg	0.1	<0.1	-	-	<0.1
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	-	-	<25
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403						
TRH C10-C14	mg/kg	20	<20	-	-	<20
TRH C15-C28	mg/kg	45	<45	-	-	<45
TRH C29-C36	mg/kg	45	<45	-	-	<45
TRH C37-C40	mg/kg	100	<100	-	-	<100
TRH C10-C36 Total	mg/kg	110	<110	-	-	<110
TRH C10-C40 Total	mg/kg	210	<210	-	-	<210
TRH F Bands						
TRH >C10-C16 (F2)	mg/kg	25	<25	-	-	<25
TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	<25	-	-	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	-	-	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	-	-	<120
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420						
Naphthalene	mg/kg	0.1	<0.1	-	-	<0.1
2-methylnaphthalene	mg/kg	0.1	<0.1	-	-	<0.1
1-methylnaphthalene	mg/kg	0.1	<0.1	-	-	<0.1
Acenaphthylene	mg/kg	0.1	<0.1	-	-	<0.1
Acenaphthene	mg/kg	0.1	<0.1	-	-	<0.1
Fluorene	mg/kg	0.1	<0.1	-	-	<0.1
Phenanthrene	mg/kg	0.1	<0.1	-	-	<0.1
Anthracene	mg/kg	0.1	<0.1	-	-	<0.1
Fluoranthene	mg/kg	0.1	<0.1	-	-	<0.1
Pyrene	mg/kg	0.1	<0.1	-	-	<0.1
Benzo(a)anthracene	mg/kg	0.1	<0.1	-	-	<0.1
Chrysene	mg/kg	0.1	<0.1	-	-	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	-	-	<0.1
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	-	-	<0.1
Benzo(a)pyrene	mg/kg	0.1	<0.1	-	-	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	-	-	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	-	-	<0.1
Benzo(ghi)perylene	mg/kg	0.1	<0.1	-	-	<0.1
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=0*	TEQ	0.2	<0.2	-	-	<0.2
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=LOR*	TEQ (mg/kg)	0.3	<0.3	-	-	<0.3
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=LOR/2*	TEQ (mg/kg)	0.2	<0.2	-	-	<0.2
Total PAH	mg/kg	0.8	<0.8	-	-	<0.8

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.005 Soil 04 Dec 2014 TP22 0.0-0.1	SE134169.006 Soil 04 Dec 2014 TP22 0.4-0.5	SE134169.007 Soil 04 Dec 2014 TP22 1.9-2.0	SE134169.008 Soil 04 Dec 2014 TP23 0.0-0.1
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)							
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		**94**	-	-	**94**
2-fluorobiphenyl (Surrogate)	%	-		**84**	-	-	**80**
d14-p-terphenyl (Surrogate)	%	-		**92**	-	-	**96**
Speciated Phenols in Soil Method: AN420							
Phenol	mg/kg	0.5		<0.5	-	-	<0.5
2-methyl phenol (o-cresol)	mg/kg	0.5		<0.5	-	-	<0.5
3/4-methyl phenol (m/p-cresol)	mg/kg	1		<1	-	-	<1
Total Cresol	mg/kg	1.5		<1.5	-	-	<1.5
2-chlorophenol	mg/kg	0.5		<0.5	-	-	<0.5
2,4-dimethylphenol	mg/kg	0.5		<0.5	-	-	<0.5
2,6-dichlorophenol	mg/kg	0.5		<0.5	-	-	<0.5
2,4-dichlorophenol	mg/kg	0.5		<0.5	-	-	<0.5
2,4,6-trichlorophenol	mg/kg	0.5		<0.5	-	-	<0.5
2-nitrophenol	mg/kg	0.5		<0.5	-	-	<0.5
4-nitrophenol	mg/kg	1		<1	-	-	<1
2,4,5-trichlorophenol	mg/kg	0.5		<0.5	-	-	<0.5
2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1		<1	-	-	<1
Pentachlorophenol	mg/kg	0.5		<0.5	-	-	<0.5
2,4-dinitrophenol	mg/kg	2		<2	-	-	<2
4-chloro-3-methylphenol	mg/kg	2		<2	-	-	<2
Surrogates							
2,4,6-Tribromophenol (Surrogate)	%	-		**80**	-	-	**88**
d5-phenol (Surrogate)	%	-		**73**	-	-	**75**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134169.005 Soil 04 Dec 2014 TP22 0.0-0.1	SE134169.006 Soil 04 Dec 2014 TP22 0.4-0.5	SE134169.007 Soil 04 Dec 2014 TP22 1.9-2.0	SE134169.008 Soil 04 Dec 2014 TP23 0.0-0.1
OC Pesticides in Soil Method: AN400/AN420						
Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	-	-	<0.1
Alpha BHC	mg/kg	0.1	<0.1	-	-	<0.1
Lindane	mg/kg	0.1	<0.1	-	-	<0.1
Heptachlor	mg/kg	0.1	<0.1	-	-	<0.1
Aldrin	mg/kg	0.1	<0.1	-	-	<0.1
Beta BHC	mg/kg	0.1	<0.1	-	-	<0.1
Delta BHC	mg/kg	0.1	<0.1	-	-	<0.1
Heptachlor epoxide	mg/kg	0.1	<0.1	-	-	<0.1
o,p'-DDE	mg/kg	0.1	<0.1	-	-	<0.1
Alpha Endosulfan	mg/kg	0.2	<0.2	-	-	<0.2
Gamma Chlordane	mg/kg	0.1	<0.1	-	-	<0.1
Alpha Chlordane	mg/kg	0.1	<0.1	-	-	<0.1
trans-Nonachlor	mg/kg	0.1	<0.1	-	-	<0.1
p,p'-DDE	mg/kg	0.1	<0.1	-	-	<0.1
Dieldrin	mg/kg	0.2	<0.2	-	-	<0.2
Endrin	mg/kg	0.2	<0.2	-	-	<0.2
o,p'-DDD	mg/kg	0.1	<0.1	-	-	<0.1
o,p'-DDT	mg/kg	0.1	<0.1	-	-	<0.1
Beta Endosulfan	mg/kg	0.2	<0.2	-	-	<0.2
p,p'-DDD	mg/kg	0.1	<0.1	-	-	<0.1
p,p'-DDT	mg/kg	0.1	<0.1	-	-	<0.1
Endosulfan sulphate	mg/kg	0.1	<0.1	-	-	<0.1
Endrin Aldehyde	mg/kg	0.1	<0.1	-	-	<0.1
Methoxychlor	mg/kg	0.1	<0.1	-	-	<0.1
Endrin Ketone	mg/kg	0.1	<0.1	-	-	<0.1
Isodrin	mg/kg	0.1	<0.1	-	-	<0.1
Mirex	mg/kg	0.1	<0.1	-	-	<0.1
Surrogates						
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	**93**	-	-	**95**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134169.005 Soil 04 Dec 2014 TP22 0.0-0.1	SE134169.006 Soil 04 Dec 2014 TP22 0.4-0.5	SE134169.007 Soil 04 Dec 2014 TP22 1.9-2.0	SE134169.008 Soil 04 Dec 2014 TP23 0.0-0.1
PCBs in Soil Method: AN400/AN420						
Arochlor 1016	mg/kg	0.2	<0.2	-	-	<0.2
Arochlor 1221	mg/kg	0.2	<0.2	-	-	<0.2
Arochlor 1232	mg/kg	0.2	<0.2	-	-	<0.2
Arochlor 1242	mg/kg	0.2	<0.2	-	-	<0.2
Arochlor 1248	mg/kg	0.2	<0.2	-	-	<0.2
Arochlor 1254	mg/kg	0.2	<0.2	-	-	<0.2
Arochlor 1260	mg/kg	0.2	<0.2	-	-	<0.2
Arochlor 1262	mg/kg	0.2	<0.2	-	-	<0.2
Arochlor 1268	mg/kg	0.2	<0.2	-	-	<0.2
Total PCBs (Arochlors)	mg/kg	1	<1	-	-	<1
Surrogates						
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	**93**	-	-	**95**
pH in soil (1:5) Method: AN101						
pH	pH Units	-	-	**8.4**	-	-
Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) Method: AN122						
Exchangeable Sodium, Na	mg/kg	2	-	**15**	-	-
Exchangeable Sodium, Na	meq/100g	0.01	-	**0.06**	-	-
Exchangeable Sodium Percentage*	%	0.1	-	**0.3**	-	-
Exchangeable Potassium, K	mg/kg	2	-	**120**	-	-
Exchangeable Potassium, K	meq/100g	0.01	-	**0.31**	-	-
Exchangeable Potassium Percentage*	%	0.1	-	**1.5**	-	-
Exchangeable Calcium, Ca	mg/kg	2	-	**3500**	-	-
Exchangeable Calcium, Ca	meq/100g	0.01	-	**17**	-	-
Exchangeable Calcium Percentage*	%	0.1	-	**87.4**	-	-
Exchangeable Magnesium, Mg	mg/kg	2	-	**260**	-	-
Exchangeable Magnesium, Mg	meq/100g	0.02	-	**2.1**	-	-
Exchangeable Magnesium Percentage*	%	0.1	-	**10.8**	-	-
Cation Exchange Capacity	meq/100g	0.02	-	**20**	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.005 Soil 04 Dec 2014 TP22 0.0-0.1	SE134169.006 Soil 04 Dec 2014 TP22 0.4-0.5	SE134169.007 Soil 04 Dec 2014 TP22 1.9-2.0	SE134169.008 Soil 04 Dec 2014 TP23 0.0-0.1
TOC in Soil Method: AN188							
Total Organic Carbon	%w/w	0.05		-	**0.91**	-	-
Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest Method: AN040/AN320							
Arsenic, As	mg/kg	3		**5**	**8**	-	**6**
Cadmium, Cd	mg/kg	0.3		<0.3	<0.3	-	<0.3
Chromium, Cr	mg/kg	0.3		**22**	**18**	-	**20**
Copper, Cu	mg/kg	0.5		**14**	**19**	-	**17**
Lead, Pb	mg/kg	1		**34**	**25**	-	**27**
Iron, Fe	mg/kg	50		-	**22000**	-	-
Nickel, Ni	mg/kg	0.5		**10**	**17**	-	**11**
Zinc, Zn	mg/kg	0.5		**45**	**63**	-	**49**
Particle sizing of soils <75µm by hydrometer Method: AN005							
Sedimentation Diameter 1	mm	0.0001		-	**0.0520**	-	-
Passing Sedimentation Diameter 1	%w/w	1		-	**37**	-	-
Retained Sedimentation Diameter 1	%w/w	1		-	**1**	-	-
Sedimentation Diameter 2	mm	0.0001		-	**0.0369**	-	-
Passing Sedimentation Diameter 2	%w/w	1		-	**36**	-	-
Retained Sedimentation Diameter 2	%w/w	1		-	**1**	-	-
Sedimentation Diameter 3	mm	0.0001		-	**0.0262**	-	-
Passing Sedimentation Diameter 3	%w/w	1		-	**34**	-	-
Retained Sedimentation Diameter 3	%w/w	1		-	**2**	-	-
Sedimentation Diameter 4	mm	0.0001		-	**0.0187**	-	-
Passing Sedimentation Diameter 4	%w/w	1		-	**31**	-	-
Retained Sedimentation Diameter 4	%w/w	1		-	**2**	-	-
Sedimentation Diameter 5	mm	0.0001		-	**0.0137**	-	-
Passing Sedimentation Diameter 5	%w/w	1		-	**29**	-	-
Retained Sedimentation Diameter 5	%w/w	1		-	**2**	-	-
Sedimentation Diameter 6	mm	0.0001		-	**0.0098**	-	-
Passing Sedimentation Diameter 6	%w/w	1		-	**26**	-	-
Retained Sedimentation Diameter 6	%w/w	1		-	**3**	-	-
Sedimentation Diameter 7	mm	0.0001		-	**0.0070**	-	-
Passing Sedimentation Diameter 7	%w/w	1		-	**24**	-	-
Retained Sedimentation Diameter 7	%w/w	1		-	**2**	-	-
Sedimentation Diameter 8	mm	0.0001		-	**0.0049**	-	-
Passing Sedimentation Diameter 8	%w/w	1		-	**23**	-	-
Retained Sedimentation Diameter 8	%w/w	1		-	**1**	-	-
Sedimentation Diameter 9	mm	0.0001		-	**0.0035**	-	-
Passing Sedimentation Diameter 9	%w/w	1		-	**23**	-	-
Retained Sedimentation Diameter 9	%w/w	1		-	<1	-	-
Sedimentation Diameter 10	mm	0.0001		-	**0.0014**	-	-
Passing Sedimentation Diameter 10	%w/w	1		-	**21**	-	-
Retained Sedimentation Diameter 10	%w/w	1		-	**1**	-	-
Sedimentation Diameter 11	mm	0.0001		-	**0.0010**	-	-
Passing Sedimentation Diameter 11	%w/w	1		-	**20**	-	-
Retained Sedimentation Diameter 11	%w/w	1		-	**1**	-	-
Mercury in Soil Method: AN312							
Mercury	mg/kg	0.01		**0.02**	**0.03**	-	**0.02**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134169.005 Soil 04 Dec 2014 TP22 0.0-0.1	SE134169.006 Soil 04 Dec 2014 TP22 0.4-0.5	SE134169.007 Soil 04 Dec 2014 TP22 1.9-2.0	SE134169.008 Soil 04 Dec 2014 TP23 0.0-0.1
Gravimetric Determination of Asbestos in Soil Method: AN605						
Total Sample Weight*	g	1	**690**	**762**	**715**	**615**
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001
Fibre Type*	No unit	-	-	-	-	-
Moisture Content Method: AN002						
% Moisture	%	0.5	**13**	**9.0**	-	**13**
VOCs in Water Method: AN433/AN434						
Monocyclic Aromatic Hydrocarbons						
Benzene	µg/L	0.5	-	-	-	-
Toluene	µg/L	0.5	-	-	-	-
Ethylbenzene	µg/L	0.5	-	-	-	-
m/p-xylene	µg/L	1	-	-	-	-
o-xylene	µg/L	0.5	-	-	-	-
Polycyclic VOCs						
Naphthalene	µg/L	0.5	-	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-	-
Totals						
Total Xylenes	µg/L	1.5	-	-	-	-
Total BTEX	µg/L	3	-	-	-	-

Parameter	Units	LOR	Sample Number: SE134169.005 Sample Matrix: Soil Sample Date: 04 Dec 2014 Sample Name: TP22 0.0-0.1	SE134169.006 Soil 04 Dec 2014 TP22 0.4-0.5	SE134169.007 Soil 04 Dec 2014 TP22 1.9-2.0	SE134169.008 Soil 04 Dec 2014 TP23 0.0-0.1
Volatile Petroleum Hydrocarbons in Water Method: AN433/AN434/AN410						
TRH C6-C10	µg/L	50	-	-	-	-
TRH C6-C9	µg/L	40	-	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-	-
VPH F Bands						
Benzene (F0)	µg/L	0.5	-	-	-	-
TRH C6-C10 minus BTEX (F1)	µg/L	50	-	-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420						
Naphthalene	µg/L	0.1	-	-	-	-
2-methylnaphthalene	µg/L	0.1	-	-	-	-
1-methylnaphthalene	µg/L	0.1	-	-	-	-
Acenaphthylene	µg/L	0.1	-	-	-	-
Acenaphthene	µg/L	0.1	-	-	-	-
Fluorene	µg/L	0.1	-	-	-	-
Phenanthrene	µg/L	0.1	-	-	-	-
Anthracene	µg/L	0.1	-	-	-	-
Fluoranthene	µg/L	0.1	-	-	-	-
Pyrene	µg/L	0.1	-	-	-	-
Benzo(a)anthracene	µg/L	0.1	-	-	-	-
Chrysene	µg/L	0.1	-	-	-	-
Benzo(b&j)fluoranthene	µg/L	0.1	-	-	-	-
Benzo(k)fluoranthene	µg/L	0.1	-	-	-	-
Benzo(a)pyrene	µg/L	0.1	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/L	0.1	-	-	-	-
Dibenzo(a&h)anthracene	µg/L	0.1	-	-	-	-
Benzo(ghi)perylene	µg/L	0.1	-	-	-	-
Total PAH (18)	µg/L	1	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.005 Soil 04 Dec 2014 TP22 0.0-0.1	SE134169.006 Soil 04 Dec 2014 TP22 0.4-0.5	SE134169.007 Soil 04 Dec 2014 TP22 1.9-2.0	SE134169.008 Soil 04 Dec 2014 TP23 0.0-0.1
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420 (continued)							
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		-	-	-	-
2-fluorobiphenyl (Surrogate)	%	-		-	-	-	-
d14-p-terphenyl (Surrogate)	%	-		-	-	-	-
Trace Metals (Dissolved) in Water by ICPMS Method: AN318							
Arsenic, As	µg/L	1		-	-	-	-
Cadmium, Cd	µg/L	0.1		-	-	-	-
Chromium, Cr	µg/L	1		-	-	-	-
Copper, Cu	µg/L	1		-	-	-	-
Lead, Pb	µg/L	1		-	-	-	-
Nickel, Ni	µg/L	1		-	-	-	-
Zinc, Zn	µg/L	5		-	-	-	-
Mercury (dissolved) in Water Method: AN311/AN312							
Mercury	mg/L	0.0001		-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.009 Soil 04 Dec 2014 TP23 0.9-1.0	SE134169.010 Soil 04 Dec 2014 TP24 0.0-0.1	SE134169.011 Soil 04 Dec 2014 TP25 0.0-0.1	SE134169.012 Soil 04 Dec 2014 QC 1
VOC's in Soil Method: AN433/AN434							
Monocyclic Aromatic Hydrocarbons							
Benzene	mg/kg	0.1		-	<0.1	<0.1	-
Toluene	mg/kg	0.1		-	<0.1	<0.1	-
Ethylbenzene	mg/kg	0.1		-	<0.1	<0.1	-
m/p-xylene	mg/kg	0.2		-	<0.2	<0.2	-
o-xylene	mg/kg	0.1		-	<0.1	<0.1	-
Polycyclic VOCs							
Naphthalene	mg/kg	0.1		-	<0.1	<0.1	-
Surrogates							
Dibromofluoromethane (Surrogate)	%	-		-	**77**	**70**	-
d4-1,2-dichloroethane (Surrogate)	%	-		-	**74**	**72**	-
d8-toluene (Surrogate)	%	-		-	**93**	**102**	-
Bromofluorobenzene (Surrogate)	%	-		-	**94**	**91**	-
Totals							
Total Xylenes*	mg/kg	0.3		-	<0.3	<0.3	-
Total BTEX*	mg/kg	0.6		-	<0.6	<0.6	-
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410							
TRH C6-C10	mg/kg	25		-	<25	<25	-
TRH C6-C9	mg/kg	20		-	<20	<20	-
Surrogates							
Dibromofluoromethane (Surrogate)	%	-		-	**77**	**70**	-
d4-1,2-dichloroethane (Surrogate)	%	-		-	**74**	**72**	-
d8-toluene (Surrogate)	%	-		-	**93**	**102**	-
Bromofluorobenzene (Surrogate)	%	-		-	**94**	**91**	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.009 Soil 04 Dec 2014 TP23 0.9-1.0	SE134169.010 Soil 04 Dec 2014 TP24 0.0-0.1	SE134169.011 Soil 04 Dec 2014 TP25 0.0-0.1	SE134169.012 Soil 04 Dec 2014 QC 1
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410 (continued)							
VPH F Bands							
Benzene (F0)	mg/kg	0.1		-	<0.1	<0.1	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25		-	<25	<25	-
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403							
TRH C10-C14	mg/kg	20		-	<20	<20	-
TRH C15-C28	mg/kg	45		-	<45	**160**	-
TRH C29-C36	mg/kg	45		-	<45	**92**	-
TRH C37-C40	mg/kg	100		-	<100	<100	-
TRH C10-C36 Total	mg/kg	110		-	<110	**250**	-
TRH C10-C40 Total	mg/kg	210		-	<210	**250**	-
TRH F Bands							
TRH >C10-C16 (F2)	mg/kg	25		-	<25	<25	-
TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25		-	<25	<25	-
TRH >C16-C34 (F3)	mg/kg	90		-	<90	**210**	-
TRH >C34-C40 (F4)	mg/kg	120		-	<120	<120	-
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420							
Naphthalene	mg/kg	0.1		-	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1		-	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Chrysene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1		-	<0.1	<0.1	<0.1
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=0*	TEQ	0.2		-	<0.2	<0.2	<0.2
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=LOR*	TEQ (mg/kg)	0.3		-	<0.3	<0.3	<0.3
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=LOR/2*	TEQ (mg/kg)	0.2		-	<0.2	<0.2	<0.2
Total PAH	mg/kg	0.8		-	<0.8	<0.8	<0.8

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.009 Soil 04 Dec 2014 TP23 0.9-1.0	SE134169.010 Soil 04 Dec 2014 TP24 0.0-0.1	SE134169.011 Soil 04 Dec 2014 TP25 0.0-0.1	SE134169.012 Soil 04 Dec 2014 QC 1
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)							
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		-	**98**	**98**	**94**
2-fluorobiphenyl (Surrogate)	%	-		-	**84**	**90**	**82**
d14-p-terphenyl (Surrogate)	%	-		-	**90**	**92**	**96**
Speciated Phenols in Soil Method: AN420							
Phenol	mg/kg	0.5		-	<0.5	<0.5	-
2-methyl phenol (o-cresol)	mg/kg	0.5		-	<0.5	<0.5	-
3/4-methyl phenol (m/p-cresol)	mg/kg	1		-	<1	<1	-
Total Cresol	mg/kg	1.5		-	<1.5	<1.5	-
2-chlorophenol	mg/kg	0.5		-	<0.5	<0.5	-
2,4-dimethylphenol	mg/kg	0.5		-	<0.5	<0.5	-
2,6-dichlorophenol	mg/kg	0.5		-	<0.5	<0.5	-
2,4-dichlorophenol	mg/kg	0.5		-	<0.5	<0.5	-
2,4,6-trichlorophenol	mg/kg	0.5		-	<0.5	<0.5	-
2-nitrophenol	mg/kg	0.5		-	<0.5	<0.5	-
4-nitrophenol	mg/kg	1		-	<1	<1	-
2,4,5-trichlorophenol	mg/kg	0.5		-	<0.5	<0.5	-
2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1		-	<1	<1	-
Pentachlorophenol	mg/kg	0.5		-	<0.5	<0.5	-
2,4-dinitrophenol	mg/kg	2		-	<2	<2	-
4-chloro-3-methylphenol	mg/kg	2		-	<2	<2	-
Surrogates							
2,4,6-Tribromophenol (Surrogate)	%	-		-	**75**	**88**	-
d5-phenol (Surrogate)	%	-		-	**73**	**71**	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.009 Soil 04 Dec 2014 TP23 0.9-1.0	SE134169.010 Soil 04 Dec 2014 TP24 0.0-0.1	SE134169.011 Soil 04 Dec 2014 TP25 0.0-0.1	SE134169.012 Soil 04 Dec 2014 QC 1
OC Pesticides in Soil Method: AN400/AN420							
Hexachlorobenzene (HCB)	mg/kg	0.1		-	<0.1	<0.1	-
Alpha BHC	mg/kg	0.1		-	<0.1	<0.1	-
Lindane	mg/kg	0.1		-	<0.1	<0.1	-
Heptachlor	mg/kg	0.1		-	<0.1	<0.1	-
Aldrin	mg/kg	0.1		-	<0.1	<0.1	-
Beta BHC	mg/kg	0.1		-	<0.1	<0.1	-
Delta BHC	mg/kg	0.1		-	<0.1	<0.1	-
Heptachlor epoxide	mg/kg	0.1		-	<0.1	<0.1	-
o,p'-DDE	mg/kg	0.1		-	<0.1	<0.1	-
Alpha Endosulfan	mg/kg	0.2		-	<0.2	<0.2	-
Gamma Chlordane	mg/kg	0.1		-	<0.1	<0.1	-
Alpha Chlordane	mg/kg	0.1		-	<0.1	<0.1	-
trans-Nonachlor	mg/kg	0.1		-	<0.1	<0.1	-
p,p'-DDE	mg/kg	0.1		-	<0.1	<0.1	-
Dieldrin	mg/kg	0.2		-	<0.2	<0.2	-
Endrin	mg/kg	0.2		-	<0.2	<0.2	-
o,p'-DDD	mg/kg	0.1		-	<0.1	<0.1	-
o,p'-DDT	mg/kg	0.1		-	<0.1	<0.1	-
Beta Endosulfan	mg/kg	0.2		-	<0.2	<0.2	-
p,p'-DDD	mg/kg	0.1		-	<0.1	<0.1	-
p,p'-DDT	mg/kg	0.1		-	<0.1	<0.1	-
Endosulfan sulphate	mg/kg	0.1		-	<0.1	<0.1	-
Endrin Aldehyde	mg/kg	0.1		-	<0.1	<0.1	-
Methoxychlor	mg/kg	0.1		-	<0.1	<0.1	-
Endrin Ketone	mg/kg	0.1		-	<0.1	<0.1	-
Isodrin	mg/kg	0.1		-	<0.1	<0.1	-
Mirex	mg/kg	0.1		-	<0.1	<0.1	-
Surrogates							
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-		-	**89**	**113**	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134169.009 Soil 04 Dec 2014 TP23 0.9-1.0	SE134169.010 Soil 04 Dec 2014 TP24 0.0-0.1	SE134169.011 Soil 04 Dec 2014 TP25 0.0-0.1	SE134169.012 Soil 04 Dec 2014 QC 1
PCBs in Soil Method: AN400/AN420						
Arochlor 1016	mg/kg	0.2	-	<0.2	<0.2	-
Arochlor 1221	mg/kg	0.2	-	<0.2	<0.2	-
Arochlor 1232	mg/kg	0.2	-	<0.2	<0.2	-
Arochlor 1242	mg/kg	0.2	-	<0.2	<0.2	-
Arochlor 1248	mg/kg	0.2	-	<0.2	<0.2	-
Arochlor 1254	mg/kg	0.2	-	<0.2	<0.2	-
Arochlor 1260	mg/kg	0.2	-	<0.2	<0.2	-
Arochlor 1262	mg/kg	0.2	-	<0.2	<0.2	-
Arochlor 1268	mg/kg	0.2	-	<0.2	<0.2	-
Total PCBs (Arochlors)	mg/kg	1	-	<1	<1	-
Surrogates						
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	-	**89**	**113**	-
pH in soil (1:5) Method: AN101						
pH	pH Units	-	**7.7**	-	-	-
Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) Method: AN122						
Exchangeable Sodium, Na	mg/kg	2	**15**	-	-	-
Exchangeable Sodium, Na	meq/100g	0.01	**0.06**	-	-	-
Exchangeable Sodium Percentage*	%	0.1	**0.5**	-	-	-
Exchangeable Potassium, K	mg/kg	2	**110**	-	-	-
Exchangeable Potassium, K	meq/100g	0.01	**0.29**	-	-	-
Exchangeable Potassium Percentage*	%	0.1	**2.1**	-	-	-
Exchangeable Calcium, Ca	mg/kg	2	**1800**	-	-	-
Exchangeable Calcium, Ca	meq/100g	0.01	**8.9**	-	-	-
Exchangeable Calcium Percentage*	%	0.1	**64.7**	-	-	-
Exchangeable Magnesium, Mg	mg/kg	2	**550**	-	-	-
Exchangeable Magnesium, Mg	meq/100g	0.02	**4.5**	-	-	-
Exchangeable Magnesium Percentage*	%	0.1	**32.7**	-	-	-
Cation Exchange Capacity	meq/100g	0.02	**14**	-	-	-

Parameter	Units	LOR	Sample Number: SE134169.009 Sample Matrix: Soil Sample Date: 04 Dec 2014 Sample Name: TP23 0.9-1.0	SE134169.010 Soil 04 Dec 2014 TP24 0.0-0.1	SE134169.011 Soil 04 Dec 2014 TP25 0.0-0.1	SE134169.012 Soil 04 Dec 2014 QC 1
TOC in Soil Method: AN188						
Total Organic Carbon	%w/w	0.05	**1.3**	-	-	-
Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest Method: AN040/AN320						
Arsenic, As	mg/kg	3	**7**	**6**	**6**	**7**
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.3	**16**	**37**	**32**	**19**
Copper, Cu	mg/kg	0.5	**20**	**8.8**	**7.1**	**19**
Lead, Pb	mg/kg	1	**25**	**34**	**29**	**26**
Iron, Fe	mg/kg	50	**24000**	-	-	-
Nickel, Ni	mg/kg	0.5	**18**	**6.4**	**7.0**	**13**
Zinc, Zn	mg/kg	0.5	**77**	**50**	**33**	**53**
Particle sizing of soils <75µm by hydrometer Method: AN005						
Sedimentation Diameter 1	mm	0.0001	**0.0540**	-	-	-
Passing Sedimentation Diameter 1	%w/w	1	**55**	-	-	-
Retained Sedimentation Diameter 1	%w/w	1	**1**	-	-	-
Sedimentation Diameter 2	mm	0.0001	**0.0384**	-	-	-
Passing Sedimentation Diameter 2	%w/w	1	**52**	-	-	-
Retained Sedimentation Diameter 2	%w/w	1	**2**	-	-	-
Sedimentation Diameter 3	mm	0.0001	**0.0275**	-	-	-
Passing Sedimentation Diameter 3	%w/w	1	**47**	-	-	-
Retained Sedimentation Diameter 3	%w/w	1	**5**	-	-	-
Sedimentation Diameter 4	mm	0.0001	**0.0195**	-	-	-
Passing Sedimentation Diameter 4	%w/w	1	**46**	-	-	-
Retained Sedimentation Diameter 4	%w/w	1	**1**	-	-	-
Sedimentation Diameter 5	mm	0.0001	**0.0144**	-	-	-
Passing Sedimentation Diameter 5	%w/w	1	**42**	-	-	-
Retained Sedimentation Diameter 5	%w/w	1	**4**	-	-	-
Sedimentation Diameter 6	mm	0.0001	**0.0102**	-	-	-
Passing Sedimentation Diameter 6	%w/w	1	**40**	-	-	-
Retained Sedimentation Diameter 6	%w/w	1	**2**	-	-	-
Sedimentation Diameter 7	mm	0.0001	**0.0073**	-	-	-
Passing Sedimentation Diameter 7	%w/w	1	**37**	-	-	-
Retained Sedimentation Diameter 7	%w/w	1	**2**	-	-	-
Sedimentation Diameter 8	mm	0.0001	**0.0052**	-	-	-
Passing Sedimentation Diameter 8	%w/w	1	**34**	-	-	-
Retained Sedimentation Diameter 8	%w/w	1	**4**	-	-	-
Sedimentation Diameter 9	mm	0.0001	**0.0037**	-	-	-
Passing Sedimentation Diameter 9	%w/w	1	**32**	-	-	-
Retained Sedimentation Diameter 9	%w/w	1	**1**	-	-	-
Sedimentation Diameter 10	mm	0.0001	**0.0015**	-	-	-
Passing Sedimentation Diameter 10	%w/w	1	**31**	-	-	-
Retained Sedimentation Diameter 10	%w/w	1	**1**	-	-	-
Sedimentation Diameter 11	mm	0.0001	**0.0011**	-	-	-
Passing Sedimentation Diameter 11	%w/w	1	**30**	-	-	-
Retained Sedimentation Diameter 11	%w/w	1	**1**	-	-	-
Mercury in Soil Method: AN312						
Mercury	mg/kg	0.01	**0.03**	**0.03**	**0.04**	**0.02**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134169.009 Soil 04 Dec 2014 TP23 0.9-1.0	SE134169.010 Soil 04 Dec 2014 TP24 0.0-0.1	SE134169.011 Soil 04 Dec 2014 TP25 0.0-0.1	SE134169.012 Soil 04 Dec 2014 QC 1
Gravimetric Determination of Asbestos in Soil Method: AN605						
Total Sample Weight*	g	1	**601**	**438**	**418**	**587**
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001
Fibre Type*	No unit	-	-	-	-	-
Moisture Content Method: AN002						
% Moisture	%	0.5	**10**	**16**	**13**	**12**
VOCs in Water Method: AN433/AN434						
Monocyclic Aromatic Hydrocarbons						
Benzene	µg/L	0.5	-	-	-	-
Toluene	µg/L	0.5	-	-	-	-
Ethylbenzene	µg/L	0.5	-	-	-	-
m/p-xylene	µg/L	1	-	-	-	-
o-xylene	µg/L	0.5	-	-	-	-
Polycyclic VOCs						
Naphthalene	µg/L	0.5	-	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-	-
Totals						
Total Xylenes	µg/L	1.5	-	-	-	-
Total BTEX	µg/L	3	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134169.009 Soil 04 Dec 2014 TP23 0.9-1.0	SE134169.010 Soil 04 Dec 2014 TP24 0.0-0.1	SE134169.011 Soil 04 Dec 2014 TP25 0.0-0.1	SE134169.012 Soil 04 Dec 2014 QC 1
Volatile Petroleum Hydrocarbons in Water Method: AN433/AN434/AN410						
TRH C6-C10	µg/L	50	-	-	-	-
TRH C6-C9	µg/L	40	-	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-	-
VPH F Bands						
Benzene (F0)	µg/L	0.5	-	-	-	-
TRH C6-C10 minus BTEX (F1)	µg/L	50	-	-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420						
Naphthalene	µg/L	0.1	-	-	-	-
2-methylnaphthalene	µg/L	0.1	-	-	-	-
1-methylnaphthalene	µg/L	0.1	-	-	-	-
Acenaphthylene	µg/L	0.1	-	-	-	-
Acenaphthene	µg/L	0.1	-	-	-	-
Fluorene	µg/L	0.1	-	-	-	-
Phenanthrene	µg/L	0.1	-	-	-	-
Anthracene	µg/L	0.1	-	-	-	-
Fluoranthene	µg/L	0.1	-	-	-	-
Pyrene	µg/L	0.1	-	-	-	-
Benzo(a)anthracene	µg/L	0.1	-	-	-	-
Chrysene	µg/L	0.1	-	-	-	-
Benzo(b&j)fluoranthene	µg/L	0.1	-	-	-	-
Benzo(k)fluoranthene	µg/L	0.1	-	-	-	-
Benzo(a)pyrene	µg/L	0.1	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/L	0.1	-	-	-	-
Dibenzo(a&h)anthracene	µg/L	0.1	-	-	-	-
Benzo(ghi)perylene	µg/L	0.1	-	-	-	-
Total PAH (18)	µg/L	1	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.009 Soil 04 Dec 2014 TP23 0.9-1.0	SE134169.010 Soil 04 Dec 2014 TP24 0.0-0.1	SE134169.011 Soil 04 Dec 2014 TP25 0.0-0.1	SE134169.012 Soil 04 Dec 2014 QC 1
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420 (continued)							
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		-	-	-	-
2-fluorobiphenyl (Surrogate)	%	-		-	-	-	-
d14-p-terphenyl (Surrogate)	%	-		-	-	-	-
Trace Metals (Dissolved) in Water by ICPMS Method: AN318							
Arsenic, As	µg/L	1		-	-	-	-
Cadmium, Cd	µg/L	0.1		-	-	-	-
Chromium, Cr	µg/L	1		-	-	-	-
Copper, Cu	µg/L	1		-	-	-	-
Lead, Pb	µg/L	1		-	-	-	-
Nickel, Ni	µg/L	1		-	-	-	-
Zinc, Zn	µg/L	5		-	-	-	-
Mercury (dissolved) in Water Method: AN311/AN312							
Mercury	mg/L	0.0001		-	-	-	-

Parameter	Units	LOR	Sample Number: SE134169.013 Sample Matrix: Water Sample Date: 04 Dec 2014 Sample Name: R1	SE134169.014 Water 04 Dec 2014 Trip Blank 1	SE134169.015 Water 04 Dec 2014 Trip Spike 1
VOC's in Soil Method: AN433/AN434					
Monocyclic Aromatic Hydrocarbons					
Benzene	mg/kg	0.1	-	-	-
Toluene	mg/kg	0.1	-	-	-
Ethylbenzene	mg/kg	0.1	-	-	-
m/p-xylene	mg/kg	0.2	-	-	-
o-xylene	mg/kg	0.1	-	-	-
Polycyclic VOCs					
Naphthalene	mg/kg	0.1	-	-	-
Surrogates					
Dibromofluoromethane (Surrogate)	%	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-
Totals					
Total Xylenes*	mg/kg	0.3	-	-	-
Total BTEX*	mg/kg	0.6	-	-	-
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410					
TRH C6-C10	mg/kg	25	-	-	-
TRH C6-C9	mg/kg	20	-	-	-
Surrogates					
Dibromofluoromethane (Surrogate)	%	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.013 Water 04 Dec 2014 R1	SE134169.014 Water 04 Dec 2014 Trip Blank 1	SE134169.015 Water 04 Dec 2014 Trip Spike 1
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410 (continued)						
VPH F Bands						
Benzene (F0)	mg/kg	0.1		-	-	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25		-	-	-
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403						
TRH C10-C14	mg/kg	20		-	-	-
TRH C15-C28	mg/kg	45		-	-	-
TRH C29-C36	mg/kg	45		-	-	-
TRH C37-C40	mg/kg	100		-	-	-
TRH C10-C36 Total	mg/kg	110		-	-	-
TRH C10-C40 Total	mg/kg	210		-	-	-
TRH F Bands						
TRH >C10-C16 (F2)	mg/kg	25		-	-	-
TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25		-	-	-
TRH >C16-C34 (F3)	mg/kg	90		-	-	-
TRH >C34-C40 (F4)	mg/kg	120		-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420						
Naphthalene	mg/kg	0.1		-	-	-
2-methylnaphthalene	mg/kg	0.1		-	-	-
1-methylnaphthalene	mg/kg	0.1		-	-	-
Acenaphthylene	mg/kg	0.1		-	-	-
Acenaphthene	mg/kg	0.1		-	-	-
Fluorene	mg/kg	0.1		-	-	-
Phenanthrene	mg/kg	0.1		-	-	-
Anthracene	mg/kg	0.1		-	-	-
Fluoranthene	mg/kg	0.1		-	-	-
Pyrene	mg/kg	0.1		-	-	-
Benzo(a)anthracene	mg/kg	0.1		-	-	-
Chrysene	mg/kg	0.1		-	-	-
Benzo(b&j)fluoranthene	mg/kg	0.1		-	-	-
Benzo(k)fluoranthene	mg/kg	0.1		-	-	-
Benzo(a)pyrene	mg/kg	0.1		-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1		-	-	-
Dibenzo(a&h)anthracene	mg/kg	0.1		-	-	-
Benzo(ghi)perylene	mg/kg	0.1		-	-	-
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=0*	TEQ	0.2		-	-	-
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=LOR*	TEQ (mg/kg)	0.3		-	-	-
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=LOR/2*	TEQ (mg/kg)	0.2		-	-	-
Total PAH	mg/kg	0.8		-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.013 Water 04 Dec 2014 R1	SE134169.014 Water 04 Dec 2014 Trip Blank 1	SE134169.015 Water 04 Dec 2014 Trip Spike 1
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)						
Surrogates						
d5-nitrobenzene (Surrogate)	%	-		-	-	-
2-fluorobiphenyl (Surrogate)	%	-		-	-	-
d14-p-terphenyl (Surrogate)	%	-		-	-	-
Speciated Phenols in Soil Method: AN420						
Phenol	mg/kg	0.5		-	-	-
2-methyl phenol (o-cresol)	mg/kg	0.5		-	-	-
3/4-methyl phenol (m/p-cresol)	mg/kg	1		-	-	-
Total Cresol	mg/kg	1.5		-	-	-
2-chlorophenol	mg/kg	0.5		-	-	-
2,4-dimethylphenol	mg/kg	0.5		-	-	-
2,6-dichlorophenol	mg/kg	0.5		-	-	-
2,4-dichlorophenol	mg/kg	0.5		-	-	-
2,4,6-trichlorophenol	mg/kg	0.5		-	-	-
2-nitrophenol	mg/kg	0.5		-	-	-
4-nitrophenol	mg/kg	1		-	-	-
2,4,5-trichlorophenol	mg/kg	0.5		-	-	-
2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1		-	-	-
Pentachlorophenol	mg/kg	0.5		-	-	-
2,4-dinitrophenol	mg/kg	2		-	-	-
4-chloro-3-methylphenol	mg/kg	2		-	-	-
Surrogates						
2,4,6-Tribromophenol (Surrogate)	%	-		-	-	-
d5-phenol (Surrogate)	%	-		-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.013 Water 04 Dec 2014 R1	SE134169.014 Water 04 Dec 2014 Trip Blank 1	SE134169.015 Water 04 Dec 2014 Trip Spike 1
OC Pesticides in Soil Method: AN400/AN420						
Hexachlorobenzene (HCB)	mg/kg	0.1		-	-	-
Alpha BHC	mg/kg	0.1		-	-	-
Lindane	mg/kg	0.1		-	-	-
Heptachlor	mg/kg	0.1		-	-	-
Aldrin	mg/kg	0.1		-	-	-
Beta BHC	mg/kg	0.1		-	-	-
Delta BHC	mg/kg	0.1		-	-	-
Heptachlor epoxide	mg/kg	0.1		-	-	-
o,p'-DDE	mg/kg	0.1		-	-	-
Alpha Endosulfan	mg/kg	0.2		-	-	-
Gamma Chlordane	mg/kg	0.1		-	-	-
Alpha Chlordane	mg/kg	0.1		-	-	-
trans-Nonachlor	mg/kg	0.1		-	-	-
p,p'-DDE	mg/kg	0.1		-	-	-
Dieldrin	mg/kg	0.2		-	-	-
Endrin	mg/kg	0.2		-	-	-
o,p'-DDD	mg/kg	0.1		-	-	-
o,p'-DDT	mg/kg	0.1		-	-	-
Beta Endosulfan	mg/kg	0.2		-	-	-
p,p'-DDD	mg/kg	0.1		-	-	-
p,p'-DDT	mg/kg	0.1		-	-	-
Endosulfan sulphate	mg/kg	0.1		-	-	-
Endrin Aldehyde	mg/kg	0.1		-	-	-
Methoxychlor	mg/kg	0.1		-	-	-
Endrin Ketone	mg/kg	0.1		-	-	-
Isodrin	mg/kg	0.1		-	-	-
Mirex	mg/kg	0.1		-	-	-
Surrogates						
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-		-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.013 Water 04 Dec 2014 R1	SE134169.014 Water 04 Dec 2014 Trip Blank 1	SE134169.015 Water 04 Dec 2014 Trip Spike 1
PCBs in Soil Method: AN400/AN420						
Arochlor 1016	mg/kg	0.2		-	-	-
Arochlor 1221	mg/kg	0.2		-	-	-
Arochlor 1232	mg/kg	0.2		-	-	-
Arochlor 1242	mg/kg	0.2		-	-	-
Arochlor 1248	mg/kg	0.2		-	-	-
Arochlor 1254	mg/kg	0.2		-	-	-
Arochlor 1260	mg/kg	0.2		-	-	-
Arochlor 1262	mg/kg	0.2		-	-	-
Arochlor 1268	mg/kg	0.2		-	-	-
Total PCBs (Arochlors)	mg/kg	1		-	-	-
Surrogates						
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-		-	-	-
pH in soil (1:5) Method: AN101						
pH	pH Units	-		-	-	-
Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) Method: AN122						
Exchangeable Sodium, Na	mg/kg	2		-	-	-
Exchangeable Sodium, Na	meq/100g	0.01		-	-	-
Exchangeable Sodium Percentage*	%	0.1		-	-	-
Exchangeable Potassium, K	mg/kg	2		-	-	-
Exchangeable Potassium, K	meq/100g	0.01		-	-	-
Exchangeable Potassium Percentage*	%	0.1		-	-	-
Exchangeable Calcium, Ca	mg/kg	2		-	-	-
Exchangeable Calcium, Ca	meq/100g	0.01		-	-	-
Exchangeable Calcium Percentage*	%	0.1		-	-	-
Exchangeable Magnesium, Mg	mg/kg	2		-	-	-
Exchangeable Magnesium, Mg	meq/100g	0.02		-	-	-
Exchangeable Magnesium Percentage*	%	0.1		-	-	-
Cation Exchange Capacity	meq/100g	0.02		-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.013 Water 04 Dec 2014 R1	SE134169.014 Water 04 Dec 2014 Trip Blank 1	SE134169.015 Water 04 Dec 2014 Trip Spike 1
TOC in Soil Method: AN188						
Total Organic Carbon	%w/w	0.05		-	-	-
Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest Method: AN040/AN320						
Arsenic, As	mg/kg	3		-	-	-
Cadmium, Cd	mg/kg	0.3		-	-	-
Chromium, Cr	mg/kg	0.3		-	-	-
Copper, Cu	mg/kg	0.5		-	-	-
Lead, Pb	mg/kg	1		-	-	-
Iron, Fe	mg/kg	50		-	-	-
Nickel, Ni	mg/kg	0.5		-	-	-
Zinc, Zn	mg/kg	0.5		-	-	-
Particle sizing of soils <75µm by hydrometer Method: AN005						
Sedimentation Diameter 1	mm	0.0001		-	-	-
Passing Sedimentation Diameter 1	%w/w	1		-	-	-
Retained Sedimentation Diameter 1	%w/w	1		-	-	-
Sedimentation Diameter 2	mm	0.0001		-	-	-
Passing Sedimentation Diameter 2	%w/w	1		-	-	-
Retained Sedimentation Diameter 2	%w/w	1		-	-	-
Sedimentation Diameter 3	mm	0.0001		-	-	-
Passing Sedimentation Diameter 3	%w/w	1		-	-	-
Retained Sedimentation Diameter 3	%w/w	1		-	-	-
Sedimentation Diameter 4	mm	0.0001		-	-	-
Passing Sedimentation Diameter 4	%w/w	1		-	-	-
Retained Sedimentation Diameter 4	%w/w	1		-	-	-
Sedimentation Diameter 5	mm	0.0001		-	-	-
Passing Sedimentation Diameter 5	%w/w	1		-	-	-
Retained Sedimentation Diameter 5	%w/w	1		-	-	-
Sedimentation Diameter 6	mm	0.0001		-	-	-
Passing Sedimentation Diameter 6	%w/w	1		-	-	-
Retained Sedimentation Diameter 6	%w/w	1		-	-	-
Sedimentation Diameter 7	mm	0.0001		-	-	-
Passing Sedimentation Diameter 7	%w/w	1		-	-	-
Retained Sedimentation Diameter 7	%w/w	1		-	-	-
Sedimentation Diameter 8	mm	0.0001		-	-	-
Passing Sedimentation Diameter 8	%w/w	1		-	-	-
Retained Sedimentation Diameter 8	%w/w	1		-	-	-
Sedimentation Diameter 9	mm	0.0001		-	-	-
Passing Sedimentation Diameter 9	%w/w	1		-	-	-
Retained Sedimentation Diameter 9	%w/w	1		-	-	-
Sedimentation Diameter 10	mm	0.0001		-	-	-
Passing Sedimentation Diameter 10	%w/w	1		-	-	-
Retained Sedimentation Diameter 10	%w/w	1		-	-	-
Sedimentation Diameter 11	mm	0.0001		-	-	-
Passing Sedimentation Diameter 11	%w/w	1		-	-	-
Retained Sedimentation Diameter 11	%w/w	1		-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.013 Water 04 Dec 2014 R1	SE134169.014 Water 04 Dec 2014 Trip Blank 1	SE134169.015 Water 04 Dec 2014 Trip Spike 1
Mercury in Soil Method: AN312						
Mercury	mg/kg	0.01		-	-	-
Gravimetric Determination of Asbestos in Soil Method: AN605						
Total Sample Weight*	g	1		-	-	-
Asbestos in soil (>7mm ACM)*	%w/w	0.01		-	-	-
Asbestos in soil (>2mm to <7mm AF/FA)*	%w/w	0.001		-	-	-
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001		-	-	-
Fibre Type*	No unit	-		-	-	-
Moisture Content Method: AN002						
% Moisture	%	0.5		-	-	-
VOCs in Water Method: AN433/AN434						
Monocyclic Aromatic Hydrocarbons						
Benzene	µg/L	0.5		-	<0.5	[91%]
Toluene	µg/L	0.5		-	<0.5	[93%]
Ethylbenzene	µg/L	0.5		-	<0.5	[94%]
m/p-xylene	µg/L	1		-	<1	[96%]
o-xylene	µg/L	0.5		-	<0.5	[97%]
Polycyclic VOCs						
Naphthalene	µg/L	0.5		-	<0.5	<0.5
Surrogates						
Dibromofluoromethane (Surrogate)	%	-		-	**117**	**94**
d4-1,2-dichloroethane (Surrogate)	%	-		-	**111**	**91**
d8-toluene (Surrogate)	%	-		-	**98**	**91**
Bromofluorobenzene (Surrogate)	%	-		-	**83**	**111**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134169.013 Water 04 Dec 2014 R1	SE134169.014 Water 04 Dec 2014 Trip Blank 1	SE134169.015 Water 04 Dec 2014 Trip Spike 1
VOCs in Water Method: AN433/AN434 (continued)						
Totals						
Total Xylenes	µg/L	1.5		-	<1.5	-
Total BTEX	µg/L	3		-	<3	-
Volatile Petroleum Hydrocarbons in Water Method: AN433/AN434/AN410						
TRH C6-C10	µg/L	50		-	<50	-
TRH C6-C9	µg/L	40		-	<40	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-		-	**117**	-
d4-1,2-dichloroethane (Surrogate)	%	-		-	**111**	-
d8-toluene (Surrogate)	%	-		-	**98**	-
Bromofluorobenzene (Surrogate)	%	-		-	**83**	-
VPH F Bands						
Benzene (F0)	µg/L	0.5		-	<0.5	-
TRH C6-C10 minus BTEX (F1)	µg/L	50		-	<50	-
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420						
Naphthalene	µg/L	0.1		<0.1	-	-
2-methylnaphthalene	µg/L	0.1		<0.1	-	-
1-methylnaphthalene	µg/L	0.1		<0.1	-	-
Acenaphthylene	µg/L	0.1		<0.1	-	-
Acenaphthene	µg/L	0.1		<0.1	-	-
Fluorene	µg/L	0.1		<0.1	-	-
Phenanthrene	µg/L	0.1		<0.1	-	-
Anthracene	µg/L	0.1		<0.1	-	-
Fluoranthene	µg/L	0.1		<0.1	-	-
Pyrene	µg/L	0.1		<0.1	-	-
Benzo(a)anthracene	µg/L	0.1		<0.1	-	-
Chrysene	µg/L	0.1		<0.1	-	-
Benzo(b&j)fluoranthene	µg/L	0.1		<0.1	-	-
Benzo(k)fluoranthene	µg/L	0.1		<0.1	-	-
Benzo(a)pyrene	µg/L	0.1		<0.1	-	-
Indeno(1,2,3-cd)pyrene	µg/L	0.1		<0.1	-	-
Dibenzo(a&h)anthracene	µg/L	0.1		<0.1	-	-
Benzo(ghi)perylene	µg/L	0.1		<0.1	-	-
Total PAH (18)	µg/L	1		<1	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134169.013 Water 04 Dec 2014 R1	SE134169.014 Water 04 Dec 2014 Trip Blank 1	SE134169.015 Water 04 Dec 2014 Trip Spike 1
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420 (continued)					
Surrogates					
d5-nitrobenzene (Surrogate)	%	-	**64**	-	-
2-fluorobiphenyl (Surrogate)	%	-	**62**	-	-
d14-p-terphenyl (Surrogate)	%	-	**86**	-	-
Trace Metals (Dissolved) in Water by ICPMS Method: AN318					
Arsenic, As	µg/L	1	<1	-	-
Cadmium, Cd	µg/L	0.1	<0.1	-	-
Chromium, Cr	µg/L	1	<1	-	-
Copper, Cu	µg/L	1	**3**	-	-
Lead, Pb	µg/L	1	<1	-	-
Nickel, Ni	µg/L	1	<1	-	-
Zinc, Zn	µg/L	5	**14**	-	-
Mercury (dissolved) in Water Method: AN311/AN312					
Mercury	mg/L	0.0001	**0.0002**	-	-

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) Method: ME-(AU)-[ENV]AN122

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Exchangeable Sodium, Na	LB069122	mg/kg	2		84%
Exchangeable Sodium, Na	LB069122	meq/100g	0.01	<0.01	NA
Exchangeable Sodium Percentage*	LB069122	%	0.1	90.3	NA
Exchangeable Potassium, K	LB069122	mg/kg	2		95%
Exchangeable Potassium, K	LB069122	meq/100g	0.01	<0.01	NA
Exchangeable Potassium Percentage*	LB069122	%	0.1	33.2	NA
Exchangeable Calcium, Ca	LB069122	mg/kg	2		86%
Exchangeable Calcium, Ca	LB069122	meq/100g	0.01	<0.01	NA
Exchangeable Calcium Percentage*	LB069122	%	0.1	<0.1	NA
Exchangeable Magnesium, Mg	LB069122	mg/kg	2		86%
Exchangeable Magnesium, Mg	LB069122	meq/100g	0.02	<0.02	NA
Exchangeable Magnesium Percentage*	LB069122	%	0.1	<0.1	NA
Cation Exchange Capacity	LB069122	meq/100g	0.02	<0.02	NA

Mercury (dissolved) in Water Method: ME-(AU)-[ENV]AN311/AN312

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Mercury	LB069222	mg/L	0.0001	<0.0001	0%	90%	98%

Mercury in Soil Method: ME-(AU)-[ENV]AN312

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Mercury	LB069015	mg/kg	0.01	<0.01	0%	103%	76%
	LB069016	mg/kg	0.01	<0.01	0%	104%	95%

Moisture Content Method: ME-(AU)-[ENV]AN002

Parameter	QC Reference	Units	LOR	DUP %RPD
% Moisture	LB068977	%	0.5	3 - 12%

OC Pesticides in Soil Method: ME-(AU)-[ENV]AN400/AN420

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Hexachlorobenzene (HCB)	LB068883	mg/kg	0.1	<0.1	0%	NA
Alpha BHC	LB068883	mg/kg	0.1	<0.1	0%	NA
Lindane	LB068883	mg/kg	0.1	<0.1	0%	NA
Heptachlor	LB068883	mg/kg	0.1	<0.1	0%	109%
Aldrin	LB068883	mg/kg	0.1	<0.1	0%	108%
Beta BHC	LB068883	mg/kg	0.1	<0.1	0%	NA
Delta BHC	LB068883	mg/kg	0.1	<0.1	0%	106%
Heptachlor epoxide	LB068883	mg/kg	0.1	<0.1	0%	NA
o,p'-DDE	LB068883	mg/kg	0.1	<0.1	0%	NA
Alpha Endosulfan	LB068883	mg/kg	0.2	<0.2	0%	NA
Gamma Chlordane	LB068883	mg/kg	0.1	<0.1	0%	NA
Alpha Chlordane	LB068883	mg/kg	0.1	<0.1	0%	NA
trans-Nonachlor	LB068883	mg/kg	0.1	<0.1	0%	NA
p,p'-DDE	LB068883	mg/kg	0.1	<0.1	0%	NA
Dieldrin	LB068883	mg/kg	0.2	<0.2	0%	104%
Endrin	LB068883	mg/kg	0.2	<0.2	0%	113%
o,p'-DDD	LB068883	mg/kg	0.1	<0.1	0%	NA
o,p'-DDT	LB068883	mg/kg	0.1	<0.1	0%	NA
Beta Endosulfan	LB068883	mg/kg	0.2	<0.2	0%	NA
p,p'-DDD	LB068883	mg/kg	0.1	<0.1	0%	NA
p,p'-DDT	LB068883	mg/kg	0.1	<0.1	0%	107%
Endosulfan sulphate	LB068883	mg/kg	0.1	<0.1	0%	NA
Endrin Aldehyde	LB068883	mg/kg	0.1	<0.1	0%	NA
Methoxychlor	LB068883	mg/kg	0.1	<0.1	0%	NA

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

OC Pesticides in Soil **Method: ME-(AU)-[ENV]AN400/AN420 (continued)**

				MB	DUP %RPD	LCS %Recovery
Endrin Ketone	LB068883	mg/kg	0.1	<0.1	0%	NA
Isodrin	LB068883	mg/kg	0.1	<0.1	0%	NA
Mirex	LB068883	mg/kg	0.1	<0.1	0%	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Tetrachloro-m-xylene (TCMX) (Surrogate)	LB068883	%	-	102%	2%	111%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil **Method: ME-(AU)-[ENV]AN420**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Naphthalene	LB068883	mg/kg	0.1	<0.1	0%	98%	110%
2-methylnaphthalene	LB068883	mg/kg	0.1	<0.1	0%	NA	NA
1-methylnaphthalene	LB068883	mg/kg	0.1	<0.1	0%	NA	NA
Acenaphthylene	LB068883	mg/kg	0.1	<0.1	0%	100%	114%
Acenaphthene	LB068883	mg/kg	0.1	<0.1	0%	96%	108%
Fluorene	LB068883	mg/kg	0.1	<0.1	0%	NA	NA
Phenanthrene	LB068883	mg/kg	0.1	<0.1	0%	109%	116%
Anthracene	LB068883	mg/kg	0.1	<0.1	0%	105%	123%
Fluoranthene	LB068883	mg/kg	0.1	<0.1	10%	111%	117%
Pyrene	LB068883	mg/kg	0.1	<0.1	18%	106%	119%
Benzo(a)anthracene	LB068883	mg/kg	0.1	<0.1	0%	NA	NA
Chrysene	LB068883	mg/kg	0.1	<0.1	0%	NA	NA
Benzo(b&j)fluoranthene	LB068883	mg/kg	0.1	<0.1	0%	NA	NA
Benzo(k)fluoranthene	LB068883	mg/kg	0.1	<0.1	0%	NA	NA
Benzo(a)pyrene	LB068883	mg/kg	0.1	<0.1	0%	104%	115%
Indeno(1,2,3-cd)pyrene	LB068883	mg/kg	0.1	<0.1	0%	NA	NA
Dibenzo(a&h)anthracene	LB068883	mg/kg	0.1	<0.1	0%	NA	NA
Benzo(ghi)perylene	LB068883	mg/kg	0.1	<0.1	0%	NA	NA
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=0*	LB068883	TEQ	0.2	<0.2	0%	NA	NA
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=LOR*	LB068883	TEQ (mg/kg)	0.3	<0.3	0%	NA	NA
Carcinogenic PAHs (as BaP TEQ)-assume results <LOR=LOR/2*	LB068883	TEQ (mg/kg)	0.2	<0.2	0%	NA	NA
Total PAH	LB068883	mg/kg	0.8	<0.8	0%	NA	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
d5-nitrobenzene (Surrogate)	LB068883	%	-	100%	18%	84%	106%
2-fluorobiphenyl (Surrogate)	LB068883	%	-	82%	13%	76%	90%
d14-p-terphenyl (Surrogate)	LB068883	%	-	112%	21%	98%	84%

PAH (Polynuclear Aromatic Hydrocarbons) in Water **Method: ME-(AU)-[ENV]AN420**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Naphthalene	LB068894	µg/L	0.1	<0.1	0%	101%
2-methylnaphthalene	LB068894	µg/L	0.1	<0.1	0%	NA
1-methylnaphthalene	LB068894	µg/L	0.1	<0.1	0%	NA
Acenaphthylene	LB068894	µg/L	0.1	<0.1	0%	98%
Acenaphthene	LB068894	µg/L	0.1	<0.1	0%	97%
Fluorene	LB068894	µg/L	0.1	<0.1	0%	NA
Phenanthrene	LB068894	µg/L	0.1	<0.1	0%	111%
Anthracene	LB068894	µg/L	0.1	<0.1	0%	109%
Fluoranthene	LB068894	µg/L	0.1	<0.1	0%	101%
Pyrene	LB068894	µg/L	0.1	<0.1	0%	110%
Benzo(a)anthracene	LB068894	µg/L	0.1	<0.1	0%	NA
Chrysene	LB068894	µg/L	0.1	<0.1	0%	NA
Benzo(b&j)fluoranthene	LB068894	µg/L	0.1	<0.1	0%	NA
Benzo(k)fluoranthene	LB068894	µg/L	0.1	<0.1	0%	NA
Benzo(a)pyrene	LB068894	µg/L	0.1	<0.1	0%	123%
Indeno(1,2,3-cd)pyrene	LB068894	µg/L	0.1	<0.1	0%	NA
Dibenzo(a&h)anthracene	LB068894	µg/L	0.1	<0.1	0%	NA
Benzo(ghi)perylene	LB068894	µg/L	0.1	<0.1	0%	NA
Total PAH (18)	LB068894	µg/L	1	<1		

Surrogates

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: ME-(AU)-[ENV]AN420 (continued)

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
d5-nitrobenzene (Surrogate)	LB068894	%	-	82%	0%	104%
2-fluorobiphenyl (Surrogate)	LB068894	%	-	72%	6%	94%
d14-p-terphenyl (Surrogate)	LB068894	%	-	94%	0%	116%

PCBs in Soil Method: ME-(AU)-[ENV]AN400/AN420

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Arochlor 1016	LB068883	mg/kg	0.2	<0.2	0%	NA
Arochlor 1221	LB068883	mg/kg	0.2	<0.2	0%	NA
Arochlor 1232	LB068883	mg/kg	0.2	<0.2	0%	NA
Arochlor 1242	LB068883	mg/kg	0.2	<0.2	0%	NA
Arochlor 1248	LB068883	mg/kg	0.2	<0.2	0%	NA
Arochlor 1254	LB068883	mg/kg	0.2	<0.2	0%	NA
Arochlor 1260	LB068883	mg/kg	0.2	<0.2	0%	93%
Arochlor 1262	LB068883	mg/kg	0.2	<0.2	0%	NA
Arochlor 1268	LB068883	mg/kg	0.2	<0.2	0%	NA
Total PCBs (Arochlors)	LB068883	mg/kg	1	<1	0%	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Tetrachloro-m-xylene (TCMX) (Surrogate)	LB068883	%	-	102%	2%	112%

pH in soil (1:5) Method: ME-(AU)-[ENV]AN101

Parameter	QC Reference	Units	LOR	DUP %RPD	LCS %Recovery
pH	LB069166	pH Units	-	1%	99%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Speciated Phenols in Soil **Method: ME-(AU)-[ENV]AN420**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Phenol	LB068883	mg/kg	0.5	<0.5	0%	89%
2-methyl phenol (o-cresol)	LB068883	mg/kg	0.5	<0.5	64%	NA
3/4-methyl phenol (m/p-cresol)	LB068883	mg/kg	1	<1	0%	NA
Total Cresol	LB068883	mg/kg	1.5	<1.5	0%	NA
2-chlorophenol	LB068883	mg/kg	0.5	<0.5	0%	NA
2,4-dimethylphenol	LB068883	mg/kg	0.5	<0.5	0%	NA
2,6-dichlorophenol	LB068883	mg/kg	0.5	<0.5	0%	NA
2,4-dichlorophenol	LB068883	mg/kg	0.5	<0.5	0%	107%
2,4,6-trichlorophenol	LB068883	mg/kg	0.5	<0.5	0%	112%
2-nitrophenol	LB068883	mg/kg	0.5	<0.5	0%	NA
4-nitrophenol	LB068883	mg/kg	1	<1	0%	NA
2,4,5-trichlorophenol	LB068883	mg/kg	0.5	<0.5	0%	NA
2,3,4,6/2,3,5,6-tetrachlorophenol	LB068883	mg/kg	1	<1	0%	NA
Pentachlorophenol	LB068883	mg/kg	0.5	<0.5	0%	73%
2,4-dinitrophenol	LB068883	mg/kg	2	<2	0%	NA
4-chloro-3-methylphenol	LB068883	mg/kg	2	<2	0%	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
2,4,6-Tribromophenol (Surrogate)	LB068883	%	-	89%	2%	91%
d5-phenol (Surrogate)	LB068883	%	-	97%	2%	90%

TOC in Soil **Method: ME-(AU)-[ENV]AN188**

Parameter	QC Reference	Units	LOR	DUP %RPD	LCS %Recovery
Total Organic Carbon	LB069173	%w/w	0.05	0 - 7%	96%

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest **Method: ME-(AU)-[ENV]AN040/AN320**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Arsenic, As	LB069012	mg/kg	3	<3	15 - 78%	91%	63%
	LB069013	mg/kg	3	<3	14%	90%	76%
Cadmium, Cd	LB069012	mg/kg	0.3	<0.3	0 - 5%	93%	71%
	LB069013	mg/kg	0.3	<0.3	1%	91%	81%
Chromium, Cr	LB069012	mg/kg	0.3	<0.3	7 - 24%	91%	54%
	LB069013	mg/kg	0.3	<0.3	4 - 9%	89%	65%
Copper, Cu	LB069012	mg/kg	0.5	<0.5	4 - 5%	93%	55%
	LB069013	mg/kg	0.5	<0.5	0 - 4%	92%	81%
Lead, Pb	LB069012	mg/kg	1	<1	4 - 24%	93%	51%
	LB069013	mg/kg	1	<1	4 - 6%	92%	70%
Iron, Fe	LB069012	mg/kg	50	<50	18%	92%	
	LB069013	mg/kg	50	<50		91%	
Nickel, Ni	LB069012	mg/kg	0.5	<0.5	2 - 11%	90%	64%
	LB069013	mg/kg	0.5	<0.5	8%	87%	76%
Zinc, Zn	LB069012	mg/kg	0.5	<0.5	4 - 5%	93%	36%
	LB069013	mg/kg	0.5	<0.5	7 - 8%	91%	75%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Trace Metals (Dissolved) in Water by ICPMS Method: ME-(AU)-[ENV]AN318

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Arsenic, As	LB068946	µg/L	1	<1	3%	92%	93%
Cadmium, Cd	LB068946	µg/L	0.1	<0.1	0%	94%	97%
Chromium, Cr	LB068946	µg/L	1	<1	0%	96%	96%
Copper, Cu	LB068946	µg/L	1	<1	0%	99%	101%
Lead, Pb	LB068946	µg/L	1	<1	0%	97%	97%
Nickel, Ni	LB068946	µg/L	1	<1	0%	98%	98%
Zinc, Zn	LB068946	µg/L	5	<5	0%	96%	102%

TRH (Total Recoverable Hydrocarbons) in Soil Method: ME-(AU)-[ENV]AN403

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
TRH C10-C14	LB068883	mg/kg	20	<20	0%	100%
TRH C15-C28	LB068883	mg/kg	45	<45	0%	100%
TRH C29-C36	LB068883	mg/kg	45	<45	0%	83%
TRH C37-C40	LB068883	mg/kg	100	<100	0%	NA
TRH C10-C36 Total	LB068883	mg/kg	110	<110	0%	NA
TRH C10-C40 Total	LB068883	mg/kg	210	<210	0%	NA

TRH F Bands

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
TRH >C10-C16 (F2)	LB068883	mg/kg	25	<25	0%	100%
TRH >C10-C16 (F2) minus Naphthalene	LB068883	mg/kg	25	<25	0%	NA
TRH >C16-C34 (F3)	LB068883	mg/kg	90	<90	0%	95%
TRH >C34-C40 (F4)	LB068883	mg/kg	120	<120	0%	80%

VOC's in Soil Method: ME-(AU)-[ENV]AN433/AN434

Monocyclic Aromatic Hydrocarbons

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Benzene	LB068917	mg/kg	0.1	<0.1	0%	84%	74%
Toluene	LB068917	mg/kg	0.1	<0.1	0%	86%	89%
Ethylbenzene	LB068917	mg/kg	0.1	<0.1	0%	86%	82%
m/p-xylene	LB068917	mg/kg	0.2	<0.2	0%	92%	87%
o-xylene	LB068917	mg/kg	0.1	<0.1	0%	88%	87%

Polycyclic VOCs

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Naphthalene	LB068917	mg/kg	0.1	<0.1	0%	NA	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Dibromofluoromethane (Surrogate)	LB068917	%	-	84%	3 - 9%	89%	85%
d4-1,2-dichloroethane (Surrogate)	LB068917	%	-	90%	3 - 18%	90%	99%
d8-toluene (Surrogate)	LB068917	%	-	93%	11 - 12%	97%	108%
Bromofluorobenzene (Surrogate)	LB068917	%	-	87%	5 - 7%	119%	108%

Totals

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Total Xylenes*	LB068917	mg/kg	0.3	<0.3	0%	NA	NA
Total BTEX*	LB068917	mg/kg	0.6	<0.6	0%	NA	NA

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

VOCs in Water Method: ME-(AU)-[ENV]AN433/AN434

Monocyclic Aromatic Hydrocarbons

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Benzene	LB068997	µg/L	0.5	<0.5	103%
Toluene	LB068997	µg/L	0.5	<0.5	105%
Ethylbenzene	LB068997	µg/L	0.5	<0.5	109%
m/p-xylene	LB068997	µg/L	1	<1	107%
o-xylene	LB068997	µg/L	0.5	<0.5	108%

Polycyclic VOCs

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Naphthalene	LB068997	µg/L	0.5	<0.5	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Dibromofluoromethane (Surrogate)	LB068997	%	-	113%	90%
d4-1,2-dichloroethane (Surrogate)	LB068997	%	-	111%	89%
d8-toluene (Surrogate)	LB068997	%	-	98%	95%
Bromofluorobenzene (Surrogate)	LB068997	%	-	84%	106%

Totals

Parameter	QC Reference	Units	LOR	MB
Total Xylenes	LB068997	µg/L	1.5	<1.5
Total BTEX	LB068997	µg/L	3	<3

Volatile Petroleum Hydrocarbons in Soil Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
TRH C6-C10	LB068917	mg/kg	25	<25	0%	98%	92%
TRH C6-C9	LB068917	mg/kg	20	<20	0%	87%	87%

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Dibromofluoromethane (Surrogate)	LB068917	%	-	84%	3 - 9%	89%	85%
d4-1,2-dichloroethane (Surrogate)	LB068917	%	-	90%	3 - 18%	90%	99%
d8-toluene (Surrogate)	LB068917	%	-	93%	11 - 12%	97%	108%
Bromofluorobenzene (Surrogate)	LB068917	%	-	87%	5 - 7%	119%	108%

VPH F Bands

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Benzene (F0)	LB068917	mg/kg	0.1	<0.1	0%	NA	NA
TRH C6-C10 minus BTEX (F1)	LB068917	mg/kg	25	<25	0%	122%	110%

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Volatile Petroleum Hydrocarbons in Water **Method: ME-(AU)-[ENV]AN433/AN434/AN410**

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
TRH C6-C10	LB068997	µg/L	50	<50	100%
TRH C6-C9	LB068997	µg/L	40	<40	100%

Surrogates

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Dibromofluoromethane (Surrogate)	LB068997	%	-	113%	90%
d4-1,2-dichloroethane (Surrogate)	LB068997	%	-	111%	89%
d8-toluene (Surrogate)	LB068997	%	-	98%	95%
Bromofluorobenzene (Surrogate)	LB068997	%	-	84%	106%

VPH F Bands

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Benzene (F0)	LB068997	µg/L	0.5	<0.5	NA
TRH C6-C10 minus BTEX (F1)	LB068997	µg/L	50	<50	102%

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN005	Following wet sieving of the sample,(particles smaller than 75 µm) a dispersing solution is added and a hydrometer is used to measure sedimentation. Soil density is determined and the percentage of each size fraction calculated. Referenced to AS1289.3.6.3.
AN020	Unpreserved water sample is filtered through a 0.45µm membrane filter and acidified with nitric acid similar to APHA3030B.
AN040	A portion of sample is digested with Nitric acid to decompose organic matter and Hydrochloric acid to complete the digestion of metals and then filtered for analsysis by ASS or ICP as per USEPA Method 200.8.
AN040/AN320	A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.
AN083	Separatory funnels are used for aqueous samples and extracted by transferring an appropriate volume (mass) of liquid into a separatory funnel and adding 3 serial aliquots of dichloromethane. Samples receive a single extraction at pH 7 to recover base / neutral analytes and two extractions at pH < 2 to recover acidic analytes. QC samples are prepared by spiking organic free water with target analytes and extracting as per samples.
AN088	Orbital rolling for Organic pollutants are extracted from soil/sediment by transferring an appropriate mass of sample to a clear soil jar and extracting with 1:1 Dichloromethane/Acetone. Orbital Rolling method is intended for the extraction of semi-volatile organic compounds from soil/sediment samples, and is based somewhat on USEPA method 3570 (Micro Organic extraction and sample preparation). Method 3700.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl2) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN122	Exchangeable Cations, CEC and ESP: Soil sample is extracted in 1 M Ammonium Acetate at pH=7 (or 1M Ammonium Chloride at pH=7) with cations (Na, K, Ca & Mg) then determined by ICP OES/ICP MS and reported as Exchangeable Cations. For saline soils, these results can be corrected for water soluble cations and reported as Exchangeable cations in meq/100g or soil can be pretreated (aqueous ethanol/aqueous glycerol) prior to extraction. Cation Exchange Capacity (CEC) is the sum of the exchangeable cations in meq/100g.
AN122	The Exchangeable Sodium Percentage (ESP) is calculated as the exchangeable sodium divided by the CEC (all in meq/100g) times 100. ESP can be used to categorise the sodicity of the soil as below: ESP < 6% non-sodic ESP 6-15% sodic ESP >15% strongly sodic Method is refernced to Rayment and Higginson, 1992, sections 15D3 and 15N1.-
AN188	The organic material in the soil sample is oxidised with chromic acid in the presence of excess sulphuric acid, without external heat being applied. The excess dichromate ion is determined by titration with standard ammonium iron (II) sulphate solution and the amount of oxidised material is calculated from the quantity of dichromate reduced. Referenced to NEPM 105 and AS1289.1.1.1.

METHOD	METHODOLOGY SUMMARY
AN311/AN312	Mercury by Cold Vapour AAS in Waters: Mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500.
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500
AN318	Determination of elements at trace level in waters by ICP-MS technique, in accordance with USEPA 6020A.
AN400	OC and OP Pesticides by GC-ECD: The determination of organochlorine (OC) and organophosphorus (OP) pesticides and polychlorinated biphenyls (PCBs) in soils, sludges and groundwater. (Based on USEPA methods 3510, 3550, 8140 and 8080.)
AN403	Total Recoverable Hydrocarbons: Determination of Hydrocarbons by gas chromatography after a solvent extraction. Detection is by flame ionisation detector (FID) that produces an electronic signal in proportion to the combustible matter passing through it. Total Recoverable Hydrocarbons (TRH) are routinely reported as four alkane groupings based on the carbon chain length of the compounds: C6-C9, C10-C14, C15-C28 and C29-C36 and in recognition of the NEPM 1999 (2013), >C10-C16 (F2), >C16-C34 (F3) and >C34-C40 (F4). F2 is reported directly and also corrected by subtracting Naphthalene (from VOC method AN433) where available.
AN403	Additionally, the volatile C6-C9 fraction may be determined by a purge and trap technique and GC/MS because of the potential for volatiles loss. Total Petroleum Hydrocarbons (TPH) follows the same method of analysis after silica gel cleanup of the solvent extract. Aliphatic/Aromatic Speciation follows the same method of analysis after fractionation of the solvent extract over silica with differential polarity of the eluent solvents .
AN403	The GC/FID method is not well suited to the analysis of refined high boiling point materials (ie lubricating oils or greases) but is particularly suited for measuring diesel, kerosene and petrol if care to control volatility is taken. This method will detect naturally occurring hydrocarbons, lipids, animal fats, phenols and PAHs if they are present at sufficient levels, dependant on the use of specific cleanup/fractionation techniques. Reference USEPA 3510B, 8015B.
AN420	(SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols (etc) in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).
AN420	SVOC Compounds: Semi-Volatile Organic Compounds (SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).
AN433/AN434	VOCs and C6-C9 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.
AN433/AN434/AN410	VOCs and C6-C9/C6-C10 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.
AN605	This technique gravimetrically deteremines the mass of Asbestos Containing Material retained on a 7mm Sieve and assumes that 15% of this ACM is asbestos. This calculated asbestos weight is then calculated as a percentage of the total sample weight.

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN605	This technique also gravimetrically deteremines the mass of Fibrous Asbestos (FA) and Asbestos Fines (AF) Containing Material retained on and passing a 2mm sieve post 7mm Sieving. Assumes that FA and AF are 100% asbestos containing. This calculated asbestos weight is then calculated as a percentage of the screened fraction sample weights.
AN605	AMO = Amosite CRY = Chrysotile CRO = Crocidolite
AN605	In sofar as is trechnically feasible, this report is consistent with the analytical reporting recommendations in the Western Australian Department of Health Guidelines for the Assessment Remediation and Management of Asbestos - Contaminated Sites in Western Australia - May 2009.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	This analysis is not covered by the scope of accreditation.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
^	Performed by outside laboratory.	NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions/General-Conditions-of-Services-English.aspx. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

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STATEMENT OF QA/QC PERFORMANCE

SE134169 R0

CLIENT DETAILS

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Project	**9623 - ESA - Old Canberra Brickworks**
Order Number	(Not specified)
Samples	15

LABORATORY DETAILS

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SGS Reference	SE134169 R0
Report Number	0000098775
Date Reported	17 Dec 2014

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS Environmental Services' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document and was supplied by the Client.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Duplicate	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	1 item
Matrix Spike	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	6 items
	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	2 items

SAMPLE SUMMARY

Sample counts by matrix	12 Soils, 3 Waters	Type of documentation received	COC
Date documentation received	5/12/2014	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	3.7°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes		

HOLDING TIME SUMMARY

SE134169 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.5-0.6	SE134169.002	LB069122	04 Dec 2014	05 Dec 2014	01 Jan 2015	11 Dec 2014	01 Jan 2015	12 Dec 2014
TP22 0.4-0.5	SE134169.006	LB069122	04 Dec 2014	05 Dec 2014	01 Jan 2015	11 Dec 2014	01 Jan 2015	12 Dec 2014
TP23 0.9-1.0	SE134169.009	LB069122	04 Dec 2014	05 Dec 2014	01 Jan 2015	11 Dec 2014	01 Jan 2015	12 Dec 2014

Gravimetric Determination of Asbestos in Soil

Method: ME-(AU)-[ENV]AN605

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.0-0.1	SE134169.001	LB069185	04 Dec 2014	05 Dec 2014	02 Jun 2015	11 Dec 2014	02 Jun 2015	12 Dec 2014
TP20 0.5-0.6	SE134169.002	LB069185	04 Dec 2014	05 Dec 2014	02 Jun 2015	11 Dec 2014	02 Jun 2015	12 Dec 2014
TP21 0.0-0.11	SE134169.003	LB069185	04 Dec 2014	05 Dec 2014	02 Jun 2015	11 Dec 2014	02 Jun 2015	12 Dec 2014
TP21 0.5-0.6	SE134169.004	LB069185	04 Dec 2014	05 Dec 2014	02 Jun 2015	11 Dec 2014	02 Jun 2015	12 Dec 2014
TP22 0.0-0.1	SE134169.005	LB069185	04 Dec 2014	05 Dec 2014	02 Jun 2015	11 Dec 2014	02 Jun 2015	12 Dec 2014
TP22 0.4-0.5	SE134169.006	LB069185	04 Dec 2014	05 Dec 2014	02 Jun 2015	11 Dec 2014	02 Jun 2015	12 Dec 2014
TP22 1.9-2.0	SE134169.007	LB069185	04 Dec 2014	05 Dec 2014	02 Jun 2015	11 Dec 2014	02 Jun 2015	12 Dec 2014
TP23 0.0-0.1	SE134169.008	LB069185	04 Dec 2014	05 Dec 2014	02 Jun 2015	11 Dec 2014	02 Jun 2015	12 Dec 2014
TP23 0.9-1.0	SE134169.009	LB069185	04 Dec 2014	05 Dec 2014	02 Jun 2015	11 Dec 2014	02 Jun 2015	12 Dec 2014
TP24 0.0-0.1	SE134169.010	LB069185	04 Dec 2014	05 Dec 2014	02 Jun 2015	11 Dec 2014	02 Jun 2015	12 Dec 2014
TP25 0.0-0.1	SE134169.011	LB069185	04 Dec 2014	05 Dec 2014	02 Jun 2015	11 Dec 2014	02 Jun 2015	12 Dec 2014
QC 1	SE134169.012	LB069185	04 Dec 2014	05 Dec 2014	02 Jun 2015	11 Dec 2014	02 Jun 2015	12 Dec 2014

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
R1	SE134169.013	LB069222	04 Dec 2014	05 Dec 2014	01 Jan 2015	12 Dec 2014	01 Jan 2015	12 Dec 2014

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.0-0.1	SE134169.001	LB069015	04 Dec 2014	05 Dec 2014	01 Jan 2015	10 Dec 2014	01 Jan 2015	12 Dec 2014
TP20 0.5-0.6	SE134169.002	LB069015	04 Dec 2014	05 Dec 2014	01 Jan 2015	10 Dec 2014	01 Jan 2015	12 Dec 2014
TP21 0.0-0.11	SE134169.003	LB069015	04 Dec 2014	05 Dec 2014	01 Jan 2015	10 Dec 2014	01 Jan 2015	12 Dec 2014
TP21 0.5-0.6	SE134169.004	LB069015	04 Dec 2014	05 Dec 2014	01 Jan 2015	10 Dec 2014	01 Jan 2015	12 Dec 2014
TP22 0.0-0.1	SE134169.005	LB069016	04 Dec 2014	05 Dec 2014	01 Jan 2015	10 Dec 2014	01 Jan 2015	12 Dec 2014
TP22 0.4-0.5	SE134169.006	LB069016	04 Dec 2014	05 Dec 2014	01 Jan 2015	10 Dec 2014	01 Jan 2015	12 Dec 2014
TP23 0.0-0.1	SE134169.008	LB069016	04 Dec 2014	05 Dec 2014	01 Jan 2015	10 Dec 2014	01 Jan 2015	12 Dec 2014
TP23 0.9-1.0	SE134169.009	LB069016	04 Dec 2014	05 Dec 2014	01 Jan 2015	10 Dec 2014	01 Jan 2015	12 Dec 2014
TP24 0.0-0.1	SE134169.010	LB069016	04 Dec 2014	05 Dec 2014	01 Jan 2015	10 Dec 2014	01 Jan 2015	12 Dec 2014
TP25 0.0-0.1	SE134169.011	LB069016	04 Dec 2014	05 Dec 2014	01 Jan 2015	10 Dec 2014	01 Jan 2015	12 Dec 2014
QC 1	SE134169.012	LB069016	04 Dec 2014	05 Dec 2014	01 Jan 2015	10 Dec 2014	01 Jan 2015	12 Dec 2014

Moisture Content

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.0-0.1	SE134169.001	LB068977	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	14 Dec 2014	10 Dec 2014
TP20 0.5-0.6	SE134169.002	LB068977	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	14 Dec 2014	10 Dec 2014
TP21 0.0-0.11	SE134169.003	LB068977	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	14 Dec 2014	10 Dec 2014
TP21 0.5-0.6	SE134169.004	LB068977	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	14 Dec 2014	10 Dec 2014
TP22 0.0-0.1	SE134169.005	LB068977	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	14 Dec 2014	10 Dec 2014
TP22 0.4-0.5	SE134169.006	LB068977	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	14 Dec 2014	10 Dec 2014
TP23 0.0-0.1	SE134169.008	LB068977	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	14 Dec 2014	10 Dec 2014
TP23 0.9-1.0	SE134169.009	LB068977	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	14 Dec 2014	10 Dec 2014
TP24 0.0-0.1	SE134169.010	LB068977	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	14 Dec 2014	10 Dec 2014
TP25 0.0-0.1	SE134169.011	LB068977	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	14 Dec 2014	10 Dec 2014
QC 1	SE134169.012	LB068977	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	14 Dec 2014	10 Dec 2014

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.0-0.1	SE134169.001	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP21 0.0-0.11	SE134169.003	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP22 0.0-0.1	SE134169.005	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP23 0.0-0.1	SE134169.008	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP24 0.0-0.1	SE134169.010	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP25 0.0-0.1	SE134169.011	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
QC 1	SE134169.012	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014

HOLDING TIME SUMMARY

SE134169 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.0-0.1	SE134169.001	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014
TP21 0.0-0.11	SE134169.003	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014
TP22 0.0-0.1	SE134169.005	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014
TP23 0.0-0.1	SE134169.008	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014
TP24 0.0-0.1	SE134169.010	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014
TP25 0.0-0.1	SE134169.011	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014
QC 1	SE134169.012	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
R1	SE134169.013	LB068894	04 Dec 2014	05 Dec 2014	11 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.0-0.1	SE134169.001	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP21 0.0-0.11	SE134169.003	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP22 0.0-0.1	SE134169.005	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP23 0.0-0.1	SE134169.008	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP24 0.0-0.1	SE134169.010	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP25 0.0-0.1	SE134169.011	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
QC 1	SE134169.012	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.5-0.6	SE134169.002	LB069166	04 Dec 2014	05 Dec 2014	11 Dec 2014	11 Dec 2014	12 Dec 2014	12 Dec 2014
TP22 0.4-0.5	SE134169.006	LB069166	04 Dec 2014	05 Dec 2014	11 Dec 2014	11 Dec 2014	12 Dec 2014	12 Dec 2014
TP23 0.9-1.0	SE134169.009	LB069166	04 Dec 2014	05 Dec 2014	11 Dec 2014	11 Dec 2014	12 Dec 2014	12 Dec 2014

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.0-0.1	SE134169.001	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP21 0.0-0.11	SE134169.003	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP22 0.0-0.1	SE134169.005	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP23 0.0-0.1	SE134169.008	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP24 0.0-0.1	SE134169.010	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
TP25 0.0-0.1	SE134169.011	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014
QC 1	SE134169.012	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	11 Dec 2014

TOC in Soil

Method: ME-(AU)-[ENV]AN188

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.5-0.6	SE134169.002	LB069173	04 Dec 2014	05 Dec 2014	01 Jan 2015	11 Dec 2014	01 Jan 2015	12 Dec 2014
TP22 0.4-0.5	SE134169.006	LB069173	04 Dec 2014	05 Dec 2014	01 Jan 2015	11 Dec 2014	01 Jan 2015	12 Dec 2014
TP23 0.9-1.0	SE134169.009	LB069173	04 Dec 2014	05 Dec 2014	01 Jan 2015	11 Dec 2014	01 Jan 2015	12 Dec 2014

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.0-0.1	SE134169.001	LB069012	04 Dec 2014	05 Dec 2014	02 Jun 2015	10 Dec 2014	02 Jun 2015	12 Dec 2014
TP20 0.5-0.6	SE134169.002	LB069012	04 Dec 2014	05 Dec 2014	02 Jun 2015	10 Dec 2014	02 Jun 2015	12 Dec 2014
TP21 0.0-0.11	SE134169.003	LB069013	04 Dec 2014	05 Dec 2014	02 Jun 2015	10 Dec 2014	02 Jun 2015	12 Dec 2014
TP21 0.5-0.6	SE134169.004	LB069013	04 Dec 2014	05 Dec 2014	02 Jun 2015	10 Dec 2014	02 Jun 2015	12 Dec 2014
TP22 0.0-0.1	SE134169.005	LB069013	04 Dec 2014	05 Dec 2014	02 Jun 2015	10 Dec 2014	02 Jun 2015	12 Dec 2014
TP22 0.4-0.5	SE134169.006	LB069013	04 Dec 2014	05 Dec 2014	02 Jun 2015	10 Dec 2014	02 Jun 2015	12 Dec 2014
TP23 0.0-0.1	SE134169.008	LB069013	04 Dec 2014	05 Dec 2014	02 Jun 2015	10 Dec 2014	02 Jun 2015	12 Dec 2014
TP23 0.9-1.0	SE134169.009	LB069013	04 Dec 2014	05 Dec 2014	02 Jun 2015	10 Dec 2014	02 Jun 2015	12 Dec 2014
TP24 0.0-0.1	SE134169.010	LB069013	04 Dec 2014	05 Dec 2014	02 Jun 2015	10 Dec 2014	02 Jun 2015	12 Dec 2014
TP25 0.0-0.1	SE134169.011	LB069013	04 Dec 2014	05 Dec 2014	02 Jun 2015	10 Dec 2014	02 Jun 2015	12 Dec 2014
QC 1	SE134169.012	LB069013	04 Dec 2014	05 Dec 2014	02 Jun 2015	10 Dec 2014	02 Jun 2015	12 Dec 2014

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
R1	SE134169.013	LB068946	04 Dec 2014	05 Dec 2014	02 Jun 2015	09 Dec 2014	02 Jun 2015	10 Dec 2014

HOLDING TIME SUMMARY

SE134169 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.0-0.1	SE134169.001	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014
TP21 0.0-0.11	SE134169.003	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014
TP22 0.0-0.1	SE134169.005	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014
TP23 0.0-0.1	SE134169.008	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014
TP24 0.0-0.1	SE134169.010	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014
TP25 0.0-0.1	SE134169.011	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014
QC 1	SE134169.012	LB068883	04 Dec 2014	05 Dec 2014	18 Dec 2014	08 Dec 2014	17 Jan 2015	12 Dec 2014

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.0-0.1	SE134169.001	LB068917	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014
TP21 0.0-0.11	SE134169.003	LB068917	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014
TP22 0.0-0.1	SE134169.005	LB068917	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014
TP23 0.0-0.1	SE134169.008	LB068917	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014
TP24 0.0-0.1	SE134169.010	LB068917	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014
TP25 0.0-0.1	SE134169.011	LB068917	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
Trip Blank 1	SE134169.014	LB068997	04 Dec 2014	05 Dec 2014	11 Dec 2014	09 Dec 2014	18 Jan 2015	11 Dec 2014
Trip Spike 1	SE134169.015	LB068997	04 Dec 2014	05 Dec 2014	11 Dec 2014	09 Dec 2014	18 Jan 2015	11 Dec 2014

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP20 0.0-0.1	SE134169.001	LB068917	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014
TP21 0.0-0.11	SE134169.003	LB068917	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014
TP22 0.0-0.1	SE134169.005	LB068917	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014
TP23 0.0-0.1	SE134169.008	LB068917	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014
TP24 0.0-0.1	SE134169.010	LB068917	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014
TP25 0.0-0.1	SE134169.011	LB068917	04 Dec 2014	05 Dec 2014	18 Dec 2014	09 Dec 2014	18 Jan 2015	12 Dec 2014

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
Trip Blank 1	SE134169.014	LB068997	04 Dec 2014	05 Dec 2014	11 Dec 2014	09 Dec 2014	18 Jan 2015	11 Dec 2014
Trip Spike 1	SE134169.015	LB068997	04 Dec 2014	05 Dec 2014	11 Dec 2014	09 Dec 2014	18 Jan 2015	11 Dec 2014

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Tetrachloro-m-xylene (TCMX) (Surrogate)	TP20 0.0-0.1	SE134169.001	%	60 - 130%	100
	TP21 0.0-0.11	SE134169.003	%	60 - 130%	98
	TP22 0.0-0.1	SE134169.005	%	60 - 130%	93
	TP23 0.0-0.1	SE134169.008	%	60 - 130%	95
	TP24 0.0-0.1	SE134169.010	%	60 - 130%	89
	TP25 0.0-0.1	SE134169.011	%	60 - 130%	113

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	TP20 0.0-0.1	SE134169.001	%	70 - 130%	98
	TP21 0.0-0.11	SE134169.003	%	70 - 130%	86
	TP22 0.0-0.1	SE134169.005	%	70 - 130%	84
	TP23 0.0-0.1	SE134169.008	%	70 - 130%	80
	TP24 0.0-0.1	SE134169.010	%	70 - 130%	84
	TP25 0.0-0.1	SE134169.011	%	70 - 130%	90
	QC 1	SE134169.012	%	70 - 130%	82
d14-p-terphenyl (Surrogate)	TP20 0.0-0.1	SE134169.001	%	70 - 130%	106
	TP21 0.0-0.11	SE134169.003	%	70 - 130%	88
	TP22 0.0-0.1	SE134169.005	%	70 - 130%	92
	TP23 0.0-0.1	SE134169.008	%	70 - 130%	96
	TP24 0.0-0.1	SE134169.010	%	70 - 130%	90
	TP25 0.0-0.1	SE134169.011	%	70 - 130%	92
	QC 1	SE134169.012	%	70 - 130%	96
d5-nitrobenzene (Surrogate)	TP20 0.0-0.1	SE134169.001	%	70 - 130%	116
	TP21 0.0-0.11	SE134169.003	%	70 - 130%	102
	TP22 0.0-0.1	SE134169.005	%	70 - 130%	94
	TP23 0.0-0.1	SE134169.008	%	70 - 130%	94
	TP24 0.0-0.1	SE134169.010	%	70 - 130%	98
	TP25 0.0-0.1	SE134169.011	%	70 - 130%	98
	QC 1	SE134169.012	%	70 - 130%	94

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	R1	SE134169.013	%	40 - 130%	62
d14-p-terphenyl (Surrogate)	R1	SE134169.013	%	40 - 130%	86
d5-nitrobenzene (Surrogate)	R1	SE134169.013	%	40 - 130%	64

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Tetrachloro-m-xylene (TCMX) (Surrogate)	TP20 0.0-0.1	SE134169.001	%	60 - 130%	100
	TP21 0.0-0.11	SE134169.003	%	60 - 130%	98
	TP22 0.0-0.1	SE134169.005	%	60 - 130%	93
	TP23 0.0-0.1	SE134169.008	%	60 - 130%	95
	TP24 0.0-0.1	SE134169.010	%	60 - 130%	89
	TP25 0.0-0.1	SE134169.011	%	60 - 130%	113

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2,4,6-Tribromophenol (Surrogate)	TP20 0.0-0.1	SE134169.001	%	70 - 130%	83
	TP21 0.0-0.11	SE134169.003	%	70 - 130%	84
	TP22 0.0-0.1	SE134169.005	%	70 - 130%	80
	TP23 0.0-0.1	SE134169.008	%	70 - 130%	88
	TP24 0.0-0.1	SE134169.010	%	70 - 130%	75
	TP25 0.0-0.1	SE134169.011	%	70 - 130%	88
d5-phenol (Surrogate)	TP20 0.0-0.1	SE134169.001	%	50 - 130%	70
	TP21 0.0-0.11	SE134169.003	%	50 - 130%	73
	TP22 0.0-0.1	SE134169.005	%	50 - 130%	73
	TP23 0.0-0.1	SE134169.008	%	50 - 130%	75
	TP24 0.0-0.1	SE134169.010	%	50 - 130%	73
	TP25 0.0-0.1	SE134169.011	%	50 - 130%	71

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued)

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TP20 0.0-0.1	SE134169.001	%	60 - 130%	75
	TP21 0.0-0.11	SE134169.003	%	60 - 130%	76
	TP22 0.0-0.1	SE134169.005	%	60 - 130%	87
	TP23 0.0-0.1	SE134169.008	%	60 - 130%	73
	TP24 0.0-0.1	SE134169.010	%	60 - 130%	94
	TP25 0.0-0.1	SE134169.011	%	60 - 130%	91
d4-1,2-dichloroethane (Surrogate)	TP20 0.0-0.1	SE134169.001	%	60 - 130%	85
	TP21 0.0-0.11	SE134169.003	%	60 - 130%	84
	TP22 0.0-0.1	SE134169.005	%	60 - 130%	92
	TP23 0.0-0.1	SE134169.008	%	60 - 130%	84
	TP24 0.0-0.1	SE134169.010	%	60 - 130%	74
	TP25 0.0-0.1	SE134169.011	%	60 - 130%	72
d8-toluene (Surrogate)	TP20 0.0-0.1	SE134169.001	%	60 - 130%	85
	TP21 0.0-0.11	SE134169.003	%	60 - 130%	88
	TP22 0.0-0.1	SE134169.005	%	60 - 130%	97
	TP23 0.0-0.1	SE134169.008	%	60 - 130%	86
	TP24 0.0-0.1	SE134169.010	%	60 - 130%	93
	TP25 0.0-0.1	SE134169.011	%	60 - 130%	102
Dibromofluoromethane (Surrogate)	TP20 0.0-0.1	SE134169.001	%	60 - 130%	70
	TP21 0.0-0.11	SE134169.003	%	60 - 130%	73
	TP22 0.0-0.1	SE134169.005	%	60 - 130%	79
	TP23 0.0-0.1	SE134169.008	%	60 - 130%	72
	TP24 0.0-0.1	SE134169.010	%	60 - 130%	77
	TP25 0.0-0.1	SE134169.011	%	60 - 130%	70

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	Trip Blank 1	SE134169.014	%	40 - 130%	83
	Trip Spike 1	SE134169.015	%	40 - 130%	111
d4-1,2-dichloroethane (Surrogate)	Trip Blank 1	SE134169.014	%	40 - 130%	111
	Trip Spike 1	SE134169.015	%	40 - 130%	91
d8-toluene (Surrogate)	Trip Blank 1	SE134169.014	%	40 - 130%	98
	Trip Spike 1	SE134169.015	%	40 - 130%	91
Dibromofluoromethane (Surrogate)	Trip Blank 1	SE134169.014	%	40 - 130%	117
	Trip Spike 1	SE134169.015	%	40 - 130%	94

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TP20 0.0-0.1	SE134169.001	%	60 - 130%	75
	TP21 0.0-0.11	SE134169.003	%	60 - 130%	76
	TP22 0.0-0.1	SE134169.005	%	60 - 130%	87
	TP23 0.0-0.1	SE134169.008	%	60 - 130%	73
	TP24 0.0-0.1	SE134169.010	%	60 - 130%	94
	TP25 0.0-0.1	SE134169.011	%	60 - 130%	91
d4-1,2-dichloroethane (Surrogate)	TP20 0.0-0.1	SE134169.001	%	60 - 130%	85
	TP21 0.0-0.11	SE134169.003	%	60 - 130%	84
	TP22 0.0-0.1	SE134169.005	%	60 - 130%	92
	TP23 0.0-0.1	SE134169.008	%	60 - 130%	84
	TP24 0.0-0.1	SE134169.010	%	60 - 130%	74
	TP25 0.0-0.1	SE134169.011	%	60 - 130%	72
d8-toluene (Surrogate)	TP20 0.0-0.1	SE134169.001	%	60 - 130%	85
	TP21 0.0-0.11	SE134169.003	%	60 - 130%	88
	TP22 0.0-0.1	SE134169.005	%	60 - 130%	97
	TP23 0.0-0.1	SE134169.008	%	60 - 130%	86
	TP24 0.0-0.1	SE134169.010	%	60 - 130%	93
	TP25 0.0-0.1	SE134169.011	%	60 - 130%	102
Dibromofluoromethane (Surrogate)	TP20 0.0-0.1	SE134169.001	%	60 - 130%	70
	TP21 0.0-0.11	SE134169.003	%	60 - 130%	73
	TP22 0.0-0.1	SE134169.005	%	60 - 130%	79
	TP23 0.0-0.1	SE134169.008	%	60 - 130%	72
	TP24 0.0-0.1	SE134169.010	%	60 - 130%	77
	TP25 0.0-0.1	SE134169.011	%	60 - 130%	70

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Volatile Petroleum Hydrocarbons in Water — **Method: ME-(AU)-[ENV]AN433/AN434/AN410**

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	Trip Blank 1	SE134169.014	%	40 - 130%	83
d4-1,2-dichloroethane (Surrogate)	Trip Blank 1	SE134169.014	%	60 - 130%	111
d8-toluene (Surrogate)	Trip Blank 1	SE134169.014	%	40 - 130%	98
Dibromofluoromethane (Surrogate)	Trip Blank 1	SE134169.014	%	40 - 130%	117

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

Sample Number	Parameter	Units	LOR	Result
LB069222.001	Mercury	mg/L	0.0001	<0.0001

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result
LB069015.001	Mercury	mg/kg	0.01	<0.01
LB069016.001	Mercury	mg/kg	0.01	<0.01

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB068883.001		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1
		Alpha BHC	mg/kg	0.1	<0.1
		Lindane	mg/kg	0.1	<0.1
		Heptachlor	mg/kg	0.1	<0.1
		Aldrin	mg/kg	0.1	<0.1
		Beta BHC	mg/kg	0.1	<0.1
		Delta BHC	mg/kg	0.1	<0.1
		Heptachlor epoxide	mg/kg	0.1	<0.1
		Alpha Endosulfan	mg/kg	0.2	<0.2
		Gamma Chlordane	mg/kg	0.1	<0.1
		Alpha Chlordane	mg/kg	0.1	<0.1
		p,p'-DDE	mg/kg	0.1	<0.1
		Dieldrin	mg/kg	0.2	<0.2
		Endrin	mg/kg	0.2	<0.2
		Beta Endosulfan	mg/kg	0.2	<0.2
		p,p'-DDD	mg/kg	0.1	<0.1
		p,p'-DDT	mg/kg	0.1	<0.1
		Endosulfan sulphate	mg/kg	0.1	<0.1
		Endrin Aldehyde	mg/kg	0.1	<0.1
		Methoxychlor	mg/kg	0.1	<0.1
		Endrin Ketone	mg/kg	0.1	<0.1
		Isodrin	mg/kg	0.1	<0.1
		Mirex	mg/kg	0.1	<0.1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	102

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB068883.001		Naphthalene	mg/kg	0.1	<0.1
		2-methylnaphthalene	mg/kg	0.1	<0.1
		1-methylnaphthalene	mg/kg	0.1	<0.1
		Acenaphthylene	mg/kg	0.1	<0.1
		Acenaphthene	mg/kg	0.1	<0.1
		Fluorene	mg/kg	0.1	<0.1
		Phenanthrene	mg/kg	0.1	<0.1
		Anthracene	mg/kg	0.1	<0.1
		Fluoranthene	mg/kg	0.1	<0.1
		Pyrene	mg/kg	0.1	<0.1
		Benzo(a)anthracene	mg/kg	0.1	<0.1
		Chrysene	mg/kg	0.1	<0.1
		Benzo(a)pyrene	mg/kg	0.1	<0.1
		Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1
		Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1
		Benzo(ghi)perylene	mg/kg	0.1	<0.1
		Total PAH	mg/kg	0.8	<0.8
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	100

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB068883.001	Surrogates	2-fluorobiphenyl (Surrogate)	%	-	82
		d14-p-terphenyl (Surrogate)	%	-	112

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB068894.001		Naphthalene	µg/L	0.1	<0.1
		2-methylnaphthalene	µg/L	0.1	<0.1
		1-methylnaphthalene	µg/L	0.1	<0.1
		Acenaphthylene	µg/L	0.1	<0.1
		Acenaphthene	µg/L	0.1	<0.1
		Fluorene	µg/L	0.1	<0.1
		Phenanthrene	µg/L	0.1	<0.1
		Anthracene	µg/L	0.1	<0.1
		Fluoranthene	µg/L	0.1	<0.1
		Pyrene	µg/L	0.1	<0.1
		Benzo(a)anthracene	µg/L	0.1	<0.1
		Chrysene	µg/L	0.1	<0.1
		Benzo(a)pyrene	µg/L	0.1	<0.1
		Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1
		Dibenzo(a&h)anthracene	µg/L	0.1	<0.1
		Benzo(ghi)perylene	µg/L	0.1	<0.1
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	82
		2-fluorobiphenyl (Surrogate)	%	-	72
		d14-p-terphenyl (Surrogate)	%	-	94

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB068883.001		Arochlor 1016	mg/kg	0.2	<0.2
		Arochlor 1221	mg/kg	0.2	<0.2
		Arochlor 1232	mg/kg	0.2	<0.2
		Arochlor 1242	mg/kg	0.2	<0.2
		Arochlor 1248	mg/kg	0.2	<0.2
		Arochlor 1254	mg/kg	0.2	<0.2
		Arochlor 1260	mg/kg	0.2	<0.2
		Arochlor 1262	mg/kg	0.2	<0.2
		Arochlor 1268	mg/kg	0.2	<0.2
		Total PCBs (Arochlors)	mg/kg	1	<1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	102

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB068883.001		Phenol	mg/kg	0.5	<0.5
		2-methyl phenol (o-cresol)	mg/kg	0.5	<0.5
		3/4-methyl phenol (m/p-cresol)	mg/kg	1	<1
		2-chlorophenol	mg/kg	0.5	<0.5
		2,4-dimethylphenol	mg/kg	0.5	<0.5
		2,6-dichlorophenol	mg/kg	0.5	<0.5
		2,4-dichlorophenol	mg/kg	0.5	<0.5
		2,4,6-trichlorophenol	mg/kg	0.5	<0.5
		2-nitrophenol	mg/kg	0.5	<0.5
		4-nitrophenol	mg/kg	1	<1
		2,4,5-trichlorophenol	mg/kg	0.5	<0.5
		2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1	<1
		Pentachlorophenol	mg/kg	0.5	<0.5
		2,4-dinitrophenol	mg/kg	2	<2
		4-chloro-3-methylphenol	mg/kg	2	<2
	Surrogates	2,4,6-Tribromophenol (Surrogate)	%	-	89
		d5-phenol (Surrogate)	%	-	97

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest (continued)

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result
LB069012.001	Arsenic, As	mg/kg	3	<3
	Cadmium, Cd	mg/kg	0.3	<0.3
	Chromium, Cr	mg/kg	0.3	<0.3
	Copper, Cu	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Iron, Fe	mg/kg	50	<50
	Nickel, Ni	mg/kg	0.5	<0.5
	Zinc, Zn	mg/kg	0.5	<0.5
LB069013.001	Arsenic, As	mg/kg	3	<3
	Cadmium, Cd	mg/kg	0.3	<0.3
	Chromium, Cr	mg/kg	0.3	<0.3
	Copper, Cu	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Iron, Fe	mg/kg	50	<50
	Nickel, Ni	mg/kg	0.5	<0.5
	Zinc, Zn	mg/kg	0.5	<0.5

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Sample Number	Parameter	Units	LOR	Result
LB068946.001	Arsenic, As	µg/L	1	<1
	Cadmium, Cd	µg/L	0.1	<0.1
	Chromium, Cr	µg/L	1	<1
	Copper, Cu	µg/L	1	<1
	Lead, Pb	µg/L	1	<1
	Nickel, Ni	µg/L	1	<1
	Zinc, Zn	µg/L	5	<5

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number	Parameter	Units	LOR	Result
LB068883.001	TRH C10-C14	mg/kg	20	<20
	TRH C15-C28	mg/kg	45	<45
	TRH C29-C36	mg/kg	45	<45
	TRH C37-C40	mg/kg	100	<100
	TRH C10-C36 Total	mg/kg	110	<110

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result
LB068917.001	Monocyclic Aromatic	Benzene	mg/kg	0.1	<0.1
	Hydrocarbons	Toluene	mg/kg	0.1	<0.1
		Ethylbenzene	mg/kg	0.1	<0.1
		m/p-xylene	mg/kg	0.2	<0.2
		o-xylene	mg/kg	0.1	<0.1
	Polycyclic VOCs	Naphthalene	mg/kg	0.1	<0.1
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	84
		d4-1,2-dichloroethane (Surrogate)	%	-	90
		d8-toluene (Surrogate)	%	-	93
		Bromofluorobenzene (Surrogate)	%	-	87
	Totals	Total BTEX*	mg/kg	0.6	<0.6

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result
LB068997.001	Monocyclic Aromatic	Benzene	µg/L	0.5	<0.5
	Hydrocarbons	Toluene	µg/L	0.5	<0.5
		Ethylbenzene	µg/L	0.5	<0.5
		m/p-xylene	µg/L	1	<1
		o-xylene	µg/L	0.5	<0.5
	Polycyclic VOCs	Naphthalene	µg/L	0.5	<0.5
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	113
		d4-1,2-dichloroethane (Surrogate)	%	-	111
		d8-toluene (Surrogate)	%	-	98
		Bromofluorobenzene (Surrogate)	%	-	84

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result
LB068917.001		TRH C6-C9	mg/kg	20	<20
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	84
		d4-1,2-dichloroethane (Surrogate)	%	-	90
		d8-toluene (Surrogate)	%	-	93

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result
LB068997.001		TRH C6-C9	µg/L	40	<40
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	113
		d4-1,2-dichloroethane (Surrogate)	%	-	111
		d8-toluene (Surrogate)	%	-	98
		Bromofluorobenzene (Surrogate)	%	-	84

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134309.001	LB069222.014	Mercury	µg/L	0.0001	<0.0001	<0.0001	200	0
SE134309.006	LB069222.020	Mercury	µg/L	0.0001	<0.0001	<0.0001	200	0

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134157.001	LB069015.014	Mercury	mg/kg	0.01	<0.05	<0.05	200	0
SE134169.004	LB069015.024	Mercury	mg/kg	0.01	0.02	0.02	200	0
SE134201.002	LB069016.014	Mercury	mg/kg	0.01	<0.01	<0.01	200	0
SE134201.011	LB069016.024	Mercury	mg/kg	0.01	0.02	0.01	200	0

Moisture Content

Method: ME-(AU)-[ENV]AN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134169.011	LB068977.011	% Moisture	%w/w	0.5	13	15	37	12
SE134169.012	LB068977.013	% Moisture	%	0.5	12	12	38	3

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134169.003	LB068883.010		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Lindane	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor	mg/kg	0.1	<0.1	<0.1	200	0
			Aldrin	mg/kg	0.1	<0.1	<0.1	200	0
			Beta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Delta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Dieldrin	mg/kg	0.2	<0.2	<0.2	200	0
			Endrin	mg/kg	0.2	<0.2	<0.2	200	0
			o,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			p,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	200	0
			Methoxychlor	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Ketone	mg/kg	0.1	<0.1	<0.1	200	0
			Isodrin	mg/kg	0.1	<0.1	<0.1	200	0
			Mirex	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.15	0.15	30	2

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134157.001	LB068883.004	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Acenaphthylene	mg/kg	0.1	<0.1	<0.1	200	0
		Acenaphthene	mg/kg	0.1	<0.1	<0.1	200	0
		Fluorene	mg/kg	0.1	<0.1	<0.1	200	0
		Phenanthrene	mg/kg	0.1	<0.1	<0.1	200	0
		Anthracene	mg/kg	0.1	<0.1	<0.1	200	0
		Fluoranthene	mg/kg	0.1	0.1	<0.1	155	10
		Pyrene	mg/kg	0.1	0.1	<0.1	148	18
		Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
		Chrysene	mg/kg	0.1	<0.1	<0.1	200	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134157.001	LB068883.004		Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	173	0
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	197	0
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	200	0
			Carcinogenic PAHs (as BaP TEQ)-assume results	TEQ (mg/kg)	0.2	<0.2	<0.2	200	0
			Carcinogenic PAHs (as BaP TEQ)-assume results	TEQ (mg/kg)	0.3	<0.3	<0.3	134	0
			Carcinogenic PAHs (as BaP TEQ)-assume results	TEQ (mg/kg)	0.2	<0.2	<0.2	175	0
			Total PAH	mg/kg	0.8	0.8	<0.8	187	0
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.7	0.5	30	18
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	13
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.6	0.5	30	21

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134212.001	LB068894.005		Naphthalene	µg/L	0.1	<0.1	<0.1	200	0
			2-methylnaphthalene	µg/L	0.1	<0.1	<0.1	200	0
			1-methylnaphthalene	µg/L	0.1	<0.1	<0.1	200	0
			Acenaphthylene	µg/L	0.1	<0.1	<0.1	200	0
			Acenaphthene	µg/L	0.1	<0.1	<0.1	200	0
			Fluorene	µg/L	0.1	<0.1	<0.1	200	0
			Phenanthrene	µg/L	0.1	<0.1	<0.1	200	0
			Anthracene	µg/L	0.1	<0.1	<0.1	200	0
			Fluoranthene	µg/L	0.1	<0.1	<0.1	200	0
			Pyrene	µg/L	0.1	<0.1	<0.1	200	0
			Benzo(a)anthracene	µg/L	0.1	<0.1	<0.1	200	0
			Chrysene	µg/L	0.1	<0.1	<0.1	200	0
			Benzo(b&j)fluoranthene	µg/L	0.1	<0.1	<0.1	200	0
			Benzo(k)fluoranthene	µg/L	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	µg/L	0.1	<0.1	<0.1	200	0
			Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1	<0.1	200	0
			Dibenzo(a&h)anthracene	µg/L	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	µg/L	0.1	<0.1	<0.1	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	µg/L	-	0.33	0.33	30	0
			2-fluorobiphenyl (Surrogate)	µg/L	-	0.30	0.32	30	6
			d14-p-terphenyl (Surrogate)	µg/L	-	0.46	0.46	30	0

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134169.003	LB068883.010		Arochlor 1016	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1221	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1232	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1242	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1248	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1254	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1260	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1262	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1268	mg/kg	0.2	<0.2	<0.2	200	0
			Total PCBs (Arochlors)	mg/kg	1	<1	<1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0	0	30	2

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134092.002	LB069166.018	pH	pH Units	-	8.5	8.6	31	1
SE134160.001	LB069166.012	pH	pH Units	-	7.7	7.7	31	1

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Original	Duplicate	Parameter	Units	LOR

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Speciated Phenols in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134169.003	LB068883.010	Phenol	mg/kg	0.5	<0.5	<0.5	200	0
		2-methyl phenol (o-cresol)	mg/kg	0.5	1.0	<0.5	133	64
		3/4-methyl phenol (m/p-cresol)	mg/kg	1	<1	<1	200	0
		Total Cresol	mg/kg	1.5	<1.5	<1.5	200	0
		2-chlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
		2,4-dimethylphenol	mg/kg	0.5	<0.5	<0.5	200	0
		2,6-dichlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
		2,4-dichlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
		2,4,6-trichlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
		2-nitrophenol	mg/kg	0.5	<0.5	<0.5	200	0
		4-nitrophenol	mg/kg	1	<1	<1	200	0
		2,4,5-trichlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
		2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1	<1	<1	200	0
		Pentachlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
		2,4-dinitrophenol	mg/kg	2	<2	<2	200	0
		4-chloro-3-methylphenol	mg/kg	2	<2	<2	200	0
	Surrogates	2,4,6-Tribromophenol (Surrogate)	mg/kg	-	4.2	4.1	30	2
		d5-phenol (Surrogate)	mg/kg	-	1.5	1.5	30	2

TOC in Soil

Method: ME-(AU)-[ENV]AN188

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134169.002	LB069173.004	Total Organic Carbon	%w/w	0.05	0.56	0.52	24	7
SE134203.002	LB069173.009	Total Organic Carbon	%w/w	0.05	2.0	1.9630845094	18	0

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134119.001	LB069012.014	Arsenic, As	mg/kg	3	4	<3	69	78 ③
		Cadmium, Cd	mg/kg	0.3	0.3	<0.3	130	5
		Chromium, Cr	mg/kg	0.3	26	27	32	7
		Copper, Cu	mg/kg	0.5	96	100	31	5
		Lead, Pb	mg/kg	1	39	41	33	4
		Nickel, Ni	mg/kg	0.5	10	12	35	11
		Zinc, Zn	mg/kg	0.5	120	130	32	5
SE134169.002	LB069012.024	Arsenic, As	mg/kg	3	3	<3	65	15
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Chromium, Cr	mg/kg	0.3	33	26	32	24
		Copper, Cu	mg/kg	0.5	13	13	34	4
		Lead, Pb	mg/kg	1	17	13	37	24
		Iron, Fe	mg/kg	50	24000	20000	30	18
		Nickel, Ni	mg/kg	0.5	8.6	8.8	36	2
		Zinc, Zn	mg/kg	0.5	28	27	37	4
SE134199.001	LB069013.014	Chromium, Cr	mg/kg	0.3	13	14	34	9
		Copper, Cu	mg/kg	0.5	36	38	31	4
		Lead, Pb	mg/kg	1	160	160	31	6
		Zinc, Zn	mg/kg	0.5	250	270	31	7
SE134201.008	LB069013.024	Arsenic, As	mg/kg	3	5	5	50	14
		Cadmium, Cd	mg/kg	0.3	<0.3	0.3	137	1
		Chromium, Cr	mg/kg	0.3	7.8	7.5	37	4
		Copper, Cu	mg/kg	0.5	21	21	32	0
		Lead, Pb	mg/kg	1	15	16	36	4
		Nickel, Ni	mg/kg	0.5	7.5	8.0	36	8
		Zinc, Zn	mg/kg	0.5	71	77	33	8

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134176.004	LB068946.019	Arsenic, As	µg/L	1	3	3	45	3
		Cadmium, Cd	µg/L	0.1	<0.1	<0.1	200	0
		Chromium, Cr	µg/L	1	<1	<1	200	0
		Copper, Cu	µg/L	1	2	2	68	0
		Lead, Pb	µg/L	1	<1	<1	200	0
		Nickel, Ni	µg/L	1	<1	<1	145	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Trace Metals (Dissolved) in Water by ICPMS (continued)

Method: ME-(AU)-[ENV]AN318

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134176.004	LB068946.019		Zinc, Zn	µg/L	5	27	27	33	0

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134157.001	LB068883.004		TRH C10-C14	mg/kg	20	<20	<20	200	0
			TRH C15-C28	mg/kg	45	<45	<45	200	0
			TRH C29-C36	mg/kg	45	<45	<45	200	0
			TRH C37-C40	mg/kg	100	<100	<100	200	0
			TRH C10-C36 Total	mg/kg	110	<110	<110	200	0
			TRH C10-C40 Total	mg/kg	210	<210	<210	200	0
		TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	<25	<25	200	0
			TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	<25	<25	200	0
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	200	0
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	200	0

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134169.010	LB068917.014	Monocyclic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
		Aromatic	Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.9	3.8	50	3
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	3.7	4.4	50	18
			d8-toluene (Surrogate)	mg/kg	-	4.7	5.3	50	12
			Bromofluorobenzene (Surrogate)	mg/kg	-	4.7	5.0	50	7
		Totals	Total Xylenes*	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX*	mg/kg	0.6	<0.6	<0.6	200	0
SE134169.011	LB068917.016	Monocyclic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
		Aromatic	Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.5	3.8	50	9
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	3.6	3.7	50	3
			d8-toluene (Surrogate)	mg/kg	-	5.1	4.6	50	11
			Bromofluorobenzene (Surrogate)	mg/kg	-	4.6	4.3	50	5
		Totals	Total Xylenes*	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX*	mg/kg	0.6	<0.6	<0.6	200	0

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134169.010	LB068917.014		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.9	3.8	30	3
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	3.7	4.4	30	18
			d8-toluene (Surrogate)	mg/kg	-	4.7	5.3	30	12
			Bromofluorobenzene (Surrogate)	mg/kg	-	4.7	5.0	30	7
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0
SE134169.011	LB068917.016		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.5	3.8	30	9
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	3.6	3.7	30	3
			d8-toluene (Surrogate)	mg/kg	-	5.1	4.6	30	11
			Bromofluorobenzene (Surrogate)	mg/kg	-	4.6	4.3	30	5
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069122.005	Exchangeable Sodium, Na	mg/kg	2	NA	160	80 - 120	84
	Exchangeable Potassium, K	mg/kg	2	NA	330	80 - 120	95
	Exchangeable Calcium, Ca	mg/kg	2	NA	4347	80 - 120	86
	Exchangeable Magnesium, Mg	mg/kg	2	NA	1578	80 - 120	86

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069015.002	Mercury	mg/kg	0.01	0.21	0.2	70 - 130	103
LB069016.002	Mercury	mg/kg	0.01	0.21	0.2	70 - 130	104

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB068883.002		Heptachlor	mg/kg	0.1	0.2	0.2	60 - 140	109
		Aldrin	mg/kg	0.1	0.2	0.2	60 - 140	108
		Delta BHC	mg/kg	0.1	0.2	0.2	60 - 140	106
		Dieldrin	mg/kg	0.2	0.2	0.2	60 - 140	104
		Endrin	mg/kg	0.2	0.2	0.2	60 - 140	113
		p,p'-DDT	mg/kg	0.1	0.2	0.2	60 - 140	107
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.17	0.15	40 - 130	111

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB068883.002		Naphthalene	mg/kg	0.1	3.9	4	60 - 140	98
		Acenaphthylene	mg/kg	0.1	4.0	4	60 - 140	100
		Acenaphthene	mg/kg	0.1	3.8	4	60 - 140	96
		Phenanthrene	mg/kg	0.1	4.4	4	60 - 140	109
		Anthracene	mg/kg	0.1	4.2	4	60 - 140	105
		Fluoranthene	mg/kg	0.1	4.4	4	60 - 140	111
		Pyrene	mg/kg	0.1	4.2	4	60 - 140	106
		Benzo(a)pyrene	mg/kg	0.1	4.2	4	60 - 140	104
	Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	84
		2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	76
		d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	40 - 130	98

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB068894.002		Naphthalene	µg/L	0.1	40	40	60 - 140	101
		Acenaphthylene	µg/L	0.1	39	40	60 - 140	98
		Acenaphthene	µg/L	0.1	39	40	60 - 140	97
		Phenanthrene	µg/L	0.1	44	40	60 - 140	111
		Anthracene	µg/L	0.1	44	40	60 - 140	109
		Fluoranthene	µg/L	0.1	40	40	60 - 140	101
		Pyrene	µg/L	0.1	44	40	60 - 140	110
		Benzo(a)pyrene	µg/L	0.1	49	40	60 - 140	123
	Surrogates	d5-nitrobenzene (Surrogate)	µg/L	-	0.5	0.5	40 - 130	104
		2-fluorobiphenyl (Surrogate)	µg/L	-	0.5	0.5	40 - 130	94
		d14-p-terphenyl (Surrogate)	µg/L	-	0.6	0.5	40 - 130	116

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB068883.002	Arochlor 1260	mg/kg	0.2	0.4	0.4	60 - 140	93

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069166.001	pH	pH Units	-	7.4	7.415	98 - 102	99

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number	Parameter	Units	LOR

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Speciated Phenols in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB068883.002		Phenol	mg/kg	0.5	0.9	1	70 - 130	89
		2,4-dichlorophenol	mg/kg	0.5	1.1	1	70 - 130	107
		2,4,6-trichlorophenol	mg/kg	0.5	1.1	1	70 - 130	112
		Pentachlorophenol	mg/kg	0.5	0.7	1	70 - 130	73
	Surrogates	2,4,6-Tribromophenol (Surrogate)	mg/kg	-	4.5	5	40 - 130	91
		d5-phenol (Surrogate)	mg/kg	-	1.8	2	40 - 130	90

TOC in Soil

Method: ME-(AU)-[ENV]AN188

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069173.002	Total Organic Carbon	%w/w	0.05	0.31	0.325	80 - 120	96

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069012.002	Arsenic, As	mg/kg	3	45	50	80 - 120	91
	Cadmium, Cd	mg/kg	0.3	47	50	80 - 120	93
	Chromium, Cr	mg/kg	0.3	46	50	80 - 120	91
	Copper, Cu	mg/kg	0.5	47	50	80 - 120	93
	Lead, Pb	mg/kg	1	47	50	80 - 120	93
	Iron, Fe	mg/kg	50	<50	50	80 - 120	92
	Nickel, Ni	mg/kg	0.5	45	50	80 - 120	90
	Zinc, Zn	mg/kg	0.5	47	50	80 - 120	93
LB069013.002	Arsenic, As	mg/kg	3	45	50	80 - 120	90
	Cadmium, Cd	mg/kg	0.3	46	50	80 - 120	91
	Chromium, Cr	mg/kg	0.3	45	50	80 - 120	89
	Copper, Cu	mg/kg	0.5	46	50	80 - 120	92
	Lead, Pb	mg/kg	1	46	50	80 - 120	92
	Iron, Fe	mg/kg	50	<50	50	80 - 120	91
	Nickel, Ni	mg/kg	0.5	44	50	80 - 120	87
	Zinc, Zn	mg/kg	0.5	46	50	80 - 120	91

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB068946.002	Arsenic, As	µg/L	1	18	20	80 - 120	92
	Cadmium, Cd	µg/L	0.1	19	20	80 - 120	94
	Chromium, Cr	µg/L	1	19	20	80 - 120	96
	Copper, Cu	µg/L	1	20	20	80 - 120	99
	Lead, Pb	µg/L	1	19	20	80 - 120	97
	Nickel, Ni	µg/L	1	20	20	80 - 120	98
	Zinc, Zn	µg/L	5	19	20	80 - 120	96

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB068883.002		TRH C10-C14	mg/kg	20	40	40	60 - 140	100
		TRH C15-C28	mg/kg	45	<45	40	60 - 140	100
		TRH C29-C36	mg/kg	45	<45	40	60 - 140	83
	TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	40	40	60 - 140	100
		TRH >C16-C34 (F3)	mg/kg	90	<90	40	60 - 140	95
		TRH >C34-C40 (F4)	mg/kg	120	<120	20	60 - 140	80

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB068917.002	Monocyclic	Benzene	mg/kg	0.1	2.4	2.9	60 - 140	84
	Aromatic	Toluene	mg/kg	0.1	2.5	2.9	60 - 140	86
		Ethylbenzene	mg/kg	0.1	2.5	2.9	60 - 140	86
		m/p-xylene	mg/kg	0.2	5.3	5.8	60 - 140	92
		o-xylene	mg/kg	0.1	2.5	2.9	60 - 140	88
	Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.5	5	60 - 140	89
		d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.5	5	60 - 140	90
		d8-toluene (Surrogate)	mg/kg	-	4.9	5	60 - 140	97
		Bromofluorobenzene (Surrogate)	mg/kg	-	5.9	5	60 - 140	119

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB068997.002	Monocyclic Aromatic	Benzene	µg/L	0.5	47	45.45	60 - 140	103
		Toluene	µg/L	0.5	48	45.45	60 - 140	105
		Ethylbenzene	µg/L	0.5	49	45.45	60 - 140	109
		m/p-xylene	µg/L	1	97	90.9	60 - 140	107
		o-xylene	µg/L	0.5	49	45.45	60 - 140	108
	Surrogates	Dibromofluoromethane (Surrogate)	µg/L	-	4.5	5	60 - 140	90
		d4-1,2-dichloroethane (Surrogate)	µg/L	-	4.4	5	60 - 140	89
		d8-toluene (Surrogate)	µg/L	-	4.7	5	60 - 140	95
		Bromofluorobenzene (Surrogate)	µg/L	-	5.3	5	60 - 140	106

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB068917.002		TRH C6-C10	mg/kg	25	<25	24.65	60 - 140	98
		TRH C6-C9	mg/kg	20	20	23.2	60 - 140	87
	Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.5	5	60 - 140	89
		d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.5	5	60 - 140	90
		d8-toluene (Surrogate)	mg/kg	-	4.9	5	60 - 140	97
		Bromofluorobenzene (Surrogate)	mg/kg	-	5.9	5	60 - 140	119
	VPH F Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	7.25	60 - 140	122

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB068997.002		TRH C6-C10	µg/L	50	940	946.63	60 - 140	100
		TRH C6-C9	µg/L	40	820	818.71	60 - 140	100
	Surrogates	Dibromofluoromethane (Surrogate)	µg/L	-	4.5	5	60 - 140	90
		d4-1,2-dichloroethane (Surrogate)	µg/L	-	4.4	5	60 - 140	89
		d8-toluene (Surrogate)	µg/L	-	4.7	5	60 - 140	95
		Bromofluorobenzene (Surrogate)	µg/L	-	5.3	5	60 - 140	106
	VPH F Bands	TRH C6-C10 minus BTEX (F1)	µg/L	50	650	639.67	60 - 140	102

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134169.013	LB069222.012	Mercury	mg/L	0.0001	0.0080	0.0002	0.008	98

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134092.001	LB069015.004	Mercury	mg/kg	0.01	0.18	<0.05	0.2	76
SE134169.005	LB069016.004	Mercury	mg/kg	0.01	0.21	0.02	0.2	95

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134157.002	LB068883.007		Naphthalene	mg/kg	0.1	4.4	<0.1	4	110
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	-	-
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	-	-
			Acenaphthylene	mg/kg	0.1	4.6	<0.1	4	114
			Acenaphthene	mg/kg	0.1	4.3	<0.1	4	108
			Fluorene	mg/kg	0.1	<0.1	<0.1	-	-
			Phenanthrene	mg/kg	0.1	4.7	0.1	4	116
			Anthracene	mg/kg	0.1	4.9	<0.1	4	123
			Fluoranthene	mg/kg	0.1	4.8	0.2	4	117
			Pyrene	mg/kg	0.1	4.9	0.2	4	119
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	-	-
			Chrysene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	0.1	-	-
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(a)pyrene	mg/kg	0.1	4.7	<0.1	4	115
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	-	-
			Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	-	-
			Carcinogenic PAHs (as BaP TEQ)-assume results	TEQ	0.2	4.7	<0.2	-	-
			Carcinogenic PAHs (as BaP TEQ)-assume results	TEQ (mg/kg)	0.3	4.8	<0.3	-	-
			Carcinogenic PAHs (as BaP TEQ)-assume results	TEQ (mg/kg)	0.2	4.8	<0.2	-	-
			Total PAH	mg/kg	0.8	37	1.1	-	-
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.6	-	106
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	-	90
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.4	0.5	-	84

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134092.001	LB069012.004	Arsenic, As	mg/kg	3	37	6	50	63 ④
		Cadmium, Cd	mg/kg	0.3	36	0.3	50	71
		Chromium, Cr	mg/kg	0.3	49	22	50	54 ④
		Copper, Cu	mg/kg	0.5	56	29	50	55 ④
		Lead, Pb	mg/kg	1	49	24	50	51 ④
		Nickel, Ni	mg/kg	0.5	39	6.7	50	64 ④
		Zinc, Zn	mg/kg	0.5	70	52	50	36 ④
SE134169.003	LB069013.004	Arsenic, As	mg/kg	3	41	<3	50	76
		Cadmium, Cd	mg/kg	0.3	41	<0.3	50	81
		Chromium, Cr	mg/kg	0.3	58	26	50	65 ④
		Copper, Cu	mg/kg	0.5	48	7.1	50	81
		Lead, Pb	mg/kg	1	54	19	50	70 ④
		Nickel, Ni	mg/kg	0.5	44	6.4	50	76
		Zinc, Zn	mg/kg	0.5	66	28	50	75

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134169.013	LB068946.004	Arsenic, As	µg/L	1	19	<1	20	93
		Cadmium, Cd	µg/L	0.1	19	<0.1	20	97
		Chromium, Cr	µg/L	1	19	<1	20	96
		Copper, Cu	µg/L	1	23	3	20	101
		Lead, Pb	µg/L	1	19	<1	20	97

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Trace Metals (Dissolved) in Water by ICPMS (continued)

Method: ME-(AU)-[ENV]AN318

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134169.013	LB068946.004	Nickel, Ni	µg/L	1	21	<1	20	98
		Zinc, Zn	µg/L	5	34	14	20	102

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134157.001	LB068917.004	Monocyclic	Benzene	mg/kg	0.1	2.2	<0.1	2.9	74
		Aromatic	Toluene	mg/kg	0.1	2.6	<0.1	2.9	89
			Ethylbenzene	mg/kg	0.1	2.4	<0.1	2.9	82
			m/p-xylene	mg/kg	0.2	5.0	<0.2	5.8	87
			o-xylene	mg/kg	0.1	2.5	<0.1	2.9	87
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	-	-
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.3	3.8	5	85
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.0	4.5	5	99
			d8-toluene (Surrogate)	mg/kg	-	5.4	4.7	5	108
			Bromofluorobenzene (Surrogate)	mg/kg	-	5.4	4.4	5	108
		Totals	Total Xylenes*	mg/kg	0.3	7.6	<0.3	-	-
			Total BTEX*	mg/kg	0.6	15	<0.6	-	-

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134157.001	LB068917.004		TRH C6-C10	mg/kg	25	<25	<25	24.65	92
			TRH C6-C9	mg/kg	20	20	<20	23.2	87
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.3	3.8	5	85
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.0	4.5	5	99
			d8-toluene (Surrogate)	mg/kg	-	5.4	4.7	5	108
			Bromofluorobenzene (Surrogate)	mg/kg	-	5.4	4.4	5	108
		VPH F	Benzene (F0)	mg/kg	0.1	2.2	<0.1	-	-
		Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	7.25	110

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here:
http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

*	Non-accredited analysis.
-	Sample not analysed for this analyte.
^	Analysis performed by external laboratory.

IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.

①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to Analytical Report comments for further information.

This document is issued, on the Client's behalf, by the Company under its General Conditions of Service, available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions/General-Conditions-of-Services-English.aspx. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any other holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This test report shall not be reproduced, except in full.

Robson ENVIRONMENTAL

Occupational Hygiene Health Safety & Environmental Consulting

CHAIN OF CUSTODY FORM

Job No.: 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
~~140 Gladstone Street~~
Fyshwick ACT 2609
ABN: 55 008 660 900

Contact: Ben Kendon
Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
~~Fyshwick ACT 2609~~

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required **YES** NO

Job Name: ESA

SGS Job Ref: SY140911-1-IS

Required Turnaround Time:
24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

Doc No: EAR-F013 Revision No: 2
Date Issued: 5/11/13
Next Review Date: 05/11/15

~~To:~~
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax: (02) 8594 0499
Email:
ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
1	TP20 (0.0-0.1)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
2	TP20 (0.5 - 0.6)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
3	TP21 (0.0-0.11)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
4	TP21 (0.5-0.6)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
5	TP22 (0.0-0.1)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
6	TP22 (0.4-0.5)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
	TP22 (0.9-1.0)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	Hold	
7	TP22 (1.9-2.0)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	Asbestos (WA method)	
	TP22 (2.6-2.7)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	Hold	
8	TP23 (0.0-0.1)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP23 (0.4-0.5)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	Hold	
10	TP23 (0.9-1.0)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
	TP23 (1.9-2.0)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	Hold	
Relinquished by: BK	Date: 5/11/14		Time: 3pm	Received by:			Time: 5/11/14 7:30pm	
Relinquished by:	Date:		Time:	Received by:			Time:	
Relinquished by:	Date:		Time:	Received by:			Time:	

RECEIVED
05 DEC 2014
SE134169

Robson ENVIRONMENTAL

Occupational Hygiene Health Safety & Environmental Consulting

CHAIN OF CUSTODY FORM

Job No. : 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
~~140 Gladstone Street~~
Fyshwick ACT 2609
ABN: 55 008 660 900

Contact: Ben Kendon
Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
~~Fyshwick ACT 2609~~

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required **YES** NO

Job Name: Stage 1 ESA

SGS Job Ref: SY140911-1-IS

Required Turnaround Time:
24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

Doc No: EAR-F013 Revision No: 1
Date Issued: 13/04/2012

To:
~~SGS~~
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax: (02) 8594 0499
Email:
ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
10	TP24 (0.0-0.1)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
11	TP25 (0.0 - 0.1)	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
12	QC 1	4/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	
13	R1	4/12/2014	NA	1 Plastic 1 glass 500ml amber 2 BTEX Vials.	Water	ice	PAH and 8 heavy metals	
14	Trip Blank 1	2/12/2014 (date prep)	NA	1 Btex vial	Water	ice	BTEX and TRH C6-C9	
15	Trip Spike 1	2/12/2014 (date prep)	NA	1 Btex vial	Water	ice	BTEX and TRH C6-C9	

Relinquished by: BK	Date: 5/12/14		Time:	Received by: L. As	Time: 5/12/14 7.30pm
Relinquished by:	Date:		Time:	Received by:	Time:
Relinquished by:	Date:		Time:	Received by:	Time:

SGS

SE134169

Job:

	Matrix	250 JAR	125 JAR	BAG	60ml vials	100ml Nalgene	1L UP P	500 UP P	250 ZnAcetate P	250 / 500 NaOH BP	125 / 250 UP P	125 / 250 Metal Total*	125 / 250 Metal Filtered*	125 HCl P	1L UP AG	500 / 1L H_2SO_4 AG	125 / 250 H_2SO_4 P	100 / 200 UP AG	40 NaThio GV	250 UP OPAQUE P	500 NaThio STERILE P	200 NaThio STERILE P	Storage Location	Bottles Supplied By	Comment	Cooling Method
																										CP
1-12	S	1		1		1																	S162 MSB	SLS	S 11	Temp
13	A					1									1				2				WOA2	4	1	3.7°C
14, 15	W				2																		11	11	11	Good Order
																										Y / N
																										Clearly Labelled
																										Y / N
																										Correct Pres.
																										Y / N
																										No Head-space
																										Y / N / NA
																										Sufficient Vol
																										Y / N
																										Doc Date
																										05/12
																										Doc Type
																										COC
																										Complete Docs
																										Y / N
																										Requested TAT
																										Std

4 Soils on Hold

SAMPLE RECEIPT ADVICE

SE134169

CLIENT DETAILS

Contact	Ben Kendon
Client	Robson Environmental Pty Ltd
Address	140 Gladstone Street, FYSHWICK PO Box 112, FYSHWICK ACT 2609
Telephone	(02) 6239 5656
Facsimile	(02) 6239 5669
Email	ben@robsonlabs.com.au
Project	**9623 - ESA - Old Canberra Brickworks**
Order Number	(Not specified)
Samples	15

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
Samples Received	Fri 5/12/2014
Report Due	Fri 12/12/2014
SGS Reference	**SE134169**

SUBMISSION DETAILS

This is to confirm that 15 samples were received on Friday 5/12/2014. Results are expected to be ready by Friday 12/12/2014. Please quote SGS reference SE134169 when making enquiries. Refer below for details relating to sample integrity upon receipt.

Sample counts by matrix	12 Soils, 3 Waters	Type of documentation received	COC
Date documentation received	5/12/2014	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	3.7°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes		

Samples will be held for one month for water samples and two months for soil samples from date of report, unless otherwise instructed.

COMMENTS

Trip Spike can only be analysed for BTEX.
Clay Content - Subcontracted to SGS Cairns, 2/58 Comport St, Portsmith QLD 4870, NATA Accreditation Number: 2562, Site Number: 3146.
4 soil samples have been placed on hold as per client's request. These samples will not be processed.

To the extent not inconsistent with the other provisions of this document and unless specifically agreed otherwise in writing by SGS , all SGS services are rendered in accordance with the applicable SGS General Conditions of Service accessible at http://www.sgs.com/en/Terms-and-Conditions/General-Conditions-of-Services-English.aspx as at the date of this document.
Attention is drawn to the limitations of liability and to the clauses of indemnification.

SAMPLE RECEIPT ADVICE

SE134169

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	OC Pesticides in Soil	PAH (Polynuclear Aromatic Hydrocarbons) in Soil	PCBs in Soil	pH in soil (1:5)	Speciated Phenols in Soil	TRH (Total Recoverable Hydrocarbons) in Soil	VOC's in Soil	Volatile Petroleum Hydrocarbons in Soil
001	TP20 0.0-0.1	28	25	11	-	18	10	12	8
002	TP20 0.5-0.6	-	-	-	1	-	-	-	-
003	TP21 0.0-0.11	28	25	11	-	18	10	12	8
005	TP22 0.0-0.1	28	25	11	-	18	10	12	8
006	TP22 0.4-0.5	-	-	-	1	-	-	-	-
008	TP23 0.0-0.1	28	25	11	-	18	10	12	8
009	TP23 0.9-1.0	-	-	-	1	-	-	-	-
010	TP24 0.0-0.1	28	25	11	-	18	10	12	8
011	TP25 0.0-0.1	28	25	11	-	18	10	12	8
012	QC 1	-	25	-	-	-	-	-	-

CONTINUED OVERLEAF

The above table represents SGS Environmental Services' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .

SAMPLE RECEIPT ADVICE

SE134169

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	Clay and Fine Silt in Soil/Aggregate	Exchangeable Cations and Cation Exchange Capacity	Gravimetric Determination of Asbestos in Soil	Mercury in Soil	Moisture Content	TOC in Soil	Total Recoverable Metals in Soil by ICPOES from	VOCs in Water
001	TP20 0.0-0.1	-	-	5	1	1	-	7	-
002	TP20 0.5-0.6	1	13	5	1	1	1	8	-
003	TP21 0.0-0.11	-	-	5	1	1	-	7	-
004	TP21 0.5-0.6	-	-	5	1	1	-	7	-
005	TP22 0.0-0.1	-	-	5	1	1	-	7	-
006	TP22 0.4-0.5	1	13	5	1	1	1	8	-
007	TP22 1.9-2.0	-	-	5	-	-	-	-	-
008	TP23 0.0-0.1	-	-	5	1	1	-	7	-
009	TP23 0.9-1.0	1	13	5	1	1	1	8	-
010	TP24 0.0-0.1	-	-	5	1	1	-	7	-
011	TP25 0.0-0.1	-	-	5	1	1	-	7	-
012	QC 1	-	-	5	1	1	-	7	-
014	Trip Blank 1	-	-	-	-	-	-	-	12
015	Trip Spike 1	-	-	-	-	-	-	-	12

CONTINUED OVERLEAF

The above table represents SGS Environmental Services' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .

SAMPLE RECEIPT ADVICE

SE134169

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	Mercury (dissolved) in Water	PAH (Polynuclear Aromatic Hydrocarbons) in Water	Trace Metals (Dissolved) in Water by ICPMS	Volatile Petroleum Hydrocarbons in Water
013	R1	1	22	7	-
014	Trip Blank 1	-	-	-	8

The above table represents SGS Environmental Services' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 120574

Client:
Robson Environmental Pty Ltd
PO Box 112
Fyshwick
ACT 2609

Attention: Ben Kendon

Sample log in details:

Your Reference:	**9623, ESA**		
No. of samples:	1 Soil		
Date samples received / completed instructions received	8/12/2014	/	8/12/2014

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	15/12/14	/	15/12/14
Date of Preliminary Report:	Not Issued		

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

PAHs in Soil		
Our Reference:	UNITS	120574-1
Your Reference	----------	QC2
Date Sampled	----------	4/12/2014
Type of sample		Soil
Date extracted	-	9/12/2014
Date analysed	-	9/12/2014
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	<0.1
Pyrene	mg/kg	<0.1
Benzo(a)anthracene	mg/kg	<0.1
Chrysene	mg/kg	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Benzo(a)pyrene TEQ NEPM B1	mg/kg	<0.5
Total Positive PAHs	mg/kg	NIL (+)VE
Surrogate p-Terphenyl-d14	%	96

Acid Extractable metals in soil		
Our Reference:	UNITS	120574-1
Your Reference	----------	QC2
Date Sampled	----------	4/12/2014
Type of sample		Soil
Date digested	-	09/12/2014
Date analysed	-	09/12/2014
Arsenic	mg/kg	8
Cadmium	mg/kg	<0.4
Chromium	mg/kg	25
Copper	mg/kg	23
Lead	mg/kg	28
Mercury	mg/kg	<0.1
Nickel	mg/kg	20
Zinc	mg/kg	62

Moisture		
Our Reference:	UNITS	120574-1
Your Reference	----------	QC2
Date Sampled	----------	4/12/2014
Type of sample		Soil
Date prepared	-	9/12/2014
Date analysed	-	10/12/2014
Moisture	%	11

Asbestos ID - soils		
Our Reference:	UNITS	120574-1
Your Reference	----------	QC2
Date Sampled	----------	4/12/2014
Type of sample		Soil
Date analysed	-	11/12/2014
Sample mass tested	g	758.81g
Sample Description	-	Brown coarse grain soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg
Trace Analysis	-	No asbestos detected
ACM >7mm Estimation*	g	--
ACM <7mm Estimation*	g	--
FA and AF Estimation*	g	--
Total Asbestos g/kg*	g/kg	<0.1
ACM >7mm Estimation %(w/w)*	%	<0.01
ACM <7mm Estimation %(w/w)*	%	<0.001
FA and AF Estimation %(w/w)*	%	<0.001
Total Asb Est w/w* Note#	%	<0.001

Method ID	Methodology Summary
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 deg C for a minimum of 12 hours.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** # The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light Microscopy and Dispersion Staining Techniques.
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			9/12/2014	[NT]	[NT]	LCS-2	9/12/2014
Date analysed	-			09/12/2014	[NT]	[NT]	LCS-2	09/12/2014
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-2	110%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-2	93%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-2	86%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-2	78%
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-2	94%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-2	79%
Benzo(b,j+k) fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	[NT]	[NT]	LCS-2	94%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	96	[NT]	[NT]	LCS-2	101%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date digested	-			09/12/2014	[NT]	[NT]	LCS-2	09/12/2014
Date analysed	-			09/12/2014	[NT]	[NT]	LCS-2	09/12/2014
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	[NT]	[NT]	LCS-2	115%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	[NT]	[NT]	LCS-2	110%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-2	114%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-2	113%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-2	106%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	LCS-2	103%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-2	109%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-2	110%

Report Comments:

This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.
This is reported outside our scope of NATA accreditation.

Asbestos ID was analysed by Approved Identifier: Lulu Guo
Asbestos ID was authorised by Approved Signatory: Lulu Guo

INS: Insufficient sample for this test
NA: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

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

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

Robson ENVIRONMENTAL

Occupational Hygiene
Health Safety &
Environmental Consulting

CHAIN OF CUSTODY FORM

Job No.: 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
Unit 1, 140 Gladstone Street
Fyshwick ACT 2609
ABN: 55 008 660 900

Contact: Ben Kendon
Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required **YES** NO

Job Name: ESA

Required Turnaround Time:
24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

Doc No: EAR-F014 Revision No: 2
Date Issued: 5/11/13
Next Review Date: 05/11/15

To:
Envirolab
12 Ashley Street
Chatswood NSW 2607

Contact:Jacinta
Phone: (02) 9910 6200
Mobile:
Fax: (02) 9910 6201
Email:
ABN: 91 004 591 664

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Jars	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
1-	QC2	4/12/2014	West of dump	1 Jar 1 plastic bag	Soil	Ice	PAH, 8 heavy metals and asbestos (WA)	Please forward to Envirolab

Relinquished by: BK (05/12/2014)	Date: 05/12/2014		Time: 3pm	Received by: Daniel Ford.	Time: 8.12.14 @ 14:45
Relinquished by:	Date:		Time:	Received by:	Time:
Relinquished by:	Date:		Time:	Received by:	Time:

ENVIROLAB

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 120574
Date Received: 8.12.14
Time Received: 14:45
Received by: D.F.
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

SAMPLE RECEIPT ADVICE

Client:

Robson Environmental Pty Ltd
PO Box 112
Fyshwick ACT 2609

ph: 02 6239 5656
Fax: 02 6239 5669

Attention: Ben Kendon

Sample log in details:

Your reference:	**9623, ESA**
Envirolab Reference:	**120574**
Date received:	8/12/2014
Date results expected to be reported:	**15/12/14**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	1 Soil
Turnaround time requested:	Standard
Temperature on receipt (°C)	8.8
Cooling Method:	Ice Pack
Sampling Date Provided:	YES

Comments:

If there is sufficient sample after testing, samples will be held for the following time frames from date of receipt of samples:
Water samples - 1 month
Soil and other solid samples - 2 months
Samples collected in canisters - 1 week. Canisters will then be cleaned.
All other samples are not retained after analysis
If you require samples to be retained for longer periods then retention fees will apply as per our pricelist.

Contact details:

Please direct any queries to Aileen Hie or Jacinta Hurst
ph: 02 9910 6200 fax: 02 9910 6201
email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au

ANALYTICAL REPORT

WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS

Contact	Ben Kendon
Client	Robson Environmental Pty Ltd
Address	140 Gladstone Street, FYSHWICK PO Box 112, FYSHWICK ACT 2609
Telephone	(02) 6239 5656
Facsimile	(02) 6239 5669
Email	ben@robsonlabs.com.au
Project	**9623 - ESA - Old Canberra Brickworks**
Order Number	**SY140911-1-IS**
Samples	33
Date Received	11/12/2014

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE134376 R0**
Report Number	0000099681
Date Reported	6/1/2015
Date Started	16/12/2014

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

Clay Content subcontracted to SGS Cairns, 2/58 Comport St, Portsmith QLD 4870, NATA Accreditation Number: 2562, Site Number: 3146.

No respirable fibres detected in all soil samples using trace analysis technique as per AS 4964-2004.
Asbestos weight is approximate.
FA +AF measured gravimetrically (excluding free fibres).

Sample # 3,11: A portion of the sample supplied has been sub-sampled for asbestos according to SGS In-house procedures. We therefore cannot guarantee that the sub-sample is representative of the entire sample supplied.
SGS Environmental Services recommends supplying approximately 50-100g of sample in a separate container.
Sample # 14 : Asbestos found in cement sheet fragment.
Asbestos analysed by Approved Identifier Ravee Sivasubramaniam .

SIGNATORIES

Andy Sutton
Senior Organic Chemist

Deanne Norris
Organic Chemist

Dong Liang
Metals/Inorganics Team Leader

Huong Crawford
Production Manager

Kamrul Ahsan
Senior Chemist

Ly Kim Ha
Organic Section Head

VOC's in Soil [AN433/AN434]

PARAMETER	UOM	LOR	TP1 0.4-0.5 SOIL - 9/12/2014 SE134376.002	TP2 0.0-0.1 SOIL - 9/12/2014 SE134376.004	TP3 0.0-0.1 SOIL - 9/12/2014 SE134376.007	TP5 0.0-0.1 SOIL - 9/12/2014 SE134376.010	TP4 0.9-1.0 SOIL - 10/12/2014 SE134376.019	TP6 0.0-0.1 SOIL - 10/12/2014 SE134376.022
Benzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Xylenes*	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total BTEX*	mg/kg	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

PARAMETER	UOM	LOR	TP7 0.4-0.5 SOIL - 10/12/2014 SE134376.025
Benzene	mg/kg	0.1	<0.1
Toluene	mg/kg	0.1	<0.1
Ethylbenzene	mg/kg	0.1	<0.1
m/p-xylene	mg/kg	0.2	<0.2
o-xylene	mg/kg	0.1	<0.1
Total Xylenes*	mg/kg	0.3	<0.3
Total BTEX*	mg/kg	0.6	<0.6
Naphthalene	mg/kg	0.1	<0.1

Volatile Petroleum Hydrocarbons in Soil [AN433/AN434/AN410]

PARAMETER	UOM	LOR	TP1 0.4-0.5 SOIL - 9/12/2014 SE134376.002	TP2 0.0-0.1 SOIL - 9/12/2014 SE134376.004	TP3 0.0-0.1 SOIL - 9/12/2014 SE134376.007	TP5 0.0-0.1 SOIL - 9/12/2014 SE134376.010	TP4 0.9-1.0 SOIL - 10/12/2014 SE134376.019	TP6 0.0-0.1 SOIL - 10/12/2014 SE134376.022
TRH C6-C9	mg/kg	20	<20	<20	<20	<20	<20	<20
Benzene (F0)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25	<25

PARAMETER	UOM	LOR	TP7 0.4-0.5 SOIL - 10/12/2014 SE134376.025
TRH C6-C9	mg/kg	20	<20
Benzene (F0)	mg/kg	0.1	<0.1
TRH C6-C10	mg/kg	25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25

TRH (Total Recoverable Hydrocarbons) in Soil [AN403]

PARAMETER	UOM	LOR	TP1 0.4-0.5 SOIL - 9/12/2014 SE134376.002	TP2 0.0-0.1 SOIL - 9/12/2014 SE134376.004	TP3 0.0-0.1 SOIL - 9/12/2014 SE134376.007	TP5 0.0-0.1 SOIL - 9/12/2014 SE134376.010	TP4 0.9-1.0 SOIL - 10/12/2014 SE134376.019	TP6 0.0-0.1 SOIL - 10/12/2014 SE134376.022
TRH C10-C14	mg/kg	20	<20	<20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45	<45	<45	<45	<45	<45	<45
TRH C29-C36	mg/kg	45	<45	<45	<45	<45	<45	<45
TRH C37-C40	mg/kg	100	<100	<100	<100	<100	<100	<100
TRH >C10-C16 (F2)	mg/kg	25	<25	<25	<25	<25	<25	<25
TRH >C10-C16 (F2) minus	mg/kg	25	<25	<25	<25	<25	<25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	<90	<90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	<120	<120	<120
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	<110	<110	<110
TRH C10-C40 Total	mg/kg	210	<210	<210	<210	<210	<210	<210

PARAMETER	UOM	LOR	TP7 0.4-0.5 SOIL - 10/12/2014 SE134376.025
TRH C10-C14	mg/kg	20	<20
TRH C15-C28	mg/kg	45	<45
TRH C29-C36	mg/kg	45	<45
TRH C37-C40	mg/kg	100	<100
TRH >C10-C16 (F2)	mg/kg	25	<25
TRH >C10-C16 (F2) minus	mg/kg	25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120
TRH C10-C36 Total	mg/kg	110	<110
TRH C10-C40 Total	mg/kg	210	<210

PAH (Polynuclear Aromatic Hydrocarbons) in Soil [AN420]

PARAMETER	UOM	LOR	TP1 0.4-0.5 SOIL - 9/12/2014 SE134376.002	TP2 0.0-0.1 SOIL - 9/12/2014 SE134376.004	TP3 0.0-0.1 SOIL - 9/12/2014 SE134376.007	TP5 0.0-0.1 SOIL - 9/12/2014 SE134376.010	TP5 1.9-2.0 SOIL - 9/12/2014 SE134376.012	QC 3 SOIL - 9/12/2014 SE134376.014
Naphthalene	mg/kg	0.1	<0.1	**0.2**	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	<0.1	**0.6**	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.1	<0.1	**0.4**	<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
Acenaphthene	mg/kg	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
Phenanthrene	mg/kg	0.1	<0.1	**0.1**	<0.1	**0.3**	**0.1**	<0.1
Anthracene	mg/kg	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	**0.4**	<0.1	<0.1
Pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	**0.3**	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	**0.2**	<0.1	<0.1
Chrysene	mg/kg	0.1	<0.1	<0.1	<0.1	**0.1**	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	**0.2**	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	**0.1**	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carcinogenic PAHs (as BaP TEQ)-	TEQ	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Carcinogenic PAHs (as BaP TEQ)-	TEQ (mg/kg)	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Carcinogenic PAHs (as BaP TEQ)-	TEQ (mg/kg)	0.2	<0.2	<0.2	<0.2	**0.2**	<0.2	<0.2
Total PAH	mg/kg	0.8	<0.8	**1.5**	<0.8	**2.0**	<0.8	<0.8

PARAMETER	UOM	LOR	TP4 0.9-1.0 SOIL - 10/12/2014 SE134376.019	TP6 0.0-0.1 SOIL - 10/12/2014 SE134376.022	TP7 0.4-0.5 SOIL - 10/12/2014 SE134376.025	QC5 SOIL - 10/12/2014 SE134376.030
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Carcinogenic PAHs (as BaP TEQ)-	TEQ	0.2	<0.2	<0.2	<0.2	<0.2
Carcinogenic PAHs (as BaP TEQ)-	TEQ (mg/kg)	0.3	<0.3	<0.3	<0.3	<0.3
Carcinogenic PAHs (as BaP TEQ)-	TEQ (mg/kg)	0.2	<0.2	<0.2	<0.2	<0.2
Total PAH	mg/kg	0.8	<0.8	<0.8	<0.8	<0.8

Speciated Phenols in Soil [AN420]

PARAMETER	UOM	LOR	TP1 0.4-0.5 SOIL - 9/12/2014 SE134376.002	TP2 0.0-0.1 SOIL - 9/12/2014 SE134376.004	TP3 0.0-0.1 SOIL - 9/12/2014 SE134376.007	TP5 0.0-0.1 SOIL - 9/12/2014 SE134376.010	TP4 0.9-1.0 SOIL - 10/12/2014 SE134376.019	TP6 0.0-0.1 SOIL - 10/12/2014 SE134376.022
Phenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-methyl phenol (o-cresol)	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
3/4-methyl phenol (m/p-cresol)	mg/kg	1	<1	<1	<1	<1	<1	<1
Total Cresol	mg/kg	1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
2-chlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dimethylphenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,6-dichlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dichlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,6-trichlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-nitrophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-nitrophenol	mg/kg	1	<1	<1	<1	<1	<1	<1
2,4,5-trichlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1	<1	<1	<1	<1	<1	<1
Pentachlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dinitrophenol	mg/kg	2	<2	<2	<2	<2	<2	<2
4-chloro-3-methylphenol	mg/kg	2	<2	<2	<2	<2	<2	<2

PARAMETER	UOM	LOR	TP7 0.4-0.5 SOIL - 10/12/2014 SE134376.025
Phenol	mg/kg	0.5	<0.5
2-methyl phenol (o-cresol)	mg/kg	0.5	<0.5
3/4-methyl phenol (m/p-cresol)	mg/kg	1	<1
Total Cresol	mg/kg	1.5	<1.5
2-chlorophenol	mg/kg	0.5	<0.5
2,4-dimethylphenol	mg/kg	0.5	<0.5
2,6-dichlorophenol	mg/kg	0.5	<0.5
2,4-dichlorophenol	mg/kg	0.5	<0.5
2,4,6-trichlorophenol	mg/kg	0.5	<0.5
2-nitrophenol	mg/kg	0.5	<0.5
4-nitrophenol	mg/kg	1	<1
2,4,5-trichlorophenol	mg/kg	0.5	<0.5
2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1	<1
Pentachlorophenol	mg/kg	0.5	<0.5
2,4-dinitrophenol	mg/kg	2	<2
4-chloro-3-methylphenol	mg/kg	2	<2

OC Pesticides in Soil [AN400/AN420]

PARAMETER	UOM	LOR	TP1 0.4-0.5 SOIL - 9/12/2014 SE134376.002	TP2 0.0-0.1 SOIL - 9/12/2014 SE134376.004	TP3 0.0-0.1 SOIL - 9/12/2014 SE134376.007	TP5 0.0-0.1 SOIL - 9/12/2014 SE134376.010	TP4 0.9-1.0 SOIL - 10/12/2014 SE134376.019	TP6 0.0-0.1 SOIL - 10/12/2014 SE134376.022
Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lindane	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Delta BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDE	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o,p'-DDD	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDT	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p,p'-DDD	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Ketone	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isodrin	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mirex	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

OC Pesticides in Soil [AN400/AN420] (continued)

PARAMETER	UOM	LOR	TP7 0.4-0.5 SOIL - 10/12/2014 SE134376.025
Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1
Alpha BHC	mg/kg	0.1	<0.1
Lindane	mg/kg	0.1	<0.1
Heptachlor	mg/kg	0.1	<0.1
Aldrin	mg/kg	0.1	<0.1
Beta BHC	mg/kg	0.1	<0.1
Delta BHC	mg/kg	0.1	<0.1
Heptachlor epoxide	mg/kg	0.1	<0.1
o,p'-DDE	mg/kg	0.1	<0.1
Alpha Endosulfan	mg/kg	0.2	<0.2
Gamma Chlordane	mg/kg	0.1	<0.1
Alpha Chlordane	mg/kg	0.1	<0.1
trans-Nonachlor	mg/kg	0.1	<0.1
p,p'-DDE	mg/kg	0.1	<0.1
Dieldrin	mg/kg	0.2	<0.2
Endrin	mg/kg	0.2	<0.2
o,p'-DDD	mg/kg	0.1	<0.1
o,p'-DDT	mg/kg	0.1	<0.1
Beta Endosulfan	mg/kg	0.2	<0.2
p,p'-DDD	mg/kg	0.1	<0.1
p,p'-DDT	mg/kg	0.1	<0.1
Endosulfan sulphate	mg/kg	0.1	<0.1
Endrin Aldehyde	mg/kg	0.1	<0.1
Methoxychlor	mg/kg	0.1	<0.1
Endrin Ketone	mg/kg	0.1	<0.1
Isodrin	mg/kg	0.1	<0.1
Mirex	mg/kg	0.1	<0.1

PCBs in Soil [AN400/AN420]

PARAMETER	UOM	LOR	TP1 0.4-0.5 SOIL - 9/12/2014 SE134376.002	TP2 0.0-0.1 SOIL - 9/12/2014 SE134376.004	TP3 0.0-0.1 SOIL - 9/12/2014 SE134376.007	TP5 0.0-0.1 SOIL - 9/12/2014 SE134376.010	TP4 0.9-1.0 SOIL - 10/12/2014 SE134376.019	TP6 0.0-0.1 SOIL - 10/12/2014 SE134376.022
Arochlor 1016	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1221	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1232	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1242	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1248	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1254	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1260	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1262	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1268	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total PCBs (Arochlors)	mg/kg	1	<1	<1	<1	<1	<1	<1

PARAMETER	UOM	LOR	TP7 0.4-0.5 SOIL - 10/12/2014 SE134376.025
Arochlor 1016	mg/kg	0.2	<0.2
Arochlor 1221	mg/kg	0.2	<0.2
Arochlor 1232	mg/kg	0.2	<0.2
Arochlor 1242	mg/kg	0.2	<0.2
Arochlor 1248	mg/kg	0.2	<0.2
Arochlor 1254	mg/kg	0.2	<0.2
Arochlor 1260	mg/kg	0.2	<0.2
Arochlor 1262	mg/kg	0.2	<0.2
Arochlor 1268	mg/kg	0.2	<0.2
Total PCBs (Arochlors)	mg/kg	1	<1

pH in soil (1:5) [AN101]

PARAMETER	UOM	LOR	TP2 0.9-1.0 SOIL - 9/12/2014 SE134376.005	TP2 2.9-3.0 SOIL - 9/12/2014 SE134376.006	TP5 1.1-1.2 SOIL - 9/12/2014 SE134376.011	TP5 4.1-4.2 SOIL - 9/12/2014 SE134376.013	TP7 0.9-1.0 SOIL - 10/12/2014 SE134376.026	TP7 4.8-4.9 SOIL - 10/12/2014 SE134376.029
pH	pH Units	-	**7.5**	**6.4**	**6.0**	**6.5**	**7.3**	**6.5**

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) [AN122]

PARAMETER	UOM	LOR	TP2 0.9-1.0 SOIL - 9/12/2014 SE134376.005	TP2 2.9-3.0 SOIL - 9/12/2014 SE134376.006	TP5 1.1-1.2 SOIL - 9/12/2014 SE134376.011	TP5 4.1-4.2 SOIL - 9/12/2014 SE134376.013	TP7 0.9-1.0 SOIL - 10/12/2014 SE134376.026	TP7 4.8-4.9 SOIL - 10/12/2014 SE134376.029
Exchangeable Sodium, Na	mg/kg	2	18	29	24	27	140	25
Exchangeable Sodium, Na	meq/100g	0.01	0.08	0.13	0.10	0.12	0.60	0.11
Exchangeable Sodium Percentage*	%	0.1	1.0	0.9	1.0	1.0	5.1	1.0
Exchangeable Potassium, K	mg/kg	2	140	290	200	120	120	73
Exchangeable Potassium, K	meq/100g	0.01	0.35	0.73	0.51	0.30	0.31	0.19
Exchangeable Potassium	%	0.1	4.8	5.5	4.8	2.5	2.7	1.6
Exchangeable Calcium, Ca	mg/kg	2	1200	1800	1700	1200	1300	1100
Exchangeable Calcium, Ca	meq/100g	0.01	5.9	8.8	8.5	6.2	6.4	5.7
Exchangeable Calcium Percentage*	%	0.1	80.7	65.4	80.0	52.0	55.3	49.9
Exchangeable Magnesium, Mg	mg/kg	2	120	460	180	640	520	660
Exchangeable Magnesium, Mg	meq/100g	0.02	0.98	3.8	1.5	5.3	4.3	5.4
Exchangeable Magnesium	%	0.1	13.4	28.2	14.2	44.4	36.9	47.5
Cation Exchange Capacity	meq/100g	0.02	7.3	13	11	12	12	11

TOC in Soil [AN188]

PARAMETER	UOM	LOR	TP2 0.9-1.0 SOIL - 9/12/2014 SE134376.005	TP2 2.9-3.0 SOIL - 9/12/2014 SE134376.006	TP5 1.1-1.2 SOIL - 9/12/2014 SE134376.011	TP5 4.1-4.2 SOIL - 9/12/2014 SE134376.013	TP7 0.9-1.0 SOIL - 10/12/2014 SE134376.026	TP7 4.8-4.9 SOIL - 10/12/2014 SE134376.029
Total Organic Carbon	%w/w	0.05	**0.61**	**0.24**	**1.5**	**0.05**	**0.51**	**0.12**

Particle sizing of soils by sieving [AN005]

PARAMETER	UOM	LOR	TP2 0.9-1.0 SOIL - 9/12/2014 SE134376.005	TP2 2.9-3.0 SOIL - 9/12/2014 SE134376.006	TP5 1.1-1.2 SOIL - 9/12/2014 SE134376.011	TP5 4.1-4.2 SOIL - 9/12/2014 SE134376.013	TP7 0.9-1.0 SOIL - 10/12/2014 SE134376.026	TP7 4.8-4.9 SOIL - 10/12/2014 SE134376.029
Passing 75µm	%w/w	1	**33**	**69**	**52**	**50**	**69**	**35**
Retained 75µm	%w/w	1	**67**	**31**	**48**	**51**	**31**	**65**

Particle sizing of soils <75µm by hydrometer [AN005]

PARAMETER	UOM	LOR	TP2 0.9-1.0 SOIL - 9/12/2014 SE134376.005	TP2 2.9-3.0 SOIL - 9/12/2014 SE134376.006	TP5 1.1-1.2 SOIL - 9/12/2014 SE134376.011	TP5 4.1-4.2 SOIL - 9/12/2014 SE134376.013	TP7 0.9-1.0 SOIL - 10/12/2014 SE134376.026	TP7 4.8-4.9 SOIL - 10/12/2014 SE134376.029
Sedimentation Diameter 1	mm	0.0001	0.0574	0.0540	0.0554	0.0540	0.0533	0.0562
Passing Sedimentation Diameter 1	%w/w	1	27	49	40	49	53	35
Retained Sedimentation Diameter 1	%w/w	1	6	20	12	3	16	1
Sedimentation Diameter 2	mm	0.0001	0.0408	0.0384	0.0394	0.0387	0.0382	0.0401
Passing Sedimentation Diameter 2	%w/w	1	25	47	38	45	49	31
Retained Sedimentation Diameter 2	%w/w	1	2	2	2	4	4	3
Sedimentation Diameter 3	mm	0.0001	0.0209	0.0275	0.0280	0.0277	0.0272	0.0285
Passing Sedimentation Diameter 3	%w/w	1	24	42	36	40	46	29
Retained Sedimentation Diameter 3	%w/w	1	1	4	2	4	3	2
Sedimentation Diameter 4	mm	0.0001	0.0207	0.0196	0.0199	0.0197	0.0194	0.0203
Passing Sedimentation Diameter 4	%w/w	1	20	40	35	38	42	27
Retained Sedimentation Diameter 4	%w/w	1	3	2	1	2	3	2
Sedimentation Diameter 5	mm	0.0001	0.0152	0.0143	0.0146	0.0145	0.0143	0.0149
Passing Sedimentation Diameter 5	%w/w	1	18	39	31	36	40	25
Retained Sedimentation Diameter 5	%w/w	1	2	1	3	2	2	2
Sedimentation Diameter 6	mm	0.0001	0.0108	0.0102	0.0105	0.0103	0.0102	0.0106
Passing Sedimentation Diameter 6	%w/w	1	16	36	27	35	38	23
Retained Sedimentation Diameter 6	%w/w	1	2	3	4	1	2	2
Sedimentation Diameter 7	mm	0.0001	0.0076	0.0073	0.0075	0.0073	0.0072	0.0075
Passing Sedimentation Diameter 7	%w/w	1	16	34	24	32	38	23
Retained Sedimentation Diameter 7	%w/w	1	<1	2	3	2	<1	<1
Sedimentation Diameter 8	mm	0.0001	0.0054	0.0052	0.0053	0.0052	0.0051	0.0054
Passing Sedimentation Diameter 8	%w/w	1	15	31	23	31	37	19
Retained Sedimentation Diameter 8	%w/w	1	1	2	1	1	1	3
Sedimentation Diameter 9	mm	0.0001	0.0038	0.0037	0.0038	0.0037	0.0037	0.0038
Passing Sedimentation Diameter 9	%w/w	1	14	31	19	29	32	19
Retained Sedimentation Diameter 9	%w/w	1	1	<1	3	2	4	<1
Sedimentation Diameter 10	mm	0.0001	0.0016	0.0015	0.0015	0.0015	0.0015	0.0015
Passing Sedimentation Diameter 10	%w/w	1	14	29	18	27	31	18
Retained Sedimentation Diameter 10	%w/w	1	<1	2	1	2	1	1
Sedimentation Diameter 11	mm	0.0001	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011
Passing Sedimentation Diameter 11	%w/w	1	14	27	16	25	29	16
Retained Sedimentation Diameter 11	%w/w	1	<1	2	2	2	2	2
Sedimentation Diameter 12	mm	0.0001	-	-	-	-	-	-
Passing Sedimentation Diameter 12	%w/w	1	-	-	-	-	-	-
Retained Sedimentation Diameter 12	%w/w	1	-	-	-	-	-	-

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest [AN040/AN320]

PARAMETER	UOM	LOR	TP1 0.0-0.1 SOIL - 9/12/2014 SE134376.001	TP1 0.4-0.5 SOIL - 9/12/2014 SE134376.002	TP1 1.1-1.2 SOIL - 9/12/2014 SE134376.003	TP2 0.0-0.1 SOIL - 9/12/2014 SE134376.004	TP2 0.9-1.0 SOIL - 9/12/2014 SE134376.005	TP2 2.9-3.0 SOIL - 9/12/2014 SE134376.006
Arsenic, As	mg/kg	3	11	10	9	7	8	3
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	0.5	<0.3	<0.3	0.3
Chromium, Cr	mg/kg	0.3	11	10	23	19	15	40
Copper, Cu	mg/kg	0.5	28	27	72	16	19	22
Lead, Pb	mg/kg	1	25	24	57	60	24	59
Iron, Fe	mg/kg	50	-	-	-	-	15000	40000
Nickel, Ni	mg/kg	0.5	44	34	18	14	19	13
Zinc, Zn	mg/kg	0.5	160	75	230	94	130	290

PARAMETER	UOM	LOR	TP3 0.0-0.1 SOIL - 9/12/2014 SE134376.007	TP3 0.4-0.5 SOIL - 9/12/2014 SE134376.008	TP3 1.4-1.5 SOIL - 9/12/2014 SE134376.009	TP5 0.0-0.1 SOIL - 9/12/2014 SE134376.010	TP5 1.1-1.2 SOIL - 9/12/2014 SE134376.011	TP5 1.9-2.0 SOIL - 9/12/2014 SE134376.012
Arsenic, As	mg/kg	3	7	9	12	7	9	8
Cadmium, Cd	mg/kg	0.3	<0.3	0.5	0.4	0.4	0.5	<0.3
Chromium, Cr	mg/kg	0.3	17	21	21	18	21	18
Copper, Cu	mg/kg	0.5	30	23	69	25	51	35
Lead, Pb	mg/kg	1	24	58	470	170	70	34
Iron, Fe	mg/kg	50	-	-	-	-	-	-
Nickel, Ni	mg/kg	0.5	19	12	11	18	18	16
Zinc, Zn	mg/kg	0.5	82	290	330	260	250	270

PARAMETER	UOM	LOR	TP5 4.1-4.2 SOIL - 9/12/2014 SE134376.013	QC 3 SOIL - 9/12/2014 SE134376.014	TP4 0.0-0.1 SOIL - 10/12/2014 SE134376.018	TP4 0.9-1.0 SOIL - 10/12/2014 SE134376.019	TP4 1.9-2.0 SOIL - 10/12/2014 SE134376.020	TP4 3.6-3.7 SOIL - 10/12/2014 SE134376.021
Arsenic, As	mg/kg	3	3	8	5	3	10	4
Cadmium, Cd	mg/kg	0.3	<0.3	0.4	<0.3	0.7	<0.3	<0.3
Chromium, Cr	mg/kg	0.3	30	19	26	9.2	21	15
Copper, Cu	mg/kg	0.5	13	22	9.4	8.0	25	14
Lead, Pb	mg/kg	1	22	99	50	250	110	11
Iron, Fe	mg/kg	50	30000	-	-	-	-	-
Nickel, Ni	mg/kg	0.5	12	18	6.3	4.8	16	7.5
Zinc, Zn	mg/kg	0.5	93	250	43	110	120	83

PARAMETER	UOM	LOR	TP6 0.0-0.1 SOIL - 10/12/2014 SE134376.022	TP6 1.9-2.0 SOIL - 10/12/2014 SE134376.023	TP6 3.4-3.5 SOIL - 10/12/2014 SE134376.024	TP7 0.4-0.5 SOIL - 10/12/2014 SE134376.025	TP7 0.9-1.0 SOIL - 10/12/2014 SE134376.026	TP7 4.8-4.9 SOIL - 10/12/2014 SE134376.029
Arsenic, As	mg/kg	3	5	5	6	4	4	<3
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	0.4	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.3	22	21	18	24	18	20
Copper, Cu	mg/kg	0.5	14	12	42	11	7.1	11
Lead, Pb	mg/kg	1	28	26	89	19	22	8
Iron, Fe	mg/kg	50	-	-	-	-	7600	12000
Nickel, Ni	mg/kg	0.5	14	9.3	11	7.1	5.9	10
Zinc, Zn	mg/kg	0.5	26	520	260	21	22	150

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest [AN040/AN320] (continued)

PARAMETER	UOM	LOR	QC5 SOIL - 10/12/2014 SE134376.030
Arsenic, As	mg/kg	3	**6**
Cadmium, Cd	mg/kg	0.3	<0.3
Chromium, Cr	mg/kg	0.3	**25**
Copper, Cu	mg/kg	0.5	**10**
Lead, Pb	mg/kg	1	**28**
Iron, Fe	mg/kg	50	-
Nickel, Ni	mg/kg	0.5	**7.8**
Zinc, Zn	mg/kg	0.5	**25**

Mercury in Soil [AN312]

PARAMETER	UOM	LOR	TP1 0.0-0.1 SOIL - 9/12/2014 SE134376.001	TP1 0.4-0.5 SOIL - 9/12/2014 SE134376.002	TP1 1.1-1.2 SOIL - 9/12/2014 SE134376.003	TP2 0.0-0.1 SOIL - 9/12/2014 SE134376.004	TP2 0.9-1.0 SOIL - 9/12/2014 SE134376.005	TP2 2.9-3.0 SOIL - 9/12/2014 SE134376.006
Mercury	mg/kg	0.01	<0.01	<0.01	0.40	0.03	0.03	0.02

PARAMETER	UOM	LOR	TP3 0.0-0.1 SOIL - 9/12/2014 SE134376.007	TP3 0.4-0.5 SOIL - 9/12/2014 SE134376.008	TP3 1.4-1.5 SOIL - 9/12/2014 SE134376.009	TP5 0.0-0.1 SOIL - 9/12/2014 SE134376.010	TP5 1.1-1.2 SOIL - 9/12/2014 SE134376.011	TP5 1.9-2.0 SOIL - 9/12/2014 SE134376.012
Mercury	mg/kg	0.01	0.01	<0.01	<0.01	0.04	0.19	0.16

PARAMETER	UOM	LOR	TP5 4.1-4.2 SOIL - 9/12/2014 SE134376.013	QC 3 SOIL - 9/12/2014 SE134376.014	TP4 0.0-0.1 SOIL - 10/12/2014 SE134376.018	TP4 0.9-1.0 SOIL - 10/12/2014 SE134376.019	TP4 1.9-2.0 SOIL - 10/12/2014 SE134376.020	TP4 3.6-3.7 SOIL - 10/12/2014 SE134376.021
Mercury	mg/kg	0.01	0.01	0.04	0.02	0.04	0.02	<0.01

PARAMETER	UOM	LOR	TP6 0.0-0.1 SOIL - 10/12/2014 SE134376.022	TP6 1.9-2.0 SOIL - 10/12/2014 SE134376.023	TP6 3.4-3.5 SOIL - 10/12/2014 SE134376.024	TP7 0.4-0.5 SOIL - 10/12/2014 SE134376.025	TP7 0.9-1.0 SOIL - 10/12/2014 SE134376.026	TP7 4.8-4.9 SOIL - 10/12/2014 SE134376.029
Mercury	mg/kg	0.01	0.03	0.01	<0.01	0.02	0.02	<0.01

PARAMETER	UOM	LOR	QC5 SOIL - 10/12/2014 SE134376.030
Mercury	mg/kg	0.01	0.03

Gravimetric Determination of Asbestos in Soil [AN605]

PARAMETER	UOM	LOR	TP1 0.0-0.1 SOIL - 9/12/2014 SE134376.001	TP1 0.4-0.5 SOIL - 9/12/2014 SE134376.002	TP1 1.1-1.2 SOIL - 9/12/2014 SE134376.003	TP2 0.0-0.1 SOIL - 9/12/2014 SE134376.004	TP2 0.9-1.0 SOIL - 9/12/2014 SE134376.005	TP2 2.9-3.0 SOIL - 9/12/2014 SE134376.006
Total Sample Weight*	g	1	619	640	332	630	638	610
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fibre Type*	No unit	-	-	-	-	-	-	-

PARAMETER	UOM	LOR	TP3 0.0-0.1 SOIL - 9/12/2014 SE134376.007	TP3 0.4-0.5 SOIL - 9/12/2014 SE134376.008	TP3 1.4-1.5 SOIL - 9/12/2014 SE134376.009	TP5 0.0-0.1 SOIL - 9/12/2014 SE134376.010	TP5 1.9-2.0 SOIL - 9/12/2014 SE134376.012	TP5 4.1-4.2 SOIL - 9/12/2014 SE134376.013
Total Sample Weight*	g	1	418	671	662	553	546	594
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fibre Type*	No unit	-	-	-	-	-	-	-

PARAMETER	UOM	LOR	QC 3 SOIL - 9/12/2014 SE134376.014	TP4 0.0-0.1 SOIL - 10/12/2014 SE134376.018	TP4 0.9-1.0 SOIL - 10/12/2014 SE134376.019	TP4 1.9-2.0 SOIL - 10/12/2014 SE134376.020	TP4 3.6-3.7 SOIL - 10/12/2014 SE134376.021	TP6 0.0-0.1 SOIL - 10/12/2014 SE134376.022
Total Sample Weight*	g	1	520	549	777	610	658	524
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm	%w/w	0.001	0.010	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fibre Type*	No unit	-	CRY	-	-	-	-	-

PARAMETER	UOM	LOR	TP6 1.9-2.0 SOIL - 10/12/2014 SE134376.023	TP6 3.4-3.5 SOIL - 10/12/2014 SE134376.024	TP7 0.4-0.5 SOIL - 10/12/2014 SE134376.025	TP7 0.9-1.0 SOIL - 10/12/2014 SE134376.026	TP7 2.9-3.0 SOIL - 10/12/2014 SE134376.027	TP7 3.9-4.0 SOIL - 10/12/2014 SE134376.028
Total Sample Weight*	g	1	530	613	652	675	772	596
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fibre Type*	No unit	-	-	-	-	-	-	-

PARAMETER	UOM	LOR	TP7 4.8-4.9 SOIL - 10/12/2014 SE134376.029	QC5 SOIL - 10/12/2014 SE134376.030
Total Sample Weight*	g	1	649	645
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm	%w/w	0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001
Fibre Type*	No unit	-	-	-

Fibre Identification in soil [AN602]

PARAMETER	UOM	LOR	TP5 1.1-1.2 SOIL - 9/12/2014 SE134376.011
Asbestos Detected	No unit	-	No
Estimated Fibres	%w/w	0.01	<0.01

Fibre ID in bulk materials [AN602]

PARAMETER	UOM	LOR	TP3 0.0-0.1 MATERIAL - 9/12/2014 SE134376.033
Asbestos Detected	No unit	-	Yes

Moisture Content [AN002]

PARAMETER	UOM	LOR	TP1 0.0-0.1 SOIL - 9/12/2014 SE134376.001	TP1 0.4-0.5 SOIL - 9/12/2014 SE134376.002	TP1 1.1-1.2 SOIL - 9/12/2014 SE134376.003	TP2 0.0-0.1 SOIL - 9/12/2014 SE134376.004	TP2 0.9-1.0 SOIL - 9/12/2014 SE134376.005	TP2 2.9-3.0 SOIL - 9/12/2014 SE134376.006
% Moisture	%	0.5	21	18	12	17	15	17

PARAMETER	UOM	LOR	TP3 0.0-0.1 SOIL - 9/12/2014 SE134376.007	TP3 0.4-0.5 SOIL - 9/12/2014 SE134376.008	TP3 1.4-1.5 SOIL - 9/12/2014 SE134376.009	TP5 0.0-0.1 SOIL - 9/12/2014 SE134376.010	TP5 1.1-1.2 SOIL - 9/12/2014 SE134376.011	TP5 1.9-2.0 SOIL - 9/12/2014 SE134376.012
% Moisture	%	0.5	16	15	15	17	12	11

PARAMETER	UOM	LOR	TP5 4.1-4.2 SOIL - 9/12/2014 SE134376.013	QC 3 SOIL - 9/12/2014 SE134376.014	TP4 0.0-0.1 SOIL - 10/12/2014 SE134376.018	TP4 0.9-1.0 SOIL - 10/12/2014 SE134376.019	TP4 1.9-2.0 SOIL - 10/12/2014 SE134376.020	TP4 3.6-3.7 SOIL - 10/12/2014 SE134376.021
% Moisture	%	0.5	12	15	16	5.1	14	7.7

PARAMETER	UOM	LOR	TP6 0.0-0.1 SOIL - 10/12/2014 SE134376.022	TP6 1.9-2.0 SOIL - 10/12/2014 SE134376.023	TP6 3.4-3.5 SOIL - 10/12/2014 SE134376.024	TP7 0.4-0.5 SOIL - 10/12/2014 SE134376.025	TP7 0.9-1.0 SOIL - 10/12/2014 SE134376.026	TP7 4.8-4.9 SOIL - 10/12/2014 SE134376.029
% Moisture	%	0.5	26	14	16	9.4	11	10

PARAMETER	UOM	LOR	QC5 SOIL - 10/12/2014 SE134376.030
% Moisture	%	0.5	15

VOCs in Water [AN433/AN434]

PARAMETER	UOM	LOR	Trip Blank 2 WATER - 9/12/2014 SE134376.016	Trip Spike 2 WATER - 8/12/2014 SE134376.017	TB3 WATER - 10/12/2014 SE134376.031	TS3 WATER - 8/12/2014 SE134376.032
Benzene	µg/L	0.5	<0.5	[104%]	<0.5	[105%]
Toluene	µg/L	0.5	<0.5	[113%]	<0.5	[111%]
Ethylbenzene	µg/L	0.5	<0.5	[113%]	<0.5	[116%]
m/p-xylene	µg/L	1	<1	[104%]	<1	[106%]
o-xylene	µg/L	0.5	<0.5	[111%]	<0.5	[113%]
Total Xylenes	µg/L	1.5	<1.5	-	<1.5	-
Total BTEX	µg/L	3	<3	-	<3	-
Naphthalene	µg/L	0.5	<0.5	-	<0.5	-

Volatile Petroleum Hydrocarbons in Water [AN433/AN434/AN410]

PARAMETER	UOM	LOR	Trip Blank 2 WATER - 9/12/2014 SE134376.016	TB3 WATER - 10/12/2014 SE134376.031
TRH C6-C9	µg/L	40	<40	<40
Benzene (F0)	µg/L	0.5	<0.5	<0.5
TRH C6-C10	µg/L	50	<50	<50
TRH C6-C10 minus BTEX (F1)	µg/L	50	<50	<50

PAH (Polynuclear Aromatic Hydrocarbons) in Water [AN420]

PARAMETER	UOM	LOR	R2 WATER - 9/12/2014 SE134376.015
Naphthalene	µg/L	0.1	<0.1
2-methylnaphthalene	µg/L	0.1	<0.1
1-methylnaphthalene	µg/L	0.1	<0.1
Acenaphthylene	µg/L	0.1	<0.1
Acenaphthene	µg/L	0.1	<0.1
Fluorene	µg/L	0.1	<0.1
Phenanthrene	µg/L	0.1	<0.1
Anthracene	µg/L	0.1	<0.1
Fluoranthene	µg/L	0.1	<0.1
Pyrene	µg/L	0.1	<0.1
Benzo(a)anthracene	µg/L	0.1	<0.1
Chrysene	µg/L	0.1	<0.1
Benzo(b&j)fluoranthene	µg/L	0.1	<0.1
Benzo(k)fluoranthene	µg/L	0.1	<0.1
Benzo(a)pyrene	µg/L	0.1	<0.1
Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1
Dibenzo(a&h)anthracene	µg/L	0.1	<0.1
Benzo(ghi)perylene	µg/L	0.1	<0.1
Total PAH (18)	µg/L	1	<1

Trace Metals (Dissolved) in Water by ICPMS [AN318]

PARAMETER	UOM	LOR	R2 WATER - 9/12/2014 SE134376.015
Arsenic, As	µg/L	1	<1
Cadmium, Cd	µg/L	0.1	<0.1
Copper, Cu	µg/L	1	**4**
Chromium, Cr	µg/L	1	<1
Nickel, Ni	µg/L	1	<1
Lead, Pb	µg/L	1	<1
Zinc, Zn	µg/L	5	**20**

Mercury (dissolved) in Water [AN311/AN312]

PARAMETER	UOM	LOR	R2 WATER - 9/12/2014 SE134376.015
Mercury	mg/L	0.0001	<0.0001

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN005	The particle size distribution of a soil is determined by wet sieving, using a maximum of 900 mL of deionised water to sieve all fractions down to 75 µm. Referenced to AS1289.3.6.1 and AS1141.11.
AN020	Unpreserved water sample is filtered through a 0.45µm membrane filter and acidified with nitric acid similar to APHA3030B.
AN040	A portion of sample is digested with Nitric acid to decompose organic matter and Hydrochloric acid to complete the digestion of metals and then filtered for analsysis by ASS or ICP as per USEPA Method 200.8.
AN040/AN320	A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.
AN083	Separatory funnels are used for aqueous samples and extracted by transferring an appropriate volume (mass) of liquid into a separatory funnel and adding 3 serial aliquots of dichloromethane. Samples receive a single extraction at pH 7 to recover base / neutral analytes and two extractions at pH < 2 to recover acidic analytes. QC samples are prepared by spiking organic free water with target analytes and extracting as per samples.
AN088	Orbital rolling for Organic pollutants are extracted from soil/sediment by transferring an appropriate mass of sample to a clear soil jar and extracting with 1:1 Dichloromethane/Acetone. Orbital Rolling method is intended for the extraction of semi-volatile organic compounds from soil/sediment samples, and is based somewhat on USEPA method 3570 (Micro Organic extraction and sample preparation). Method 3700.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl2) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN122	Exchangeable Cations, CEC and ESP: Soil sample is extracted in 1M Ammonium Acetate at pH=7 (or 1M Ammonium Chloride at pH=7) with cations (Na, K, Ca & Mg) then determined by ICP OES/ICP MS and reported as Exchangeable Cations. For saline soils, these results can be corrected for water soluble cations and reported as Exchangeable cations in meq/100g or soil can be pretreated (aqueous ethanol/aqueous glycerol) prior to extraction. Cation Exchange Capacity (CEC) is the sum of the exchangeable cations in meq/100g.
AN188	The organic material in the soil sample is oxidised with chromic acid in the presence of excess sulphuric acid , without external heat being applied. The excess dichromate ion is determined by titration with standard ammonium iron (II) sulphate solution and the amount of oxidised material is calculated from the quantity of dichromate reduced. Referenced to NEPM 105 and AS1289.1.1.1.
AN311/AN312	Mercury by Cold Vapour AAS in Waters: Mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500.
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid , mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser . Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500
AN318	Determination of elements at trace level in waters by ICP-MS technique, in accordance with USEPA 6020A.
AN400	OC and OP Pesticides by GC-ECD: The determination of organochlorine (OC) and organophosphorus (OP) pesticides and polychlorinated biphenyls (PCBs) in soils, sludges and groundwater. (Based on USEPA methods 3510, 3550, 8140 and 8080.)
AN403	Total Recoverable Hydrocarbons: Determination of Hydrocarbons by gas chromatography after a solvent extraction. Detection is by flame ionisation detector (FID) that produces an electronic signal in proportion to the combustible matter passing through it. Total Recoverable Hydrocarbons (TRH) are routinely reported as four alkane groupings based on the carbon chain length of the compounds: C6-C9, C10-C14, C15-C28 and C29-C36 and in recognition of the NEPM 1999 (2013), >C10-C16 (F2), >C16-C34 (F3) and >C34-C40 (F4). F2 is reported directly and also corrected by subtracting Naphthalene (from VOC method AN433) where available.
AN420	(SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols (etc) in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).
AN433/AN434	VOCs and C6-C9 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.

AN433/AN434/AN410	VOCs and C6-C9/C6-C10 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.
AN602	Qualitative identification of chrysotile, amosite and crocidolite in bulk samples by polarised light microscopy (PLM) in conjunction with dispersion staining (DS). AS4964 provides the basis for this document. Unequivocal identification of the asbestos minerals present is made by obtaining sufficient diagnostic `clues`, which provide a reasonable degree of certainty, dispersion staining is a mandatory `clue` for positive identification. If sufficient `clues` are absent, then positive identification of asbestos is not possible. This procedure requires removal of suspect fibres/bundles from the sample which cannot be returned.
AN605	This technique gravimetrically deteremines the mass of Asbestos Containing Material retained on a 7mm Sieve and assumes that 15% of this ACM is asbestos. This calculated asbestos weight is then calculated as a percentage of the total sample weight.

FOOTNOTES

*	Analysis not covered by the scope of accreditation.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
^	Performed by outside laboratory.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: http://www.sgs.com.au/~/media/Local/Australia/Documents/ Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

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ANALYTICAL REPORT

WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS

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Project	**9623 - ESA - Old Canberra Brickworks**
Order Number	**SY140911-1-IS**
Samples	33

LABORATORY DETAILS

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Email	au.environmental.sydney@sgs.com
SGS Reference	SE134376 R0
Report Number	0000099682
Date Reported	06 Jan 2015
Date Received	11 Dec 2014

COMMENTS

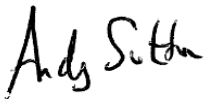
Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

Clay Content subcontracted to SGS Cairns, 2/58 Comport St, Portsmith QLD 4870, NATA Accreditation Number: 2562, Site Number: 3146.

No respirable fibres detected in all soil samples using trace analysis technique as per AS 4964-2004.
Asbestos weight is approximate.
FA +AF measured gravimetrically (excluding free fibres).

Sample # 3,11: A portion of the sample supplied has been sub-sampled for asbestos according to SGS In-house procedures. We therefore cannot guarantee that the sub-sample is representative of the entire sample supplied.
SGS Environmental Services recommends supplying approximately 50-100g of sample in a separate container.
Sample # 14 : Asbestos found in cement sheet fragment.
Asbestos analysed by Approved Identifier Ravee Sivasubramaniam .

SIGNATORIES



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Huong Crawford
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Kamrul Ahsan
Senior Chemist

Ly Kim Ha
Organic Section Head

ANALYTICAL REPORT

RESULTS

Fibre Identification in soil — Method AN602

Laboratory Reference	Client Reference	Matrix	Sample Description	Date Sampled	Fibre Identification	Est.%w/w
SE134376.011	TP5 1.1-1.2	Soil	55g Soil,clay,rocks	09 Dec 2014	No Asbestos Found	<0.01

ANALYTICAL REPORT

RESULTS

Fibre ID in bulk materials — Method AN602

Laboratory Reference	Client Reference	Matrix	Sample Description	Date Sampled	Fibre Identification	Est.%w/w
SE134376.033	TP3 0.0-0.1	Other	20x10x3mm Cement sheet fragments	09 Dec 2014	Chrysotile Asbestos Detected	

METHOD	METHODOLOGY SUMMARY
AN602	Qualitative identification of chrysotile, amosite and crocidolite in bulk samples by polarised light microscopy (PLM) in conjunction with dispersion staining (DS). AS4964 provides the basis for this document. Unequivocal identification of the asbestos minerals present is made by obtaining sufficient diagnostic `clues`, which provide a reasonable degree of certainty, dispersion staining is a mandatory `clue` for positive identification. If sufficient `clues` are absent, then positive identification of asbestos is not possible. This procedure requires removal of suspect fibres/bundles from the sample which cannot be returned.
AN602	Fibres/material that cannot be unequivocably identified as one of the three asbestos forms, will be reported as unknown mineral fibres (umf).
AN602	AS4964.2004 Method for the Qualitative Identification of Asbestos in Bulk Samples , Section 8.4, Trace Analysis Criteria, Note 4 states:"Depending upon sample condition and fibre type, the detection limit of this technique has been found to lie generally in the range of 1 in 1,000 to 1 in 10,000 parts by weight, equivalent to 1 to 0.1 g/kg."
AN605	This technique gravimetrically deteremines the mass of Asbestos Containing Material retained on a 7mm Sieve and assumes that 15% of this ACM is asbestos. This calculated asbestos weight is then calculated as a percentage of the total sample weight.
AN605	This technique also gravimetrically deteremines the mass of Fibrous Asbestos (FA) and Asbestos Fines (AF) Containing Material retained on and passing a 2mm sieve post 7mm Sieving. Assumes that FA and AF are 100% asbestos containing. This calculated asbestos weight is then calculated as a percentage of the screened fraction sample weights.
AN605	AMO = Amosite CRY = Chrysotile CRO = Crocidolite
AN605	In sofar as is trechnically feasible, this report is consistent with the analytical reporting recommendations in the Western Australian Department of Health Guidelines for the Assessment Remediation and Management of Asbestos - Contaminated Sites in Western Australia - May 2009.

FOOTNOTES

Amosite	-	Brown Asbestos	NA	-	Not Analysed
Chrysotile	-	White Asbestos	LNR	-	Listed, Not Required
Crocidolite	-	Blue Asbestos	*	-	Not Accredited
Amphiboles	-	Amosite and/or Crocidolite	**	-	Indicative data, theoretical holding time exceeded.

(In reference to soil samples only) This report does not comply with the analytical reporting recommendations in the Western Australian Department of Health Guidelines for the Assessment and Remediation and Management of Asbestos Contaminated sites in Western Australia - May 2009.

Sampled by the client.

Where reported: 'Asbestos Detected': Asbestos detected by polarized light microscopy, including dispersion staining.
Where reported: 'No Asbestos Found': No Asbestos Found by polarized light microscopy, including dispersion staining.
Where reported: 'UMF Detected': Mineral fibres of unknown type detected by polarized light microscopy, including dispersion staining. Confirmation by another independent analytical technique may be necessary.

Even after disintegration it can be very difficult, or impossible, to detect the presence of asbestos in some asbestos-containing bulk materials using polarised light microscopy. This is due to the low grade or small length or diameter of asbestos fibres present in the material, or to the fact that very fine fibres have been distributed intimately throughout the materials.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

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STATEMENT OF QA/QC PERFORMANCE

SE134376 R0

CLIENT DETAILS

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Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	SE134376 R0
Report Number	0000099683
Date Reported	06 Jan 2015

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS Environmental Services' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document and was supplied by the Client.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Analysis Date	pH in soil (1:5)	2 items
Duplicate	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	1 item
	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	1 item
Matrix Spike	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	7 items
	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	7 items

SAMPLE SUMMARY

Sample counts by matrix	27 Soils, 5 Waters &	Type of documentation received	COC
Date documentation received	11/12/2014	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	4.6°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes		

HOLDING TIME SUMMARY

SE134376 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP2 0.9-1.0	SE134376.005	LB069537	09 Dec 2014	11 Dec 2014	06 Jan 2015	18 Dec 2014	06 Jan 2015	22 Dec 2014
TP2 2.9-3.0	SE134376.006	LB069537	09 Dec 2014	11 Dec 2014	06 Jan 2015	18 Dec 2014	06 Jan 2015	22 Dec 2014
TP5 1.1-1.2	SE134376.011	LB069537	09 Dec 2014	11 Dec 2014	06 Jan 2015	18 Dec 2014	06 Jan 2015	22 Dec 2014
TP5 4.1-4.2	SE134376.013	LB069537	09 Dec 2014	11 Dec 2014	06 Jan 2015	18 Dec 2014	06 Jan 2015	22 Dec 2014
TP7 0.9-1.0	SE134376.026	LB069537	10 Dec 2014	11 Dec 2014	07 Jan 2015	18 Dec 2014	07 Jan 2015	22 Dec 2014
TP7 4.8-4.9	SE134376.029	LB069537	10 Dec 2014	11 Dec 2014	07 Jan 2015	18 Dec 2014	07 Jan 2015	22 Dec 2014

Gravimetric Determination of Asbestos in Soil

Method: ME-(AU)-[ENV]AN605

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1 0.0-0.1	SE134376.001	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP1 0.4-0.5	SE134376.002	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP1 1.1-1.2	SE134376.003	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP2 0.0-0.1	SE134376.004	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP2 0.9-1.0	SE134376.005	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP2 2.9-3.0	SE134376.006	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP3 0.0-0.1	SE134376.007	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP3 0.4-0.5	SE134376.008	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP3 1.4-1.5	SE134376.009	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP5 0.0-0.1	SE134376.010	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP5 1.1-1.2	SE134376.011	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP5 1.9-2.0	SE134376.012	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP5 4.1-4.2	SE134376.013	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
QC 3	SE134376.014	LB069655	09 Dec 2014	11 Dec 2014	07 Jun 2015	19 Dec 2014	07 Jun 2015	22 Dec 2014
TP4 0.0-0.1	SE134376.018	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014
TP4 0.9-1.0	SE134376.019	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014
TP4 1.9-2.0	SE134376.020	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014
TP4 3.6-3.7	SE134376.021	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014
TP6 0.0-0.1	SE134376.022	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014
TP6 1.9-2.0	SE134376.023	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014
TP6 3.4-3.5	SE134376.024	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014
TP7 0.4-0.5	SE134376.025	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014
TP7 0.9-1.0	SE134376.026	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014
TP7 2.9-3.0	SE134376.027	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014
TP7 3.9-4.0	SE134376.028	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014
TP7 4.8-4.9	SE134376.029	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014
QC5	SE134376.030	LB069655	10 Dec 2014	11 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	22 Dec 2014

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
R2	SE134376.015	LB069632	09 Dec 2014	11 Dec 2014	06 Jan 2015	19 Dec 2014	06 Jan 2015	19 Dec 2014

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1 0.0-0.1	SE134376.001	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP1 0.4-0.5	SE134376.002	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP1 1.1-1.2	SE134376.003	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP2 0.0-0.1	SE134376.004	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP2 0.9-1.0	SE134376.005	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP2 2.9-3.0	SE134376.006	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP3 0.0-0.1	SE134376.007	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP3 0.4-0.5	SE134376.008	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP3 1.4-1.5	SE134376.009	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP5 0.0-0.1	SE134376.010	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP5 1.1-1.2	SE134376.011	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP5 1.9-2.0	SE134376.012	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP5 4.1-4.2	SE134376.013	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
QC 3	SE134376.014	LB069366	09 Dec 2014	11 Dec 2014	06 Jan 2015	16 Dec 2014	06 Jan 2015	22 Dec 2014
TP4 0.0-0.1	SE134376.018	LB069366	10 Dec 2014	11 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP4 0.9-1.0	SE134376.019	LB069366	10 Dec 2014	11 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP4 1.9-2.0	SE134376.020	LB069366	10 Dec 2014	11 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014

HOLDING TIME SUMMARY

SE134376 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Mercury in Soil (continued)

Method: ME-(AU)-[ENV]AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP4 3.6-3.7	SE134376.021	LB069366	10 Dec 2014	11 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP6 0.0-0.1	SE134376.022	LB069366	10 Dec 2014	11 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP6 1.9-2.0	SE134376.023	LB069367	10 Dec 2014	11 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP6 3.4-3.5	SE134376.024	LB069367	10 Dec 2014	11 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP7 0.4-0.5	SE134376.025	LB069367	10 Dec 2014	11 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP7 0.9-1.0	SE134376.026	LB069367	10 Dec 2014	11 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP7 4.8-4.9	SE134376.029	LB069367	10 Dec 2014	11 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
QC5	SE134376.030	LB069367	10 Dec 2014	11 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014

Moisture Content

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1 0.0-0.1	SE134376.001	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP1 0.4-0.5	SE134376.002	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP1 1.1-1.2	SE134376.003	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP2 0.0-0.1	SE134376.004	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP2 0.9-1.0	SE134376.005	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP2 2.9-3.0	SE134376.006	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP3 0.0-0.1	SE134376.007	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP3 0.4-0.5	SE134376.008	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP3 1.4-1.5	SE134376.009	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP5 0.0-0.1	SE134376.010	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP5 1.1-1.2	SE134376.011	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP5 1.9-2.0	SE134376.012	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP5 4.1-4.2	SE134376.013	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
QC 3	SE134376.014	LB069403	09 Dec 2014	11 Dec 2014	23 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP4 0.0-0.1	SE134376.018	LB069403	10 Dec 2014	11 Dec 2014	24 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP4 0.9-1.0	SE134376.019	LB069403	10 Dec 2014	11 Dec 2014	24 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP4 1.9-2.0	SE134376.020	LB069403	10 Dec 2014	11 Dec 2014	24 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP4 3.6-3.7	SE134376.021	LB069403	10 Dec 2014	11 Dec 2014	24 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP6 0.0-0.1	SE134376.022	LB069403	10 Dec 2014	11 Dec 2014	24 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP6 1.9-2.0	SE134376.023	LB069403	10 Dec 2014	11 Dec 2014	24 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP6 3.4-3.5	SE134376.024	LB069403	10 Dec 2014	11 Dec 2014	24 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP7 0.4-0.5	SE134376.025	LB069403	10 Dec 2014	11 Dec 2014	24 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP7 0.9-1.0	SE134376.026	LB069403	10 Dec 2014	11 Dec 2014	24 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
TP7 4.8-4.9	SE134376.029	LB069403	10 Dec 2014	11 Dec 2014	24 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014
QC5	SE134376.030	LB069403	10 Dec 2014	11 Dec 2014	24 Dec 2014	16 Dec 2014	21 Dec 2014	17 Dec 2014

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1 0.4-0.5	SE134376.002	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP2 0.0-0.1	SE134376.004	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP3 0.0-0.1	SE134376.007	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP5 0.0-0.1	SE134376.010	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP5 1.9-2.0	SE134376.012	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC 3	SE134376.014	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP4 0.9-1.0	SE134376.019	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP6 0.0-0.1	SE134376.022	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP7 0.4-0.5	SE134376.025	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC5	SE134376.030	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1 0.4-0.5	SE134376.002	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP2 0.0-0.1	SE134376.004	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP3 0.0-0.1	SE134376.007	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP5 0.0-0.1	SE134376.010	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP5 1.9-2.0	SE134376.012	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
QC 3	SE134376.014	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP4 0.9-1.0	SE134376.019	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP6 0.0-0.1	SE134376.022	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP7 0.4-0.5	SE134376.025	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014

HOLDING TIME SUMMARY

SE134376 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC5	SE134376.030	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
R2	SE134376.015	LB069310	09 Dec 2014	11 Dec 2014	16 Dec 2014	15 Dec 2014	24 Jan 2015	18 Dec 2014

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1 0.4-0.5	SE134376.002	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP2 0.0-0.1	SE134376.004	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP3 0.0-0.1	SE134376.007	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP5 0.0-0.1	SE134376.010	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP5 1.9-2.0	SE134376.012	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC 3	SE134376.014	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP4 0.9-1.0	SE134376.019	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP6 0.0-0.1	SE134376.022	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP7 0.4-0.5	SE134376.025	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC5	SE134376.030	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP2 0.9-1.0	SE134376.005	LB069410	09 Dec 2014	11 Dec 2014	16 Dec 2014	16 Dec 2014	17 Dec 2014	17 Dec 2014
TP2 2.9-3.0	SE134376.006	LB069410	09 Dec 2014	11 Dec 2014	16 Dec 2014	16 Dec 2014	17 Dec 2014	17 Dec 2014
TP5 1.1-1.2	SE134376.011	LB069410	09 Dec 2014	11 Dec 2014	16 Dec 2014	16 Dec 2014	17 Dec 2014	17 Dec 2014
TP5 4.1-4.2	SE134376.013	LB069410	09 Dec 2014	11 Dec 2014	16 Dec 2014	16 Dec 2014	17 Dec 2014	17 Dec 2014
TP7 0.9-1.0	SE134376.026	LB069427	10 Dec 2014	11 Dec 2014	17 Dec 2014	16 Dec 2014	17 Dec 2014	18 Dec 2014†
TP7 4.8-4.9	SE134376.029	LB069427	10 Dec 2014	11 Dec 2014	17 Dec 2014	16 Dec 2014	17 Dec 2014	18 Dec 2014†

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1 0.4-0.5	SE134376.002	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP2 0.0-0.1	SE134376.004	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP3 0.0-0.1	SE134376.007	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP5 0.0-0.1	SE134376.010	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP5 1.9-2.0	SE134376.012	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC 3	SE134376.014	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP4 0.9-1.0	SE134376.019	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP6 0.0-0.1	SE134376.022	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP7 0.4-0.5	SE134376.025	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC5	SE134376.030	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014

TOC in Soil

Method: ME-(AU)-[ENV]AN188

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP2 0.9-1.0	SE134376.005	LB069712	09 Dec 2014	11 Dec 2014	06 Jan 2015	22 Dec 2014	06 Jan 2015	22 Dec 2014
TP2 2.9-3.0	SE134376.006	LB069712	09 Dec 2014	11 Dec 2014	06 Jan 2015	22 Dec 2014	06 Jan 2015	22 Dec 2014
TP5 1.1-1.2	SE134376.011	LB069712	09 Dec 2014	11 Dec 2014	06 Jan 2015	22 Dec 2014	06 Jan 2015	22 Dec 2014
TP5 4.1-4.2	SE134376.013	LB069712	09 Dec 2014	11 Dec 2014	06 Jan 2015	22 Dec 2014	06 Jan 2015	22 Dec 2014
TP7 0.9-1.0	SE134376.026	LB069712	10 Dec 2014	11 Dec 2014	07 Jan 2015	22 Dec 2014	07 Jan 2015	22 Dec 2014
TP7 4.8-4.9	SE134376.029	LB069712	10 Dec 2014	11 Dec 2014	07 Jan 2015	22 Dec 2014	07 Jan 2015	22 Dec 2014

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1 0.0-0.1	SE134376.001	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
TP1 0.4-0.5	SE134376.002	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
TP1 1.1-1.2	SE134376.003	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
TP2 0.0-0.1	SE134376.004	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
TP2 0.9-1.0	SE134376.005	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
TP2 2.9-3.0	SE134376.006	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
TP3 0.0-0.1	SE134376.007	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
TP3 0.4-0.5	SE134376.008	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
TP3 1.4-1.5	SE134376.009	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
TP5 0.0-0.1	SE134376.010	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014

HOLDING TIME SUMMARY

SE134376 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest (continued)

Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP5 1.1-1.2	SE134376.011	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
TP5 1.9-2.0	SE134376.012	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
TP5 4.1-4.2	SE134376.013	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
QC 3	SE134376.014	LB069505	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	22 Dec 2014
TP4 0.0-0.1	SE134376.018	LB069505	10 Dec 2014	11 Dec 2014	08 Jun 2015	17 Dec 2014	08 Jun 2015	22 Dec 2014
TP4 0.9-1.0	SE134376.019	LB069505	10 Dec 2014	11 Dec 2014	08 Jun 2015	17 Dec 2014	08 Jun 2015	22 Dec 2014
TP4 1.9-2.0	SE134376.020	LB069505	10 Dec 2014	11 Dec 2014	08 Jun 2015	17 Dec 2014	08 Jun 2015	22 Dec 2014
TP4 3.6-3.7	SE134376.021	LB069505	10 Dec 2014	11 Dec 2014	08 Jun 2015	17 Dec 2014	08 Jun 2015	22 Dec 2014
TP6 0.0-0.1	SE134376.022	LB069505	10 Dec 2014	11 Dec 2014	08 Jun 2015	17 Dec 2014	08 Jun 2015	22 Dec 2014
TP6 1.9-2.0	SE134376.023	LB069540	10 Dec 2014	11 Dec 2014	08 Jun 2015	18 Dec 2014	08 Jun 2015	22 Dec 2014
TP6 3.4-3.5	SE134376.024	LB069540	10 Dec 2014	11 Dec 2014	08 Jun 2015	18 Dec 2014	08 Jun 2015	22 Dec 2014
TP7 0.4-0.5	SE134376.025	LB069540	10 Dec 2014	11 Dec 2014	08 Jun 2015	18 Dec 2014	08 Jun 2015	22 Dec 2014
TP7 0.9-1.0	SE134376.026	LB069540	10 Dec 2014	11 Dec 2014	08 Jun 2015	18 Dec 2014	08 Jun 2015	22 Dec 2014
TP7 4.8-4.9	SE134376.029	LB069540	10 Dec 2014	11 Dec 2014	08 Jun 2015	18 Dec 2014	08 Jun 2015	22 Dec 2014
QC5	SE134376.030	LB069540	10 Dec 2014	11 Dec 2014	08 Jun 2015	18 Dec 2014	08 Jun 2015	22 Dec 2014

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
R2	SE134376.015	LB069485	09 Dec 2014	11 Dec 2014	07 Jun 2015	17 Dec 2014	07 Jun 2015	18 Dec 2014

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1 0.4-0.5	SE134376.002	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP2 0.0-0.1	SE134376.004	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP3 0.0-0.1	SE134376.007	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP5 0.0-0.1	SE134376.010	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP5 1.9-2.0	SE134376.012	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC 3	SE134376.014	LB069312	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP4 0.9-1.0	SE134376.019	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP6 0.0-0.1	SE134376.022	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP7 0.4-0.5	SE134376.025	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC5	SE134376.030	LB069312	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1 0.4-0.5	SE134376.002	LB069296	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP2 0.0-0.1	SE134376.004	LB069296	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP3 0.0-0.1	SE134376.007	LB069296	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP5 0.0-0.1	SE134376.010	LB069296	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP4 0.9-1.0	SE134376.019	LB069296	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP6 0.0-0.1	SE134376.022	LB069296	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP7 0.4-0.5	SE134376.025	LB069296	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
Trip Blank 2	SE134376.016	LB069439	09 Dec 2014	11 Dec 2014	16 Dec 2014	15 Dec 2014	24 Jan 2015	18 Dec 2014
Trip Spike 2	SE134376.017	LB069439	08 Dec 2014	11 Dec 2014	15 Dec 2014	15 Dec 2014	24 Jan 2015	18 Dec 2014
TB3	SE134376.031	LB069439	10 Dec 2014	11 Dec 2014	17 Dec 2014	15 Dec 2014	24 Jan 2015	18 Dec 2014
TS3	SE134376.032	LB069439	08 Dec 2014	11 Dec 2014	15 Dec 2014	15 Dec 2014	24 Jan 2015	18 Dec 2014

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1 0.4-0.5	SE134376.002	LB069296	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP2 0.0-0.1	SE134376.004	LB069296	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP3 0.0-0.1	SE134376.007	LB069296	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP5 0.0-0.1	SE134376.010	LB069296	09 Dec 2014	11 Dec 2014	23 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP4 0.9-1.0	SE134376.019	LB069296	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP6 0.0-0.1	SE134376.022	LB069296	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014
TP7 0.4-0.5	SE134376.025	LB069296	10 Dec 2014	11 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	19 Dec 2014

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Volatile Petroleum Hydrocarbons in Water (continued)

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
Trip Blank 2	SE134376.016	LB069439	09 Dec 2014	11 Dec 2014	16 Dec 2014	15 Dec 2014	24 Jan 2015	18 Dec 2014
Trip Spike 2	SE134376.017	LB069439	08 Dec 2014	11 Dec 2014	15 Dec 2014	15 Dec 2014	24 Jan 2015	18 Dec 2014
TB3	SE134376.031	LB069439	10 Dec 2014	11 Dec 2014	17 Dec 2014	15 Dec 2014	24 Jan 2015	18 Dec 2014
TS3	SE134376.032	LB069439	08 Dec 2014	11 Dec 2014	15 Dec 2014	15 Dec 2014	24 Jan 2015	18 Dec 2014

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Tetrachloro-m-xylene (TCMX) (Surrogate)	TP1 0.4-0.5	SE134376.002	%	60 - 130%	101
	TP2 0.0-0.1	SE134376.004	%	60 - 130%	110
	TP3 0.0-0.1	SE134376.007	%	60 - 130%	107
	TP5 0.0-0.1	SE134376.010	%	60 - 130%	108
	TP4 0.9-1.0	SE134376.019	%	60 - 130%	107
	TP6 0.0-0.1	SE134376.022	%	60 - 130%	107
	TP7 0.4-0.5	SE134376.025	%	60 - 130%	113

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	TP1 0.4-0.5	SE134376.002	%	70 - 130%	80
	TP2 0.0-0.1	SE134376.004	%	70 - 130%	86
	TP3 0.0-0.1	SE134376.007	%	70 - 130%	80
	TP5 0.0-0.1	SE134376.010	%	70 - 130%	84
	TP5 1.9-2.0	SE134376.012	%	70 - 130%	88
	QC 3	SE134376.014	%	70 - 130%	86
	TP4 0.9-1.0	SE134376.019	%	70 - 130%	78
	TP6 0.0-0.1	SE134376.022	%	70 - 130%	74
	TP7 0.4-0.5	SE134376.025	%	70 - 130%	74
	QC5	SE134376.030	%	70 - 130%	76
d14-p-terphenyl (Surrogate)	TP1 0.4-0.5	SE134376.002	%	70 - 130%	104
	TP2 0.0-0.1	SE134376.004	%	70 - 130%	98
	TP3 0.0-0.1	SE134376.007	%	70 - 130%	108
	TP5 0.0-0.1	SE134376.010	%	70 - 130%	98
	TP5 1.9-2.0	SE134376.012	%	70 - 130%	94
	QC 3	SE134376.014	%	70 - 130%	100
	TP4 0.9-1.0	SE134376.019	%	70 - 130%	108
	TP6 0.0-0.1	SE134376.022	%	70 - 130%	108
	TP7 0.4-0.5	SE134376.025	%	70 - 130%	104
	QC5	SE134376.030	%	70 - 130%	106
d5-nitrobenzene (Surrogate)	TP1 0.4-0.5	SE134376.002	%	70 - 130%	98
	TP2 0.0-0.1	SE134376.004	%	70 - 130%	98
	TP3 0.0-0.1	SE134376.007	%	70 - 130%	100
	TP5 0.0-0.1	SE134376.010	%	70 - 130%	100
	TP5 1.9-2.0	SE134376.012	%	70 - 130%	100
	QC 3	SE134376.014	%	70 - 130%	96
	TP4 0.9-1.0	SE134376.019	%	70 - 130%	94
	TP6 0.0-0.1	SE134376.022	%	70 - 130%	90
	TP7 0.4-0.5	SE134376.025	%	70 - 130%	86
	QC5	SE134376.030	%	70 - 130%	88

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	R2	SE134376.015	%	40 - 130%	68
d14-p-terphenyl (Surrogate)	R2	SE134376.015	%	40 - 130%	100
d5-nitrobenzene (Surrogate)	R2	SE134376.015	%	40 - 130%	72

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Tetrachloro-m-xylene (TCMX) (Surrogate)	TP1 0.4-0.5	SE134376.002	%	60 - 130%	101
	TP2 0.0-0.1	SE134376.004	%	60 - 130%	110
	TP3 0.0-0.1	SE134376.007	%	60 - 130%	107
	TP5 0.0-0.1	SE134376.010	%	60 - 130%	108
	TP4 0.9-1.0	SE134376.019	%	60 - 130%	107
	TP6 0.0-0.1	SE134376.022	%	60 - 130%	107
	TP7 0.4-0.5	SE134376.025	%	60 - 130%	113

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2,4,6-Tribromophenol (Surrogate)	TP1 0.4-0.5	SE134376.002	%	70 - 130%	83
	TP2 0.0-0.1	SE134376.004	%	70 - 130%	81
	TP3 0.0-0.1	SE134376.007	%	70 - 130%	82
	TP5 0.0-0.1	SE134376.010	%	70 - 130%	86

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Speciated Phenols in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2,4,6-Tribromophenol (Surrogate)	TP4 0.9-1.0	SE134376.019	%	70 - 130%	84
	TP6 0.0-0.1	SE134376.022	%	70 - 130%	86
	TP7 0.4-0.5	SE134376.025	%	70 - 130%	88
d5-phenol (Surrogate)	TP1 0.4-0.5	SE134376.002	%	50 - 130%	89
	TP2 0.0-0.1	SE134376.004	%	50 - 130%	89
	TP3 0.0-0.1	SE134376.007	%	50 - 130%	75
	TP5 0.0-0.1	SE134376.010	%	50 - 130%	88
	TP4 0.9-1.0	SE134376.019	%	50 - 130%	88
	TP6 0.0-0.1	SE134376.022	%	50 - 130%	86
	TP7 0.4-0.5	SE134376.025	%	50 - 130%	73

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TP1 0.4-0.5	SE134376.002	%	60 - 130%	72
	TP2 0.0-0.1	SE134376.004	%	60 - 130%	72
	TP3 0.0-0.1	SE134376.007	%	60 - 130%	77
	TP5 0.0-0.1	SE134376.010	%	60 - 130%	72
	TP4 0.9-1.0	SE134376.019	%	60 - 130%	77
	TP6 0.0-0.1	SE134376.022	%	60 - 130%	72
	TP7 0.4-0.5	SE134376.025	%	60 - 130%	77
d4-1,2-dichloroethane (Surrogate)	TP1 0.4-0.5	SE134376.002	%	60 - 130%	85
	TP2 0.0-0.1	SE134376.004	%	60 - 130%	83
	TP3 0.0-0.1	SE134376.007	%	60 - 130%	94
	TP5 0.0-0.1	SE134376.010	%	60 - 130%	87
	TP4 0.9-1.0	SE134376.019	%	60 - 130%	96
	TP6 0.0-0.1	SE134376.022	%	60 - 130%	85
	TP7 0.4-0.5	SE134376.025	%	60 - 130%	94
d8-toluene (Surrogate)	TP1 0.4-0.5	SE134376.002	%	60 - 130%	83
	TP2 0.0-0.1	SE134376.004	%	60 - 130%	81
	TP3 0.0-0.1	SE134376.007	%	60 - 130%	92
	TP5 0.0-0.1	SE134376.010	%	60 - 130%	86
	TP4 0.9-1.0	SE134376.019	%	60 - 130%	98
	TP6 0.0-0.1	SE134376.022	%	60 - 130%	84
	TP7 0.4-0.5	SE134376.025	%	60 - 130%	97
Dibromofluoromethane (Surrogate)	TP1 0.4-0.5	SE134376.002	%	60 - 130%	76
	TP2 0.0-0.1	SE134376.004	%	60 - 130%	75
	TP3 0.0-0.1	SE134376.007	%	60 - 130%	76
	TP5 0.0-0.1	SE134376.010	%	60 - 130%	70
	TP4 0.9-1.0	SE134376.019	%	60 - 130%	79
	TP6 0.0-0.1	SE134376.022	%	60 - 130%	77
	TP7 0.4-0.5	SE134376.025	%	60 - 130%	76

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	Trip Blank 2	SE134376.016	%	40 - 130%	87
	Trip Spike 2	SE134376.017	%	40 - 130%	106
	TB3	SE134376.031	%	40 - 130%	84
	TS3	SE134376.032	%	40 - 130%	108
d4-1,2-dichloroethane (Surrogate)	Trip Blank 2	SE134376.016	%	40 - 130%	100
	Trip Spike 2	SE134376.017	%	40 - 130%	94
	TB3	SE134376.031	%	40 - 130%	105
	TS3	SE134376.032	%	40 - 130%	93
d8-toluene (Surrogate)	Trip Blank 2	SE134376.016	%	40 - 130%	97
	Trip Spike 2	SE134376.017	%	40 - 130%	96
	TB3	SE134376.031	%	40 - 130%	99
	TS3	SE134376.032	%	40 - 130%	97
Dibromofluoromethane (Surrogate)	Trip Blank 2	SE134376.016	%	40 - 130%	104
	Trip Spike 2	SE134376.017	%	40 - 130%	95
	TB3	SE134376.031	%	40 - 130%	108
	TS3	SE134376.032	%	40 - 130%	94

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TP1 0.4-0.5	SE134376.002	%	60 - 130%	72
	TP2 0.0-0.1	SE134376.004	%	60 - 130%	72
	TP3 0.0-0.1	SE134376.007	%	60 - 130%	77
	TP5 0.0-0.1	SE134376.010	%	60 - 130%	72
	TP4 0.9-1.0	SE134376.019	%	60 - 130%	77
	TP6 0.0-0.1	SE134376.022	%	60 - 130%	72
	TP7 0.4-0.5	SE134376.025	%	60 - 130%	77
d4-1,2-dichloroethane (Surrogate)	TP1 0.4-0.5	SE134376.002	%	60 - 130%	85
	TP2 0.0-0.1	SE134376.004	%	60 - 130%	83
	TP3 0.0-0.1	SE134376.007	%	60 - 130%	94
	TP5 0.0-0.1	SE134376.010	%	60 - 130%	87
	TP4 0.9-1.0	SE134376.019	%	60 - 130%	96
	TP6 0.0-0.1	SE134376.022	%	60 - 130%	85
	TP7 0.4-0.5	SE134376.025	%	60 - 130%	94
d8-toluene (Surrogate)	TP1 0.4-0.5	SE134376.002	%	60 - 130%	83
	TP2 0.0-0.1	SE134376.004	%	60 - 130%	81
	TP3 0.0-0.1	SE134376.007	%	60 - 130%	92
	TP5 0.0-0.1	SE134376.010	%	60 - 130%	86
	TP4 0.9-1.0	SE134376.019	%	60 - 130%	98
	TP6 0.0-0.1	SE134376.022	%	60 - 130%	84
	TP7 0.4-0.5	SE134376.025	%	60 - 130%	97
Dibromofluoromethane (Surrogate)	TP1 0.4-0.5	SE134376.002	%	60 - 130%	76
	TP2 0.0-0.1	SE134376.004	%	60 - 130%	75
	TP3 0.0-0.1	SE134376.007	%	60 - 130%	76
	TP5 0.0-0.1	SE134376.010	%	60 - 130%	70
	TP4 0.9-1.0	SE134376.019	%	60 - 130%	79
	TP6 0.0-0.1	SE134376.022	%	60 - 130%	77
	TP7 0.4-0.5	SE134376.025	%	60 - 130%	76

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	Trip Blank 2	SE134376.016	%	40 - 130%	87
	TB3	SE134376.031	%	40 - 130%	84
d4-1,2-dichloroethane (Surrogate)	Trip Blank 2	SE134376.016	%	60 - 130%	100
	TB3	SE134376.031	%	60 - 130%	105
d8-toluene (Surrogate)	Trip Blank 2	SE134376.016	%	40 - 130%	97
	TB3	SE134376.031	%	40 - 130%	99
Dibromofluoromethane (Surrogate)	Trip Blank 2	SE134376.016	%	40 - 130%	104
	TB3	SE134376.031	%	40 - 130%	108

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

Sample Number	Parameter	Units	LOR	Result
LB069632.001	Mercury	mg/L	0.0001	<0.0001

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result
LB069366.001	Mercury	mg/kg	0.01	<0.01
LB069367.001	Mercury	mg/kg	0.01	<0.01

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB069312.001		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1
		Alpha BHC	mg/kg	0.1	<0.1
		Lindane	mg/kg	0.1	<0.1
		Heptachlor	mg/kg	0.1	<0.1
		Aldrin	mg/kg	0.1	<0.1
		Beta BHC	mg/kg	0.1	<0.1
		Delta BHC	mg/kg	0.1	<0.1
		Heptachlor epoxide	mg/kg	0.1	<0.1
		Alpha Endosulfan	mg/kg	0.2	<0.2
		Gamma Chlordane	mg/kg	0.1	<0.1
		Alpha Chlordane	mg/kg	0.1	<0.1
		p,p'-DDE	mg/kg	0.1	<0.1
		Dieldrin	mg/kg	0.2	<0.2
		Endrin	mg/kg	0.2	<0.2
		Beta Endosulfan	mg/kg	0.2	<0.2
		p,p'-DDD	mg/kg	0.1	<0.1
		p,p'-DDT	mg/kg	0.1	<0.1
		Endosulfan sulphate	mg/kg	0.1	<0.1
		Endrin Aldehyde	mg/kg	0.1	<0.1
		Methoxychlor	mg/kg	0.1	<0.1
		Endrin Ketone	mg/kg	0.1	<0.1
		Isodrin	mg/kg	0.1	<0.1
		Mirex	mg/kg	0.1	<0.1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	112

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB069312.001		Naphthalene	mg/kg	0.1	<0.1
		2-methylnaphthalene	mg/kg	0.1	<0.1
		1-methylnaphthalene	mg/kg	0.1	<0.1
		Acenaphthylene	mg/kg	0.1	<0.1
		Acenaphthene	mg/kg	0.1	<0.1
		Fluorene	mg/kg	0.1	<0.1
		Phenanthrene	mg/kg	0.1	<0.1
		Anthracene	mg/kg	0.1	<0.1
		Fluoranthene	mg/kg	0.1	<0.1
		Pyrene	mg/kg	0.1	<0.1
		Benzo(a)anthracene	mg/kg	0.1	<0.1
		Chrysene	mg/kg	0.1	<0.1
		Benzo(a)pyrene	mg/kg	0.1	<0.1
		Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1
		Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1
		Benzo(ghi)perylene	mg/kg	0.1	<0.1
		Total PAH	mg/kg	0.8	<0.8
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	112

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB069312.001	Surrogates	2-fluorobiphenyl (Surrogate)	%	-	90
		d14-p-terphenyl (Surrogate)	%	-	114

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB069310.001		Naphthalene	µg/L	0.1	<0.1
		2-methylnaphthalene	µg/L	0.1	<0.1
		1-methylnaphthalene	µg/L	0.1	<0.1
		Acenaphthylene	µg/L	0.1	<0.1
		Acenaphthene	µg/L	0.1	<0.1
		Fluorene	µg/L	0.1	<0.1
		Phenanthrene	µg/L	0.1	<0.1
		Anthracene	µg/L	0.1	<0.1
		Fluoranthene	µg/L	0.1	<0.1
		Pyrene	µg/L	0.1	<0.1
		Benzo(a)anthracene	µg/L	0.1	<0.1
		Chrysene	µg/L	0.1	<0.1
		Benzo(a)pyrene	µg/L	0.1	<0.1
		Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1
		Dibenzo(a&h)anthracene	µg/L	0.1	<0.1
		Benzo(ghi)perylene	µg/L	0.1	<0.1
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	80
		2-fluorobiphenyl (Surrogate)	%	-	68
		d14-p-terphenyl (Surrogate)	%	-	82

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB069312.001		Arochlor 1016	mg/kg	0.2	<0.2
		Arochlor 1221	mg/kg	0.2	<0.2
		Arochlor 1232	mg/kg	0.2	<0.2
		Arochlor 1242	mg/kg	0.2	<0.2
		Arochlor 1248	mg/kg	0.2	<0.2
		Arochlor 1254	mg/kg	0.2	<0.2
		Arochlor 1260	mg/kg	0.2	<0.2
		Arochlor 1262	mg/kg	0.2	<0.2
		Arochlor 1268	mg/kg	0.2	<0.2
		Total PCBs (Arochlors)	mg/kg	1	<1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	112

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB069312.001		Phenol	mg/kg	0.5	<0.5
		2-methyl phenol (o-cresol)	mg/kg	0.5	<0.5
		3/4-methyl phenol (m/p-cresol)	mg/kg	1	<1
		2-chlorophenol	mg/kg	0.5	<0.5
		2,4-dimethylphenol	mg/kg	0.5	<0.5
		2,6-dichlorophenol	mg/kg	0.5	<0.5
		2,4-dichlorophenol	mg/kg	0.5	<0.5
		2,4,6-trichlorophenol	mg/kg	0.5	<0.5
		2-nitrophenol	mg/kg	0.5	<0.5
		4-nitrophenol	mg/kg	1	<1
		2,4,5-trichlorophenol	mg/kg	0.5	<0.5
		2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1	<1
		Pentachlorophenol	mg/kg	0.5	<0.5
		2,4-dinitrophenol	mg/kg	2	<2
		4-chloro-3-methylphenol	mg/kg	2	<2
	Surrogates	2,4,6-Tribromophenol (Surrogate)	%	-	85
		d5-phenol (Surrogate)	%	-	90

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest (continued)

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result
LB069505.001	Arsenic, As	mg/kg	3	<3
	Cadmium, Cd	mg/kg	0.3	<0.3
	Chromium, Cr	mg/kg	0.3	<0.3
	Copper, Cu	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Iron, Fe	mg/kg	50	<50
	Nickel, Ni	mg/kg	0.5	<0.5
	Zinc, Zn	mg/kg	0.5	<0.5
LB069540.001	Arsenic, As	mg/kg	3	<3
	Cadmium, Cd	mg/kg	0.3	<0.3
	Chromium, Cr	mg/kg	0.3	<0.3
	Copper, Cu	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Iron, Fe	mg/kg	50	<50
	Nickel, Ni	mg/kg	0.5	<0.5
	Zinc, Zn	mg/kg	0.5	<0.5

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Sample Number	Parameter	Units	LOR	Result
LB069485.001	Arsenic, As	µg/L	1	<1
	Cadmium, Cd	µg/L	0.1	<0.1
	Chromium, Cr	µg/L	1	<1
	Copper, Cu	µg/L	1	<1
	Lead, Pb	µg/L	1	<1
	Nickel, Ni	µg/L	1	<1
	Zinc, Zn	µg/L	5	<5

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number	Parameter	Units	LOR	Result
LB069312.001	TRH C10-C14	mg/kg	20	<20
	TRH C15-C28	mg/kg	45	<45
	TRH C29-C36	mg/kg	45	<45
	TRH C37-C40	mg/kg	100	<100
	TRH C10-C36 Total	mg/kg	110	<110

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result
LB069296.001	Monocyclic Aromatic	Benzene	mg/kg	0.1	<0.1
	Hydrocarbons	Toluene	mg/kg	0.1	<0.1
		Ethylbenzene	mg/kg	0.1	<0.1
		m/p-xylene	mg/kg	0.2	<0.2
		o-xylene	mg/kg	0.1	<0.1
	Polycyclic VOCs	Naphthalene	mg/kg	0.1	<0.1
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	82
		d4-1,2-dichloroethane (Surrogate)	%	-	96
		d8-toluene (Surrogate)	%	-	96
		Bromofluorobenzene (Surrogate)	%	-	82
	Totals	Total BTEX*	mg/kg	0.6	<0.6

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result
LB069439.001	Monocyclic Aromatic	Benzene	µg/L	0.5	<0.5
	Hydrocarbons	Toluene	µg/L	0.5	<0.5
		Ethylbenzene	µg/L	0.5	<0.5
		m/p-xylene	µg/L	1	<1
		o-xylene	µg/L	0.5	<0.5
	Polycyclic VOCs	Naphthalene	µg/L	0.5	<0.5
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	100
		d4-1,2-dichloroethane (Surrogate)	%	-	99
		d8-toluene (Surrogate)	%	-	103
		Bromofluorobenzene (Surrogate)	%	-	94

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result
LB069296.001		TRH C6-C9	mg/kg	20	<20
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	82
		d4-1,2-dichloroethane (Surrogate)	%	-	96
		d8-toluene (Surrogate)	%	-	96

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result
LB069439.001		TRH C6-C9	µg/L	40	<40
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	100
		d4-1,2-dichloroethane (Surrogate)	%	-	99
		d8-toluene (Surrogate)	%	-	103
		Bromofluorobenzene (Surrogate)	%	-	94

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134600.016	LB069632.017	Mercury	µg/L	0.0001	<0.0001	<0.0001	42	0

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134376.010	LB069366.014	Mercury	mg/kg	0.01	0.04	0.04	154	0
SE134376.022	LB069366.024	Mercury	mg/kg	0.01	0.03	0.02	200	0
SE134396.005	LB069367.014	Mercury	mg/kg	0.01	0.01	0.01	200	0
SE134396.014	LB069367.024	Mercury	mg/kg	0.01	<0.01	<0.01	200	0

Moisture Content

Method: ME-(AU)-[ENV]AN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134376.010	LB069403.011	% Moisture	%w/w	0.5	17	17	36	1
SE134376.023	LB069403.022	% Moisture	%	0.5	14	15	37	6
SE134376.030	LB069403.028	% Moisture	%	0.5	15	15	37	1

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134376.004	LB069312.006		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Lindane	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor	mg/kg	0.1	<0.1	<0.1	200	0
			Aldrin	mg/kg	0.1	<0.1	<0.1	200	0
			Beta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Delta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Dieldrin	mg/kg	0.2	<0.2	<0.2	200	0
			Endrin	mg/kg	0.2	<0.2	<0.2	200	0
			o,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			p,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	200	0
			Methoxychlor	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Ketone	mg/kg	0.1	<0.1	<0.1	200	0
			Isodrin	mg/kg	0.1	<0.1	<0.1	200	0
			Mirex	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.17	0.16	30	2

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134376.025	LB069312.013	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Acenaphthylene	mg/kg	0.1	<0.1	<0.1	200	0
		Acenaphthene	mg/kg	0.1	<0.1	<0.1	200	0
		Fluorene	mg/kg	0.1	<0.1	<0.1	200	0
		Phenanthrene	mg/kg	0.1	<0.1	<0.1	200	0
		Anthracene	mg/kg	0.1	<0.1	<0.1	200	0
		Fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
		Pyrene	mg/kg	0.1	<0.1	<0.1	200	0
		Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
		Chrysene	mg/kg	0.1	<0.1	<0.1	200	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134376.025	LB069312.013		Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	200	0
			Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ (mg/kg)	0.2	<0.2	<0.2	200	0
			Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	<0.3	<0.3	134	0
			Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	<0.2	<0.2	175	0
			Total PAH	mg/kg	0.8	<0.8	<0.8	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.4	0.4	30	0
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.4	30	6
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	0

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134406.002	LB069310.008		Naphthalene	µg/L	0.1	<0.1	0	200	0
			2-methylnaphthalene	µg/L	0.1	<0.1	0	200	0
			1-methylnaphthalene	µg/L	0.1	<0.1	0	200	0
			Acenaphthylene	µg/L	0.1	<0.1	0	200	0
			Acenaphthene	µg/L	0.1	<0.1	0	200	0
			Fluorene	µg/L	0.1	<0.1	0	200	0
			Phenanthrene	µg/L	0.1	<0.1	0	200	0
			Anthracene	µg/L	0.1	<0.1	0	200	0
			Fluoranthene	µg/L	0.1	<0.1	0	200	0
			Pyrene	µg/L	0.1	<0.1	0	200	0
			Benzo(a)anthracene	µg/L	0.1	<0.1	0	200	0
			Chrysene	µg/L	0.1	<0.1	0	200	0
			Benzo(b&j)fluoranthene	µg/L	0.1	<0.1	0	200	0
			Benzo(k)fluoranthene	µg/L	0.1	<0.1	0	200	0
			Benzo(a)pyrene	µg/L	0.1	<0.1	0	200	0
			Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1	0	200	0
			Dibenzo(a&h)anthracene	µg/L	0.1	<0.1	0	200	0
			Benzo(ghi)perylene	µg/L	0.1	<0.1	0	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	µg/L	-	0.4	0.42	30	13
			2-fluorobiphenyl (Surrogate)	µg/L	-	0.4	0.39	30	8
			d14-p-terphenyl (Surrogate)	µg/L	-	0.5	0.49	30	4

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134376.004	LB069312.006		Arochlor 1016	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1221	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1232	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1242	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1248	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1254	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1260	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1262	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1268	mg/kg	0.2	<0.2	<0.2	200	0
			Total PCBs (Arochlors)	mg/kg	1	<1	<1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0	0	30	2

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134376.013	LB069410.011	pH	pH Units	-	6.5	6.7	32	3
SE134396.018	LB069427.010	pH	pH Units	-	4.8	4.7	32	3

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Original	Duplicate	Parameter	Units	LOR

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Speciated Phenols in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134376.010	LB069312.008	Phenol	mg/kg	0.5	<0.5	<0.5	200	0
		2-methyl phenol (o-cresol)	mg/kg	0.5	<0.5	<0.5	200	0
		3/4-methyl phenol (m/p-cresol)	mg/kg	1	<1	<1	200	0
		Total Cresol	mg/kg	1.5	<1.5	<1.5	200	0
		2-chlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
		2,4-dimethylphenol	mg/kg	0.5	<0.5	<0.5	200	0
		2,6-dichlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
		2,4-dichlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
		2,4,6-trichlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
		2-nitrophenol	mg/kg	0.5	<0.5	<0.5	200	0
		4-nitrophenol	mg/kg	1	<1	<1	200	0
		2,4,5-trichlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
		2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1	<1	<1	200	0
		Pentachlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
		2,4-dinitrophenol	mg/kg	2	<2	<2	200	0
		4-chloro-3-methylphenol	mg/kg	2	<2	<2	200	0
	Surrogates	2,4,6-Tribromophenol (Surrogate)	mg/kg	-	4.3	4.3	30	0
		d5-phenol (Surrogate)	mg/kg	-	1.8	1.8	30	1

TOC in Soil

Method: ME-(AU)-[ENV]AN188

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134376.006	LB069712.006	Total Organic Carbon	%w/w	0.05	0.24	0.22	36	8

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134376.010	LB069505.014	Arsenic, As	mg/kg	3	7	7	44	5
		Cadmium, Cd	mg/kg	0.3	0.4	0.4	107	3
		Chromium, Cr	mg/kg	0.3	18	20	33	8
		Copper, Cu	mg/kg	0.5	25	25	32	0
		Lead, Pb	mg/kg	1	170	120	31	36 ④
		Nickel, Ni	mg/kg	0.5	18	18	33	2
		Zinc, Zn	mg/kg	0.5	260	260	31	1
SE134376.022	LB069505.024	Arsenic, As	mg/kg	3	5	4	53	13
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Chromium, Cr	mg/kg	0.3	22	22	32	4
		Copper, Cu	mg/kg	0.5	14	13	34	1
		Lead, Pb	mg/kg	1	28	20	34	32
		Nickel, Ni	mg/kg	0.5	14	11	34	20
		Zinc, Zn	mg/kg	0.5	26	26	38	2
SE134483.007	LB069540.014	Arsenic, As	mg/kg	3	<3	<3	74	43
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Chromium, Cr	mg/kg	0.3	10	8.6	35	15
		Copper, Cu	mg/kg	0.5	0.7	0.9	93	32
		Lead, Pb	mg/kg	1	13	8	40	41 ②
		Nickel, Ni	mg/kg	0.5	1.5	1.6	62	8
		Zinc, Zn	mg/kg	0.5	7.1	6.6	59	7
SE134580.001	LB069540.024	Arsenic, As	mg/kg	3	8	8	42	5
		Cadmium, Cd	mg/kg	0.3	0.5	0.4	93	12
		Chromium, Cr	mg/kg	0.3	13	16	33	15
		Copper, Cu	mg/kg	0.5	29	28	32	6
		Lead, Pb	mg/kg	1	77	69	31	10
		Nickel, Ni	mg/kg	0.5	21	21	32	1
		Zinc, Zn	mg/kg	0.5	340	250	31	30

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134483.003	LB069485.011	Arsenic, As	µg/L	1	<1	<1	200	0
		Cadmium, Cd	µg/L	0.1	<0.1	0.1	111	17
		Chromium, Cr	µg/L	1	<1	<1	200	0
		Copper, Cu	µg/L	1	2	2	66	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Trace Metals (Dissolved) in Water by ICPMS (continued)

Method: ME-(AU)-[ENV]AN318

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134483.003	LB069485.011		Lead, Pb	µg/L	1	<1	<1	200	0
			Nickel, Ni	µg/L	1	8	7	28	1
			Zinc, Zn	µg/L	5	210	210	17	1

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134376.025	LB069312.013		TRH C10-C14	mg/kg	20	<20	<20	200	0
			TRH C15-C28	mg/kg	45	<45	<45	200	0
			TRH C29-C36	mg/kg	45	<45	<45	200	0
			TRH C37-C40	mg/kg	100	<100	<100	200	0
			TRH C10-C36 Total	mg/kg	110	<110	<110	200	0
			TRH C10-C40 Total	mg/kg	210	<210	<210	200	0
		TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	<25	<25	200	0
			TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	<25	<25	200	0
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	200	0
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	200	0

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.009	LB069296.014	Monocyclic Aromatic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
			Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.1	4.3	50	6
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.1	4.4	50	5
			d8-toluene (Surrogate)	mg/kg	-	4.2	4.3	50	4
			Bromofluorobenzene (Surrogate)	mg/kg	-	3.9	4.2	50	6
		Totals	Total Xylenes*	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX*	mg/kg	0.6	<0.6	<0.6	200	0
SE134396.032	LB069296.024	Monocyclic Aromatic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
			Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.5	3.8	50	6
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	3.7	3.9	50	4
			d8-toluene (Surrogate)	mg/kg	-	3.6	3.8	50	6
			Bromofluorobenzene (Surrogate)	mg/kg	-	3.9	3.8	50	2
		Totals	Total Xylenes*	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX*	mg/kg	0.6	<0.6	<0.6	200	0

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134406.001	LB069439.011	Monocyclic Aromatic	Benzene	µg/L	0.5	<0.5	0	200	0
			Toluene	µg/L	0.5	<0.5	0	200	0
			Ethylbenzene	µg/L	0.5	<0.5	0	200	0
			m/p-xylene	µg/L	1	<1	0	200	0
			o-xylene	µg/L	0.5	<0.5	0	200	0
		Polycyclic	Naphthalene	µg/L	0.5	<0.5	0	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	µg/L	-	6.2	6.1	30	1
			d4-1,2-dichloroethane (Surrogate)	µg/L	-	6.1	5.92	30	3
			d8-toluene (Surrogate)	µg/L	-	4.8	4.71	30	2
			Bromofluorobenzene (Surrogate)	µg/L	-	4.1	3.99	30	2

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.009	LB069296.014		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.1	4.3	30	6
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.1	4.4	30	5

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Volatile Petroleum Hydrocarbons in Soil (continued)

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.009	LB069296.014	Surrogates	d8-toluene (Surrogate)	mg/kg	-	4.2	4.3	30	4
			Bromofluorobenzene (Surrogate)	mg/kg	-	3.9	4.2	30	6
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0
SE134396.032	LB069296.024		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.5	3.8	30	6
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	3.7	3.9	30	4
			d8-toluene (Surrogate)	mg/kg	-	3.6	3.8	30	6
			Bromofluorobenzene (Surrogate)	mg/kg	-	3.9	3.8	30	2
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134406.001	LB069439.011		TRH C6-C10	µg/L	50	<50	0	200	0
			TRH C6-C9	µg/L	40	<40	0	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	µg/L	-	6.2	6.1	30	1
			d4-1,2-dichloroethane (Surrogate)	µg/L	-	6.1	5.92	30	3
			d8-toluene (Surrogate)	µg/L	-	4.8	4.71	30	2
			Bromofluorobenzene (Surrogate)	µg/L	-	4.1	3.99	30	2
		VPH F Bands	Benzene (F0)	µg/L	0.5	<0.5	0	200	0
			TRH C6-C10 minus BTEX (F1)	µg/L	50	<50	0	200	0

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069537.025	Exchangeable Sodium, Na	mg/kg	2	NA	160	80 - 120	114
	Exchangeable Potassium, K	mg/kg	2	NA	330	80 - 120	102
	Exchangeable Calcium, Ca	mg/kg	2	NA	4347	80 - 120	86
	Exchangeable Magnesium, Mg	mg/kg	2	NA	1578	80 - 120	86

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069366.002	Mercury	mg/kg	0.01	0.20	0.2	70 - 130	99
LB069367.002	Mercury	mg/kg	0.01	0.19	0.2	70 - 130	97

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069312.002		Heptachlor	mg/kg	0.1	0.2	0.2	60 - 140	106
		Aldrin	mg/kg	0.1	0.2	0.2	60 - 140	104
		Delta BHC	mg/kg	0.1	0.2	0.2	60 - 140	97
		Dieldrin	mg/kg	0.2	0.2	0.2	60 - 140	100
		Endrin	mg/kg	0.2	0.2	0.2	60 - 140	107
		p,p'-DDT	mg/kg	0.1	0.2	0.2	60 - 140	106
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.15	0.15	40 - 130	100

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069312.002		Naphthalene	mg/kg	0.1	4.4	4	60 - 140	111
		Acenaphthylene	mg/kg	0.1	4.3	4	60 - 140	106
		Acenaphthene	mg/kg	0.1	4.5	4	60 - 140	112
		Phenanthrene	mg/kg	0.1	4.8	4	60 - 140	121
		Anthracene	mg/kg	0.1	4.5	4	60 - 140	112
		Fluoranthene	mg/kg	0.1	4.8	4	60 - 140	121
		Pyrene	mg/kg	0.1	4.5	4	60 - 140	112
		Benzo(a)pyrene	mg/kg	0.1	4.5	4	60 - 140	111
	Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	40 - 130	96
		2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	86
		d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	40 - 130	96

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069310.002		Naphthalene	µg/L	0.1	38	40	60 - 140	95
		Acenaphthylene	µg/L	0.1	33	40	60 - 140	82
		Acenaphthene	µg/L	0.1	41	40	60 - 140	102
		Phenanthrene	µg/L	0.1	48	40	60 - 140	121
		Anthracene	µg/L	0.1	38	40	60 - 140	96
		Fluoranthene	µg/L	0.1	36	40	60 - 140	91
		Pyrene	µg/L	0.1	30	40	60 - 140	75
		Benzo(a)pyrene	µg/L	0.1	43	40	60 - 140	108
	Surrogates	d5-nitrobenzene (Surrogate)	µg/L	-	0.5	0.5	40 - 130	104
		2-fluorobiphenyl (Surrogate)	µg/L	-	0.4	0.5	40 - 130	88
		d14-p-terphenyl (Surrogate)	µg/L	-	0.5	0.5	40 - 130	100

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069312.002	Arochlor 1260	mg/kg	0.2	0.4	0.4	60 - 140	91

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069410.001	pH	pH Units	-	7.3	7.415	98 - 102	99
LB069427.001	pH	pH Units	-	7.4	7.415	98 - 102	99

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number	Parameter	Units	LOR

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Speciated Phenols in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069312.002		Phenol	mg/kg	0.5	1.1	1	70 - 130	105
		2,4-dichlorophenol	mg/kg	0.5	0.9	1	70 - 130	92
		2,4,6-trichlorophenol	mg/kg	0.5	1.2	1	70 - 130	119
		Pentachlorophenol	mg/kg	0.5	0.9	1	70 - 130	94
	Surrogates	2,4,6-Tribromophenol (Surrogate)	mg/kg	-	4.9	5	40 - 130	99
		d5-phenol (Surrogate)	mg/kg	-	1.9	2	40 - 130	93

TOC in Soil

Method: ME-(AU)-[ENV]AN188

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069712.002	Total Organic Carbon	%w/w	0.05	0.32	0.325	80 - 120	99

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069505.002	Arsenic, As	mg/kg	3	44	50	80 - 120	89
	Cadmium, Cd	mg/kg	0.3	47	50	80 - 120	95
	Chromium, Cr	mg/kg	0.3	47	50	80 - 120	93
	Copper, Cu	mg/kg	0.5	46	50	80 - 120	91
	Lead, Pb	mg/kg	1	47	50	80 - 120	93
	Iron, Fe	mg/kg	50	<50	50	80 - 120	93
	Nickel, Ni	mg/kg	0.5	45	50	80 - 120	90
	Zinc, Zn	mg/kg	0.5	47	50	80 - 120	93
LB069540.002	Arsenic, As	mg/kg	3	44	50	80 - 120	89
	Cadmium, Cd	mg/kg	0.3	47	50	80 - 120	95
	Chromium, Cr	mg/kg	0.3	46	50	80 - 120	93
	Copper, Cu	mg/kg	0.5	45	50	80 - 120	90
	Lead, Pb	mg/kg	1	46	50	80 - 120	92
	Iron, Fe	mg/kg	50	<50	50	80 - 120	92
	Nickel, Ni	mg/kg	0.5	45	50	80 - 120	90
	Zinc, Zn	mg/kg	0.5	47	50	80 - 120	93

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069485.002	Arsenic, As	µg/L	1	20	20	80 - 120	98
	Cadmium, Cd	µg/L	0.1	20	20	80 - 120	102
	Chromium, Cr	µg/L	1	20	20	80 - 120	100
	Copper, Cu	µg/L	1	21	20	80 - 120	104
	Lead, Pb	µg/L	1	20	20	80 - 120	102
	Nickel, Ni	µg/L	1	20	20	80 - 120	102
	Zinc, Zn	µg/L	5	21	20	80 - 120	105

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069312.002		TRH C10-C14	mg/kg	20	33	40	60 - 140	83
		TRH C15-C28	mg/kg	45	<45	40	60 - 140	88
		TRH C29-C36	mg/kg	45	<45	40	60 - 140	90
	TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	34	40	60 - 140	85
		TRH >C16-C34 (F3)	mg/kg	90	<90	40	60 - 140	88
		TRH >C34-C40 (F4)	mg/kg	120	<120	20	60 - 140	95

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069296.002	Monocyclic	Benzene	mg/kg	0.1	2.3	2.9	60 - 140	80
	Aromatic	Toluene	mg/kg	0.1	2.3	2.9	60 - 140	78
		Ethylbenzene	mg/kg	0.1	2.5	2.9	60 - 140	86
		m/p-xylene	mg/kg	0.2	5.3	5.8	60 - 140	92
		o-xylene	mg/kg	0.1	2.5	2.9	60 - 140	88
	Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.3	5	60 - 140	85
		d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.8	5	60 - 140	95
		d8-toluene (Surrogate)	mg/kg	-	4.9	5	60 - 140	97
		Bromofluorobenzene (Surrogate)	mg/kg	-	5.8	5	60 - 140	116

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069439.002	Monocyclic	Benzene	µg/L	0.5	44	45.45	60 - 140	96
	Aromatic	Toluene	µg/L	0.5	50	45.45	60 - 140	110
		Ethylbenzene	µg/L	0.5	50	45.45	60 - 140	110
		m/p-xylene	µg/L	1	88	90.9	60 - 140	96
		o-xylene	µg/L	0.5	48	45.45	60 - 140	105
	Surrogates	Dibromofluoromethane (Surrogate)	µg/L	-	4.2	5	60 - 140	84
		d4-1,2-dichloroethane (Surrogate)	µg/L	-	4.2	5	60 - 140	84
		d8-toluene (Surrogate)	µg/L	-	4.9	5	60 - 140	99
		Bromofluorobenzene (Surrogate)	µg/L	-	4.7	5	60 - 140	93

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069296.002		TRH C6-C10	mg/kg	25	<25	24.65	60 - 140	86
		TRH C6-C9	mg/kg	20	<20	23.2	60 - 140	75
	Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.3	5	60 - 140	85
		d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.8	5	60 - 140	95
		d8-toluene (Surrogate)	mg/kg	-	4.9	5	60 - 140	97
		Bromofluorobenzene (Surrogate)	mg/kg	-	5.8	5	60 - 140	116
	VPH F Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	7.25	60 - 140	84

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069439.002		TRH C6-C10	µg/L	50	1000	946.63	60 - 140	109
		TRH C6-C9	µg/L	40	840	818.71	60 - 140	103
	Surrogates	Dibromofluoromethane (Surrogate)	µg/L	-	4.2	5	60 - 140	84
		d4-1,2-dichloroethane (Surrogate)	µg/L	-	4.2	5	60 - 140	84
		d8-toluene (Surrogate)	µg/L	-	4.9	5	60 - 140	99
		Bromofluorobenzene (Surrogate)	µg/L	-	4.7	5	60 - 140	93
	VPH F Bands	TRH C6-C10 minus BTEX (F1)	µg/L	50	750	639.67	60 - 140	117

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134376.001	LB069366.004	Mercury	mg/kg	0.01	0.18	<0.01	0.2	88
SE134376.023	LB069367.004	Mercury	mg/kg	0.01	0.20	0.01	0.2	95

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134376.001	LB069505.004	Arsenic, As	mg/kg	3	39	11	50	57 ④
		Cadmium, Cd	mg/kg	0.3	34	<0.3	50	67 ④
		Chromium, Cr	mg/kg	0.3	43	11	50	64 ④
		Copper, Cu	mg/kg	0.5	51	28	50	47 ④
		Lead, Pb	mg/kg	1	56	25	50	62 ④
		Nickel, Ni	mg/kg	0.5	68	44	50	47 ④
		Zinc, Zn	mg/kg	0.5	160	160	50	7 ④
SE134376.023	LB069540.004	Arsenic, As	mg/kg	3	34	5	50	59 ④
		Cadmium, Cd	mg/kg	0.3	34	<0.3	50	68 ④
		Chromium, Cr	mg/kg	0.3	53	21	50	64 ④
		Copper, Cu	mg/kg	0.5	46	12	50	68 ④
		Lead, Pb	mg/kg	1	56	26	50	59 ④
		Nickel, Ni	mg/kg	0.5	42	9.3	50	65 ④
		Zinc, Zn	mg/kg	0.5	310	520	50	-416 ⑨

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134376.015	LB069485.004	Arsenic, As	µg/L	1	20	<1	20	101
		Cadmium, Cd	µg/L	0.1	21	<0.1	20	104
		Chromium, Cr	µg/L	1	20	<1	20	100
		Copper, Cu	µg/L	1	25	4	20	105
		Lead, Pb	µg/L	1	21	<1	20	102
		Nickel, Ni	µg/L	1	21	<1	20	102
		Zinc, Zn	µg/L	5	40	20	20	100

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134376.002	LB069296.004	Monocyclic	Benzene	mg/kg	0.1	2.2	<0.1	2.9	77
		Aromatic	Toluene	mg/kg	0.1	2.2	<0.1	2.9	77
			Ethylbenzene	mg/kg	0.1	2.3	<0.1	2.9	78
			m/p-xylene	mg/kg	0.2	4.9	<0.2	5.8	84
			o-xylene	mg/kg	0.1	2.2	<0.1	2.9	77
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	-	-
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.8	3.8	5	77
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.9	4.2	5	98
			d8-toluene (Surrogate)	mg/kg	-	4.7	4.2	5	94
			Bromofluorobenzene (Surrogate)	mg/kg	-	5.2	3.6	5	105
		Totals	Total Xylenes*	mg/kg	0.3	7.1	<0.3	-	-
			Total BTEX*	mg/kg	0.6	14	<0.6	-	-

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134376.002	LB069296.004		TRH C6-C10	mg/kg	25	<25	<25	24.65	83
			TRH C6-C9	mg/kg	20	<20	<20	23.2	81
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.8	3.8	5	77
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.9	4.2	5	98
			d8-toluene (Surrogate)	mg/kg	-	4.7	4.2	5	94
			Bromofluorobenzene (Surrogate)	mg/kg	-	5.2	3.6	5	105
		VPH F	Benzene (F0)	mg/kg	0.1	2.2	<0.1	-	-
		Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	7.25	93

MATRIX SPIKE DUPLICATES

SE134376 R0

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here:
http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

*	Non-accredited analysis.
-	Sample not analysed for this analyte.
^	Analysis performed by external laboratory.

IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.

①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to Analytical Report comments for further information.

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COC received 12/12/14 @ 7:25am

Robson ENVIRONMENTAL Occupational Hygiene Health Safety & Environmental Consulting **CHAIN OF CUSTODY FORM** **Job No.: 9623**	**From:** Robson Environmental Pty Ltd PO Box 112 Fyshwick ACT 2609 140 Gladstone Street Fyshwick ACT 2609 ABN: 55 008 660 900 Contact: Ben Kendon Phone: (02) 6239 5656 Mobile: 0437 008 278 Fax: (02) 6239 5669 Email: results@robsonenviro.com.au ben@robsonenviro.com.au	Client Information: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609 Site Address: Old Canberra Brickworks Denman Street Yarralumla ACT 2600 Sampled by: AR ESDAT Files Required YES NO Job Name: ESA Required Turnaround Time: SGS Job Ref: SY140911-1-IS 24hr; 36hr; 48hr; 72hr & **5 to 7 Days**	Doc No: EAR-F013 Revision No: 2 Date Issued: 5/11/13 Next Review Date: 05/11/15 To: SGS 33 Maddox Street Alexandria NSW 2015 Contact: Matthew Phone: (02) 8594 0400 Mobile: Fax: (02) 8594 0499 Email: ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
1	TP1 (0.0-0.1)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
2	TP1 (0.4 - 0.5)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP1 (0.9-1.0)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice		Hold
3	TP1 (1.1-1.2)	9/12/2014	East side of dump	1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
4	TP2 (0.0-0.1)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP2(0.4-0.5)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice		Hold
5	TP2 (0.9-1.0)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
	TP2 (1.9-2.0)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice		Hold
6	TP2 (2.9-3.0)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
7 ;33	TP3 (0.0-0.1)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
8	TP3 (0.4-0.5)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
	TP3 (0.9-1.0)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice		Hold
9 Revised 12/12/14	TP3(1.4-1.5)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	

Relinquished by: BK	Date: 10/12/14	Time: 3pm	Received by:	Time: 11/12/14 9.00
Relinquished by:	Date:	Time:	Received by:	Time:
Relinquished by:	Date:	Time:	Received by:	Time:

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11 DEC 2014

SE134376

page 1 of 4.

Robson ENVIRONMENTAL

Occupational Hygiene
Health Safety &
Environmental Consulting

CHAIN OF CUSTODY FORM

Job No. : 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
140 Gladstone Street
Fyshwick ACT 2609
ABN: 55 008 660 900

Contact: Ben Kendon
Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required
YES NO

Job Name: Stage 1 ESA

Required Turnaround Time:
24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

SGS Job Ref: SY140911-1-IS

Doc No: EAR-F013 Revision No: 1
Date Issued: 13/04/2012

To:
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax: (02) 8594 0499
Email:
ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
10	TP5(0.0-0.1)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP5 (0.4 - 0.5)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice		Hold
11	TP5 (1.1-1.2)	9/12/2014	East side of dump	1 glass jar	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
12	TP5 (1.9-2.0)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA) and PAH	
	TP5 (3.4-3.5)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice		Hold
13	TP5 (4.1-4 2)	9/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
14	QC 3	9/12/2014	West of dump	1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	
15	R2	9/12/2014	NA	1 amber 500ml, 2 BTEX vials and 1 plastic	Water	ice	PAH and Heavy Metals (8)	
16	Trip Blank 2		NA	2 Btex vials	Water	ice	BTEX and TRH C6-C9	
17	Trip Spike 2	8/12/2014 (date prep)	NA	1 Btex vial	Water	ice	BTEX and TRH C6-C9	

Received 12/12/14

Relinquished by:BK	Date:10/12/14		Time:	Received by: L.As	Time: 11/12/14 9:00	
Relinquished by:	Date:		Time:	Received by:	Time:	
Relinquished by:	Date:		Time:	Received by:	Time:	

Robson ENVIRONMENTAL

Occupational Hygiene Health Safety & Environmental Consulting

CHAIN OF CUSTODY FORM

Job No.: 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
140 Gladstone Street
Fyshwick ACT 2609
ABN: 55 008 660 900

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Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required YES NO

Job Name: ESA

SGS Job Ref: SY140911-1-IS

Required Turnaround Time:
24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

Doc No: EAR-F013 Revision No: 2
Date Issued: 5/11/13
Next Review Date: 05/11/15

To:
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax: (02) 8594 0499
Email:
ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
18	TP4 (0.0-0.1)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
	TP4 (0.4 - 0.5)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice		Hold
19	TP4 (0.9-1.0)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
20	TP4 (1.9-2.0)	10/12/2014	East side of dump	1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
	TP4 (2.9-3.0)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice		Hold
21	TP4(3.6-3.7)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
22	TP6 (0.0-0.1)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP6 (0.4-0.5)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice		Hold
	TP6 (0.9-1.0)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice		Hold
23	TP6 (1.9-2.0)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
	TP6 (2.9-3.0)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice		Hold
24	TP6 (3.4-3.5)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
Lab 12/12/14	TP7(0.0-0.1)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice		Hold
Relinquished by: BK	Date: 10/12/14		Time: 3pm	Received by:			Time: 11/12/14 9:00	
Relinquished by:	Date:		Time:	Received by:			Time:	
Relinquished by:	Date:		Time:	Received by:			Time:	

Robson ENVIRONMENTAL

Occupational Hygiene Health Safety & Environmental Consulting

CHAIN OF CUSTODY FORM

Job No.: 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
140 Gladstone Street
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Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required **YES** NO

Job Name: ESA

SGS Job Ref: SY140911-1-IS

Required Turnaround Time:
24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

Doc No: EAR-F013 Revision No: 2
Date Issued: 5/11/13
Next Review Date: 05/11/15

To:
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
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Fax: (02) 8594 0499
Email:
ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
25	TP7 (0.4-0.5)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
26	TP7 (0.9 - 1.0)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
27	TP7 (2.9-3.0)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	Asbestos (WA)	
28	TP7 (3.9-4.0)	10/12/2014	East side of dump	1 plastic bag	soil	ice	Asbestos (WA)	
29	TP7(4.8.9-4.9)	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
30	QC5	10/12/2014	East side of dump	1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	
31	TB3	10/12/2014	East side of dump	2 BTEX Vials	soil	ice	BTEX and TRH C6-C9	
32	TS3	prep 8/12/14	East side of dump	1 Btex vial	soil	ice	BTEX and TRH C6-C9	
	Received 12/12/14							

Relinquished by: BK	Date: 10/12/14		Time: 3pm	Received by:	Time: 11/12/14 6:00
Relinquished by:	Date:		Time:	Received by:	Time:
Relinquished by:	Date:		Time:	Received by:	Time:

page 4 of 4.

AU.SampleReceipt.Sydney (Sydney)

From: Ben Kendon [Ben@robsonenviro.com.au]
Sent: Monday, 22 December 2014 8:51 AM
To: AU.SampleReceipt.Sydney (Sydney)
Subject: RE: SE134376 - 9623

Emily,

Fibre ID is fine.

Thanks ,

Ben Kendon

Robson ENVIRONMENTAL

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Senior Consultant
Environmental Assessment and Remediation/HMLS
BA Grad Dip Geology
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From: AU.SampleReceipt.Sydney (Sydney) [mailto:AU.SampleReceipt.Sydney@sgs.com]
Sent: Saturday, 20 December 2014 1:58 PM
To: Ben Kendon
Subject: SE134376 - 9623

Dear Ben,

TP5 1.1-1.2- jar only supplied insufficient sample for WA Asbestos analysis. Do you want just Fibre id for this sample?

Please advise as soon as possible. Thank You.

Kind Regards,

Emily Yin
Environmental Services

90 Soils

SGS

SE18437G

Job:

Matrix	250 JAR	125 JAR	BAG	100ml metal bottle	1L UP P	500 UP P	250 ZnAcetate P	250 / 500 NaOH BP	125 / 250 UP P	125 / 250 Metal Total*	125 / 250 Metal Filtered*	125 HCl P	1L UP AG	500 / 1L H_2SO_4 AG	125 / 250 H_2SO_4 P	100 / 200 UP AG	40 NaThio GV	250 UP OPAQUE P	500 NaThio STERILE P	200 NaThio STERILE P	40ml vial	Storage Location	Bottles Supplied By	Comment	Cooling Method
																									CP
S	1		1																			SI88-90 HSB	SGS	5-11	Temp
S			1																			SI88-90	client	-	4.6°C
W				1									1				2					WO88	SGS	5-11	Good Order
W																	2					"	"	"	Y / N
W																					1	"	"	"	Clearly Labelled
M			1																						Y / N
S	1																								Correct Pres.
																									Y / N
																									No Head-space
																									Y / N / NA
				12 Soils on hold																					Sufficient Vol
																									Y / N
																									Doc Date
																									Doc Type
																									Complete Docs
																									Y / N
																									Requested TAT

SAMPLE RECEIPT ADVICE

SE134376

CLIENT DETAILS

Contact	Ben Kendon
Client	Robson Environmental Pty Ltd
Address	140 Gladstone Street, FYSHWICK PO Box 112, FYSHWICK ACT 2609
Telephone	(02) 6239 5656
Facsimile	(02) 6239 5669
Email	ben@robsonlabs.com.au
Project	**9623 - ESA - Old Canberra Brickworks**
Order Number	**SY140911-1-IS**
Samples	33

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
Samples Received	Thu 11/12/2014
Report Due	Mon 22/12/2014
SGS Reference	**SE134376**

SUBMISSION DETAILS

This is to confirm that 33 samples were received on Thursday 11/12/2014. Results are expected to be ready by Monday 22/12/2014. Please quote SGS reference SE134376 when making enquiries. Refer below for details relating to sample integrity upon receipt.

Sample counts by matrix	27 Soils, 5 Waters & 1 Mat	Type of documentation received	COC
Date documentation received	11/12/2014	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	4.6°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes		

Samples will be held for one month for water samples and two months for soil samples from date of report, unless otherwise instructed.

COMMENTS

Trip Spike can only be analysed for BTEX.
TP1(1.1-1.2), a separate portion was not supplied for Asbestos analysis. A sub-sample will be used from the bag provided.
Clay Content - Subcontracted to SGS Cairns, 2/58 Comport St, Portsmith QLD 4870, NATA Accreditation Number: 2562, Site Number: 3146.
12 soil samples have been placed on hold as per client's request. These samples will not be processed.
TP5 1.1-1.2- jar only supplied insufficient sample for WA Asbestos analysis.

Fibre ID will be analysed.
This SRA cancels and supersedes the previous SRA sent due to TP5 1.1-1.2- jar only supplied insufficient sample for WA Asbestos analysis.

To the extent not inconsistent with the other provisions of this document and unless specifically agreed otherwise in writing by SGS, all SGS services are rendered in accordance with the applicable SGS General Conditions of Service accessible at http://www.sgs.com/en/Terms-and-Conditions/General-Conditions-of-Services-English.aspx as at the date of this document.
Attention is drawn to the limitations of liability and to the clauses of indemnification.

SAMPLE RECEIPT ADVICE

SE134376

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	OC Pesticides in Soil	PAH (Polynuclear Aromatic Hydrocarbons) in Soil	PCBs in Soil	pH in soil (1:5)	Speciated Phenols in Soil	TRH (Total Recoverable Hydrocarbons) in Soil	VOC's in Soil	Volatile Petroleum Hydrocarbons in Soil
002	TP1 0.4-0.5	28	25	11	-	18	10	12	8
004	TP2 0.0-0.1	28	25	11	-	18	10	12	8
005	TP2 0.9-1.0	-	-	-	1	-	-	-	-
006	TP2 2.9-3.0	-	-	-	1	-	-	-	-
007	TP3 0.0-0.1	28	25	11	-	18	10	12	8
010	TP5 0.0-0.1	28	25	11	-	18	10	12	8
011	TP5 1.1-1.2	-	-	-	1	-	-	-	-
012	TP5 1.9-2.0	-	25	-	-	-	-	-	-
013	TP5 4.1-4.2	-	-	-	1	-	-	-	-
014	QC 3	-	25	-	-	-	-	-	-
019	TP4 0.9-1.0	28	25	11	-	18	10	12	8
022	TP6 0.0-0.1	28	25	11	-	18	10	12	8

CONTINUED OVERLEAF

The above table represents SGS Environmental Services' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .

SAMPLE RECEIPT ADVICE

SE134376

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	OC Pesticides in Soil	PAH (Polynuclear Aromatic Hydrocarbons) in Soil	PCBs in Soil	pH in soil (1:5)	Speciated Phenols in Soil	TRH (Total Recoverable Hydrocarbons) in Soil	VOC's in Soil	Volatile Petroleum Hydrocarbons in Soil
025	TP7 0.4-0.5	28	25	11	-	18	10	12	8
026	TP7 0.9-1.0	-	-	-	1	-	-	-	-
029	TP7 4.8-4.9	-	-	-	1	-	-	-	-
030	QC5	-	25	-	-	-	-	-	-

CONTINUED OVERLEAF

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SAMPLE RECEIPT ADVICE

SE134376

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	Exchangeable Cations and Cation Exchange Capacity	Fibre Identification in soil	Gravimetric Determination of Asbestos in Soil	Mercury in Soil	Particle sizing of soils <75µm by hydrometer	Particle sizing of soils by sieving	TOC in Soil	Total Recoverable Metals in Soil by ICPOES from
001	TP1 0.0-0.1	-	-	5	1	-	-	-	7
002	TP1 0.4-0.5	-	-	5	1	-	-	-	7
003	TP1 1.1-1.2	-	-	5	1	-	-	-	7
004	TP2 0.0-0.1	-	-	5	1	-	-	-	7
005	TP2 0.9-1.0	13	-	5	1	36	2	1	8
006	TP2 2.9-3.0	13	-	5	1	36	2	1	8
007	TP3 0.0-0.1	-	-	5	1	-	-	-	7
008	TP3 0.4-0.5	-	-	5	1	-	-	-	7
009	TP3 1.4-1.5	-	-	5	1	-	-	-	7
010	TP5 0.0-0.1	-	-	5	1	-	-	-	7
011	TP5 1.1-1.2	13	2	-	1	36	2	1	8
012	TP5 1.9-2.0	-	-	5	1	-	-	-	7
013	TP5 4.1-4.2	13	-	5	1	36	2	1	8
014	QC 3	-	-	5	1	-	-	-	7
018	TP4 0.0-0.1	-	-	5	1	-	-	-	7
019	TP4 0.9-1.0	-	-	5	1	-	-	-	7
020	TP4 1.9-2.0	-	-	5	1	-	-	-	7
021	TP4 3.6-3.7	-	-	5	1	-	-	-	7
022	TP6 0.0-0.1	-	-	5	1	-	-	-	7
023	TP6 1.9-2.0	-	-	5	1	-	-	-	7
024	TP6 3.4-3.5	-	-	5	1	-	-	-	7

CONTINUED OVERLEAF

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SE134376

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	Exchangeable Cations and Cation Exchange Capacity	Gravimetric Determination of Asbestos in Soil	Mercury in Soil	Particle sizing of soils <75µm by hydrometer	Particle sizing of soils by sieving	TOC in Soil	Total Recoverable Metals in Soil by ICPOES from
025	TP7 0.4-0.5	-	5	1	-	-	-	7
026	TP7 0.9-1.0	13	5	1	36	2	1	8
027	TP7 2.9-3.0	-	5	-	-	-	-	-
028	TP7 3.9-4.0	-	5	-	-	-	-	-
029	TP7 4.8-4.9	13	5	1	36	2	1	8
030	QC5	-	5	1	-	-	-	7

CONTINUED OVERLEAF

The above table represents SGS Environmental Services' interpretation of the client-supplied Chain Of Custody document.
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SAMPLE RECEIPT ADVICE

SE134376

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	Mercury (dissolved) in Water	Moisture Content	PAH (Polynuclear Aromatic Hydrocarbons) in Water	Trace Metals (Dissolved) in Water by ICPMS	VOCs in Water	Volatile Petroleum Hydrocarbons in Water
001	TP1 0.0-0.1	-	1	-	-	-	-
002	TP1 0.4-0.5	-	1	-	-	-	-
003	TP1 1.1-1.2	-	1	-	-	-	-
004	TP2 0.0-0.1	-	1	-	-	-	-
005	TP2 0.9-1.0	-	1	-	-	-	-
006	TP2 2.9-3.0	-	1	-	-	-	-
007	TP3 0.0-0.1	-	1	-	-	-	-
008	TP3 0.4-0.5	-	1	-	-	-	-
009	TP3 1.4-1.5	-	1	-	-	-	-
010	TP5 0.0-0.1	-	1	-	-	-	-
011	TP5 1.1-1.2	-	1	-	-	-	-
012	TP5 1.9-2.0	-	1	-	-	-	-
013	TP5 4.1-4.2	-	1	-	-	-	-
014	QC 3	-	1	-	-	-	-
015	R2	1	-	22	7	-	-
016	Trip Blank 2	-	-	-	-	12	8
017	Trip Spike 2	-	-	-	-	9	-
018	TP4 0.0-0.1	-	1	-	-	-	-
019	TP4 0.9-1.0	-	1	-	-	-	-
020	TP4 1.9-2.0	-	1	-	-	-	-
021	TP4 3.6-3.7	-	1	-	-	-	-
022	TP6 0.0-0.1	-	1	-	-	-	-
023	TP6 1.9-2.0	-	1	-	-	-	-
024	TP6 3.4-3.5	-	1	-	-	-	-

CONTINUED OVERLEAF

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SAMPLE RECEIPT ADVICE

SE134376

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	Fibre ID in bulk materials	Moisture Content	VOCs in Water	Volatile Petroleum Hydrocarbons in Water
025	TP7 0.4-0.5	-	1	-	-
026	TP7 0.9-1.0	-	1	-	-
029	TP7 4.8-4.9	-	1	-	-
030	QC5	-	1	-	-
031	TB3	-	-	12	8
032	TS3	-	-	9	-
033	TP3 0.0-0.1	1	-	-	-

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The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 120901

Client:

Robson Environmental Pty Ltd
PO Box 112
Fyshwick
ACT 2609

Attention: Ben Kendon

Sample log in details:

Your Reference:	**9623**		
No. of samples:	2 soils		
Date samples received / completed instructions received	12/12/14	/	12/12/14

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	19/12/14	/	19/12/14
Date of Preliminary Report:	Not Issued		

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

PAHs in Soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	120901-1 QC4 09/12/2014 soil	120901-2 QC6 10/12/2014 soil
Date extracted	-	15/12/2014	15/12/2014
Date analysed	-	16/12/2014	16/12/2014
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1
Benzo(a)pyrene TEQ NEPM B1	mg/kg	<0.5	<0.5
Total Positive PAHs	mg/kg	NIL (+)VE	NIL (+)VE
Surrogate p-Terphenyl-d14	%	96	102

Acid Extractable metals in soil			
Our Reference:	UNITS	120901-1	120901-2
Your Reference	----------	QC4	QC6
Date Sampled	----------	09/12/2014	10/12/2014
Type of sample		soil	soil
Date digested	-	16/12/2014	16/12/2014
Date analysed	-	16/12/2014	16/12/2014
Arsenic	mg/kg	6	<4
Cadmium	mg/kg	<0.4	<0.4
Chromium	mg/kg	19	23
Copper	mg/kg	24	11
Lead	mg/kg	120	23
Mercury	mg/kg	<0.1	<0.1
Nickel	mg/kg	20	13
Zinc	mg/kg	250	26

Moisture			
Our Reference:	UNITS	120901-1	120901-2
Your Reference	----------	QC4	QC6
Date Sampled	----------	09/12/2014	10/12/2014
Type of sample		soil	soil
Date prepared	-	15/12/2014	15/12/2014
Date analysed	-	16/12/2014	16/12/2014
Moisture	%	15	14

Asbestos ID - soils			
Our Reference:	UNITS	120901-1	120901-2
Your Reference	----------	QC4	QC6
Date Sampled	----------	09/12/2014	10/12/2014
Type of sample		soil	soil
Date analysed	-	18/12/2014	18/12/2014
Sample mass tested	g	469.67g	560.31g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg
Trace Analysis	-	No asbestos detected	No asbestos detected
ACM >7mm Estimation*	g	--	--
ACM <7mm Estimation*	g	--	--
FA and AF Estimation*	g	--	--
Total Asbestos g/kg*	g/kg	<0.1	<0.1
ACM >7mm Estimation %(w/w)*	%	<0.01	<0.01
ACM <7mm Estimation %(w/w)*	%	<0.001	<0.001
FA and AF Estimation %(w/w)*	%	<0.001	<0.001
Total Asb Est w/w* Note#	%	<0.001	<0.001

Method ID	Methodology Summary
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 deg C for a minimum of 12 hours.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** # The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light Microscopy and Dispersion Staining Techniques.
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			15/12/2014	[NT]	[NT]	LCS-4	15/12/2014
Date analysed	-			15/12/2014	[NT]	[NT]	LCS-4	15/12/2014
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	87%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	100%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	91%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	91%
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	110%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	87%
Benzo(b,j+k) fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	[NT]	[NT]	LCS-4	95%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	104	[NT]	[NT]	LCS-4	101%

Client Reference: 9623

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date digested	-			16/12/2014	[NT]	[NT]	LCS-6	16/12/2014
Date analysed	-			16/12/2014	[NT]	[NT]	LCS-6	16/12/2014
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	[NT]	[NT]	LCS-6	106%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	[NT]	[NT]	LCS-6	107%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	104%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	108%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	96%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	LCS-6	96%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	100%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	99%

Report Comments:

This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.
This is reported outside our scope of NATA accreditation.

Asbestos ID was analysed by Approved Identifier: Paul Ching
Asbestos ID was authorised by Approved Signatory: Paul Ching

INS: Insufficient sample for this test
NA: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

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

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

Robson ENVIRONMENTAL

Occupational Hygiene
Health Safety &
Environmental Consulting

CHAIN OF CUSTODY FORM

Job No.: 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
Unit 1, 140 Gladstone Street
Fyshwick ACT 2609
ABN: 55 008 660 900

Contact: Ben Kendon
Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required YES NO

Job Name: ESA

Required Turnaround Time:
24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

Doc No: EAR-F014 Revision No: 2
Date Issued: 5/11/13
Next Review Date: 05/11/15

To:
Envirolab
12 Ashley Street
Chatswood NSW 2607

Contact: Jacinta
Phone: (02) 9910 6200
Mobile:
Fax: (02) 9910 6201
Email:
ABN: 91 004 591 664

Lab ID 120901	Sample ID	Date Sampled	Sample Location	No. of Sample Jars	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
1	QC4	9/12/2014		1 jar and 1 plastic bag	Soil	Ice	PAH, 8 heavy metals and asbestos (WA)	Please forward to Envirolab
2	QC6	10/12/2014		1 jar and 1 plastic bag	Soil	Ice	PAH, 8 heavy metals and asbestos (WA)	Please forward to Envirolab
BK Revised 14/12/14.								

Relinquished by: BK ~~(05/12/2014)~~ 12/12/14	Date: ~~05/12/2014~~ 10/12/14.		Time: 3pm	Received by: PR 12/12/14	Time: 16.15
Relinquished by:	Date:		Time:	Received by:	Time:
Relinquished by:	Date:		Time:	Received by:	Time:

ENVIROLAB GROUP

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 120901
Date Received: 12/12/14
Time Received: 16.15
Received by: PR
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Robson ENVIRONMENTAL

Occupational Hygiene
Health Safety &
Environmental Consulting

CHAIN OF CUSTODY FORM

Job No.: 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
Unit 1, 140 Gladstone Street
Fyshwick ACT 2609
ABN: 55 008 660 900

Contact: Ben Kendon
Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required YES NO

Job Name: ESA

Required Turnaround Time:
24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

Doc No: EAR-F014 Revision No: 2
Date Issued: 5/11/13
Next Review Date: 05/11/15

To:
Envirolab
12 Ashley Street
Chatswood NSW 2607

Contact: Jacinta
Phone: (02) 9910 6200
Mobile:
Fax: (02) 9910 6201
Email:
ABN: 91 004 591 664

Lab ID 120901	Sample ID	Date Sampled	Sample Location	No. of Sample Jars	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
1	QC4	9/12/2014		1 jar and 1 plastic bag	Soil	Ice	PAH, 8 heavy metals and asbestos (WA)	Please forward to Envirolab
2	QC6	10/12/2014		1 jar and 1 plastic bag	Soil	Ice	PAH, 8 heavy metals and asbestos (WA)	Please forward to Envirolab
BK Revised 14/12/14.								

Relinquished by: BK ~~(05/12/2014)~~ 12/12/14	Date: ~~05/12/2014~~ 10/12/14.		Time: 3pm	Received by: PR 12/12/14	Time: 16.15
Relinquished by:	Date:		Time:	Received by:	Time:
Relinquished by:	Date:		Time:	Received by:	Time:

ENVIROLAB GROUP

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 120901
Date Received: 12/12/14
Time Received: 16.15
Received by: PR
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

SAMPLE RECEIPT ADVICE

Client:

Robson Environmental Pty Ltd
PO Box 112
Fyshwick ACT 2609

ph: 02 6239 5656
Fax: 02 6239 5669

Attention: Ben Kendon

Sample log in details:

Your reference:	**9623**
Envirolab Reference:	**120901**
Date received:	12/12/14
Date results expected to be reported:	**19/12/14**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	2 soils
Turnaround time requested:	Standard
Temperature on receipt (°C)	19.2
Cooling Method:	Ice
Sampling Date Provided:	YES

Comments:

If there is sufficient sample after testing, samples will be held for the following time frames from date of receipt of samples:
Water samples - 1 month
Soil and other solid samples - 2 months
Samples collected in canisters - 1 week. Canisters will then be cleaned.
All other samples are not retained after analysis
If you require samples to be retained for longer periods then retention fees will apply as per our pricelist.

Contact details:

Please direct any queries to Aileen Hie or Jacinta Hurst
ph: 02 9910 6200 fax: 02 9910 6201
email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au

Robson ENVIRONMENTAL

Occupational Hygiene
Health Safety &
Environmental Consulting

CHAIN OF CUSTODY FORM

Job No. : 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
140 Gladstone Street
Fyshwick ACT 2609
ABN: 55 008 660 900

Contact: Ben Kendon
Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required **YES** NO

Job Name: Stage 1 ESA

Required Turnaround Time:
24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

SGS Job Ref: SY140911-1-IS

Doc No: EAR-F013 Revision No: 1
Date Issued: 13/04/2012

To:
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax: (02) 8594 0499
Email:
ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
	TP18(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP18(0.6-0.7)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA)	
	TP19(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP19(0.6-0.7)	11/12/2014		1 glass jar, 1 plastic bag	soil	Ice	Heavy metals and asbestos (WA)	
120902	QC5 7	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	
1	QC6 8	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	Transfer to Envirolab COC
	QC7 9	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	
2	QC8 10	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	Transfer to Envirolab COC
	TB4	11/12/2014		2 vials	water	ice	BTEX and TRH C6-C9	
	TS4	11/12/2014		2 vials	water	ice	BTEX and TRH C6-C9	
RH revised 12/12/14.								

Relinquished by: RW	Date: 11/12/14		Time:	Received by: P.Rog 12/12/14	Time: 16.15	
Relinquished by:	Date:		Time:	Received by:	Time:	
Relinquished by:	Date:		Time:	Received by:	Time:	

ENVIROLAB

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 120902

Date Received: 12/12/14
~~Time Received:~~ 16 15
Received by: PR
Temp: ~~Cool~~/Ambient
~~Cooling: Ice/Icepack~~
~~Security: Intact~~/Broken/None

Page 4 of 4

ANALYTICAL REPORT

WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS

Contact	Ben Kendon
Client	Robson Environmental Pty Ltd
Address	140 Gladstone Street, FYSHWICK PO Box 112, FYSHWICK ACT 2609
Telephone	(02) 6239 5656
Facsimile	(02) 6239 5669
Email	ben@robsonlabs.com.au
Project	**9623 - ESA - Old Canberra Brickworks**
Order Number	(Not specified)
Samples	38
Date Received	12/12/2014

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE134396 R0**
Report Number	0000099677
Date Reported	6/1/2015
Date Started	17/12/2014

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

Clay Content subcontracted to SGS Cairns, 2/58 Comport St, Portsmith QLD 4870, NATA Accreditation Number: 2562, Site Number: 3146.
E.Coli, Faecal Coliforms and Total Coliforms subcontracted to SONIC FOOD & WATER TESTING, 31-33 Lawson Street Penrith NSW 2750, NATA Accreditation Number: 4034.

Sample # 2 : Asbestos fibre bundles found in 10x4x3mm cement sheet fragments.
Sample # 16 : Asbestos fibre bundles found in cement sheet fragments and found loose in sample.
Sample # 17 : Asbestos fibre bundles found in cement sheet fragments,fibrous insulation material and loose in sample

No respirable fibres detected in all samples using trace analysis technique as per AS 4964-2004.
Asbestos weight is approximate.
FA +AF measured gravimetrically (excluding free fibres).

Asbestos analysed by Approved Identifier Ravee Sivasubramaniam .

SIGNATORIES

Deanne Norris
Organic Chemist

Dong Liang
Metals/Inorganics Team Leader

Ly Kim Ha
Organic Section Head

Ravee Sivasubramaniam
Asbestos Analyst

VOC's in Soil [AN433/AN434]

PARAMETER	UOM	LOR	TP8 0.0-0.1 SOIL - 10/12/2014 SE134396.001	TP9 0.0-0.1 SOIL - 10/12/2014 SE134396.005	TP10 0.4-0.5 SOIL - 11/12/2014 SE134396.009	TP11 0.0-0.1 SOIL - 11/12/2014 SE134396.012	TP12 0.0-0.1 SOIL - 10/12/2014 SE134396.014	TP13 0.0-0.1 SOIL - 11/12/2014 SE134396.016
Benzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Xylenes*	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total BTEX*	mg/kg	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

PARAMETER	UOM	LOR	TP14 0.0-0.1 SOIL - 11/12/2014 SE134396.019	TP15 0.0-0.1 SOIL - 10/12/2014 SE134396.023	TP16 0.0-0.1 SOIL - 11/12/2014 SE134396.025	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP18 0.0-0.1 SOIL - 11/12/2014 SE134396.030	TP19 0.0-0.1 SOIL - 11/12/2014 SE134396.032
Benzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Xylenes*	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total BTEX*	mg/kg	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Volatile Petroleum Hydrocarbons in Soil [AN433/AN434/AN410]

PARAMETER	UOM	LOR	TP8 0.0-0.1 SOIL - 10/12/2014 SE134396.001	TP9 0.0-0.1 SOIL - 10/12/2014 SE134396.005	TP10 0.4-0.5 SOIL - 11/12/2014 SE134396.009	TP11 0.0-0.1 SOIL - 11/12/2014 SE134396.012	TP12 0.0-0.1 SOIL - 10/12/2014 SE134396.014	TP13 0.0-0.1 SOIL - 11/12/2014 SE134396.016
TRH C6-C9	mg/kg	20	<20	<20	<20	<20	<20	<20
Benzene (F0)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25	<25

PARAMETER	UOM	LOR	TP14 0.0-0.1 SOIL - 11/12/2014 SE134396.019	TP15 0.0-0.1 SOIL - 10/12/2014 SE134396.023	TP16 0.0-0.1 SOIL - 11/12/2014 SE134396.025	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP18 0.0-0.1 SOIL - 11/12/2014 SE134396.030	TP19 0.0-0.1 SOIL - 11/12/2014 SE134396.032
TRH C6-C9	mg/kg	20	<20	<20	<20	<20	<20	<20
Benzene (F0)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25	<25

TRH (Total Recoverable Hydrocarbons) in Soil [AN403]

PARAMETER	UOM	LOR	TP8 0.0-0.1 SOIL - 10/12/2014 SE134396.001	TP9 0.0-0.1 SOIL - 10/12/2014 SE134396.005	TP10 0.4-0.5 SOIL - 11/12/2014 SE134396.009	TP11 0.0-0.1 SOIL - 11/12/2014 SE134396.012	TP12 0.0-0.1 SOIL - 10/12/2014 SE134396.014	TP13 0.0-0.1 SOIL - 11/12/2014 SE134396.016
TRH C10-C14	mg/kg	20	<20	<20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45	**47**	<45	<45	**99**	<45	**420**
TRH C29-C36	mg/kg	45	**46**	<45	<45	**150**	<45	**270**
TRH C37-C40	mg/kg	100	<100	<100	<100	<100	<100	<100
TRH >C10-C16 (F2)	mg/kg	25	<25	<25	<25	<25	<25	<25
TRH >C10-C16 (F2) minus	mg/kg	25	<25	<25	<25	<25	<25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	**200**	<90	**630**
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	<120	<120	<120
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	**250**	<110	**690**
TRH C10-C40 Total	mg/kg	210	<210	<210	<210	**250**	<210	**690**

PARAMETER	UOM	LOR	TP14 0.0-0.1 SOIL - 11/12/2014 SE134396.019	TP15 0.0-0.1 SOIL - 10/12/2014 SE134396.023	TP16 0.0-0.1 SOIL - 11/12/2014 SE134396.025	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP18 0.0-0.1 SOIL - 11/12/2014 SE134396.030	TP19 0.0-0.1 SOIL - 11/12/2014 SE134396.032
TRH C10-C14	mg/kg	20	<20	<20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45	<45	<45	<45	<45	<45	<45
TRH C29-C36	mg/kg	45	<45	<45	<45	**100**	<45	<45
TRH C37-C40	mg/kg	100	<100	<100	<100	<100	<100	<100
TRH >C10-C16 (F2)	mg/kg	25	<25	<25	<25	<25	<25	<25
TRH >C10-C16 (F2) minus	mg/kg	25	<25	<25	<25	<25	<25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	<90	<90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	<120	<120	<120
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	<110	<110	<110
TRH C10-C40 Total	mg/kg	210	<210	<210	<210	<210	<210	<210

PAH (Polynuclear Aromatic Hydrocarbons) in Soil [AN420]

PARAMETER	UOM	LOR	TP8 0.0-0.1 SOIL - 10/12/2014 SE134396.001	TP9 0.0-0.1 SOIL - 10/12/2014 SE134396.005	TP9 2.9-3.0 SOIL - 10/12/2014 SE134396.007	TP10 0.4-0.5 SOIL - 11/12/2014 SE134396.009	TP11 0.0-0.1 SOIL - 11/12/2014 SE134396.012	TP12 0.0-0.1 SOIL - 10/12/2014 SE134396.014
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	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
Acenaphthene	mg/kg	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
Phenanthrene	mg/kg	0.1	<0.1	<0.1	**0.1**	**0.2**	<0.1	<0.1
Anthracene	mg/kg	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
Pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	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
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carcinogenic PAHs (as BaP TEQ)-	TEQ	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Carcinogenic PAHs (as BaP TEQ)-	TEQ (mg/kg)	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Carcinogenic PAHs (as BaP TEQ)-	TEQ (mg/kg)	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total PAH	mg/kg	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8

PARAMETER	UOM	LOR	TP13 0.0-0.1 SOIL - 11/12/2014 SE134396.016	TP14 0.0-0.1 SOIL - 11/12/2014 SE134396.019	TP 14 0.9-1.0 SOIL - 11/12/2014 SE134396.020	TP14 2.9-3.0 SOIL - 11/12/2014 SE134396.021	TP15 0.0-0.1 SOIL - 10/12/2014 SE134396.023	TP16 0.0-0.1 SOIL - 11/12/2014 SE134396.025
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	0.1	**0.9**	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.1	**1.6**	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.1	**28**	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.1	**4.1**	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.1	**41**	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.1	**29**	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	**14**	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	0.1	**8.7**	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1	**18**	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1	**5.1**	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1	**9.5**	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	**7.3**	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.1	**0.8**	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	**5.9**	<0.1	<0.1	<0.1	<0.1	<0.1
Carcinogenic PAHs (as BaP TEQ)-	TEQ	0.2	**15**	<0.2	<0.2	<0.2	<0.2	<0.2
Carcinogenic PAHs (as BaP TEQ)-	TEQ (mg/kg)	0.3	**15**	<0.3	<0.3	<0.3	<0.3	<0.3
Carcinogenic PAHs (as BaP TEQ)-	TEQ (mg/kg)	0.2	**15**	<0.2	<0.2	<0.2	<0.2	<0.2
Total PAH	mg/kg	0.8	**170**	<0.8	<0.8	<0.8	<0.8	<0.8

PAH (Polynuclear Aromatic Hydrocarbons) in Soil [AN420] (continued)

PARAMETER	UOM	LOR	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP18 0.0-0.1 SOIL - 11/12/2014 SE134396.030	TP19 0.0-0.1 SOIL - 11/12/2014 SE134396.032	QC7 SOIL - 10/12/2014 SE134396.034	QC9 SOIL - 11/12/2014 SE134396.035
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	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
Acenaphthene	mg/kg	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
Phenanthrene	mg/kg	0.1	**0.2**	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.1	**0.2**	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.1	**0.2**	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	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
Benzo(b&j)fluoranthene	mg/kg	0.1	**0.1**	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carcinogenic PAHs (as BaP TEQ)-	TEQ	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Carcinogenic PAHs (as BaP TEQ)-	TEQ (mg/kg)	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Carcinogenic PAHs (as BaP TEQ)-	TEQ (mg/kg)	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total PAH	mg/kg	0.8	<0.8	<0.8	<0.8	<0.8	<0.8

Speciated Phenols in Soil [AN420]

PARAMETER	UOM	LOR	TP8 0.0-0.1 SOIL - 10/12/2014 SE134396.001	TP9 0.0-0.1 SOIL - 10/12/2014 SE134396.005	TP10 0.4-0.5 SOIL - 11/12/2014 SE134396.009	TP11 0.0-0.1 SOIL - 11/12/2014 SE134396.012	TP12 0.0-0.1 SOIL - 10/12/2014 SE134396.014	TP13 0.0-0.1 SOIL - 11/12/2014 SE134396.016
Phenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-methyl phenol (o-cresol)	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
3/4-methyl phenol (m/p-cresol)	mg/kg	1	<1	<1	<1	<1	<1	<1
Total Cresol	mg/kg	1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
2-chlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dimethylphenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,6-dichlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dichlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,6-trichlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-nitrophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-nitrophenol	mg/kg	1	<1	<1	<1	<1	<1	<1
2,4,5-trichlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1	<1	<1	<1	<1	<1	<1
Pentachlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dinitrophenol	mg/kg	2	<2	<2	<2	<2	<2	<2
4-chloro-3-methylphenol	mg/kg	2	<2	<2	<2	<2	<2	<2

PARAMETER	UOM	LOR	TP14 0.0-0.1 SOIL - 11/12/2014 SE134396.019	TP15 0.0-0.1 SOIL - 10/12/2014 SE134396.023	TP16 0.0-0.1 SOIL - 11/12/2014 SE134396.025	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP18 0.0-0.1 SOIL - 11/12/2014 SE134396.030	TP19 0.0-0.1 SOIL - 11/12/2014 SE134396.032
Phenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-methyl phenol (o-cresol)	mg/kg	0.5	<0.5	**1.0**	<0.5	<0.5	<0.5	<0.5
3/4-methyl phenol (m/p-cresol)	mg/kg	1	<1	<1	<1	<1	<1	<1
Total Cresol	mg/kg	1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
2-chlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dimethylphenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,6-dichlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dichlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,6-trichlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-nitrophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-nitrophenol	mg/kg	1	<1	<1	<1	<1	<1	<1
2,4,5-trichlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1	<1	<1	<1	<1	<1	<1
Pentachlorophenol	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dinitrophenol	mg/kg	2	<2	<2	<2	<2	<2	<2
4-chloro-3-methylphenol	mg/kg	2	<2	<2	<2	<2	<2	<2

OC Pesticides in Soil [AN400/AN420]

PARAMETER	UOM	LOR	TP8 0.0-0.1 SOIL - 10/12/2014 SE134396.001	TP9 0.0-0.1 SOIL - 10/12/2014 SE134396.005	TP10 0.4-0.5 SOIL - 11/12/2014 SE134396.009	TP11 0.0-0.1 SOIL - 11/12/2014 SE134396.012	TP12 0.0-0.1 SOIL - 10/12/2014 SE134396.014	TP13 0.0-0.1 SOIL - 11/12/2014 SE134396.016
Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lindane	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Delta BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDE	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**1.0**
Endrin	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o,p'-DDD	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDT	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p,p'-DDD	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Ketone	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isodrin	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mirex	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

OC Pesticides in Soil [AN400/AN420] (continued)

PARAMETER	UOM	LOR	TP14 0.0-0.1 SOIL - 11/12/2014 SE134396.019	TP15 0.0-0.1 SOIL - 10/12/2014 SE134396.023	TP16 0.0-0.1 SOIL - 11/12/2014 SE134396.025	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP18 0.0-0.1 SOIL - 11/12/2014 SE134396.030	TP19 0.0-0.1 SOIL - 11/12/2014 SE134396.032
Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lindane	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Delta BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDE	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o,p'-DDD	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDT	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p,p'-DDD	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Ketone	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isodrin	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mirex	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

PCBs in Soil [AN400/AN420]

PARAMETER	UOM	LOR	TP8 0.0-0.1 SOIL - 10/12/2014 SE134396.001	TP9 0.0-0.1 SOIL - 10/12/2014 SE134396.005	TP10 0.4-0.5 SOIL - 11/12/2014 SE134396.009	TP11 0.0-0.1 SOIL - 11/12/2014 SE134396.012	TP12 0.0-0.1 SOIL - 10/12/2014 SE134396.014	TP13 0.0-0.1 SOIL - 11/12/2014 SE134396.016
Arochlor 1016	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1221	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1232	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1242	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1248	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1254	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1260	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1262	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1268	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total PCBs (Arochlors)	mg/kg	1	<1	<1	<1	<1	<1	<1

PARAMETER	UOM	LOR	TP14 0.0-0.1 SOIL - 11/12/2014 SE134396.019	TP15 0.0-0.1 SOIL - 10/12/2014 SE134396.023	TP16 0.0-0.1 SOIL - 11/12/2014 SE134396.025	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP18 0.0-0.1 SOIL - 11/12/2014 SE134396.030	TP19 0.0-0.1 SOIL - 11/12/2014 SE134396.032
Arochlor 1016	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1221	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1232	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1242	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1248	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1254	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1260	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1262	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1268	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total PCBs (Arochlors)	mg/kg	1	<1	<1	<1	<1	<1	<1

pH in soil (1:5) [AN101]

PARAMETER	UOM	LOR	TP9 1.1-1.2 SOIL - 10/12/2014 SE134396.006	TP9 3.9-4.0 SOIL - 10/12/2014 SE134396.008	TP11 0.4-0.5 SOIL - 11/12/2014 SE134396.013	TP13 1.9-2.0 SOIL - 11/12/2014 SE134396.017	TP13 3.5-3.6 SOIL - 11/12/2014 SE134396.018	TP15 0.9-1.0 SOIL - 10/12/2014 SE134396.024
pH	pH Units	-	6.2	6.0	5.5	5.2	4.8	6.2

PARAMETER	UOM	LOR	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP17 2.9-3.0 SOIL - 11/12/2014 SE134396.029
pH	pH Units	-	7.2	6.7

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) [AN122]

PARAMETER	UOM	LOR	TP9 1.1-1.2 SOIL - 10/12/2014 SE134396.006	TP9 3.9-4.0 SOIL - 10/12/2014 SE134396.008	TP11 0.4-0.5 SOIL - 11/12/2014 SE134396.013	TP13 1.9-2.0 SOIL - 11/12/2014 SE134396.017	TP13 3.5-3.6 SOIL - 11/12/2014 SE134396.018	TP15 0.9-1.0 SOIL - 10/12/2014 SE134396.024
Exchangeable Sodium, Na	mg/kg	2	16	27	41	8	28	75
Exchangeable Sodium, Na	meq/100g	0.01	0.07	0.12	0.18	0.04	0.12	0.33
Exchangeable Sodium Percentage*	%	0.1	0.3	1.4	3.2	0.2	1.8	4.9
Exchangeable Potassium, K	mg/kg	2	190	240	150	95	100	130
Exchangeable Potassium, K	meq/100g	0.01	0.48	0.60	0.39	0.24	0.27	0.34
Exchangeable Potassium	%	0.1	2.0	7.0	7.0	1.6	3.9	5.1
Exchangeable Calcium, Ca	mg/kg	2	4400	1200	580	2700	740	430
Exchangeable Calcium, Ca	meq/100g	0.01	22	5.8	2.9	14	3.7	2.2
Exchangeable Calcium Percentage*	%	0.1	90.4	67.5	51.8	91.2	53.7	32.4
Exchangeable Magnesium, Mg	mg/kg	2	220	250	260	130	340	470
Exchangeable Magnesium, Mg	meq/100g	0.02	1.8	2.1	2.1	1.0	2.8	3.9
Exchangeable Magnesium	%	0.1	7.4	24.2	38.1	6.9	40.6	57.6
Cation Exchange Capacity	meq/100g	0.02	25	8.6	5.6	15	6.9	6.7

PARAMETER	UOM	LOR	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP17 2.9-3.0 SOIL - 11/12/2014 SE134396.029
Exchangeable Sodium, Na	mg/kg	2	15	75
Exchangeable Sodium, Na	meq/100g	0.01	0.06	0.32
Exchangeable Sodium Percentage*	%	0.1	0.2	2.4
Exchangeable Potassium, K	mg/kg	2	770	190
Exchangeable Potassium, K	meq/100g	0.01	2.0	0.48
Exchangeable Potassium	%	0.1	6.2	3.5
Exchangeable Calcium, Ca	mg/kg	2	4900	1300
Exchangeable Calcium, Ca	meq/100g	0.01	24	6.3
Exchangeable Calcium Percentage*	%	0.1	76.8	45.4
Exchangeable Magnesium, Mg	mg/kg	2	650	820
Exchangeable Magnesium, Mg	meq/100g	0.02	5.3	6.7
Exchangeable Magnesium	%	0.1	16.8	48.7
Cation Exchange Capacity	meq/100g	0.02	32	14

TOC in Soil [AN188]

PARAMETER	UOM	LOR	TP9 1.1-1.2 SOIL - 10/12/2014 SE134396.006	TP9 3.9-4.0 SOIL - 10/12/2014 SE134396.008	TP11 0.4-0.5 SOIL - 11/12/2014 SE134396.013	TP13 1.9-2.0 SOIL - 11/12/2014 SE134396.017	TP13 3.5-3.6 SOIL - 11/12/2014 SE134396.018	TP15 0.9-1.0 SOIL - 10/12/2014 SE134396.024
Total Organic Carbon	%w/w	0.05	1.4	0.32	0.47	0.20	0.43	0.11

PARAMETER	UOM	LOR	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP17 2.9-3.0 SOIL - 11/12/2014 SE134396.029
Total Organic Carbon	%w/w	0.05	4.4	0.18

Particle sizing of soils by sieving [AN005]

PARAMETER	UOM	LOR	TP9 1.1-1.2 SOIL - 10/12/2014 SE134396.006	TP9 3.9-4.0 SOIL - 10/12/2014 SE134396.008	TP11 0.4-0.5 SOIL - 11/12/2014 SE134396.013	TP13 1.9-2.0 SOIL - 11/12/2014 SE134396.017	TP13 3.5-3.6 SOIL - 11/12/2014 SE134396.018	TP15 0.9-1.0 SOIL - 10/12/2014 SE134396.024
Passing 75µm	%w/w	1	36	81	61	40	67	66
Retained 75µm	%w/w	1	64	19	39	60	33	34

PARAMETER	UOM	LOR	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP17 2.9-3.0 SOIL - 11/12/2014 SE134396.029
Passing 75µm	%w/w	1	77	69
Retained 75µm	%w/w	1	23	31

Particle sizing of soils <75µm by hydrometer [AN005]

PARAMETER	UOM	LOR	TP9 1.1-1.2 SOIL - 10/12/2014 SE134396.006	TP9 3.9-4.0 SOIL - 10/12/2014 SE134396.008	TP11 0.4-0.5 SOIL - 11/12/2014 SE134396.013	TP13 1.9-2.0 SOIL - 11/12/2014 SE134396.017	TP13 3.5-3.6 SOIL - 11/12/2014 SE134396.018	TP15 0.9-1.0 SOIL - 10/12/2014 SE134396.024
Sedimentation Diameter 1	mm	0.0001	0.0574	0.0509	0.0571	0.0557	0.0548	0.0547
Passing Sedimentation Diameter 1	%w/w	1	27	69	29	38	43	45
Retained Sedimentation Diameter 1	%w/w	1	37	12	32	2	24	21
Sedimentation Diameter 2	mm	0.0001	0.0411	0.0370	0.0406	0.0399	0.0391	0.0391
Passing Sedimentation Diameter 2	%w/w	1	23	60	27	34	40	40
Retained Sedimentation Diameter 2	%w/w	1	4	9	2	4	3	4
Sedimentation Diameter 3	mm	0.0001	0.0291	0.0266	0.0289	0.0284	0.0278	0.0278
Passing Sedimentation Diameter 3	%w/w	1	21	53	25	31	38	38
Retained Sedimentation Diameter 3	%w/w	1	1	7	2	2	2	2
Sedimentation Diameter 4	mm	0.0001	0.0207	0.0190	0.0205	0.0202	0.0198	0.0198
Passing Sedimentation Diameter 4	%w/w	1	20	51	24	29	36	36
Retained Sedimentation Diameter 4	%w/w	1	1	2	1	2	2	2
Sedimentation Diameter 5	mm	0.0001	0.0152	0.0140	0.0150	0.0147	0.0146	0.0146
Passing Sedimentation Diameter 5	%w/w	1	18	47	23	29	34	34
Retained Sedimentation Diameter 5	%w/w	1	2	4	1	<1	2	2
Sedimentation Diameter 6	mm	0.0001	0.0108	0.0102	0.0106	0.0105	0.0104	0.0104
Passing Sedimentation Diameter 6	%w/w	1	16	38	21	27	31	31
Retained Sedimentation Diameter 6	%w/w	1	2	9	1	2	2	2
Sedimentation Diameter 7	mm	0.0001	0.0076	0.0072	0.0075	0.0075	0.0074	0.0074
Passing Sedimentation Diameter 7	%w/w	1	16	36	20	25	29	29
Retained Sedimentation Diameter 7	%w/w	1	<1	2	1	2	2	2
Sedimentation Diameter 8	mm	0.0001	0.0054	0.0052	0.0054	0.0053	0.0053	0.0053
Passing Sedimentation Diameter 8	%w/w	1	14	29	18	21	26	26
Retained Sedimentation Diameter 8	%w/w	1	2	7	2	3	3	3
Sedimentation Diameter 9	mm	0.0001	0.0039	0.0037	0.0038	0.0038	0.0037	0.0037
Passing Sedimentation Diameter 9	%w/w	1	13	28	18	19	26	25
Retained Sedimentation Diameter 9	%w/w	1	1	1	<1	2	<1	1
Sedimentation Diameter 10	mm	0.0001	0.0016	0.0015	0.0016	0.0016	0.0015	0.0015
Passing Sedimentation Diameter 10	%w/w	1	9	25	16	17	23	23
Retained Sedimentation Diameter 10	%w/w	1	3	3	2	2	3	2
Sedimentation Diameter 11	mm	0.0001	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011
Passing Sedimentation Diameter 11	%w/w	1	7	23	14	16	20	20
Retained Sedimentation Diameter 11	%w/w	1	2	2	2	1	2	2
Sedimentation Diameter 12	mm	0.0001	-	-	-	-	-	-
Passing Sedimentation Diameter 12	%w/w	1	-	-	-	-	-	-
Retained Sedimentation Diameter 12	%w/w	1	-	-	-	-	-	-

Particle sizing of soils <75µm by hydrometer [AN005] (continued)

PARAMETER	UOM	LOR	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP17 2.9-3.0 SOIL - 11/12/2014 SE134396.029
Sedimentation Diameter 1	mm	0.0001	0.0584	0.0519
Passing Sedimentation Diameter 1	%w/w	1	20	62
Retained Sedimentation Diameter 1	%w/w	1	57	7
Sedimentation Diameter 2	mm	0.0001	0.0416	0.0371
Passing Sedimentation Diameter 2	%w/w	1	18	59
Retained Sedimentation Diameter 2	%w/w	1	2	3
Sedimentation Diameter 3	mm	0.0001	0.0296	0.0265
Passing Sedimentation Diameter 3	%w/w	1	16	56
Retained Sedimentation Diameter 3	%w/w	1	2	3
Sedimentation Diameter 4	mm	0.0001	0.0209	0.0188
Passing Sedimentation Diameter 4	%w/w	1	16	53
Retained Sedimentation Diameter 4	%w/w	1	<1	2
Sedimentation Diameter 5	mm	0.0001	0.0153	0.0138
Passing Sedimentation Diameter 5	%w/w	1	16	51
Retained Sedimentation Diameter 5	%w/w	1	<1	2
Sedimentation Diameter 6	mm	0.0001	0.0108	0.0099
Passing Sedimentation Diameter 6	%w/w	1	15	49
Retained Sedimentation Diameter 6	%w/w	1	1	2
Sedimentation Diameter 7	mm	0.0001	0.0077	0.0070
Passing Sedimentation Diameter 7	%w/w	1	14	47
Retained Sedimentation Diameter 7	%w/w	1	1	2
Sedimentation Diameter 8	mm	0.0001	0.0054	0.0050
Passing Sedimentation Diameter 8	%w/w	1	14	45
Retained Sedimentation Diameter 8	%w/w	1	<1	2
Sedimentation Diameter 9	mm	0.0001	0.0038	0.0036
Passing Sedimentation Diameter 9	%w/w	1	14	42
Retained Sedimentation Diameter 9	%w/w	1	<1	2
Sedimentation Diameter 10	mm	0.0001	0.0016	0.0015
Passing Sedimentation Diameter 10	%w/w	1	14	40
Retained Sedimentation Diameter 10	%w/w	1	<1	2
Sedimentation Diameter 11	mm	0.0001	0.0011	0.0010
Passing Sedimentation Diameter 11	%w/w	1	14	38
Retained Sedimentation Diameter 11	%w/w	1	<1	2
Sedimentation Diameter 12	mm	0.0001	-	-
Passing Sedimentation Diameter 12	%w/w	1	-	-
Retained Sedimentation Diameter 12	%w/w	1	-	-

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest [AN040/AN320]

PARAMETER	UOM	LOR	TP8 0.0-0.1 SOIL - 10/12/2014 SE134396.001	TP8 0.9-1.0 SOIL - 10/12/2014 SE134396.002	TP8 2.8-2.9 SOIL - 10/12/2014 SE134396.004	TP9 0.0-0.1 SOIL - 10/12/2014 SE134396.005	TP9 1.1-1.2 SOIL - 10/12/2014 SE134396.006	TP9 2.9-3.0 SOIL - 10/12/2014 SE134396.007
Arsenic, As	mg/kg	3	6	7	5	7	18	12
Cadmium, Cd	mg/kg	0.3	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.3	18	18	13	19	11	11
Copper, Cu	mg/kg	0.5	18	21	6.9	14	21	21
Lead, Pb	mg/kg	1	47	130	16	17	10	15
Iron, Fe	mg/kg	50	-	-	-	-	34000	-
Nickel, Ni	mg/kg	0.5	13	15	8.7	15	59	24
Zinc, Zn	mg/kg	0.5	290	470	170	41	31	110

PARAMETER	UOM	LOR	TP9 3.9-4.0 SOIL - 10/12/2014 SE134396.008	TP10 0.4-0.5 SOIL - 11/12/2014 SE134396.009	TP10 1.9-2.0 SOIL - 11/12/2014 SE134396.010	TP10 3.9-4.0 SOIL - 11/12/2014 SE134396.011	TP11 0.0-0.1 SOIL - 11/12/2014 SE134396.012	TP11 0.4-0.5 SOIL - 11/12/2014 SE134396.013
Arsenic, As	mg/kg	3	6	11	14	11	6	6
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.3	25	12	14	14	16	32
Copper, Cu	mg/kg	0.5	16	29	18	38	9.9	12
Lead, Pb	mg/kg	1	35	23	15	22	38	38
Iron, Fe	mg/kg	50	15000	-	-	-	-	21000
Nickel, Ni	mg/kg	0.5	8.8	30	46	25	8.8	10
Zinc, Zn	mg/kg	0.5	58	84	45	91	160	30

PARAMETER	UOM	LOR	TP12 0.0-0.1 SOIL - 10/12/2014 SE134396.014	TP12 0.4-0.5 SOIL - 10/12/2014 SE134396.015	TP13 0.0-0.1 SOIL - 11/12/2014 SE134396.016	TP13 1.9-2.0 SOIL - 11/12/2014 SE134396.017	TP13 3.5-3.6 SOIL - 11/12/2014 SE134396.018	TP14 0.0-0.1 SOIL - 11/12/2014 SE134396.019
Arsenic, As	mg/kg	3	7	6	9	13	4	5
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	2.3	0.5	<0.3	<0.3
Chromium, Cr	mg/kg	0.3	22	15	39	28	28	36
Copper, Cu	mg/kg	0.5	47	46	35	45	15	16
Lead, Pb	mg/kg	1	480	500	140	110	32	20
Iron, Fe	mg/kg	50	-	-	-	36000	28000	-
Nickel, Ni	mg/kg	0.5	8.2	10	23	23	11	13
Zinc, Zn	mg/kg	0.5	160	150	440	450	240	43

PARAMETER	UOM	LOR	TP 14 0.9-1.0 SOIL - 11/12/2014 SE134396.020	TP14 2.9-3.0 SOIL - 11/12/2014 SE134396.021	TP14 5.4-5.5 SOIL - 11/12/2014 SE134396.022	TP15 0.0-0.1 SOIL - 10/12/2014 SE134396.023	TP15 0.9-1.0 SOIL - 10/12/2014 SE134396.024	TP16 0.0-0.1 SOIL - 11/12/2014 SE134396.025
Arsenic, As	mg/kg	3	6	10	11	6	15	5
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.3	24	13	9.7	24	20	23
Copper, Cu	mg/kg	0.5	12	16	28	11	16	10
Lead, Pb	mg/kg	1	31	20	67	35	110	41
Iron, Fe	mg/kg	50	-	-	-	-	28000	-
Nickel, Ni	mg/kg	0.5	8.9	26	30	8.2	7.2	7.6
Zinc, Zn	mg/kg	0.5	38	55	90	47	70	68

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest [AN040/AN320] (continued)

PARAMETER	UOM	LOR	TP16 0.6-0.7 SOIL - 11/12/2014 SE134396.026	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP17 0.9-1.0 SOIL - 11/12/2014 SE134396.028	TP17 2.9-3.0 SOIL - 11/12/2014 SE134396.029	TP18 0.0-0.1 SOIL - 11/12/2014 SE134396.030	TP18 0.6-0.7 SOIL - 11/12/2014 SE134396.031
Arsenic, As	mg/kg	3	5	8	5	<3	4	5
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.3	20	17	18	19	24	23
Copper, Cu	mg/kg	0.5	9.2	16	15	9.7	8.6	13
Lead, Pb	mg/kg	1	41	29	27	11	33	43
Iron, Fe	mg/kg	50	-	20000	-	28000	-	-
Nickel, Ni	mg/kg	0.5	5.8	13	9.9	12	7.8	9.4
Zinc, Zn	mg/kg	0.5	36	70	42	97	73	36

PARAMETER	UOM	LOR	TP19 0.0-0.1 SOIL - 11/12/2014 SE134396.032	TP19 0.6-0.7 SOIL - 11/12/2014 SE134396.033	QC7 SOIL - 10/12/2014 SE134396.034	QC9 SOIL - 11/12/2014 SE134396.035
Arsenic, As	mg/kg	3	4	5	5	11
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.3	29	24	17	13
Copper, Cu	mg/kg	0.5	6.4	15	8.3	28
Lead, Pb	mg/kg	1	24	16	16	22
Iron, Fe	mg/kg	50	-	-	-	-
Nickel, Ni	mg/kg	0.5	6.8	9.2	9.4	39
Zinc, Zn	mg/kg	0.5	40	29	220	46

Mercury in Soil [AN312]

PARAMETER	UOM	LOR	TP8 0.0-0.1 SOIL - 10/12/2014 SE134396.001	TP8 0.9-1.0 SOIL - 10/12/2014 SE134396.002	TP8 2.8-2.9 SOIL - 10/12/2014 SE134396.004	TP9 0.0-0.1 SOIL - 10/12/2014 SE134396.005	TP9 1.1-1.2 SOIL - 10/12/2014 SE134396.006	TP9 2.9-3.0 SOIL - 10/12/2014 SE134396.007
Mercury	mg/kg	0.01	0.04	0.04	<0.01	0.01	<0.01	0.02

PARAMETER	UOM	LOR	TP9 3.9-4.0 SOIL - 10/12/2014 SE134396.008	TP10 0.4-0.5 SOIL - 11/12/2014 SE134396.009	TP10 1.9-2.0 SOIL - 11/12/2014 SE134396.010	TP10 3.9-4.0 SOIL - 11/12/2014 SE134396.011	TP11 0.0-0.1 SOIL - 11/12/2014 SE134396.012	TP11 0.4-0.5 SOIL - 11/12/2014 SE134396.013
Mercury	mg/kg	0.01	0.01	<0.01	<0.01	0.01	0.03	0.02

PARAMETER	UOM	LOR	TP12 0.0-0.1 SOIL - 10/12/2014 SE134396.014	TP12 0.4-0.5 SOIL - 10/12/2014 SE134396.015	TP13 0.0-0.1 SOIL - 11/12/2014 SE134396.016	TP13 1.9-2.0 SOIL - 11/12/2014 SE134396.017	TP13 3.5-3.6 SOIL - 11/12/2014 SE134396.018	TP14 0.0-0.1 SOIL - 11/12/2014 SE134396.019
Mercury	mg/kg	0.01	<0.01	<0.01	0.06	0.04	<0.01	<0.01

PARAMETER	UOM	LOR	TP 14 0.9-1.0 SOIL - 11/12/2014 SE134396.020	TP14 2.9-3.0 SOIL - 11/12/2014 SE134396.021	TP14 5.4-5.5 SOIL - 11/12/2014 SE134396.022	TP15 0.0-0.1 SOIL - 10/12/2014 SE134396.023	TP15 0.9-1.0 SOIL - 10/12/2014 SE134396.024	TP16 0.0-0.1 SOIL - 11/12/2014 SE134396.025
Mercury	mg/kg	0.01	0.04	0.02	<0.01	0.01	<0.01	<0.01

PARAMETER	UOM	LOR	TP16 0.6-0.7 SOIL - 11/12/2014 SE134396.026	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP17 0.9-1.0 SOIL - 11/12/2014 SE134396.028	TP17 2.9-3.0 SOIL - 11/12/2014 SE134396.029	TP18 0.0-0.1 SOIL - 11/12/2014 SE134396.030	TP18 0.6-0.7 SOIL - 11/12/2014 SE134396.031
Mercury	mg/kg	0.01	<0.01	0.06	0.02	0.01	0.02	<0.01

PARAMETER	UOM	LOR	TP19 0.0-0.1 SOIL - 11/12/2014 SE134396.032	TP19 0.6-0.7 SOIL - 11/12/2014 SE134396.033	QC7 SOIL - 10/12/2014 SE134396.034	QC9 SOIL - 11/12/2014 SE134396.035
Mercury	mg/kg	0.01	0.01	0.05	<0.01	<0.01

Gravimetric Determination of Asbestos in Soil [AN605]

PARAMETER	UOM	LOR	TP8 0.0-0.1 SOIL - 10/12/2014 SE134396.001	TP8 0.9-1.0 SOIL - 10/12/2014 SE134396.002	TP8 1.9-2.0 SOIL - 10/12/2014 SE134396.003	TP8 2.8-2.9 SOIL - 10/12/2014 SE134396.004	TP9 0.0-0.1 SOIL - 10/12/2014 SE134396.005	TP9 1.1-1.2 SOIL - 10/12/2014 SE134396.006
Total Sample Weight*	g	1	566	537	495	749	666	465
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm	%w/w	0.001	<0.001	0.028	<0.001	<0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fibre Type*	No unit	-	-	CRY	-	-	-	-

PARAMETER	UOM	LOR	TP9 2.9-3.0 SOIL - 10/12/2014 SE134396.007	TP9 3.9-4.0 SOIL - 10/12/2014 SE134396.008	TP10 0.4-0.5 SOIL - 11/12/2014 SE134396.009	TP10 1.9-2.0 SOIL - 11/12/2014 SE134396.010	TP10 3.9-4.0 SOIL - 11/12/2014 SE134396.011	TP11 0.0-0.1 SOIL - 11/12/2014 SE134396.012
Total Sample Weight*	g	1	513	599	875	696	724	368
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fibre Type*	No unit	-	-	-	-	-	-	-

PARAMETER	UOM	LOR	TP11 0.4-0.5 SOIL - 11/12/2014 SE134396.013	TP12 0.0-0.1 SOIL - 10/12/2014 SE134396.014	TP12 0.4-0.5 SOIL - 10/12/2014 SE134396.015	TP13 0.0-0.1 SOIL - 11/12/2014 SE134396.016	TP13 1.9-2.0 SOIL - 11/12/2014 SE134396.017	TP13 3.5-3.6 SOIL - 11/12/2014 SE134396.018
Total Sample Weight*	g	1	605	744	493	440	590	527
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm	%w/w	0.001	<0.001	<0.001	<0.001	5.7	0.046	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	0.37	0.053	<0.001
Fibre Type*	No unit	-	-	-	-	CRY,AMO,CRO	CRY,AMO,CRO	-

PARAMETER	UOM	LOR	TP14 0.0-0.1 SOIL - 11/12/2014 SE134396.019	TP 14 0.9-1.0 SOIL - 11/12/2014 SE134396.020	TP14 2.9-3.0 SOIL - 11/12/2014 SE134396.021	TP14 5.4-5.5 SOIL - 11/12/2014 SE134396.022	TP15 0.0-0.1 SOIL - 10/12/2014 SE134396.023	TP15 0.9-1.0 SOIL - 10/12/2014 SE134396.024
Total Sample Weight*	g	1	570	853	977	652	459	606
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fibre Type*	No unit	-	-	-	-	-	-	-

PARAMETER	UOM	LOR	TP16 0.0-0.1 SOIL - 11/12/2014 SE134396.025	TP16 0.6-0.7 SOIL - 11/12/2014 SE134396.026	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP17 0.9-1.0 SOIL - 11/12/2014 SE134396.028	TP17 2.9-3.0 SOIL - 11/12/2014 SE134396.029	TP18 0.0-0.1 SOIL - 11/12/2014 SE134396.030
Total Sample Weight*	g	1	424	698	472	594	650	621
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fibre Type*	No unit	-	-	-	-	-	-	-

Gravimetric Determination of Asbestos in Soil [AN605] (continued)

PARAMETER	UOM	LOR	TP18 0.6-0.7 SOIL - 11/12/2014 SE134396.031	TP19 0.0-0.1 SOIL - 11/12/2014 SE134396.032	TP19 0.6-0.7 SOIL - 11/12/2014 SE134396.033	QC7 SOIL - 10/12/2014 SE134396.034	QC9 SOIL - 11/12/2014 SE134396.035
Total Sample Weight*	g	1	**615**	**618**	**637**	**728**	**669**
Asbestos in soil (>7mm ACM)*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Asbestos in soil (>2mm to <7mm	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos in soil (<2mm AF/FA)*	%w/w	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fibre Type*	No unit	-	-	-	-	-	-

Fibre ID in bulk materials [AN602]

PARAMETER	UOM	LOR	TP9 0.0-0.1 MATERIAL - 10/12/2014 SE134396.038
Asbestos Detected	No unit	-	Yes

Moisture Content [AN002]

PARAMETER	UOM	LOR	TP8 0.0-0.1 SOIL - 10/12/2014 SE134396.001	TP8 0.9-1.0 SOIL - 10/12/2014 SE134396.002	TP8 2.8-2.9 SOIL - 10/12/2014 SE134396.004	TP9 0.0-0.1 SOIL - 10/12/2014 SE134396.005	TP9 1.1-1.2 SOIL - 10/12/2014 SE134396.006	TP9 2.9-3.0 SOIL - 10/12/2014 SE134396.007
% Moisture	%	0.5	15	18	8.7	13	16	24

PARAMETER	UOM	LOR	TP9 3.9-4.0 SOIL - 10/12/2014 SE134396.008	TP10 0.4-0.5 SOIL - 11/12/2014 SE134396.009	TP10 1.9-2.0 SOIL - 11/12/2014 SE134396.010	TP10 3.9-4.0 SOIL - 11/12/2014 SE134396.011	TP11 0.0-0.1 SOIL - 11/12/2014 SE134396.012	TP11 0.4-0.5 SOIL - 11/12/2014 SE134396.013
% Moisture	%	0.5	16	5.9	8.6	8.7	33	16

PARAMETER	UOM	LOR	TP12 0.0-0.1 SOIL - 10/12/2014 SE134396.014	TP12 0.4-0.5 SOIL - 10/12/2014 SE134396.015	TP13 0.0-0.1 SOIL - 11/12/2014 SE134396.016	TP13 1.9-2.0 SOIL - 11/12/2014 SE134396.017	TP13 3.5-3.6 SOIL - 11/12/2014 SE134396.018	TP14 0.0-0.1 SOIL - 11/12/2014 SE134396.019
% Moisture	%	0.5	18	21	29	12	18	18

PARAMETER	UOM	LOR	TP 14 0.9-1.0 SOIL - 11/12/2014 SE134396.020	TP14 2.9-3.0 SOIL - 11/12/2014 SE134396.021	TP14 5.4-5.5 SOIL - 11/12/2014 SE134396.022	TP15 0.0-0.1 SOIL - 10/12/2014 SE134396.023	TP15 0.9-1.0 SOIL - 10/12/2014 SE134396.024	TP16 0.0-0.1 SOIL - 11/12/2014 SE134396.025
% Moisture	%	0.5	11	7.9	6.9	34	15	23

PARAMETER	UOM	LOR	TP16 0.6-0.7 SOIL - 11/12/2014 SE134396.026	TP17 0.0-0.1 SOIL - 11/12/2014 SE134396.027	TP17 0.9-1.0 SOIL - 11/12/2014 SE134396.028	TP17 2.9-3.0 SOIL - 11/12/2014 SE134396.029	TP18 0.0-0.1 SOIL - 11/12/2014 SE134396.030	TP18 0.6-0.7 SOIL - 11/12/2014 SE134396.031
% Moisture	%	0.5	9.8	30	9.7	14	16	13

PARAMETER	UOM	LOR	TP19 0.0-0.1 SOIL - 11/12/2014 SE134396.032	TP19 0.6-0.7 SOIL - 11/12/2014 SE134396.033	QC7 SOIL - 10/12/2014 SE134396.034	QC9 SOIL - 11/12/2014 SE134396.035
% Moisture	%	0.5	19	16	14	7.5

Sample Subcontracted []

PARAMETER	UOM	LOR	TP8 2.8-2.9 SOIL - 10/12/2014 SE134396.004
Sample Subcontracted*	No unit	-	SUBCONTRACTED

VOCs in Water [AN433/AN434]

PARAMETER	UOM	LOR	TB4 WATER - 11/12/2014 SE134396.036	TS4 WATER - 11/12/2014 SE134396.037
Benzene	µg/L	0.5	<0.5	[112%]
Toluene	µg/L	0.5	<0.5	[105%]
Ethylbenzene	µg/L	0.5	<0.5	[111%]
m/p-xylene	µg/L	1	<1	[114%]
o-xylene	µg/L	0.5	<0.5	[113%]
Total Xylenes	µg/L	1.5	<1.5	-
Total BTEX	µg/L	3	<3	-
Naphthalene	µg/L	0.5	<0.5	-

Volatile Petroleum Hydrocarbons in Water [AN433/AN434/AN410]

PARAMETER	UOM	LOR	TB4 WATER - 11/12/2014 SE134396.036
TRH C6-C9	µg/L	40	<40
Benzene (F0)	µg/L	0.5	<0.5
TRH C6-C10	µg/L	50	<50
TRH C6-C10 minus BTEX (F1)	µg/L	50	<50

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN005	The particle size distribution of a soil is determined by wet sieving, using a maximum of 900 mL of deionised water to sieve all fractions down to 75 µm. Referenced to AS1289.3.6.1 and AS1141.11.
AN040	A portion of sample is digested with Nitric acid to decompose organic matter and Hydrochloric acid to complete the digestion of metals and then filtered for analsysis by ASS or ICP as per USEPA Method 200.8.
AN040/AN320	A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.
AN088	Orbital rolling for Organic pollutants are extracted from soil/sediment by transferring an appropriate mass of sample to a clear soil jar and extracting with 1:1 Dichloromethane/Acetone. Orbital Rolling method is intended for the extraction of semi-volatile organic compounds from soil/sediment samples, and is based somewhat on USEPA method 3570 (Micro Organic extraction and sample preparation). Method 3700.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl2) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN122	Exchangeable Cations, CEC and ESP: Soil sample is extracted in 1M Ammonium Acetate at pH=7 (or 1M Ammonium Chloride at pH=7) with cations (Na, K, Ca & Mg) then determined by ICP OES/ICP MS and reported as Exchangeable Cations. For saline soils, these results can be corrected for water soluble cations and reported as Exchangeable cations in meq/100g or soil can be pretreated (aqueous ethanol/aqueous glycerol) prior to extraction. Cation Exchange Capacity (CEC) is the sum of the exchangeable cations in meq/100g.
AN188	The organic material in the soil sample is oxidised with chromic acid in the presence of excess sulphuric acid, without external heat being applied. The excess dichromate ion is determined by titration with standard ammonium iron (II) sulphate solution and the amount of oxidised material is calculated from the quantity of dichromate reduced. Referenced to NEPM 105 and AS1289.1.1.1.
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500
AN400	OC and OP Pesticides by GC-ECD: The determination of organochlorine (OC) and organophosphorus (OP) pesticides and polychlorinated biphenyls (PCBs) in soils, sludges and groundwater. (Based on USEPA methods 3510, 3550, 8140 and 8080.)
AN403	Total Recoverable Hydrocarbons: Determination of Hydrocarbons by gas chromatography after a solvent extraction. Detection is by flame ionisation detector (FID) that produces an electronic signal in proportion to the combustible matter passing through it. Total Recoverable Hydrocarbons (TRH) are routinely reported as four alkane groupings based on the carbon chain length of the compounds: C6-C9, C10-C14, C15-C28 and C29-C36 and in recognition of the NEPM 1999 (2013), >C10-C16 (F2), >C16-C34 (F3) and >C34-C40 (F4). F2 is reported directly and also corrected by subtracting Naphthalene (from VOC method AN433) where available.
AN420	(SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols (etc) in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).
AN433/AN434	VOCs and C6-C9 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.
AN433/AN434/AN410	VOCs and C6-C9/C6-C10 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.
AN602	Qualitative identification of chrysotile, amosite and crocidolite in bulk samples by polarised light microscopy (PLM) in conjunction with dispersion staining (DS). AS4964 provides the basis for this document. Unequivocal identification of the asbestos minerals present is made by obtaining sufficient diagnostic `clues`, which provide a reasonable degree of certainty, dispersion staining is a mandatory `clue` for positive identification. If sufficient `clues` are absent, then positive identification of asbestos is not possible. This procedure requires removal of suspect fibres/bundles from the sample which cannot be returned.
AN605	This technique gravimetrically deteremines the mass of Asbestos Containing Material retained on a 7mm Sieve and assumes that 15% of this ACM is asbestos. This calculated asbestos weight is then calculated as a percentage of the total sample weight.

FOOTNOTES

*	Analysis not covered by the scope of accreditation.	-	Not analysed.	UOM	Unit of Measure.
		NVL	Not validated.	LOR	Limit of Reporting.
**	Indicative data, theoretical holding time exceeded.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		
^	Performed by outside laboratory.				

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: http://www.sgs.com.au/~/media/Local/Australia/Documents/ Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

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ANALYTICAL REPORT

WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS

Contact	Ben Kendon
Client	Robson Environmental Pty Ltd
Address	140 Gladstone Street, FYSHWICK PO Box 112, FYSHWICK ACT 2609
Telephone	(02) 6239 5656
Facsimile	(02) 6239 5669
Email	ben@robsonlabs.com.au
Project	**9623 - ESA - Old Canberra Brickworks**
Order Number	(Not specified)
Samples	38

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	SE134396 R0
Report Number	0000099678
Date Reported	06 Jan 2015
Date Received	12 Dec 2014

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

Clay Content subcontracted to SGS Cairns, 2/58 Comport St, Portsmith QLD 4870, NATA Accreditation Number: 2562, Site Number: 3146.
E.Coli, Faecal Coliforms and Total Coliforms subcontracted to SONIC FOOD & WATER TESTING, 31-33 Lawson Street Penrith NSW 2750, NATA Accreditation Number: 4034.

Sample # 2 : Asbestos fibre bundles found in 10x4x3mm cement sheet fragments.
Sample # 16 : Asbestos fibre bundles found in cement sheet fragments and found loose in sample.
Sample # 17 : Asbestos fibre bundles found in cement sheet fragments,fibrous insulation material and loose in sample

No respirable fibres detected in all samples using trace analysis technique as per AS 4964-2004.
Asbestos weight is approximate.
FA +AF measured gravimetrically (excluding free fibres).

Asbestos analysed by Approved Identifier Ravee Sivasubramaniam .

SIGNATORIES

Deanne Norris
Organic Chemist

Dong Liang
Metals/Inorganics Team Leader

Ly Kim Ha
Organic Section Head

Ravee Sivasubramaniam
Asbestos Analyst

ANALYTICAL REPORT

RESULTS

Fibre ID in bulk materials — Method AN602

Laboratory Reference	Client Reference	Matrix	Sample Description	Date Sampled	Fibre Identification	Est.%w/w
SE134396.038	TP9 0.0-0.1	Other	100x60x5mm Cement sheet fragments	10 Dec 2014	Amosite, Chrysotile & Crocidolite Asbestos Detected	

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN602	Qualitative identification of chrysotile, amosite and crocidolite in bulk samples by polarised light microscopy (PLM) in conjunction with dispersion staining (DS). AS4964 provides the basis for this document. Unequivocal identification of the asbestos minerals present is made by obtaining sufficient diagnostic `clues`, which provide a reasonable degree of certainty, dispersion staining is a mandatory `clue` for positive identification. If sufficient `clues` are absent, then positive identification of asbestos is not possible. This procedure requires removal of suspect fibres/bundles from the sample which cannot be returned.
AN602	Fibres/material that cannot be unequivocably identified as one of the three asbestos forms, will be reported as unknown mineral fibres (umf).
AN605	This technique gravimetrically deteremines the mass of Asbestos Containing Material retained on a 7mm Sieve and assumes that 15% of this ACM is asbestos. This calculated asbestos weight is then calculated as a percentage of the total sample weight.
AN605	This technique also gravimetrically deteremines the mass of Fibrous Asbestos (FA) and Asbestos Fines (AF) Containing Material retained on and passing a 2mm sieve post 7mm Sieving. Assumes that FA and AF are 100% asbestos containing. This calculated asbestos weight is then calculated as a percentage of the screened fraction sample weights.
AN605	AMO = Amosite CRY = Chrysotile CRO = Crocidolite
AN605	In sofar as is trechnically feasible, this report is consistent with the analytical reporting recommendations in the Western Australian Department of Health Guidelines for the Assessment Remediation and Management of Asbestos - Contaminated Sites in Western Australia - May 2009.

FOOTNOTES

Amosite	-	Brown Asbestos	NA	-	Not Analysed
Chrysotile	-	White Asbestos	LNR	-	Listed, Not Required
Crocidolite	-	Blue Asbestos	*	-	Not Accredited
Amphiboles	-	Amosite and/or Crocidolite	**	-	Indicative data, theoretical holding time exceeded.

(In reference to soil samples only) This report does not comply with the analytical reporting recommendations in the Western Australian Department of Health Guidelines for the Assessment and Remediation and Management of Asbestos Contaminated sites in Western Australia - May 2009.

Sampled by the client.

Where reported: 'Asbestos Detected': Asbestos detected by polarized light microscopy, including dispersion staining.
Where reported: 'No Asbestos Found': No Asbestos Found by polarized light microscopy, including dispersion staining.
Where reported: 'UMF Detected': Mineral fibres of unknown type detected by polarized light microscopy, including dispersion staining. Confirmation by another independent analytical technique may be necessary.

Even after disintegration it can be very difficult, or impossible, to detect the presence of asbestos in some asbestos-containing bulk materials using polarised light microscopy. This is due to the low grade or small length or diameter of asbestos fibres present in the material, or to the fact that very fine fibres have been distributed intimately throughout the materials.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions/General-Conditions-of-Services-English.aspx. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

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MICROBIOLOGY FINAL REPORT

SONIC FOOD & WATER TESTING

CERTIFICATE OF ANALYSIS

W1417906
[]

S.G.S AUSTRALIA PTY LTD
ALEX STENTA
U16/33 MADDOX STREET
ALEXANDRIA NSW 2015

Lab Number:	264505349
Customer Reference Number:	1220
Site:	N134396.004
Sample Type:	SOIL
Sample Notes:	
Date and Time of Collection:	Unknown,0000
Date and Time of Testing:	13/12/14,0700
Collected By:	The Client
Tested:	As Received

TESTS	RESULTS	UNITS
FAECAL COLIFORM COUNT:	Less than 200	most probable number per 100gram
ESCHERICHIA COLI COUNT:	Less than 200	most probable number per 100gram
ESCHERICHIA COLI NOT DETECTED BY THE METHOD		
TOTAL COLIFORM COUNT:	200	most probable number per 100gram

METHODS

* Total Coliforms - Sonic Food and Water Testing in-house Most Probable Number Method WT18-2008.
* Faecal Coliform - Sonic Food and Water Testing in-house Most Probable Number Method WT19-2008.
* Escherichia coli - Sonic Food and Water Testing in-house Most Probable Number method WT19-2008.

The time between sampling and the commencement of testing should not exceed 24 hours.

Signed:. . . . . RB Date:06/01/15

T.Morgan Laboratory Manager; T.Shetty Quality Manager; H.Sialepis Technical Officer; L.Vanhoff Technical Officer; K.McClenahan Scientific Officer; M.Lee Scientific Officer; P.Campora Scientific Officer; R.Bhatt Scientific Officer

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Accreditation No. 4034

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STATEMENT OF QA/QC PERFORMANCE

SE134396 R0

CLIENT DETAILS

Contact	Ben Kendon
Client	Robson Environmental Pty Ltd
Address	140 Gladstone Street, FYSHWICK PO Box 112, FYSHWICK ACT 2609
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Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	SE134396 R0
Report Number	0000099679
Date Reported	06 Jan 2015

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS Environmental Services' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document and was supplied by the Client.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Analysis Date	pH in soil (1:5)	8 items
Duplicate	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	1 item
Matrix Spike	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	2 items
	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	7 items

SAMPLE SUMMARY

Sample counts by matrix	35 Soils, 2 Waters &	Type of documentation received	COC
Date documentation received	12/12/2014	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	4.7°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes		

HOLDING TIME SUMMARY

SE134396 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP9 1.1-1.2	SE134396.006	LB069537	10 Dec 2014	12 Dec 2014	07 Jan 2015	18 Dec 2014	07 Jan 2015	23 Dec 2014
TP9 3.9-4.0	SE134396.008	LB069537	10 Dec 2014	12 Dec 2014	07 Jan 2015	18 Dec 2014	07 Jan 2015	22 Dec 2014
TP11 0.4-0.5	SE134396.013	LB069537	11 Dec 2014	12 Dec 2014	08 Jan 2015	18 Dec 2014	08 Jan 2015	22 Dec 2014
TP13 1.9-2.0	SE134396.017	LB069537	11 Dec 2014	12 Dec 2014	08 Jan 2015	18 Dec 2014	08 Jan 2015	23 Dec 2014
TP13 3.5-3.6	SE134396.018	LB069537	11 Dec 2014	12 Dec 2014	08 Jan 2015	18 Dec 2014	08 Jan 2015	22 Dec 2014
TP15 0.9-1.0	SE134396.024	LB069537	10 Dec 2014	12 Dec 2014	07 Jan 2015	18 Dec 2014	07 Jan 2015	22 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069537	11 Dec 2014	12 Dec 2014	08 Jan 2015	18 Dec 2014	08 Jan 2015	22 Dec 2014
TP17 2.9-3.0	SE134396.029	LB069537	11 Dec 2014	12 Dec 2014	08 Jan 2015	18 Dec 2014	08 Jan 2015	22 Dec 2014

Gravimetric Determination of Asbestos in Soil

Method: ME-(AU)-[ENV]AN605

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP8 0.0-0.1	SE134396.001	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
TP8 0.9-1.0	SE134396.002	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
TP8 1.9-2.0	SE134396.003	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
TP8 2.8-2.9	SE134396.004	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
TP9 0.0-0.1	SE134396.005	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
TP9 1.1-1.2	SE134396.006	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
TP9 2.9-3.0	SE134396.007	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
TP9 3.9-4.0	SE134396.008	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
TP10 0.4-0.5	SE134396.009	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP10 1.9-2.0	SE134396.010	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP10 3.9-4.0	SE134396.011	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP11 0.0-0.1	SE134396.012	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP11 0.4-0.5	SE134396.013	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP12 0.0-0.1	SE134396.014	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
TP12 0.4-0.5	SE134396.015	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
TP13 0.0-0.1	SE134396.016	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP13 1.9-2.0	SE134396.017	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP13 3.5-3.6	SE134396.018	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP14 0.0-0.1	SE134396.019	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP 14 0.9-1.0	SE134396.020	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP14 2.9-3.0	SE134396.021	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP14 5.4-5.5	SE134396.022	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP15 0.0-0.1	SE134396.023	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
TP15 0.9-1.0	SE134396.024	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
TP16 0.0-0.1	SE134396.025	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP16 0.6-0.7	SE134396.026	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP17 0.9-1.0	SE134396.028	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP17 2.9-3.0	SE134396.029	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP18 0.0-0.1	SE134396.030	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP18 0.6-0.7	SE134396.031	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP19 0.0-0.1	SE134396.032	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
TP19 0.6-0.7	SE134396.033	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014
QC7	SE134396.034	LB069663	10 Dec 2014	12 Dec 2014	08 Jun 2015	19 Dec 2014	08 Jun 2015	23 Dec 2014
QC9	SE134396.035	LB069663	11 Dec 2014	12 Dec 2014	09 Jun 2015	19 Dec 2014	09 Jun 2015	23 Dec 2014

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP8 0.0-0.1	SE134396.001	LB069367	10 Dec 2014	12 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP8 0.9-1.0	SE134396.002	LB069367	10 Dec 2014	12 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP8 2.8-2.9	SE134396.004	LB069367	10 Dec 2014	12 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP9 0.0-0.1	SE134396.005	LB069367	10 Dec 2014	12 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP9 1.1-1.2	SE134396.006	LB069367	10 Dec 2014	12 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP9 2.9-3.0	SE134396.007	LB069367	10 Dec 2014	12 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP9 3.9-4.0	SE134396.008	LB069367	10 Dec 2014	12 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP10 0.4-0.5	SE134396.009	LB069367	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	22 Dec 2014
TP10 1.9-2.0	SE134396.010	LB069367	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	22 Dec 2014
TP10 3.9-4.0	SE134396.011	LB069367	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	22 Dec 2014
TP11 0.0-0.1	SE134396.012	LB069367	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	22 Dec 2014
TP11 0.4-0.5	SE134396.013	LB069367	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	22 Dec 2014

HOLDING TIME SUMMARY

SE134396 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Mercury in Soil (continued)

Method: ME-(AU)-[ENV]AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP12 0.0-0.1	SE134396.014	LB069367	10 Dec 2014	12 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	22 Dec 2014
TP12 0.4-0.5	SE134396.015	LB069368	10 Dec 2014	12 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	19 Dec 2014
TP13 0.0-0.1	SE134396.016	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP13 1.9-2.0	SE134396.017	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP13 3.5-3.6	SE134396.018	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP14 0.0-0.1	SE134396.019	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP 14 0.9-1.0	SE134396.020	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP14 2.9-3.0	SE134396.021	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP14 5.4-5.5	SE134396.022	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP15 0.0-0.1	SE134396.023	LB069368	10 Dec 2014	12 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	19 Dec 2014
TP15 0.9-1.0	SE134396.024	LB069368	10 Dec 2014	12 Dec 2014	07 Jan 2015	16 Dec 2014	07 Jan 2015	19 Dec 2014
TP16 0.0-0.1	SE134396.025	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP16 0.6-0.7	SE134396.026	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP17 0.9-1.0	SE134396.028	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP17 2.9-3.0	SE134396.029	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP18 0.0-0.1	SE134396.030	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP18 0.6-0.7	SE134396.031	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP19 0.0-0.1	SE134396.032	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
TP19 0.6-0.7	SE134396.033	LB069368	11 Dec 2014	12 Dec 2014	08 Jan 2015	16 Dec 2014	08 Jan 2015	19 Dec 2014
QC7	SE134396.034	LB069506	10 Dec 2014	12 Dec 2014	07 Jan 2015	17 Dec 2014	07 Jan 2015	22 Dec 2014
QC9	SE134396.035	LB069506	11 Dec 2014	12 Dec 2014	08 Jan 2015	17 Dec 2014	08 Jan 2015	22 Dec 2014

Moisture Content

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP8 0.0-0.1	SE134396.001	LB069509	10 Dec 2014	12 Dec 2014	24 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP8 0.9-1.0	SE134396.002	LB069509	10 Dec 2014	12 Dec 2014	24 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP8 2.8-2.9	SE134396.004	LB069509	10 Dec 2014	12 Dec 2014	24 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP9 0.0-0.1	SE134396.005	LB069509	10 Dec 2014	12 Dec 2014	24 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP9 1.1-1.2	SE134396.006	LB069509	10 Dec 2014	12 Dec 2014	24 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP9 2.9-3.0	SE134396.007	LB069509	10 Dec 2014	12 Dec 2014	24 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP9 3.9-4.0	SE134396.008	LB069509	10 Dec 2014	12 Dec 2014	24 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP10 0.4-0.5	SE134396.009	LB069509	11 Dec 2014	12 Dec 2014	25 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP10 1.9-2.0	SE134396.010	LB069509	11 Dec 2014	12 Dec 2014	25 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP10 3.9-4.0	SE134396.011	LB069509	11 Dec 2014	12 Dec 2014	25 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP11 0.0-0.1	SE134396.012	LB069509	11 Dec 2014	12 Dec 2014	25 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP11 0.4-0.5	SE134396.013	LB069509	11 Dec 2014	12 Dec 2014	25 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP12 0.0-0.1	SE134396.014	LB069509	10 Dec 2014	12 Dec 2014	24 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP12 0.4-0.5	SE134396.015	LB069509	10 Dec 2014	12 Dec 2014	24 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP13 0.0-0.1	SE134396.016	LB069509	11 Dec 2014	12 Dec 2014	25 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP13 1.9-2.0	SE134396.017	LB069509	11 Dec 2014	12 Dec 2014	25 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP13 3.5-3.6	SE134396.018	LB069509	11 Dec 2014	12 Dec 2014	25 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP14 0.0-0.1	SE134396.019	LB069509	11 Dec 2014	12 Dec 2014	25 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP 14 0.9-1.0	SE134396.020	LB069509	11 Dec 2014	12 Dec 2014	25 Dec 2014	17 Dec 2014	22 Dec 2014	18 Dec 2014
TP14 2.9-3.0	SE134396.021	LB069592	11 Dec 2014	12 Dec 2014	25 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
TP14 5.4-5.5	SE134396.022	LB069592	11 Dec 2014	12 Dec 2014	25 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
TP15 0.0-0.1	SE134396.023	LB069592	10 Dec 2014	12 Dec 2014	24 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
TP15 0.9-1.0	SE134396.024	LB069592	10 Dec 2014	12 Dec 2014	24 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
TP16 0.0-0.1	SE134396.025	LB069592	11 Dec 2014	12 Dec 2014	25 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
TP16 0.6-0.7	SE134396.026	LB069592	11 Dec 2014	12 Dec 2014	25 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069592	11 Dec 2014	12 Dec 2014	25 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
TP17 0.9-1.0	SE134396.028	LB069592	11 Dec 2014	12 Dec 2014	25 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
TP17 2.9-3.0	SE134396.029	LB069592	11 Dec 2014	12 Dec 2014	25 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
TP18 0.0-0.1	SE134396.030	LB069592	11 Dec 2014	12 Dec 2014	25 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
TP18 0.6-0.7	SE134396.031	LB069592	11 Dec 2014	12 Dec 2014	25 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
TP19 0.0-0.1	SE134396.032	LB069592	11 Dec 2014	12 Dec 2014	25 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
TP19 0.6-0.7	SE134396.033	LB069592	11 Dec 2014	12 Dec 2014	25 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
QC7	SE134396.034	LB069592	10 Dec 2014	12 Dec 2014	24 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014
QC9	SE134396.035	LB069592	11 Dec 2014	12 Dec 2014	25 Dec 2014	18 Dec 2014	23 Dec 2014	19 Dec 2014

HOLDING TIME SUMMARY

SE134396 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP8 0.0-0.1	SE134396.001	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP9 0.0-0.1	SE134396.005	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP9 2.9-3.0	SE134396.007	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP10 0.4-0.5	SE134396.009	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP11 0.0-0.1	SE134396.012	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP12 0.0-0.1	SE134396.014	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP13 0.0-0.1	SE134396.016	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP14 0.0-0.1	SE134396.019	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP 14 0.9-1.0	SE134396.020	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP14 2.9-3.0	SE134396.021	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP15 0.0-0.1	SE134396.023	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP16 0.0-0.1	SE134396.025	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP18 0.0-0.1	SE134396.030	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP19 0.0-0.1	SE134396.032	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC7	SE134396.034	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC9	SE134396.035	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP8 0.0-0.1	SE134396.001	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP9 0.0-0.1	SE134396.005	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP9 2.9-3.0	SE134396.007	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP10 0.4-0.5	SE134396.009	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP11 0.0-0.1	SE134396.012	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP12 0.0-0.1	SE134396.014	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP13 0.0-0.1	SE134396.016	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP14 0.0-0.1	SE134396.019	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP 14 0.9-1.0	SE134396.020	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP14 2.9-3.0	SE134396.021	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP15 0.0-0.1	SE134396.023	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP16 0.0-0.1	SE134396.025	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP18 0.0-0.1	SE134396.030	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP19 0.0-0.1	SE134396.032	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
QC7	SE134396.034	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
QC9	SE134396.035	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP8 0.0-0.1	SE134396.001	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP9 0.0-0.1	SE134396.005	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP9 2.9-3.0	SE134396.007	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP10 0.4-0.5	SE134396.009	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP11 0.0-0.1	SE134396.012	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP12 0.0-0.1	SE134396.014	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP13 0.0-0.1	SE134396.016	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP14 0.0-0.1	SE134396.019	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP 14 0.9-1.0	SE134396.020	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP14 2.9-3.0	SE134396.021	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP15 0.0-0.1	SE134396.023	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP16 0.0-0.1	SE134396.025	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP18 0.0-0.1	SE134396.030	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP19 0.0-0.1	SE134396.032	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC7	SE134396.034	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC9	SE134396.035	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Sample Name	Sample No.	QC Ref

HOLDING TIME SUMMARY

SE134396 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

pH in soil (1:5) (continued)

Method: ME-(AU)-[ENV]AN101

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP9 1.1-1.2	SE134396.006	LB069427	10 Dec 2014	12 Dec 2014	17 Dec 2014	16 Dec 2014	17 Dec 2014	18 Dec 2014†
TP9 3.9-4.0	SE134396.008	LB069427	10 Dec 2014	12 Dec 2014	17 Dec 2014	16 Dec 2014	17 Dec 2014	18 Dec 2014†
TP11 0.4-0.5	SE134396.013	LB069427	11 Dec 2014	12 Dec 2014	18 Dec 2014	16 Dec 2014	17 Dec 2014	18 Dec 2014†
TP13 1.9-2.0	SE134396.017	LB069427	11 Dec 2014	12 Dec 2014	18 Dec 2014	16 Dec 2014	17 Dec 2014	18 Dec 2014†
TP13 3.5-3.6	SE134396.018	LB069427	11 Dec 2014	12 Dec 2014	18 Dec 2014	16 Dec 2014	17 Dec 2014	18 Dec 2014†
TP15 0.9-1.0	SE134396.024	LB069428	10 Dec 2014	12 Dec 2014	17 Dec 2014	16 Dec 2014	17 Dec 2014	18 Dec 2014†
TP17 0.0-0.1	SE134396.027	LB069428	11 Dec 2014	12 Dec 2014	18 Dec 2014	16 Dec 2014	17 Dec 2014	18 Dec 2014†
TP17 2.9-3.0	SE134396.029	LB069428	11 Dec 2014	12 Dec 2014	18 Dec 2014	16 Dec 2014	17 Dec 2014	18 Dec 2014†

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP8 0.0-0.1	SE134396.001	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP9 0.0-0.1	SE134396.005	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP9 2.9-3.0	SE134396.007	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP10 0.4-0.5	SE134396.009	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP11 0.0-0.1	SE134396.012	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP12 0.0-0.1	SE134396.014	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP13 0.0-0.1	SE134396.016	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP14 0.0-0.1	SE134396.019	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP 14 0.9-1.0	SE134396.020	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP14 2.9-3.0	SE134396.021	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP15 0.0-0.1	SE134396.023	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP16 0.0-0.1	SE134396.025	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP18 0.0-0.1	SE134396.030	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP19 0.0-0.1	SE134396.032	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
QC7	SE134396.034	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
QC9	SE134396.035	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014

TOC in Soil

Method: ME-(AU)-[ENV]AN188

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP9 1.1-1.2	SE134396.006	LB069792	10 Dec 2014	12 Dec 2014	07 Jan 2015	23 Dec 2014	07 Jan 2015	23 Dec 2014
TP9 3.9-4.0	SE134396.008	LB069792	10 Dec 2014	12 Dec 2014	07 Jan 2015	23 Dec 2014	07 Jan 2015	23 Dec 2014
TP11 0.4-0.5	SE134396.013	LB069792	11 Dec 2014	12 Dec 2014	08 Jan 2015	23 Dec 2014	08 Jan 2015	23 Dec 2014
TP13 1.9-2.0	SE134396.017	LB069792	11 Dec 2014	12 Dec 2014	08 Jan 2015	23 Dec 2014	08 Jan 2015	23 Dec 2014
TP13 3.5-3.6	SE134396.018	LB069792	11 Dec 2014	12 Dec 2014	08 Jan 2015	23 Dec 2014	08 Jan 2015	23 Dec 2014
TP15 0.9-1.0	SE134396.024	LB069792	10 Dec 2014	12 Dec 2014	07 Jan 2015	23 Dec 2014	07 Jan 2015	23 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069792	11 Dec 2014	12 Dec 2014	08 Jan 2015	23 Dec 2014	08 Jan 2015	23 Dec 2014
TP17 2.9-3.0	SE134396.029	LB069792	11 Dec 2014	12 Dec 2014	08 Jan 2015	23 Dec 2014	08 Jan 2015	23 Dec 2014

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP8 0.0-0.1	SE134396.001	LB069703	10 Dec 2014	12 Dec 2014	08 Jun 2015	22 Dec 2014	08 Jun 2015	23 Dec 2014
TP8 0.9-1.0	SE134396.002	LB069703	10 Dec 2014	12 Dec 2014	08 Jun 2015	22 Dec 2014	08 Jun 2015	23 Dec 2014
TP8 2.8-2.9	SE134396.004	LB069703	10 Dec 2014	12 Dec 2014	08 Jun 2015	22 Dec 2014	08 Jun 2015	23 Dec 2014
TP9 0.0-0.1	SE134396.005	LB069703	10 Dec 2014	12 Dec 2014	08 Jun 2015	22 Dec 2014	08 Jun 2015	23 Dec 2014
TP9 1.1-1.2	SE134396.006	LB069703	10 Dec 2014	12 Dec 2014	08 Jun 2015	22 Dec 2014	08 Jun 2015	23 Dec 2014
TP9 2.9-3.0	SE134396.007	LB069703	10 Dec 2014	12 Dec 2014	08 Jun 2015	22 Dec 2014	08 Jun 2015	23 Dec 2014
TP9 3.9-4.0	SE134396.008	LB069703	10 Dec 2014	12 Dec 2014	08 Jun 2015	22 Dec 2014	08 Jun 2015	23 Dec 2014
TP10 0.4-0.5	SE134396.009	LB069703	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP10 1.9-2.0	SE134396.010	LB069703	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP10 3.9-4.0	SE134396.011	LB069703	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP11 0.0-0.1	SE134396.012	LB069703	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP11 0.4-0.5	SE134396.013	LB069703	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP12 0.0-0.1	SE134396.014	LB069703	10 Dec 2014	12 Dec 2014	08 Jun 2015	22 Dec 2014	08 Jun 2015	23 Dec 2014
TP12 0.4-0.5	SE134396.015	LB069703	10 Dec 2014	12 Dec 2014	08 Jun 2015	22 Dec 2014	08 Jun 2015	23 Dec 2014
TP13 0.0-0.1	SE134396.016	LB069703	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP13 1.9-2.0	SE134396.017	LB069703	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP13 3.5-3.6	SE134396.018	LB069703	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP14 0.0-0.1	SE134396.019	LB069703	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP 14 0.9-1.0	SE134396.020	LB069703	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest (continued)

Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP14 2.9-3.0	SE134396.021	LB069705	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP14 5.4-5.5	SE134396.022	LB069705	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP15 0.0-0.1	SE134396.023	LB069705	10 Dec 2014	12 Dec 2014	08 Jun 2015	22 Dec 2014	08 Jun 2015	23 Dec 2014
TP15 0.9-1.0	SE134396.024	LB069705	10 Dec 2014	12 Dec 2014	08 Jun 2015	22 Dec 2014	08 Jun 2015	23 Dec 2014
TP16 0.0-0.1	SE134396.025	LB069705	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP16 0.6-0.7	SE134396.026	LB069705	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069705	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP17 0.9-1.0	SE134396.028	LB069705	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP17 2.9-3.0	SE134396.029	LB069705	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP18 0.0-0.1	SE134396.030	LB069705	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP18 0.6-0.7	SE134396.031	LB069705	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP19 0.0-0.1	SE134396.032	LB069705	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
TP19 0.6-0.7	SE134396.033	LB069705	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014
QC7	SE134396.034	LB069705	10 Dec 2014	12 Dec 2014	08 Jun 2015	22 Dec 2014	08 Jun 2015	23 Dec 2014
QC9	SE134396.035	LB069705	11 Dec 2014	12 Dec 2014	09 Jun 2015	22 Dec 2014	09 Jun 2015	23 Dec 2014

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP8 0.0-0.1	SE134396.001	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP9 0.0-0.1	SE134396.005	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP9 2.9-3.0	SE134396.007	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP10 0.4-0.5	SE134396.009	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP11 0.0-0.1	SE134396.012	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP12 0.0-0.1	SE134396.014	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP13 0.0-0.1	SE134396.016	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP14 0.0-0.1	SE134396.019	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP 14 0.9-1.0	SE134396.020	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP14 2.9-3.0	SE134396.021	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP15 0.0-0.1	SE134396.023	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP16 0.0-0.1	SE134396.025	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP18 0.0-0.1	SE134396.030	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
TP19 0.0-0.1	SE134396.032	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	22 Dec 2014
QC7	SE134396.034	LB069311	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
QC9	SE134396.035	LB069311	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP8 0.0-0.1	SE134396.001	LB069296	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP9 0.0-0.1	SE134396.005	LB069296	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP10 0.4-0.5	SE134396.009	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP11 0.0-0.1	SE134396.012	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP12 0.0-0.1	SE134396.014	LB069296	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP13 0.0-0.1	SE134396.016	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP14 0.0-0.1	SE134396.019	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP15 0.0-0.1	SE134396.023	LB069296	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP16 0.0-0.1	SE134396.025	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP18 0.0-0.1	SE134396.030	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP19 0.0-0.1	SE134396.032	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TB4	SE134396.036	LB069518	11 Dec 2014	12 Dec 2014	18 Dec 2014	17 Dec 2014	26 Jan 2015	18 Dec 2014
TS4	SE134396.037	LB069518	11 Dec 2014	12 Dec 2014	18 Dec 2014	17 Dec 2014	26 Jan 2015	18 Dec 2014

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP8 0.0-0.1	SE134396.001	LB069296	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP9 0.0-0.1	SE134396.005	LB069296	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP10 0.4-0.5	SE134396.009	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP11 0.0-0.1	SE134396.012	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014

HOLDING TIME SUMMARY

SE134396 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Volatile Petroleum Hydrocarbons in Soil (continued)

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP12 0.0-0.1	SE134396.014	LB069296	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP13 0.0-0.1	SE134396.016	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP14 0.0-0.1	SE134396.019	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP15 0.0-0.1	SE134396.023	LB069296	10 Dec 2014	12 Dec 2014	24 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP16 0.0-0.1	SE134396.025	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP17 0.0-0.1	SE134396.027	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP18 0.0-0.1	SE134396.030	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014
TP19 0.0-0.1	SE134396.032	LB069296	11 Dec 2014	12 Dec 2014	25 Dec 2014	15 Dec 2014	24 Jan 2015	23 Dec 2014

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TB4	SE134396.036	LB069518	11 Dec 2014	12 Dec 2014	18 Dec 2014	17 Dec 2014	26 Jan 2015	18 Dec 2014
TS4	SE134396.037	LB069518	11 Dec 2014	12 Dec 2014	18 Dec 2014	17 Dec 2014	26 Jan 2015	18 Dec 2014

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Tetrachloro-m-xylene (TCMX) (Surrogate)	TP8 0.0-0.1	SE134396.001	%	60 - 130%	93
	TP9 0.0-0.1	SE134396.005	%	60 - 130%	90
	TP10 0.4-0.5	SE134396.009	%	60 - 130%	87
	TP11 0.0-0.1	SE134396.012	%	60 - 130%	99
	TP12 0.0-0.1	SE134396.014	%	60 - 130%	97
	TP13 0.0-0.1	SE134396.016	%	60 - 130%	98
	TP14 0.0-0.1	SE134396.019	%	60 - 130%	95
	TP15 0.0-0.1	SE134396.023	%	60 - 130%	95
	TP16 0.0-0.1	SE134396.025	%	60 - 130%	97
	TP17 0.0-0.1	SE134396.027	%	60 - 130%	103
	TP18 0.0-0.1	SE134396.030	%	60 - 130%	97
	TP19 0.0-0.1	SE134396.032	%	60 - 130%	87

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	TP8 0.0-0.1	SE134396.001	%	70 - 130%	84
	TP9 0.0-0.1	SE134396.005	%	70 - 130%	80
	TP9 2.9-3.0	SE134396.007	%	70 - 130%	82
	TP10 0.4-0.5	SE134396.009	%	70 - 130%	84
	TP11 0.0-0.1	SE134396.012	%	70 - 130%	92
	TP12 0.0-0.1	SE134396.014	%	70 - 130%	82
	TP13 0.0-0.1	SE134396.016	%	70 - 130%	90
	TP14 0.0-0.1	SE134396.019	%	70 - 130%	78
	TP 14 0.9-1.0	SE134396.020	%	70 - 130%	76
	TP14 2.9-3.0	SE134396.021	%	70 - 130%	84
	TP15 0.0-0.1	SE134396.023	%	70 - 130%	88
	TP16 0.0-0.1	SE134396.025	%	70 - 130%	82
	TP17 0.0-0.1	SE134396.027	%	70 - 130%	90
	TP18 0.0-0.1	SE134396.030	%	70 - 130%	84
	TP19 0.0-0.1	SE134396.032	%	70 - 130%	84
	QC7	SE134396.034	%	70 - 130%	80
	QC9	SE134396.035	%	70 - 130%	88
d14-p-terphenyl (Surrogate)	TP8 0.0-0.1	SE134396.001	%	70 - 130%	96
	TP9 0.0-0.1	SE134396.005	%	70 - 130%	102
	TP9 2.9-3.0	SE134396.007	%	70 - 130%	94
	TP10 0.4-0.5	SE134396.009	%	70 - 130%	92
	TP11 0.0-0.1	SE134396.012	%	70 - 130%	92
	TP12 0.0-0.1	SE134396.014	%	70 - 130%	110
	TP13 0.0-0.1	SE134396.016	%	70 - 130%	96
	TP14 0.0-0.1	SE134396.019	%	70 - 130%	104
	TP 14 0.9-1.0	SE134396.020	%	70 - 130%	104
	TP14 2.9-3.0	SE134396.021	%	70 - 130%	86
	TP15 0.0-0.1	SE134396.023	%	70 - 130%	102
	TP16 0.0-0.1	SE134396.025	%	70 - 130%	100
	TP17 0.0-0.1	SE134396.027	%	70 - 130%	94
	TP18 0.0-0.1	SE134396.030	%	70 - 130%	108
	TP19 0.0-0.1	SE134396.032	%	70 - 130%	96
	QC7	SE134396.034	%	70 - 130%	114
	QC9	SE134396.035	%	70 - 130%	84
d5-nitrobenzene (Surrogate)	TP8 0.0-0.1	SE134396.001	%	70 - 130%	92
	TP9 0.0-0.1	SE134396.005	%	70 - 130%	94
	TP9 2.9-3.0	SE134396.007	%	70 - 130%	96
	TP10 0.4-0.5	SE134396.009	%	70 - 130%	96
	TP11 0.0-0.1	SE134396.012	%	70 - 130%	104
	TP12 0.0-0.1	SE134396.014	%	70 - 130%	104
	TP13 0.0-0.1	SE134396.016	%	70 - 130%	102
	TP14 0.0-0.1	SE134396.019	%	70 - 130%	104
	TP 14 0.9-1.0	SE134396.020	%	70 - 130%	100
	TP14 2.9-3.0	SE134396.021	%	70 - 130%	96
	TP15 0.0-0.1	SE134396.023	%	70 - 130%	104
	TP16 0.0-0.1	SE134396.025	%	70 - 130%	104

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
d5-nitrobenzene (Surrogate)	TP17 0.0-0.1	SE134396.027	%	70 - 130%	106
	TP18 0.0-0.1	SE134396.030	%	70 - 130%	108
	TP19 0.0-0.1	SE134396.032	%	70 - 130%	104
	QC7	SE134396.034	%	70 - 130%	104
	QC9	SE134396.035	%	70 - 130%	98

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Tetrachloro-m-xylene (TCMX) (Surrogate)	TP8 0.0-0.1	SE134396.001	%	60 - 130%	93
	TP9 0.0-0.1	SE134396.005	%	60 - 130%	90
	TP10 0.4-0.5	SE134396.009	%	60 - 130%	87
	TP11 0.0-0.1	SE134396.012	%	60 - 130%	99
	TP12 0.0-0.1	SE134396.014	%	60 - 130%	97
	TP13 0.0-0.1	SE134396.016	%	60 - 130%	98
	TP14 0.0-0.1	SE134396.019	%	60 - 130%	95
	TP15 0.0-0.1	SE134396.023	%	60 - 130%	95
	TP16 0.0-0.1	SE134396.025	%	60 - 130%	97
	TP17 0.0-0.1	SE134396.027	%	60 - 130%	103
	TP18 0.0-0.1	SE134396.030	%	60 - 130%	97
	TP19 0.0-0.1	SE134396.032	%	60 - 130%	87

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2,4,6-Tribromophenol (Surrogate)	TP8 0.0-0.1	SE134396.001	%	70 - 130%	82
	TP9 0.0-0.1	SE134396.005	%	70 - 130%	83
	TP10 0.4-0.5	SE134396.009	%	70 - 130%	75
	TP11 0.0-0.1	SE134396.012	%	70 - 130%	91
	TP12 0.0-0.1	SE134396.014	%	70 - 130%	74
	TP13 0.0-0.1	SE134396.016	%	70 - 130%	90
	TP14 0.0-0.1	SE134396.019	%	70 - 130%	88
	TP15 0.0-0.1	SE134396.023	%	70 - 130%	91
	TP16 0.0-0.1	SE134396.025	%	70 - 130%	90
	TP17 0.0-0.1	SE134396.027	%	70 - 130%	92
	TP18 0.0-0.1	SE134396.030	%	70 - 130%	84
	TP19 0.0-0.1	SE134396.032	%	70 - 130%	88
d5-phenol (Surrogate)	TP8 0.0-0.1	SE134396.001	%	50 - 130%	70
	TP9 0.0-0.1	SE134396.005	%	50 - 130%	71
	TP10 0.4-0.5	SE134396.009	%	50 - 130%	70
	TP11 0.0-0.1	SE134396.012	%	50 - 130%	74
	TP12 0.0-0.1	SE134396.014	%	50 - 130%	71
	TP13 0.0-0.1	SE134396.016	%	50 - 130%	71
	TP14 0.0-0.1	SE134396.019	%	50 - 130%	74
	TP15 0.0-0.1	SE134396.023	%	50 - 130%	72
	TP16 0.0-0.1	SE134396.025	%	50 - 130%	71
	TP17 0.0-0.1	SE134396.027	%	50 - 130%	74
	TP18 0.0-0.1	SE134396.030	%	50 - 130%	70
	TP19 0.0-0.1	SE134396.032	%	50 - 130%	70

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TP8 0.0-0.1	SE134396.001	%	60 - 130%	84
	TP9 0.0-0.1	SE134396.005	%	60 - 130%	76
	TP10 0.4-0.5	SE134396.009	%	60 - 130%	78
	TP11 0.0-0.1	SE134396.012	%	60 - 130%	79
	TP12 0.0-0.1	SE134396.014	%	60 - 130%	87
	TP13 0.0-0.1	SE134396.016	%	60 - 130%	77
	TP14 0.0-0.1	SE134396.019	%	60 - 130%	79
	TP15 0.0-0.1	SE134396.023	%	60 - 130%	74
	TP16 0.0-0.1	SE134396.025	%	60 - 130%	74
	TP17 0.0-0.1	SE134396.027	%	60 - 130%	79
	TP18 0.0-0.1	SE134396.030	%	60 - 130%	84
	TP19 0.0-0.1	SE134396.032	%	60 - 130%	79

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued)

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
d4-1,2-dichloroethane (Surrogate)	TP8 0.0-0.1	SE134396.001	%	60 - 130%	85
	TP9 0.0-0.1	SE134396.005	%	60 - 130%	74
	TP10 0.4-0.5	SE134396.009	%	60 - 130%	83
	TP11 0.0-0.1	SE134396.012	%	60 - 130%	74
	TP12 0.0-0.1	SE134396.014	%	60 - 130%	85
	TP13 0.0-0.1	SE134396.016	%	60 - 130%	71
	TP14 0.0-0.1	SE134396.019	%	60 - 130%	80
	TP15 0.0-0.1	SE134396.023	%	60 - 130%	74
	TP16 0.0-0.1	SE134396.025	%	60 - 130%	78
	TP17 0.0-0.1	SE134396.027	%	60 - 130%	79
	TP18 0.0-0.1	SE134396.030	%	60 - 130%	81
	TP19 0.0-0.1	SE134396.032	%	60 - 130%	74
d8-toluene (Surrogate)	TP8 0.0-0.1	SE134396.001	%	60 - 130%	84
	TP9 0.0-0.1	SE134396.005	%	60 - 130%	73
	TP10 0.4-0.5	SE134396.009	%	60 - 130%	83
	TP11 0.0-0.1	SE134396.012	%	60 - 130%	72
	TP12 0.0-0.1	SE134396.014	%	60 - 130%	81
	TP13 0.0-0.1	SE134396.016	%	60 - 130%	72
	TP14 0.0-0.1	SE134396.019	%	60 - 130%	81
	TP15 0.0-0.1	SE134396.023	%	60 - 130%	72
	TP16 0.0-0.1	SE134396.025	%	60 - 130%	77
	TP17 0.0-0.1	SE134396.027	%	60 - 130%	78
	TP18 0.0-0.1	SE134396.030	%	60 - 130%	79
	TP19 0.0-0.1	SE134396.032	%	60 - 130%	71
Dibromofluoromethane (Surrogate)	TP8 0.0-0.1	SE134396.001	%	60 - 130%	82
	TP9 0.0-0.1	SE134396.005	%	60 - 130%	73
	TP10 0.4-0.5	SE134396.009	%	60 - 130%	81
	TP11 0.0-0.1	SE134396.012	%	60 - 130%	71
	TP12 0.0-0.1	SE134396.014	%	60 - 130%	86
	TP13 0.0-0.1	SE134396.016	%	60 - 130%	71
	TP14 0.0-0.1	SE134396.019	%	60 - 130%	78
	TP15 0.0-0.1	SE134396.023	%	60 - 130%	72
	TP16 0.0-0.1	SE134396.025	%	60 - 130%	75
	TP17 0.0-0.1	SE134396.027	%	60 - 130%	77
	TP18 0.0-0.1	SE134396.030	%	60 - 130%	80
	TP19 0.0-0.1	SE134396.032	%	60 - 130%	71

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TB4	SE134396.036	%	40 - 130%	82
	TS4	SE134396.037	%	40 - 130%	103
d4-1,2-dichloroethane (Surrogate)	TB4	SE134396.036	%	40 - 130%	127
	TS4	SE134396.037	%	40 - 130%	118
d8-toluene (Surrogate)	TB4	SE134396.036	%	40 - 130%	89
	TS4	SE134396.037	%	40 - 130%	85
Dibromofluoromethane (Surrogate)	TB4	SE134396.036	%	40 - 130%	127
	TS4	SE134396.037	%	40 - 130%	115

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TP8 0.0-0.1	SE134396.001	%	60 - 130%	84
	TP9 0.0-0.1	SE134396.005	%	60 - 130%	76
	TP10 0.4-0.5	SE134396.009	%	60 - 130%	78
	TP11 0.0-0.1	SE134396.012	%	60 - 130%	79
	TP12 0.0-0.1	SE134396.014	%	60 - 130%	87
	TP13 0.0-0.1	SE134396.016	%	60 - 130%	77
	TP14 0.0-0.1	SE134396.019	%	60 - 130%	79
	TP15 0.0-0.1	SE134396.023	%	60 - 130%	74
	TP16 0.0-0.1	SE134396.025	%	60 - 130%	74
	TP17 0.0-0.1	SE134396.027	%	60 - 130%	79
	TP18 0.0-0.1	SE134396.030	%	60 - 130%	84
	TP19 0.0-0.1	SE134396.032	%	60 - 130%	79

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Volatile Petroleum Hydrocarbons in Soil (continued)

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
d4-1,2-dichloroethane (Surrogate)	TP8 0.0-0.1	SE134396.001	%	60 - 130%	85
	TP9 0.0-0.1	SE134396.005	%	60 - 130%	74
	TP10 0.4-0.5	SE134396.009	%	60 - 130%	83
	TP11 0.0-0.1	SE134396.012	%	60 - 130%	74
	TP12 0.0-0.1	SE134396.014	%	60 - 130%	85
	TP13 0.0-0.1	SE134396.016	%	60 - 130%	71
	TP14 0.0-0.1	SE134396.019	%	60 - 130%	80
	TP15 0.0-0.1	SE134396.023	%	60 - 130%	74
	TP16 0.0-0.1	SE134396.025	%	60 - 130%	78
	TP17 0.0-0.1	SE134396.027	%	60 - 130%	79
	TP18 0.0-0.1	SE134396.030	%	60 - 130%	81
	TP19 0.0-0.1	SE134396.032	%	60 - 130%	74
d8-toluene (Surrogate)	TP8 0.0-0.1	SE134396.001	%	60 - 130%	84
	TP9 0.0-0.1	SE134396.005	%	60 - 130%	73
	TP10 0.4-0.5	SE134396.009	%	60 - 130%	83
	TP11 0.0-0.1	SE134396.012	%	60 - 130%	72
	TP12 0.0-0.1	SE134396.014	%	60 - 130%	81
	TP13 0.0-0.1	SE134396.016	%	60 - 130%	72
	TP14 0.0-0.1	SE134396.019	%	60 - 130%	81
	TP15 0.0-0.1	SE134396.023	%	60 - 130%	72
	TP16 0.0-0.1	SE134396.025	%	60 - 130%	77
	TP17 0.0-0.1	SE134396.027	%	60 - 130%	78
	TP18 0.0-0.1	SE134396.030	%	60 - 130%	79
	TP19 0.0-0.1	SE134396.032	%	60 - 130%	71
Dibromofluoromethane (Surrogate)	TP8 0.0-0.1	SE134396.001	%	60 - 130%	82
	TP9 0.0-0.1	SE134396.005	%	60 - 130%	73
	TP10 0.4-0.5	SE134396.009	%	60 - 130%	81
	TP11 0.0-0.1	SE134396.012	%	60 - 130%	71
	TP12 0.0-0.1	SE134396.014	%	60 - 130%	86
	TP13 0.0-0.1	SE134396.016	%	60 - 130%	71
	TP14 0.0-0.1	SE134396.019	%	60 - 130%	78
	TP15 0.0-0.1	SE134396.023	%	60 - 130%	72
	TP16 0.0-0.1	SE134396.025	%	60 - 130%	75
	TP17 0.0-0.1	SE134396.027	%	60 - 130%	77
	TP18 0.0-0.1	SE134396.030	%	60 - 130%	80
	TP19 0.0-0.1	SE134396.032	%	60 - 130%	71

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TB4	SE134396.036	%	40 - 130%	82
d4-1,2-dichloroethane (Surrogate)	TB4	SE134396.036	%	60 - 130%	127
d8-toluene (Surrogate)	TB4	SE134396.036	%	40 - 130%	89
Dibromofluoromethane (Surrogate)	TB4	SE134396.036	%	40 - 130%	127

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result
LB069367.001	Mercury	mg/kg	0.01	<0.01
LB069368.001	Mercury	mg/kg	0.01	<0.01
LB069506.001	Mercury	mg/kg	0.01	<0.01

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB069311.001		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1
		Alpha BHC	mg/kg	0.1	<0.1
		Lindane	mg/kg	0.1	<0.1
		Heptachlor	mg/kg	0.1	<0.1
		Aldrin	mg/kg	0.1	<0.1
		Beta BHC	mg/kg	0.1	<0.1
		Delta BHC	mg/kg	0.1	<0.1
		Heptachlor epoxide	mg/kg	0.1	<0.1
		Alpha Endosulfan	mg/kg	0.2	<0.2
		Gamma Chlordane	mg/kg	0.1	<0.1
		Alpha Chlordane	mg/kg	0.1	<0.1
		p,p'-DDE	mg/kg	0.1	<0.1
		Dieldrin	mg/kg	0.2	<0.2
		Endrin	mg/kg	0.2	<0.2
		Beta Endosulfan	mg/kg	0.2	<0.2
		p,p'-DDD	mg/kg	0.1	<0.1
		p,p'-DDT	mg/kg	0.1	<0.1
		Endosulfan sulphate	mg/kg	0.1	<0.1
		Endrin Aldehyde	mg/kg	0.1	<0.1
		Methoxychlor	mg/kg	0.1	<0.1
		Endrin Ketone	mg/kg	0.1	<0.1
		Isodrin	mg/kg	0.1	<0.1
		Mirex	mg/kg	0.1	<0.1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	79

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB069311.001		Naphthalene	mg/kg	0.1	<0.1
		2-methylnaphthalene	mg/kg	0.1	<0.1
		1-methylnaphthalene	mg/kg	0.1	<0.1
		Acenaphthylene	mg/kg	0.1	<0.1
		Acenaphthene	mg/kg	0.1	<0.1
		Fluorene	mg/kg	0.1	<0.1
		Phenanthrene	mg/kg	0.1	<0.1
		Anthracene	mg/kg	0.1	<0.1
		Fluoranthene	mg/kg	0.1	<0.1
		Pyrene	mg/kg	0.1	<0.1
		Benzo(a)anthracene	mg/kg	0.1	<0.1
		Chrysene	mg/kg	0.1	<0.1
		Benzo(a)pyrene	mg/kg	0.1	<0.1
		Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1
		Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1
		Benzo(ghi)perylene	mg/kg	0.1	<0.1
		Total PAH	mg/kg	0.8	<0.8
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	84
		2-fluorobiphenyl (Surrogate)	%	-	70
		d14-p-terphenyl (Surrogate)	%	-	96

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number	Parameter	Units	LOR

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

PCBs in Soil (continued)

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB069311.001		Arochlor 1016	mg/kg	0.2	<0.2
		Arochlor 1221	mg/kg	0.2	<0.2
		Arochlor 1232	mg/kg	0.2	<0.2
		Arochlor 1242	mg/kg	0.2	<0.2
		Arochlor 1248	mg/kg	0.2	<0.2
		Arochlor 1254	mg/kg	0.2	<0.2
		Arochlor 1260	mg/kg	0.2	<0.2
		Arochlor 1262	mg/kg	0.2	<0.2
		Arochlor 1268	mg/kg	0.2	<0.2
		Total PCBs (Arochlors)	mg/kg	1	<1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	79

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB069311.001		Phenol	mg/kg	0.5	<0.5
		2-methyl phenol (o-cresol)	mg/kg	0.5	<0.5
		3/4-methyl phenol (m/p-cresol)	mg/kg	1	<1
		2-chlorophenol	mg/kg	0.5	<0.5
		2,4-dimethylphenol	mg/kg	0.5	<0.5
		2,6-dichlorophenol	mg/kg	0.5	<0.5
		2,4-dichlorophenol	mg/kg	0.5	<0.5
		2,4,6-trichlorophenol	mg/kg	0.5	<0.5
		2-nitrophenol	mg/kg	0.5	<0.5
		4-nitrophenol	mg/kg	1	<1
		2,4,5-trichlorophenol	mg/kg	0.5	<0.5
		2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1	<1
		Pentachlorophenol	mg/kg	0.5	<0.5
		2,4-dinitrophenol	mg/kg	2	<2
		4-chloro-3-methylphenol	mg/kg	2	<2
	Surrogates	2,4,6-Tribromophenol (Surrogate)	%	-	81
		d5-phenol (Surrogate)	%	-	71

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result
LB069703.001	Arsenic, As	mg/kg	3	<3
	Cadmium, Cd	mg/kg	0.3	<0.3
	Chromium, Cr	mg/kg	0.3	<0.3
	Copper, Cu	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Iron, Fe	mg/kg	50	<50
	Nickel, Ni	mg/kg	0.5	<0.5
	Zinc, Zn	mg/kg	0.5	<0.5
LB069705.001	Arsenic, As	mg/kg	3	<3
	Cadmium, Cd	mg/kg	0.3	<0.3
	Chromium, Cr	mg/kg	0.3	<0.3
	Copper, Cu	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Iron, Fe	mg/kg	50	<50
	Nickel, Ni	mg/kg	0.5	<0.5
	Zinc, Zn	mg/kg	0.5	<0.5

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number	Parameter	Units	LOR	Result
LB069311.001	TRH C10-C14	mg/kg	20	<20
	TRH C15-C28	mg/kg	45	<45
	TRH C29-C36	mg/kg	45	<45
	TRH C37-C40	mg/kg	100	<100
	TRH C10-C36 Total	mg/kg	110	<110

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number	Parameter	Units	LOR

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

VOC's in Soil (continued)

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result
LB069296.001	Monocyclic Aromatic	Benzene	mg/kg	0.1	<0.1
	Hydrocarbons	Toluene	mg/kg	0.1	<0.1
		Ethylbenzene	mg/kg	0.1	<0.1
		m/p-xylene	mg/kg	0.2	<0.2
		o-xylene	mg/kg	0.1	<0.1
	Polycyclic VOCs	Naphthalene	mg/kg	0.1	<0.1
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	82
		d4-1,2-dichloroethane (Surrogate)	%	-	96
		d8-toluene (Surrogate)	%	-	96
		Bromofluorobenzene (Surrogate)	%	-	82
	Totals	Total BTEX*	mg/kg	0.6	<0.6

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result
LB069518.001	Monocyclic Aromatic	Benzene	µg/L	0.5	<0.5
	Hydrocarbons	Toluene	µg/L	0.5	<0.5
		Ethylbenzene	µg/L	0.5	<0.5
		m/p-xylene	µg/L	1	<1
		o-xylene	µg/L	0.5	<0.5
	Polycyclic VOCs	Naphthalene	µg/L	0.5	<0.5
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	123
		d4-1,2-dichloroethane (Surrogate)	%	-	128
		d8-toluene (Surrogate)	%	-	90
		Bromofluorobenzene (Surrogate)	%	-	85

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result
LB069296.001		TRH C6-C9	mg/kg	20	<20
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	82
		d4-1,2-dichloroethane (Surrogate)	%	-	96
		d8-toluene (Surrogate)	%	-	96

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result
LB069518.001		TRH C6-C9	µg/L	40	<40
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	123
		d4-1,2-dichloroethane (Surrogate)	%	-	128
		d8-toluene (Surrogate)	%	-	90
		Bromofluorobenzene (Surrogate)	%	-	85

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.005	LB069367.014	Mercury	mg/kg	0.01	0.01	0.01	200	0
SE134396.014	LB069367.024	Mercury	mg/kg	0.01	<0.01	<0.01	200	0
SE134396.024	LB069368.014	Mercury	mg/kg	0.01	<0.01	<0.01	200	0
SE134396.033	LB069368.024	Mercury	mg/kg	0.01	0.05	0.04	149	0
SE134483.009	LB069506.014	Mercury	mg/kg	0.01	<0.01	<0.01	200	0
SE134532.001	LB069506.020	Mercury	mg/kg	0.01	0.08	0.10	86	20

Moisture Content

Method: ME-(AU)-[ENV]AN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.011	LB069509.011	% Moisture	%w/w	0.5	8.7	8.5	42	3
SE134396.020	LB069509.021	% Moisture	%	0.5	11	11	39	5
SE134396.030	LB069592.011	% Moisture	%w/w	0.5	16	16	36	4
SE134396.035	LB069592.017	% Moisture	%	0.5	7.5	7.9	43	5

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.032	LB069311.021		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Lindane	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor	mg/kg	0.1	<0.1	<0.1	200	0
			Aldrin	mg/kg	0.1	<0.1	<0.1	200	0
			Beta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Delta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Dieldrin	mg/kg	0.2	<0.2	<0.2	200	0
			Endrin	mg/kg	0.2	<0.2	<0.2	200	0
			o,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			p,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	200	0
			Methoxychlor	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Ketone	mg/kg	0.1	<0.1	<0.1	200	0
			Isodrin	mg/kg	0.1	<0.1	<0.1	200	0
			Mirex	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.13	0.14	30	4

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.023	LB069311.017	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Acenaphthylene	mg/kg	0.1	<0.1	<0.1	200	0
		Acenaphthene	mg/kg	0.1	<0.1	<0.1	200	0
		Fluorene	mg/kg	0.1	<0.1	<0.1	200	0
		Phenanthrene	mg/kg	0.1	<0.1	<0.1	200	0
		Anthracene	mg/kg	0.1	<0.1	<0.1	200	0
		Fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
		Pyrene	mg/kg	0.1	<0.1	<0.1	200	0
		Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
		Chrysene	mg/kg	0.1	<0.1	<0.1	200	0
		Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
		Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
		Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	200	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.023	LB069311.017		Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	200	0
			Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ (mg/kg)	0.2	<0.2	<0.2	200	0
			Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	<0.3	<0.3	134	0
			Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	<0.2	<0.2	175	0
			Total PAH	mg/kg	0.8	<0.8	<0.8	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	30	2
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.4	30	5
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	13
SE134396.032	LB069311.022		Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthylene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluorene	mg/kg	0.1	<0.1	<0.1	200	0
			Phenanthrene	mg/kg	0.1	<0.1	<0.1	200	0
			Anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Chrysene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	200	0
			Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ (mg/kg)	0.2	<0.2	<0.2	200	0
			Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	<0.3	<0.3	134	0
			Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	<0.2	<0.2	175	0
			Total PAH	mg/kg	0.8	<0.8	<0.8	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	30	0
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.4	30	2
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	4

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.032	LB069311.021		Arochlor 1016	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1221	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1232	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1242	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1248	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1254	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1260	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1262	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1268	mg/kg	0.2	<0.2	<0.2	200	0
			Total PCBs (Arochlors)	mg/kg	1	<1	<1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0	0	30	4

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.018	LB069427.010	pH	pH Units	-	4.8	4.7	32	3
SE134410.011	LB069428.012	pH	pH Units	-	7.8	7.9	31	1

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.030	LB069311.020	Phenol	mg/kg	0.5	<0.5	<0.5	200	0
		2-methyl phenol (o-cresol)	mg/kg	0.5	<0.5	<0.5	200	0
		3/4-methyl phenol (m/p-cresol)	mg/kg	1	<1	<1	200	0
		Total Cresol	mg/kg	1.5	<1.5	<1.5	200	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Speciated Phenols in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.030	LB069311.020		2-chlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
			2,4-dimethylphenol	mg/kg	0.5	<0.5	<0.5	200	0
			2,6-dichlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
			2,4-dichlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
			2,4,6-trichlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
			2-nitrophenol	mg/kg	0.5	<0.5	<0.5	200	0
			4-nitrophenol	mg/kg	1	<1	<1	200	0
			2,4,5-trichlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
			2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1	<1	<1	200	0
			Pentachlorophenol	mg/kg	0.5	<0.5	<0.5	200	0
			2,4-dinitrophenol	mg/kg	2	<2	<2	200	0
			4-chloro-3-methylphenol	mg/kg	2	<2	<2	200	0
		Surrogates	2,4,6-Tribromophenol (Surrogate)	mg/kg	-	4.2	4.3	30	4
			d5-phenol (Surrogate)	mg/kg	-	1.4	1.4	30	0

TOC in Soil

Method: ME-(AU)-[ENV]AN188

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.006	LB069792.004	Total Organic Carbon	%w/w	0.05	1.4	1.6	18	14
SE134396.008	LB069792.006	Total Organic Carbon	%w/w	0.05	0.32	0.36	30	11

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.011	LB069703.014	Arsenic, As	mg/kg	3	11	11	39	1
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	190	0
		Chromium, Cr	mg/kg	0.3	14	14	34	2
		Copper, Cu	mg/kg	0.5	38	34	31	10
		Lead, Pb	mg/kg	1	22	18	35	20
		Nickel, Ni	mg/kg	0.5	25	25	32	0
		Zinc, Zn	mg/kg	0.5	91	95	32	4
SE134396.020	LB069703.024	Arsenic, As	mg/kg	3	6	6	47	5
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	183	0
		Chromium, Cr	mg/kg	0.3	24	24	32	2
		Copper, Cu	mg/kg	0.5	12	13	34	3
		Lead, Pb	mg/kg	1	31	28	33	9
		Nickel, Ni	mg/kg	0.5	8.9	10	35	13
		Zinc, Zn	mg/kg	0.5	38	49	35	25
SE134396.030	LB069705.014	Arsenic, As	mg/kg	3	4	3	57	17
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Chromium, Cr	mg/kg	0.3	24	26	32	6
		Copper, Cu	mg/kg	0.5	8.6	7.8	36	10
		Lead, Pb	mg/kg	1	33	23	34	35 ②
		Nickel, Ni	mg/kg	0.5	7.8	7.3	37	6
		Zinc, Zn	mg/kg	0.5	73	77	33	5
SE134582.001	LB069705.023	Arsenic, As	mg/kg	3	4	5	53	5
		Cadmium, Cd	mg/kg	0.3	0.2	0.1	200	0
		Chromium, Cr	mg/kg	0.3	5.3	3.9	41	32
		Copper, Cu	mg/kg	0.5	9.5	8.7	35	9
		Lead, Pb	mg/kg	1	15	12	38	22
		Nickel, Ni	mg/kg	0.5	1.9	2.0	56	1
		Zinc, Zn	mg/kg	0.5	71	65	33	8

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.023	LB069311.016		TRH C10-C14	mg/kg	20	<20	<20	200	0
			TRH C15-C28	mg/kg	45	<45	<45	200	0
			TRH C29-C36	mg/kg	45	<45	<45	200	0
			TRH C37-C40	mg/kg	100	<100	<100	200	0
			TRH C10-C36 Total	mg/kg	110	<110	<110	200	0
			TRH C10-C40 Total	mg/kg	210	<210	<210	200	0
		TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	<25	<25	200	0
			TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	<25	<25	200	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

TRH (Total Recoverable Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN403

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.023	LB069311.016	TRH F Bands	TRH >C16-C34 (F3)	mg/kg	90	<90	<90	200	0
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	200	0
SE134396.032	LB069311.021		TRH C10-C14	mg/kg	20	<20	<20	200	0
			TRH C15-C28	mg/kg	45	<45	<45	200	0
			TRH C29-C36	mg/kg	45	<45	<45	200	0
			TRH C37-C40	mg/kg	100	<100	<100	200	0
			TRH C10-C36 Total	mg/kg	110	<110	<110	200	0
			TRH C10-C40 Total	mg/kg	210	<210	<210	200	0
		TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	<25	<25	200	0
			TRH >C10-C16 (F2) minus Naphthalene	mg/kg	25	<25	<25	200	0
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	200	0
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	200	0

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.009	LB069296.014	Monocyclic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
		Aromatic	Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.1	4.3	50	6
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.1	4.4	50	5
			d8-toluene (Surrogate)	mg/kg	-	4.2	4.3	50	4
			Bromofluorobenzene (Surrogate)	mg/kg	-	3.9	4.2	50	6
		Totals	Total Xylenes*	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX*	mg/kg	0.6	<0.6	<0.6	200	0
SE134396.032	LB069296.024	Monocyclic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
		Aromatic	Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.5	3.8	50	6
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	3.7	3.9	50	4
			d8-toluene (Surrogate)	mg/kg	-	3.6	3.8	50	6
			Bromofluorobenzene (Surrogate)	mg/kg	-	3.9	3.8	50	2
		Totals	Total Xylenes*	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX*	mg/kg	0.6	<0.6	<0.6	200	0

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396.009	LB069296.014		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.1	4.3	30	6
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.1	4.4	30	5
			d8-toluene (Surrogate)	mg/kg	-	4.2	4.3	30	4
			Bromofluorobenzene (Surrogate)	mg/kg	-	3.9	4.2	30	6
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0
SE134396.032	LB069296.024		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.5	3.8	30	6
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	3.7	3.9	30	4
			d8-toluene (Surrogate)	mg/kg	-	3.6	3.8	30	6
			Bromofluorobenzene (Surrogate)	mg/kg	-	3.9	3.8	30	2
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069537.025		Exchangeable Sodium, Na	mg/kg	2	NA	160	80 - 120	114
		Exchangeable Potassium, K	mg/kg	2	NA	330	80 - 120	102
		Exchangeable Calcium, Ca	mg/kg	2	NA	4347	80 - 120	86
		Exchangeable Magnesium, Mg	mg/kg	2	NA	1578	80 - 120	86

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069367.002		Mercury	mg/kg	0.01	0.19	0.2	70 - 130	97
LB069368.002		Mercury	mg/kg	0.01	0.19	0.2	70 - 130	97
LB069506.002		Mercury	mg/kg	0.01	0.21	0.2	70 - 130	104

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069311.002		Heptachlor	mg/kg	0.1	0.2	0.2	60 - 140	97
		Aldrin	mg/kg	0.1	0.2	0.2	60 - 140	93
		Delta BHC	mg/kg	0.1	0.2	0.2	60 - 140	95
		Dieldrin	mg/kg	0.2	<0.2	0.2	60 - 140	90
		Endrin	mg/kg	0.2	<0.2	0.2	60 - 140	100
		p,p'-DDT	mg/kg	0.1	0.2	0.2	60 - 140	92
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.13	0.15	40 - 130	85

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069311.002		Naphthalene	mg/kg	0.1	4.0	4	60 - 140	99
		Acenaphthylene	mg/kg	0.1	4.0	4	60 - 140	100
		Acenaphthene	mg/kg	0.1	3.9	4	60 - 140	97
		Phenanthrene	mg/kg	0.1	4.1	4	60 - 140	102
		Anthracene	mg/kg	0.1	3.6	4	60 - 140	89
		Fluoranthene	mg/kg	0.1	3.8	4	60 - 140	95
		Pyrene	mg/kg	0.1	3.8	4	60 - 140	95
		Benzo(a)pyrene	mg/kg	0.1	4.3	4	60 - 140	107
	Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	88
		2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	78
		d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	40 - 130	94

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069311.002	Arochlor 1260	mg/kg	0.2	0.3	0.4	60 - 140	87

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069427.001	pH	pH Units	-	7.4	7.415	98 - 102	99
LB069428.001	pH	pH Units	-	7.3	7.415	98 - 102	99

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069311.002		Phenol	mg/kg	0.5	0.9	1	70 - 130	88
		2,4-dichlorophenol	mg/kg	0.5	1.1	1	70 - 130	105
		2,4,6-trichlorophenol	mg/kg	0.5	1.1	1	70 - 130	106
		Pentachlorophenol	mg/kg	0.5	1.0	1	70 - 130	104
	Surrogates	2,4,6-Tribromophenol (Surrogate)	mg/kg	-	4.0	5	40 - 130	79
		d5-phenol (Surrogate)	mg/kg	-	1.5	2	40 - 130	75

TOC in Soil

Method: ME-(AU)-[ENV]AN188

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069792.002	Total Organic Carbon	%w/w	0.05	0.30	0.325	80 - 120	93

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest (continued)

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069703.002		Arsenic, As	mg/kg	3	44	50	80 - 120	88
		Cadmium, Cd	mg/kg	0.3	46	50	80 - 120	93
		Chromium, Cr	mg/kg	0.3	44	50	80 - 120	89
		Copper, Cu	mg/kg	0.5	42	50	80 - 120	84
		Lead, Pb	mg/kg	1	45	50	80 - 120	90
		Iron, Fe	mg/kg	50	<50	50	80 - 120	89
		Nickel, Ni	mg/kg	0.5	45	50	80 - 120	89
		Zinc, Zn	mg/kg	0.5	45	50	80 - 120	90
LB069705.002		Arsenic, As	mg/kg	3	47	50	80 - 120	94
		Cadmium, Cd	mg/kg	0.3	48	50	80 - 120	97
		Chromium, Cr	mg/kg	0.3	46	50	80 - 120	93
		Copper, Cu	mg/kg	0.5	44	50	80 - 120	87
		Lead, Pb	mg/kg	1	47	50	80 - 120	93
		Iron, Fe	mg/kg	50	<50	50	80 - 120	94
		Nickel, Ni	mg/kg	0.5	46	50	80 - 120	93
		Zinc, Zn	mg/kg	0.5	47	50	80 - 120	93

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069311.002		TRH C10-C14	mg/kg	20	36	40	60 - 140	90
		TRH C15-C28	mg/kg	45	<45	40	60 - 140	93
		TRH C29-C36	mg/kg	45	<45	40	60 - 140	80
	TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	36	40	60 - 140	90
		TRH >C16-C34 (F3)	mg/kg	90	<90	40	60 - 140	88
		TRH >C34-C40 (F4)	mg/kg	120	<120	20	60 - 140	80

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069296.002	Monocyclic	Benzene	mg/kg	0.1	2.3	2.9	60 - 140	80
	Aromatic	Toluene	mg/kg	0.1	2.3	2.9	60 - 140	78
		Ethylbenzene	mg/kg	0.1	2.5	2.9	60 - 140	86
		m/p-xylene	mg/kg	0.2	5.3	5.8	60 - 140	92
		o-xylene	mg/kg	0.1	2.5	2.9	60 - 140	88
	Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.3	5	60 - 140	85
		d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.8	5	60 - 140	95
		d8-toluene (Surrogate)	mg/kg	-	4.9	5	60 - 140	97
		Bromofluorobenzene (Surrogate)	mg/kg	-	5.8	5	60 - 140	116

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069518.002	Monocyclic	Benzene	µg/L	0.5	53	45.45	60 - 140	117
	Aromatic	Toluene	µg/L	0.5	48	45.45	60 - 140	106
		Ethylbenzene	µg/L	0.5	55	45.45	60 - 140	121
		m/p-xylene	µg/L	1	120	90.9	60 - 140	127
		o-xylene	µg/L	0.5	58	45.45	60 - 140	128
	Surrogates	Dibromofluoromethane (Surrogate)	µg/L	-	5.7	5	60 - 140	114
		d4-1,2-dichloroethane (Surrogate)	µg/L	-	5.7	5	60 - 140	115
		d8-toluene (Surrogate)	µg/L	-	4.4	5	60 - 140	87
		Bromofluorobenzene (Surrogate)	µg/L	-	5.2	5	60 - 140	104

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069296.002		TRH C6-C10	mg/kg	25	<25	24.65	60 - 140	86
		TRH C6-C9	mg/kg	20	<20	23.2	60 - 140	75
	Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.3	5	60 - 140	85
		d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.8	5	60 - 140	95
		d8-toluene (Surrogate)	mg/kg	-	4.9	5	60 - 140	97
		Bromofluorobenzene (Surrogate)	mg/kg	-	5.8	5	60 - 140	116
	VPH F Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	7.25	60 - 140	84

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number	Parameter	Units	LOR

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Volatile Petroleum Hydrocarbons in Water (continued) — **Method: ME-(AU)-[ENV]AN433/AN434/AN410**

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB069518.002		TRH C6-C10	µg/L	50	940	946.63	60 - 140	100
		TRH C6-C9	µg/L	40	830	818.71	60 - 140	101
	Surrogates	Dibromofluoromethane (Surrogate)	µg/L	-	5.7	5	60 - 140	114
		d4-1,2-dichloroethane (Surrogate)	µg/L	-	5.7	5	60 - 140	115
		d8-toluene (Surrogate)	µg/L	-	4.4	5	60 - 140	87
		Bromofluorobenzene (Surrogate)	µg/L	-	5.2	5	60 - 140	104
	VPH F Bands	TRH C6-C10 minus BTEX (F1)	µg/L	50	610	639.67	60 - 140	96

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134376.023	LB069367.004	Mercury	mg/kg	0.01	0.20	0.01	0.2	95
SE134396.015	LB069368.004	Mercury	mg/kg	0.01	0.17	<0.01	0.2	83
SE134396.034	LB069506.004	Mercury	mg/kg	0.01	0.19	<0.01	0.2	97

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134396.012	LB069311.009		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	-	-
			Alpha BHC	mg/kg	0.1	<0.1	<0.1	-	-
			Lindane	mg/kg	0.1	<0.1	<0.1	-	-
			Heptachlor	mg/kg	0.1	0.2	<0.1	0.2	111
			Aldrin	mg/kg	0.1	0.2	<0.1	0.2	104
			Beta BHC	mg/kg	0.1	<0.1	<0.1	-	-
			Delta BHC	mg/kg	0.1	0.2	<0.1	0.2	109
			Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	-	-
			o,p'-DDE	mg/kg	0.1	<0.1	<0.1	-	-
			Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	-	-
			Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	-	-
			Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	-	-
			trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	-	-
			p,p'-DDE	mg/kg	0.1	<0.1	<0.1	-	-
			Dieldrin	mg/kg	0.2	<0.2	<0.2	0.2	98
			Endrin	mg/kg	0.2	0.2	<0.2	0.2	109
			o,p'-DDD	mg/kg	0.1	<0.1	<0.1	-	-
			o,p'-DDT	mg/kg	0.1	<0.1	<0.1	-	-
			Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	-	-
			p,p'-DDD	mg/kg	0.1	<0.1	<0.1	-	-
			p,p'-DDT	mg/kg	0.1	0.2	<0.1	0.2	102
			Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	-	-
			Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	-	-
			Methoxychlor	mg/kg	0.1	<0.1	<0.1	-	-
			Endrin Ketone	mg/kg	0.1	<0.1	<0.1	-	-
			Isodrin	mg/kg	0.1	<0.1	<0.1	-	-
			Mirex	mg/kg	0.1	<0.1	<0.1	-	-
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.15	0.15	-	97

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134396.005	LB069311.006		Naphthalene	mg/kg	0.1	3.9	<0.1	4	98
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	-	-
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	-	-
			Acenaphthylene	mg/kg	0.1	3.8	<0.1	4	96
			Acenaphthene	mg/kg	0.1	3.8	<0.1	4	96
			Fluorene	mg/kg	0.1	<0.1	<0.1	-	-
			Phenanthrene	mg/kg	0.1	4.1	<0.1	4	103
			Anthracene	mg/kg	0.1	3.8	<0.1	4	94
			Fluoranthene	mg/kg	0.1	4.2	<0.1	4	104
			Pyrene	mg/kg	0.1	3.7	<0.1	4	92
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	-	-
			Chrysene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(a)pyrene	mg/kg	0.1	4.2	<0.1	4	104
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	-	-
			Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	-	-
			Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ	0.2	4.2	<0.2	-	-
			Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	4.3	<0.3	-	-
			Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	4.2	<0.2	-	-
			Total PAH	mg/kg	0.8	31	<0.8	-	-
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	-	98
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.4	-	82

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134396.005	LB069311.006	Surrogates	d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	-	96

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134396.016	LB069311.011		Arochlor 1016	mg/kg	0.2	<0.2	<0.2	-	-
			Arochlor 1221	mg/kg	0.2	<0.2	<0.2	-	-
			Arochlor 1232	mg/kg	0.2	<0.2	<0.2	-	-
			Arochlor 1242	mg/kg	0.2	<0.2	<0.2	-	-
			Arochlor 1248	mg/kg	0.2	<0.2	<0.2	-	-
			Arochlor 1254	mg/kg	0.2	<0.2	<0.2	-	-
			Arochlor 1260	mg/kg	0.2	0.4	<0.2	0.4	105
			Arochlor 1262	mg/kg	0.2	<0.2	<0.2	-	-
			Arochlor 1268	mg/kg	0.2	<0.2	<0.2	-	-
			Total PCBs (Arochlors)	mg/kg	1	<1	<1	-	-
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0	0	-	104

Speciated Phenols in Soil

Method: ME-(AU)-[ENV]AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134396.016	LB069311.011		Phenol	mg/kg	0.5	1.0	<0.5	1	99
			2-methyl phenol (o-cresol)	mg/kg	0.5	<0.5	<0.5	-	-
			3/4-methyl phenol (m/p-cresol)	mg/kg	1	<1	<1	-	-
			Total Cresol	mg/kg	1.5	<1.5	<1.5	-	-
			2-chlorophenol	mg/kg	0.5	<0.5	<0.5	-	-
			2,4-dimethylphenol	mg/kg	0.5	<0.5	<0.5	-	-
			2,6-dichlorophenol	mg/kg	0.5	<0.5	<0.5	-	-
			2,4-dichlorophenol	mg/kg	0.5	1.1	<0.5	1	111
			2,4,6-trichlorophenol	mg/kg	0.5	1.0	<0.5	1	103
			2-nitrophenol	mg/kg	0.5	<0.5	<0.5	-	-
			4-nitrophenol	mg/kg	1	<1	<1	-	-
			2,4,5-trichlorophenol	mg/kg	0.5	<0.5	<0.5	-	-
			2,3,4,6/2,3,5,6-tetrachlorophenol	mg/kg	1	<1	<1	-	-
			Pentachlorophenol	mg/kg	0.5	1.3	<0.5	1	126
			2,4-dinitrophenol	mg/kg	2	<2	<2	-	-
			4-chloro-3-methylphenol	mg/kg	2	<2	<2	-	-
		Surrogates	2,4,6-Tribromophenol (Surrogate)	mg/kg	-	4.9	4.5	5	98
			d5-phenol (Surrogate)	mg/kg	-	1.5	1.4	2	77

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134396.001	LB069703.004		Arsenic, As	mg/kg	3	42	6	50	72
			Cadmium, Cd	mg/kg	0.3	38	0.3	50	75
			Chromium, Cr	mg/kg	0.3	57	18	50	77
			Copper, Cu	mg/kg	0.5	53	18	50	71
			Lead, Pb	mg/kg	1	78	47	50	62 ④
			Nickel, Ni	mg/kg	0.5	49	13	50	72
			Zinc, Zn	mg/kg	0.5	320	290	50	50 ④
SE134396.021	LB069705.004		Arsenic, As	mg/kg	3	42	10	50	63 ④
			Cadmium, Cd	mg/kg	0.3	34	<0.3	50	67 ④
			Chromium, Cr	mg/kg	0.3	45	13	50	64 ④
			Copper, Cu	mg/kg	0.5	48	16	50	63 ④
			Lead, Pb	mg/kg	1	50	20	50	59 ④
			Nickel, Ni	mg/kg	0.5	56	26	50	60 ④
			Zinc, Zn	mg/kg	0.5	83	55	50	56 ④

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134376.002	LB069296.004	Monocyclic	Benzene	mg/kg	0.1	2.2	<0.1	2.9	77
		Aromatic	Toluene	mg/kg	0.1	2.2	<0.1	2.9	77
			Ethylbenzene	mg/kg	0.1	2.3	<0.1	2.9	78
			m/p-xylene	mg/kg	0.2	4.9	<0.2	5.8	84
			o-xylene	mg/kg	0.1	2.2	<0.1	2.9	77
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	-	-
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.8	3.8	5	77

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued)

Method: ME-(AU)-[ENV]AN433/AN434

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134376.002	LB069296.004	Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.9	4.2	5	98
			d8-toluene (Surrogate)	mg/kg	-	4.7	4.2	5	94
			Bromofluorobenzene (Surrogate)	mg/kg	-	5.2	3.6	5	105
		Totals	Total Xylenes*	mg/kg	0.3	7.1	<0.3	-	-
			Total BTEX*	mg/kg	0.6	14	<0.6	-	-

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134376.002	LB069296.004		TRH C6-C10	mg/kg	25	<25	<25	24.65	83
			TRH C6-C9	mg/kg	20	<20	<20	23.2	81
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.8	3.8	5	77
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.9	4.2	5	98
			d8-toluene (Surrogate)	mg/kg	-	4.7	4.2	5	94
			Bromofluorobenzene (Surrogate)	mg/kg	-	5.2	3.6	5	105
		VPH F	Benzene (F0)	mg/kg	0.1	2.2	<0.1	-	-
		Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	7.25	93

MATRIX SPIKE DUPLICATES

SE134396 R0

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here:
http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

*	Non-accredited analysis.
-	Sample not analysed for this analyte.
^	Analysis performed by external laboratory.

IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.

①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to Analytical Report comments for further information.

This document is issued, on the Client's behalf, by the Company under its General Conditions of Service, available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions/General-Conditions-of-Services-English.aspx. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any other holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This test report shall not be reproduced, except in full.

Robson ENVIRONMENTAL

Occupational Hygiene Health Safety & Environmental Consulting

CHAIN OF CUSTODY FORM

Job No.: 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
140 Gladstone Street
Fyshwick ACT 2609
ABN: 55 008 660 900

Contact: Ben Kendon
Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required YES NO

Job Name: ESA

Required Turnaround Time:
24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

SGS Job Ref: SY140911-1-IS

Doc No: EAR-F013 Revision No: 2
Date Issued: 5/11/13
Next Review Date: 05/11/15

To:
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax: (02) 8594 0499
Email:
ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
1	TP8 (0.0-0.1)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
.	TP8 (0.4-0.5)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
2	TP8 (0.9-1.0)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
3	TP8 (1.9-2.0)	10/12/2014		1 plastic bag	soil	ice	Asbestos (WA)	
4	TP8 (2.8-2.9)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA),E coli, Faecal Coliforms and Total Coliforms	
5, ~~8938~~	TP9(0.0-0.1)	10/12/2014		1 glass jar, 1 plastic bag + ACM fragments	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
.	TP9(0.5-0.6)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
6	TP9(1.1-1.2)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
.	TP9 (1.9-2.0)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
7	TP9 (2.9-3.0)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA) and PAH	
8	TP9 (3.9-4.0)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
.	TP10(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
BS Receipt 12/12/14 9	TP10(0.4-0.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	

Relinquished by: RW	Date: 11/12/14		Time: 3pm	Received by:	Time: 12/12/14 9.00
Relinquished by:	Date:		Time:	Received by:	Time:
Relinquished by:	Date:		Time:	Received by:	Time:

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12 DEC 2014
SE134396

page 1 of 4.

Robson ENVIRONMENTAL

Occupational Hygiene Health Safety & Environmental Consulting

CHAIN OF CUSTODY FORM

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From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
140 Gladstone Street
Fyshwick ACT 2609
ABN: 55 008 660 900

Contact: Ben Kendon
Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required YES NO

Job Name: Stage 1 ESA

SGS Job Ref: SY140911-1-IS

Required Turnaround Time: 24hr; 36hr; 48hr; 72hr & 5 to 7 **Days**

Doc No: EAR-F013 Revision No: 1
Date Issued: 13/04/2012

To:
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax: (02) 8594 0499
Email:
ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
	TP10(0.9-1.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
10	TP10(1.9-2.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
	TP10(2.9-3.0)	11/12/2014		1 glass jar	soil	ice		Hold
10	TP10(3.9-4.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
	TP10(4.9-5.0)	12/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
12	TP11(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
13	TP11(0.4-0.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
14	TP12(0.0-0.1)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
15	TP12(0.4-0.5)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
16	TP13(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP13(0.4-0.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
	TP13(0.9-1.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
17	TP13(1.9-2.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
	TP13(2.9-3.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		
18	TP13(3.5-3.6)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
Bth Revised 12/12/14 19	TP14(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	

Relinquished by:RW	Date:11/12/14		Time:	Received by:	Time: 12/12/14 4.00
Relinquished by:	Date:		Time:	Received by:	Time:
Relinquished by:	Date:		Time:	Received by:	Time:

Robson

Occupational Hygiene Health Safety & Environmental Consulting

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Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required YES NO

Job Name: Stage 1 ESA

SGS Job Ref: SY140911-1-IS

Required Turnaround Time: 24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

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ABN 44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
	TP14(0.4-0.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
20	TP14(0.9-1.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA) and PAH	
	TP14(1.9-2.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
21	TP14(2.9-3.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA) and PAH	
	TP14(4.4-4.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
22	TP14(5.4-5.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA)	
23	TP15(0.0-0.1)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP15(0.5-0.6)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
24	TP15(0.9-1.0)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
25	TP16(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
26	TP16(0.6-0.7)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA)	
27	TP17(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA) and CEC, organic carbon, clay content, iron and pH	
	TP17(0.4-0.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
28	TP17(0.9-1.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA)	
Revised	TP17(1.9-2.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
12/12/14 29	TP17(2.9-3.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	

Relinquished by:RW	Date:11/12/14		Time:	Received by:	Time: 12/12/14 4:00
Relinquished by:	Date:		Time:	Received by:	Time:
Relinquished by:	Date:		Time:	Received by:	Time:

Robson ENVIRONMENTAL

Occupational Hygiene Health Safety & Environmental Consulting

CHAIN OF CUSTODY FORM

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Client Information: Capezio and Co
Unit 2/2 Yallourn Street
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Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required YES NO

Job Name: Stage 1 ESA

SGS Job Ref: SY140911-1-IS

Required Turnaround Time: 24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

Doc No: EAR-F013 Revision No: 1
Date Issued: 13/04/2012

To:
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax: (02) 8594 0499
Email:
ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
30	TP18(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
31	TP18(0.6-0.7)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA)	
32	TP19(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
33	TP19(0.6-0.7)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA)	
34	QC6 7	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	
	QC6 8	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	Transfer to Envirolab COC
35	QC7 9	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	
	QC8 10	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	Transfer to Envirolab COC
36	TB4	11/12/2014		2 vials	water	ice	BTEX and TRH C6-C9	
37	TS4	11/12/2014		2 vials	water	ice	BTEX and TRH C6-C9	
RH Revised 12/12/14								

Relinquished by:RW	Date:11/12/14	Time:	Received by:	Time:	12/12/14 9:00
Relinquished by:	Date:	Time:	Received by:	Time:	
Relinquished by:	Date:	Time:	Received by:	Time:	

Page 4 of 4

SGS

SE134396

Job:

	Matrix	250 JAR	125 JAR	BAG	1L UP P	500 UP P	250 ZnAcetate P	250 / 500 NaOH BP	125 / 250 UP P	125 / 250 Metal Total*	125 / 250 Metal Filtered*	125 HCl P	1L UP AG	500 / 1L H_2SO_4 AG	125 / 250 H_2SO_4 P	100 / 200 UP AG	40 NaThio GV	250 UP OPAQUE P	500 NaThio STERILE P	200 NaThio STERILE P	40 Vial	Storage Location	Bottles Supplied By	Comment	Cooling Method
~~I-38~~ I-35	S	1		1																			SBS		CP
36	W																2					S190-2 ASB		All	Temp
37	W																				1	WOSS	SBS	All	4.7
38	W			1																		~~ASB~~ "	"		Good Order
~~35~~	~~SG~~ A																					ASB	Client	—	Y / N
																									Clearly Labelled
																									Y / N
																									Correct Pres.
																									Y / N
																									No Head-space
																									Y / N / NA
																									Sufficient Vol
																									Y / N
																									Doc Date
																									Doc Type
																									Complete Docs
																									Y / N
																									Requested TAT

16 SOILS on hold

~~18~~ SOILS on hold

SAMPLE RECEIPT ADVICE

SE134396

CLIENT DETAILS

Contact	Ben Kendon
Client	Robson Environmental Pty Ltd
Address	140 Gladstone Street, FYSHWICK PO Box 112, FYSHWICK ACT 2609
Telephone	(02) 6239 5656
Facsimile	(02) 6239 5669
Email	ben@robsonlabs.com.au
Project	**9623 - ESA - Old Canberra Brickworks**
Order Number	**SY140911-1-IS**
Samples	38

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
Samples Received	Fri 12/12/2014
Report Due	Tue 23/12/2014
SGS Reference	**SE134396**

SUBMISSION DETAILS

This is to confirm that 38 samples were received on Friday 12/12/2014. Results are expected to be ready by Tuesday 23/12/2014. Please quote SGS reference SE134396 when making enquiries. Refer below for details relating to sample integrity upon receipt.

Sample counts by matrix	35 Soils, 2 Waters & 1 Mat	Type of documentation received	COC
Date documentation received	12/12/2014	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	4.7°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes		

Samples will be held for one month for water samples and two months for soil samples from date of report, unless otherwise instructed.

COMMENTS

Trip Spike can only be analysed for BTEX.
Clay Content subcontracted to SGS Cairns, 2/58 Comport St, Portsmith QLD 4870, NATA Accreditation Number: 2562, Site Number: 3146.
E.Coli, Faecal Coliforms and Total Coliforms subcontracted to SONIC FOOD & WATER TESTING, 31-33 Lawson Street Penrith NSW 2750, NATA Accreditation Number: 4034.
16 soil samples have been placed on hold as per client's request. These samples will not be processed.

To the extent not inconsistent with the other provisions of this document and unless specifically agreed otherwise in writing by SGS , all SGS services are rendered in accordance with the applicable SGS General Conditions of Service accessible at http://www.sgs.com/en/Terms-and-Conditions/General-Conditions-of-Services-English.aspx as at the date of this document.
Attention is drawn to the limitations of liability and to the clauses of indemnification.

SAMPLE RECEIPT ADVICE

SE134396

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	OC Pesticides in Soil	PAH (Polynuclear Aromatic Hydrocarbons) in Soil	PCBs in Soil	pH in soil (1:5)	Speciated Phenols in Soil	TRH (Total Recoverable Hydrocarbons) in Soil	VOC's in Soil	Volatile Petroleum Hydrocarbons in Soil
001	TP8 0.0-0.1	28	25	11	-	18	10	12	8
005	TP9 0.0-0.1	28	25	11	-	18	10	12	8
006	TP9 1.1-1.2	-	-	-	1	-	-	-	-
007	TP9 2.9-3.0	-	25	-	-	-	-	-	-
008	TP9 3.9-4.0	-	-	-	1	-	-	-	-
009	TP10 0.4-0.5	28	25	11	-	18	10	12	8
012	TP11 0.0-0.1	28	25	11	-	18	10	12	8
013	TP11 0.4-0.5	-	-	-	1	-	-	-	-
014	TP12 0.0-0.1	28	25	11	-	18	10	12	8
016	TP13 0.0-0.1	28	25	11	-	18	10	12	8
017	TP13 1.9-2.0	-	-	-	1	-	-	-	-
018	TP13 3.5-3.6	-	-	-	1	-	-	-	-
019	TP14 0.0-0.1	28	25	11	-	18	10	12	8
020	TP 14 0.9-1.0	-	25	-	-	-	-	-	-
021	TP14 2.9-3.0	-	25	-	-	-	-	-	-
023	TP15 0.0-0.1	28	25	11	-	18	10	12	8
024	TP15 0.9-1.0	-	-	-	1	-	-	-	-

CONTINUED OVERLEAF

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SAMPLE RECEIPT ADVICE

SE134396

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	OC Pesticides in Soil	PAH (Polynuclear Aromatic Hydrocarbons) in Soil	PCBs in Soil	pH in soil (1:5)	Speciated Phenols in Soil	TRH (Total Recoverable Hydrocarbons) in Soil	VOC's in Soil	Volatile Petroleum Hydrocarbons in Soil
025	TP16 0.0-0.1	28	25	11	-	18	10	12	8
027	TP17 0.0-0.1	28	25	11	1	18	10	12	8
029	TP17 2.9-3.0	-	-	-	1	-	-	-	-
030	TP18 0.0-0.1	28	25	11	-	18	10	12	8
032	TP19 0.0-0.1	28	25	11	-	18	10	12	8
034	QC7	-	25	-	-	-	-	-	-
035	QC9	-	25	-	-	-	-	-	-

CONTINUED OVERLEAF

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SAMPLE RECEIPT ADVICE

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CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	Exchangeable Cations and Cation Exchange Capacity	Gravimetric Determination of Asbestos in Soil	Mercury in Soil	Particle sizing of soils <75µm by hydrometer	Particle sizing of soils by sieving	TOC in Soil	Total Recoverable Metals in Soil by ICPOES from
001	TP8 0.0-0.1	-	5	1	-	-	-	7
002	TP8 0.9-1.0	-	5	1	-	-	-	7
003	TP8 1.9-2.0	-	5	-	-	-	-	-
004	TP8 2.8-2.9	-	5	1	-	-	-	7
005	TP9 0.0-0.1	-	5	1	-	-	-	7
006	TP9 1.1-1.2	13	5	1	36	2	1	8
007	TP9 2.9-3.0	-	5	1	-	-	-	7
008	TP9 3.9-4.0	13	5	1	36	2	1	8
009	TP10 0.4-0.5	-	5	1	-	-	-	7
010	TP10 1.9-2.0	-	5	1	-	-	-	7
011	TP10 3.9-4.0	-	5	1	-	-	-	7
012	TP11 0.0-0.1	-	5	1	-	-	-	7
013	TP11 0.4-0.5	13	5	1	36	2	1	8
014	TP12 0.0-0.1	-	5	1	-	-	-	7
015	TP12 0.4-0.5	-	5	1	-	-	-	7
016	TP13 0.0-0.1	-	5	1	-	-	-	7
017	TP13 1.9-2.0	13	5	1	36	2	1	8
018	TP13 3.5-3.6	13	5	1	36	2	1	8
019	TP14 0.0-0.1	-	5	1	-	-	-	7
020	TP 14 0.9-1.0	-	5	1	-	-	-	7
021	TP14 2.9-3.0	-	5	1	-	-	-	7
022	TP14 5.4-5.5	-	5	1	-	-	-	7
023	TP15 0.0-0.1	-	5	1	-	-	-	7
024	TP15 0.9-1.0	13	5	1	36	2	1	8

CONTINUED OVERLEAF

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SAMPLE RECEIPT ADVICE

SE134396

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	Exchangeable Cations and Cation Exchange Capacity	Fibre ID in bulk materials	Gravimetric Determination of Asbestos in Soil	Mercury in Soil	Particle sizing of soils <75µm by hydrometer	Particle sizing of soils by sieving	TOC in Soil	Total Recoverable Metals in Soil by ICPOES from
025	TP16 0.0-0.1	-	-	5	1	-	-	-	7
026	TP16 0.6-0.7	-	-	5	1	-	-	-	7
027	TP17 0.0-0.1	13	-	5	1	36	2	1	8
028	TP17 0.9-1.0	-	-	5	1	-	-	-	7
029	TP17 2.9-3.0	13	-	5	1	36	2	1	8
030	TP18 0.0-0.1	-	-	5	1	-	-	-	7
031	TP18 0.6-0.7	-	-	5	1	-	-	-	7
032	TP19 0.0-0.1	-	-	5	1	-	-	-	7
033	TP19 0.6-0.7	-	-	5	1	-	-	-	7
034	QC7	-	-	5	1	-	-	-	7
035	QC9	-	-	5	1	-	-	-	7
038	TP9 0.0-0.1	-	1	-	-	-	-	-	-

CONTINUED OVERLEAF

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SAMPLE RECEIPT ADVICE

SE134396

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	Coliforms in Soil/Sludges	E. coli and Thermotolerant coliforms in Soil	Moisture Content
001	TP8 0.0-0.1	-	-	1
002	TP8 0.9-1.0	-	-	1
004	TP8 2.8-2.9	2	3	1
005	TP9 0.0-0.1	-	-	1
006	TP9 1.1-1.2	-	-	1
007	TP9 2.9-3.0	-	-	1
008	TP9 3.9-4.0	-	-	1
009	TP10 0.4-0.5	-	-	1
010	TP10 1.9-2.0	-	-	1
011	TP10 3.9-4.0	-	-	1
012	TP11 0.0-0.1	-	-	1
013	TP11 0.4-0.5	-	-	1
014	TP12 0.0-0.1	-	-	1
015	TP12 0.4-0.5	-	-	1
016	TP13 0.0-0.1	-	-	1
017	TP13 1.9-2.0	-	-	1
018	TP13 3.5-3.6	-	-	1
019	TP14 0.0-0.1	-	-	1
020	TP 14 0.9-1.0	-	-	1
021	TP14 2.9-3.0	-	-	1
022	TP14 5.4-5.5	-	-	1
023	TP15 0.0-0.1	-	-	1
024	TP15 0.9-1.0	-	-	1

CONTINUED OVERLEAF

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SAMPLE RECEIPT ADVICE

SE134396

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	Moisture Content	VOCs in Water	Volatile Petroleum Hydrocarbons in Water
025	TP16 0.0-0.1	1	-	-
026	TP16 0.6-0.7	1	-	-
027	TP17 0.0-0.1	1	-	-
028	TP17 0.9-1.0	1	-	-
029	TP17 2.9-3.0	1	-	-
030	TP18 0.0-0.1	1	-	-
031	TP18 0.6-0.7	1	-	-
032	TP19 0.0-0.1	1	-	-
033	TP19 0.6-0.7	1	-	-
034	QC7	1	-	-
035	QC9	1	-	-
036	TB4	-	12	8
037	TS4	-	12	-

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ANALYTICAL REPORT

WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Ben Kendon	Manager	Huong Crawford
Client	Robson Environmental Pty Ltd	Laboratory	SGS Alexandria Environmental
Address	140 Gladstone Street, FYSHWICK PO Box 112, FYSHWICK ACT 2609	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
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Facsimile	(02) 6239 5669	Facsimile	+61 2 8594 0499
Email	ben@robsonlabs.com.au	Email	au.environmental.sydney@sgs.com
Project	**9623 - ESA - Old Canberra Brickworks**	SGS Reference	**SE134396A R0**
Order Number	(Not specified)	Report Number	0000099911
Samples	40	Date Reported	09 Jan 2015
Date Started	07 Jan 2015	Date Received	12 Dec 2014

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

SIGNATORIES

Ly Kim Ha
Organic Section Head

Parameter	Units	LOR	Sample Number: SE134396A.001 Sample Matrix: Soil Sample Date: 10 Dec 2014 Sample Name: TP8 0.0-0.1	SE134396A.002 Soil 10 Dec 2014 TP8 0.9-1.0	SE134396A.003 Soil 10 Dec 2014 TP8 1.9-2.0	SE134396A.004 Soil 10 Dec 2014 TP8 2.8-2.9
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410						
TRH C6-C10	mg/kg	25	-	-	-	-
TRH C6-C9	mg/kg	20	-	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-	-
VPH F Bands						
Benzene (F0)	mg/kg	0.1	-	-	-	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25	-	-	-	-
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403						
TRH C10-C14	mg/kg	20	-	-	-	-
TRH C15-C28	mg/kg	45	-	-	-	-
TRH C29-C36	mg/kg	45	-	-	-	-
TRH C37-C40	mg/kg	100	-	-	-	-
TRH C10-C36 Total	mg/kg	110	-	-	-	-
TRH C10-C40 Total	mg/kg	210	-	-	-	-
TRH F Bands						
TRH >C10-C16 (F2)	mg/kg	25	-	-	-	-
TRH >C16-C34 (F3)	mg/kg	90	-	-	-	-
TRH >C34-C40 (F4)	mg/kg	120	-	-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420						
Naphthalene	mg/kg	0.1	-	-	-	-
2-methylnaphthalene	mg/kg	0.1	-	-	-	-
1-methylnaphthalene	mg/kg	0.1	-	-	-	-
Acenaphthylene	mg/kg	0.1	-	-	-	-
Acenaphthene	mg/kg	0.1	-	-	-	-
Fluorene	mg/kg	0.1	-	-	-	-
Phenanthrene	mg/kg	0.1	-	-	-	-
Anthracene	mg/kg	0.1	-	-	-	-
Fluoranthene	mg/kg	0.1	-	-	-	-
Pyrene	mg/kg	0.1	-	-	-	-
Benzo(a)anthracene	mg/kg	0.1	-	-	-	-
Chrysene	mg/kg	0.1	-	-	-	-
Benzo(b&j)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(a)pyrene	mg/kg	0.1	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	-	-	-	-
Dibenzo(a&h)anthracene	mg/kg	0.1	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.1	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ	0.2	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	-	-	-	-
Total PAH	mg/kg	0.8	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134396A.001 Soil 10 Dec 2014 TP8 0.0-0.1	SE134396A.002 Soil 10 Dec 2014 TP8 0.9-1.0	SE134396A.003 Soil 10 Dec 2014 TP8 1.9-2.0	SE134396A.004 Soil 10 Dec 2014 TP8 2.8-2.9
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)							
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		-	-	-	-
2-fluorobiphenyl (Surrogate)	%	-		-	-	-	-
d14-p-terphenyl (Surrogate)	%	-		-	-	-	-
Moisture Content Method: AN002							
% Moisture	%	0.5		-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134396A.005 Soil 10 Dec 2014 TP9 0.0-0.1	SE134396A.006 Soil 10 Dec 2014 TP9 1.1-1.2	SE134396A.007 Soil 10 Dec 2014 TP9 2.9-3.0	SE134396A.008 Soil 10 Dec 2014 TP9 3.9-4.0
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410						
TRH C6-C10	mg/kg	25	-	-	-	-
TRH C6-C9	mg/kg	20	-	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-	-
VPH F Bands						
Benzene (F0)	mg/kg	0.1	-	-	-	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25	-	-	-	-
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403						
TRH C10-C14	mg/kg	20	-	-	-	-
TRH C15-C28	mg/kg	45	-	-	-	-
TRH C29-C36	mg/kg	45	-	-	-	-
TRH C37-C40	mg/kg	100	-	-	-	-
TRH C10-C36 Total	mg/kg	110	-	-	-	-
TRH C10-C40 Total	mg/kg	210	-	-	-	-
TRH F Bands						
TRH >C10-C16 (F2)	mg/kg	25	-	-	-	-
TRH >C16-C34 (F3)	mg/kg	90	-	-	-	-
TRH >C34-C40 (F4)	mg/kg	120	-	-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420						
Naphthalene	mg/kg	0.1	-	-	-	-
2-methylnaphthalene	mg/kg	0.1	-	-	-	-
1-methylnaphthalene	mg/kg	0.1	-	-	-	-
Acenaphthylene	mg/kg	0.1	-	-	-	-
Acenaphthene	mg/kg	0.1	-	-	-	-
Fluorene	mg/kg	0.1	-	-	-	-
Phenanthrene	mg/kg	0.1	-	-	-	-
Anthracene	mg/kg	0.1	-	-	-	-
Fluoranthene	mg/kg	0.1	-	-	-	-
Pyrene	mg/kg	0.1	-	-	-	-
Benzo(a)anthracene	mg/kg	0.1	-	-	-	-
Chrysene	mg/kg	0.1	-	-	-	-
Benzo(b&j)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(a)pyrene	mg/kg	0.1	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	-	-	-	-
Dibenzo(a&h)anthracene	mg/kg	0.1	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.1	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ	0.2	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	-	-	-	-
Total PAH	mg/kg	0.8	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134396A.005 Soil 10 Dec 2014 TP9 0.0-0.1	SE134396A.006 Soil 10 Dec 2014 TP9 1.1-1.2	SE134396A.007 Soil 10 Dec 2014 TP9 2.9-3.0	SE134396A.008 Soil 10 Dec 2014 TP9 3.9-4.0
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)							
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		-	-	-	-
2-fluorobiphenyl (Surrogate)	%	-		-	-	-	-
d14-p-terphenyl (Surrogate)	%	-		-	-	-	-
Moisture Content Method: AN002							
% Moisture	%	0.5		-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134396A.009 Soil 11 Dec 2014 TP10 0.4-0.5	SE134396A.010 Soil 11 Dec 2014 TP10 1.9-2.0	SE134396A.011 Soil 11 Dec 2014 TP10 3.9-4.0	SE134396A.012 Soil 11 Dec 2014 TP11 0.0-0.1
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410						
TRH C6-C10	mg/kg	25	-	-	-	-
TRH C6-C9	mg/kg	20	-	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-	-
VPH F Bands						
Benzene (F0)	mg/kg	0.1	-	-	-	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25	-	-	-	-
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403						
TRH C10-C14	mg/kg	20	-	-	-	-
TRH C15-C28	mg/kg	45	-	-	-	-
TRH C29-C36	mg/kg	45	-	-	-	-
TRH C37-C40	mg/kg	100	-	-	-	-
TRH C10-C36 Total	mg/kg	110	-	-	-	-
TRH C10-C40 Total	mg/kg	210	-	-	-	-
TRH F Bands						
TRH >C10-C16 (F2)	mg/kg	25	-	-	-	-
TRH >C16-C34 (F3)	mg/kg	90	-	-	-	-
TRH >C34-C40 (F4)	mg/kg	120	-	-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420						
Naphthalene	mg/kg	0.1	-	-	-	-
2-methylnaphthalene	mg/kg	0.1	-	-	-	-
1-methylnaphthalene	mg/kg	0.1	-	-	-	-
Acenaphthylene	mg/kg	0.1	-	-	-	-
Acenaphthene	mg/kg	0.1	-	-	-	-
Fluorene	mg/kg	0.1	-	-	-	-
Phenanthrene	mg/kg	0.1	-	-	-	-
Anthracene	mg/kg	0.1	-	-	-	-
Fluoranthene	mg/kg	0.1	-	-	-	-
Pyrene	mg/kg	0.1	-	-	-	-
Benzo(a)anthracene	mg/kg	0.1	-	-	-	-
Chrysene	mg/kg	0.1	-	-	-	-
Benzo(b&j)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(a)pyrene	mg/kg	0.1	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	-	-	-	-
Dibenzo(a&h)anthracene	mg/kg	0.1	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.1	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ	0.2	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	-	-	-	-
Total PAH	mg/kg	0.8	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134396A.009 Soil 11 Dec 2014 TP10 0.4-0.5	SE134396A.010 Soil 11 Dec 2014 TP10 1.9-2.0	SE134396A.011 Soil 11 Dec 2014 TP10 3.9-4.0	SE134396A.012 Soil 11 Dec 2014 TP11 0.0-0.1
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)						
Surrogates						
d5-nitrobenzene (Surrogate)	%	-	-	-	-	-
2-fluorobiphenyl (Surrogate)	%	-	-	-	-	-
d14-p-terphenyl (Surrogate)	%	-	-	-	-	-
Moisture Content Method: AN002						
% Moisture	%	0.5	-	-	-	-

Parameter	Units	LOR	Sample Number: SE134396A.013 Sample Matrix: Soil Sample Date: 11 Dec 2014 Sample Name: TP11 0.4-0.5	SE134396A.014 Soil 10 Dec 2014 TP12 0.0-0.1	SE134396A.015 Soil 10 Dec 2014 TP12 0.4-0.5	SE134396A.016 Soil 11 Dec 2014 TP13 0.0-0.1
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410						
TRH C6-C10	mg/kg	25	<25	-	-	-
TRH C6-C9	mg/kg	20	<20	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	**73**	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	**84**	-	-	-
d8-toluene (Surrogate)	%	-	**106**	-	-	-
Bromofluorobenzene (Surrogate)	%	-	**90**	-	-	-
VPH F Bands						
Benzene (F0)	mg/kg	0.1	<0.1	-	-	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	-	-	-
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403						
TRH C10-C14	mg/kg	20	<20	-	-	-
TRH C15-C28	mg/kg	45	<45	-	-	-
TRH C29-C36	mg/kg	45	<45	-	-	-
TRH C37-C40	mg/kg	100	<100	-	-	-
TRH C10-C36 Total	mg/kg	110	<110	-	-	-
TRH C10-C40 Total	mg/kg	210	<210	-	-	-
TRH F Bands						
TRH >C10-C16 (F2)	mg/kg	25	<25	-	-	-
TRH >C16-C34 (F3)	mg/kg	90	<90	-	-	-
TRH >C34-C40 (F4)	mg/kg	120	<120	-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420						
Naphthalene	mg/kg	0.1	<0.1	-	-	-
2-methylnaphthalene	mg/kg	0.1	<0.1	-	-	-
1-methylnaphthalene	mg/kg	0.1	<0.1	-	-	-
Acenaphthylene	mg/kg	0.1	<0.1	-	-	-
Acenaphthene	mg/kg	0.1	<0.1	-	-	-
Fluorene	mg/kg	0.1	<0.1	-	-	-
Phenanthrene	mg/kg	0.1	<0.1	-	-	-
Anthracene	mg/kg	0.1	<0.1	-	-	-
Fluoranthene	mg/kg	0.1	<0.1	-	-	-
Pyrene	mg/kg	0.1	<0.1	-	-	-
Benzo(a)anthracene	mg/kg	0.1	<0.1	-	-	-
Chrysene	mg/kg	0.1	<0.1	-	-	-
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	-	-	-
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	-	-	-
Benzo(a)pyrene	mg/kg	0.1	<0.1	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	-	-	-
Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	-	-	-
Benzo(ghi)perylene	mg/kg	0.1	<0.1	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ	0.2	<0.2	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	<0.3	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	<0.2	-	-	-
Total PAH	mg/kg	0.8	<0.8	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134396A.013 Soil 11 Dec 2014 TP11 0.4-0.5	SE134396A.014 Soil 10 Dec 2014 TP12 0.0-0.1	SE134396A.015 Soil 10 Dec 2014 TP12 0.4-0.5	SE134396A.016 Soil 11 Dec 2014 TP13 0.0-0.1
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)						
Surrogates						
d5-nitrobenzene (Surrogate)	%	-	**86**	-	-	-
2-fluorobiphenyl (Surrogate)	%	-	**72**	-	-	-
d14-p-terphenyl (Surrogate)	%	-	**100**	-	-	-
Moisture Content Method: AN002						
% Moisture	%	0.5	-	-	-	-

Parameter	Units	LOR	Sample Number: SE134396A.017 Sample Matrix: Soil Sample Date: 11 Dec 2014 Sample Name: TP13 1.9-2.0	SE134396A.018 Soil 11 Dec 2014 TP13 3.5-3.6	SE134396A.019 Soil 11 Dec 2014 TP14 0.0-0.1	SE134396A.020 Soil 11 Dec 2014 TP 14 0.9-1.0
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410						
TRH C6-C10	mg/kg	25	<25	-	-	-
TRH C6-C9	mg/kg	20	<20	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	**74**	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	**83**	-	-	-
d8-toluene (Surrogate)	%	-	**116**	-	-	-
Bromofluorobenzene (Surrogate)	%	-	**112**	-	-	-
VPH F Bands						
Benzene (F0)	mg/kg	0.1	<0.1	-	-	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	-	-	-
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403						
TRH C10-C14	mg/kg	20	<20	-	-	-
TRH C15-C28	mg/kg	45	**310**	-	-	-
TRH C29-C36	mg/kg	45	**200**	-	-	-
TRH C37-C40	mg/kg	100	<100	-	-	-
TRH C10-C36 Total	mg/kg	110	**510**	-	-	-
TRH C10-C40 Total	mg/kg	210	**510**	-	-	-
TRH F Bands						
TRH >C10-C16 (F2)	mg/kg	25	<25	-	-	-
TRH >C16-C34 (F3)	mg/kg	90	**460**	-	-	-
TRH >C34-C40 (F4)	mg/kg	120	<120	-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420						
Naphthalene	mg/kg	0.1	<0.1	-	-	-
2-methylnaphthalene	mg/kg	0.1	<0.1	-	-	-
1-methylnaphthalene	mg/kg	0.1	<0.1	-	-	-
Acenaphthylene	mg/kg	0.1	<0.1	-	-	-
Acenaphthene	mg/kg	0.1	<0.1	-	-	-
Fluorene	mg/kg	0.1	<0.1	-	-	-
Phenanthrene	mg/kg	0.1	**0.1**	-	-	-
Anthracene	mg/kg	0.1	<0.1	-	-	-
Fluoranthene	mg/kg	0.1	<0.1	-	-	-
Pyrene	mg/kg	0.1	<0.1	-	-	-
Benzo(a)anthracene	mg/kg	0.1	<0.1	-	-	-
Chrysene	mg/kg	0.1	<0.1	-	-	-
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	-	-	-
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	-	-	-
Benzo(a)pyrene	mg/kg	0.1	<0.1	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	-	-	-
Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	-	-	-
Benzo(ghi)perylene	mg/kg	0.1	<0.1	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ	0.2	<0.2	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	<0.3	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	<0.2	-	-	-
Total PAH	mg/kg	0.8	<0.8	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134396A.017 Soil 11 Dec 2014 TP13 1.9-2.0	SE134396A.018 Soil 11 Dec 2014 TP13 3.5-3.6	SE134396A.019 Soil 11 Dec 2014 TP14 0.0-0.1	SE134396A.020 Soil 11 Dec 2014 TP 14 0.9-1.0
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)						
Surrogates						
d5-nitrobenzene (Surrogate)	%	-	**90**	-	-	-
2-fluorobiphenyl (Surrogate)	%	-	**80**	-	-	-
d14-p-terphenyl (Surrogate)	%	-	**98**	-	-	-
Moisture Content Method: AN002						
% Moisture	%	0.5	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134396A.021 Soil 11 Dec 2014 TP14 2.9-3.0	SE134396A.022 Soil 11 Dec 2014 TP14 5.4-5.5	SE134396A.023 Soil 10 Dec 2014 TP15 0.0-0.1	SE134396A.024 Soil 10 Dec 2014 TP15 0.9-1.0
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410						
TRH C6-C10	mg/kg	25	-	-	-	-
TRH C6-C9	mg/kg	20	-	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-	-
VPH F Bands						
Benzene (F0)	mg/kg	0.1	-	-	-	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25	-	-	-	-
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403						
TRH C10-C14	mg/kg	20	-	-	-	-
TRH C15-C28	mg/kg	45	-	-	-	-
TRH C29-C36	mg/kg	45	-	-	-	-
TRH C37-C40	mg/kg	100	-	-	-	-
TRH C10-C36 Total	mg/kg	110	-	-	-	-
TRH C10-C40 Total	mg/kg	210	-	-	-	-
TRH F Bands						
TRH >C10-C16 (F2)	mg/kg	25	-	-	-	-
TRH >C16-C34 (F3)	mg/kg	90	-	-	-	-
TRH >C34-C40 (F4)	mg/kg	120	-	-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420						
Naphthalene	mg/kg	0.1	-	-	-	-
2-methylnaphthalene	mg/kg	0.1	-	-	-	-
1-methylnaphthalene	mg/kg	0.1	-	-	-	-
Acenaphthylene	mg/kg	0.1	-	-	-	-
Acenaphthene	mg/kg	0.1	-	-	-	-
Fluorene	mg/kg	0.1	-	-	-	-
Phenanthrene	mg/kg	0.1	-	-	-	-
Anthracene	mg/kg	0.1	-	-	-	-
Fluoranthene	mg/kg	0.1	-	-	-	-
Pyrene	mg/kg	0.1	-	-	-	-
Benzo(a)anthracene	mg/kg	0.1	-	-	-	-
Chrysene	mg/kg	0.1	-	-	-	-
Benzo(b&j)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(a)pyrene	mg/kg	0.1	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	-	-	-	-
Dibenzo(a&h)anthracene	mg/kg	0.1	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.1	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ	0.2	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	-	-	-	-
Total PAH	mg/kg	0.8	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134396A.021 Soil 11 Dec 2014 TP14 2.9-3.0	SE134396A.022 Soil 11 Dec 2014 TP14 5.4-5.5	SE134396A.023 Soil 10 Dec 2014 TP15 0.0-0.1	SE134396A.024 Soil 10 Dec 2014 TP15 0.9-1.0
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)							
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		-	-	-	-
2-fluorobiphenyl (Surrogate)	%	-		-	-	-	-
d14-p-terphenyl (Surrogate)	%	-		-	-	-	-
Moisture Content Method: AN002							
% Moisture	%	0.5		-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134396A.025 Soil 11 Dec 2014 TP16 0.0-0.1	SE134396A.026 Soil 11 Dec 2014 TP16 0.6-0.7	SE134396A.027 Soil 11 Dec 2014 TP17 0.0-0.1	SE134396A.028 Soil 11 Dec 2014 TP17 0.9-1.0
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410						
TRH C6-C10	mg/kg	25	-	-	-	-
TRH C6-C9	mg/kg	20	-	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-	-
VPH F Bands						
Benzene (F0)	mg/kg	0.1	-	-	-	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25	-	-	-	-
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403						
TRH C10-C14	mg/kg	20	-	-	-	-
TRH C15-C28	mg/kg	45	-	-	-	-
TRH C29-C36	mg/kg	45	-	-	-	-
TRH C37-C40	mg/kg	100	-	-	-	-
TRH C10-C36 Total	mg/kg	110	-	-	-	-
TRH C10-C40 Total	mg/kg	210	-	-	-	-
TRH F Bands						
TRH >C10-C16 (F2)	mg/kg	25	-	-	-	-
TRH >C16-C34 (F3)	mg/kg	90	-	-	-	-
TRH >C34-C40 (F4)	mg/kg	120	-	-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420						
Naphthalene	mg/kg	0.1	-	-	-	-
2-methylnaphthalene	mg/kg	0.1	-	-	-	-
1-methylnaphthalene	mg/kg	0.1	-	-	-	-
Acenaphthylene	mg/kg	0.1	-	-	-	-
Acenaphthene	mg/kg	0.1	-	-	-	-
Fluorene	mg/kg	0.1	-	-	-	-
Phenanthrene	mg/kg	0.1	-	-	-	-
Anthracene	mg/kg	0.1	-	-	-	-
Fluoranthene	mg/kg	0.1	-	-	-	-
Pyrene	mg/kg	0.1	-	-	-	-
Benzo(a)anthracene	mg/kg	0.1	-	-	-	-
Chrysene	mg/kg	0.1	-	-	-	-
Benzo(b&j)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(a)pyrene	mg/kg	0.1	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	-	-	-	-
Dibenzo(a&h)anthracene	mg/kg	0.1	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.1	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ	0.2	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	-	-	-	-
Total PAH	mg/kg	0.8	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134396A.025 Soil 11 Dec 2014 TP16 0.0-0.1	SE134396A.026 Soil 11 Dec 2014 TP16 0.6-0.7	SE134396A.027 Soil 11 Dec 2014 TP17 0.0-0.1	SE134396A.028 Soil 11 Dec 2014 TP17 0.9-1.0
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)							
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		-	-	-	-
2-fluorobiphenyl (Surrogate)	%	-		-	-	-	-
d14-p-terphenyl (Surrogate)	%	-		-	-	-	-
Moisture Content Method: AN002							
% Moisture	%	0.5		-	-	-	-

Parameter	Units	LOR	Sample Number: SE134396A.029 Sample Matrix: Soil Sample Date: 11 Dec 2014 Sample Name: TP17 2.9-3.0	SE134396A.030 Soil 11 Dec 2014 TP18 0.0-0.1	SE134396A.031 Soil 11 Dec 2014 TP18 0.6-0.7	SE134396A.032 Soil 11 Dec 2014 TP19 0.0-0.1
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410						
TRH C6-C10	mg/kg	25	-	-	-	-
TRH C6-C9	mg/kg	20	-	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-	-
VPH F Bands						
Benzene (F0)	mg/kg	0.1	-	-	-	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25	-	-	-	-
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403						
TRH C10-C14	mg/kg	20	-	-	-	-
TRH C15-C28	mg/kg	45	-	-	-	-
TRH C29-C36	mg/kg	45	-	-	-	-
TRH C37-C40	mg/kg	100	-	-	-	-
TRH C10-C36 Total	mg/kg	110	-	-	-	-
TRH C10-C40 Total	mg/kg	210	-	-	-	-
TRH F Bands						
TRH >C10-C16 (F2)	mg/kg	25	-	-	-	-
TRH >C16-C34 (F3)	mg/kg	90	-	-	-	-
TRH >C34-C40 (F4)	mg/kg	120	-	-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420						
Naphthalene	mg/kg	0.1	-	-	-	-
2-methylnaphthalene	mg/kg	0.1	-	-	-	-
1-methylnaphthalene	mg/kg	0.1	-	-	-	-
Acenaphthylene	mg/kg	0.1	-	-	-	-
Acenaphthene	mg/kg	0.1	-	-	-	-
Fluorene	mg/kg	0.1	-	-	-	-
Phenanthrene	mg/kg	0.1	-	-	-	-
Anthracene	mg/kg	0.1	-	-	-	-
Fluoranthene	mg/kg	0.1	-	-	-	-
Pyrene	mg/kg	0.1	-	-	-	-
Benzo(a)anthracene	mg/kg	0.1	-	-	-	-
Chrysene	mg/kg	0.1	-	-	-	-
Benzo(b&j)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(a)pyrene	mg/kg	0.1	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	-	-	-	-
Dibenzo(a&h)anthracene	mg/kg	0.1	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.1	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ	0.2	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	-	-	-	-
Total PAH	mg/kg	0.8	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134396A.029 Soil 11 Dec 2014 TP17 2.9-3.0	SE134396A.030 Soil 11 Dec 2014 TP18 0.0-0.1	SE134396A.031 Soil 11 Dec 2014 TP18 0.6-0.7	SE134396A.032 Soil 11 Dec 2014 TP19 0.0-0.1
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)							
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		-	-	-	-
2-fluorobiphenyl (Surrogate)	%	-		-	-	-	-
d14-p-terphenyl (Surrogate)	%	-		-	-	-	-
Moisture Content Method: AN002							
% Moisture	%	0.5		-	-	-	-

Parameter	Units	LOR	Sample Number: SE134396A.033 Sample Matrix: Soil Sample Date: 11 Dec 2014 Sample Name: TP19 0.6-0.7	SE134396A.034 Soil 10 Dec 2014 QC7	SE134396A.035 Soil 11 Dec 2014 QC9	SE134396A.036 Water 11 Dec 2014 TB4
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410						
TRH C6-C10	mg/kg	25	-	-	-	-
TRH C6-C9	mg/kg	20	-	-	-	-
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	-	-	-	-
d4-1,2-dichloroethane (Surrogate)	%	-	-	-	-	-
d8-toluene (Surrogate)	%	-	-	-	-	-
Bromofluorobenzene (Surrogate)	%	-	-	-	-	-
VPH F Bands						
Benzene (F0)	mg/kg	0.1	-	-	-	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25	-	-	-	-
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403						
TRH C10-C14	mg/kg	20	-	-	-	-
TRH C15-C28	mg/kg	45	-	-	-	-
TRH C29-C36	mg/kg	45	-	-	-	-
TRH C37-C40	mg/kg	100	-	-	-	-
TRH C10-C36 Total	mg/kg	110	-	-	-	-
TRH C10-C40 Total	mg/kg	210	-	-	-	-
TRH F Bands						
TRH >C10-C16 (F2)	mg/kg	25	-	-	-	-
TRH >C16-C34 (F3)	mg/kg	90	-	-	-	-
TRH >C34-C40 (F4)	mg/kg	120	-	-	-	-
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420						
Naphthalene	mg/kg	0.1	-	-	-	-
2-methylnaphthalene	mg/kg	0.1	-	-	-	-
1-methylnaphthalene	mg/kg	0.1	-	-	-	-
Acenaphthylene	mg/kg	0.1	-	-	-	-
Acenaphthene	mg/kg	0.1	-	-	-	-
Fluorene	mg/kg	0.1	-	-	-	-
Phenanthrene	mg/kg	0.1	-	-	-	-
Anthracene	mg/kg	0.1	-	-	-	-
Fluoranthene	mg/kg	0.1	-	-	-	-
Pyrene	mg/kg	0.1	-	-	-	-
Benzo(a)anthracene	mg/kg	0.1	-	-	-	-
Chrysene	mg/kg	0.1	-	-	-	-
Benzo(b&j)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.1	-	-	-	-
Benzo(a)pyrene	mg/kg	0.1	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	-	-	-	-
Dibenzo(a&h)anthracene	mg/kg	0.1	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.1	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ	0.2	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	-	-	-	-
Total PAH	mg/kg	0.8	-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134396A.033 Soil 11 Dec 2014 TP19 0.6-0.7	SE134396A.034 Soil 10 Dec 2014 QC7	SE134396A.035 Soil 11 Dec 2014 QC9	SE134396A.036 Water 11 Dec 2014 TB4
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)							
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		-	-	-	-
2-fluorobiphenyl (Surrogate)	%	-		-	-	-	-
d14-p-terphenyl (Surrogate)	%	-		-	-	-	-
Moisture Content Method: AN002							
% Moisture	%	0.5		-	-	-	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE134396A.037 Water 11 Dec 2014 TS4	SE134396A.038 Material 10 Dec 2014 TP9 0.0-0.1	SE134396A.039 Soil 11 Dec 2014 TP13 0.9-1.0	SE134396A.040 Soil 11 Dec 2014 TP13 2.9-3.0
Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410							
TRH C6-C10	mg/kg	25		-	-	<25	<25
TRH C6-C9	mg/kg	20		-	-	<20	<20
Surrogates							
Dibromofluoromethane (Surrogate)	%	-		-	-	**73**	**71**
d4-1,2-dichloroethane (Surrogate)	%	-		-	-	**80**	**79**
d8-toluene (Surrogate)	%	-		-	-	**109**	**113**
Bromofluorobenzene (Surrogate)	%	-		-	-	**107**	**106**
VPH F Bands							
Benzene (F0)	mg/kg	0.1		-	-	<0.1	<0.1
TRH C6-C10 minus BTEX (F1)	mg/kg	25		-	-	<25	<25
TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403							
TRH C10-C14	mg/kg	20		-	-	<20	<20
TRH C15-C28	mg/kg	45		-	-	**67**	**150**
TRH C29-C36	mg/kg	45		-	-	<45	**85**
TRH C37-C40	mg/kg	100		-	-	<100	<100
TRH C10-C36 Total	mg/kg	110		-	-	<110	**240**
TRH C10-C40 Total	mg/kg	210		-	-	<210	**240**
TRH F Bands							
TRH >C10-C16 (F2)	mg/kg	25		-	-	<25	<25
TRH >C16-C34 (F3)	mg/kg	90		-	-	<90	**230**
TRH >C34-C40 (F4)	mg/kg	120		-	-	<120	<120
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420							
Naphthalene	mg/kg	0.1		-	-	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1		-	-	<0.1	**0.1**
1-methylnaphthalene	mg/kg	0.1		-	-	<0.1	<0.1
Acenaphthylene	mg/kg	0.1		-	-	<0.1	<0.1
Acenaphthene	mg/kg	0.1		-	-	<0.1	<0.1
Fluorene	mg/kg	0.1		-	-	<0.1	<0.1
Phenanthrene	mg/kg	0.1		-	-	<0.1	<0.1
Anthracene	mg/kg	0.1		-	-	<0.1	<0.1
Fluoranthene	mg/kg	0.1		-	-	<0.1	<0.1
Pyrene	mg/kg	0.1		-	-	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1		-	-	<0.1	<0.1
Chrysene	mg/kg	0.1		-	-	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1		-	-	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1		-	-	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1		-	-	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1		-	-	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.1		-	-	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1		-	-	<0.1	<0.1
Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ	0.2		-	-	<0.2	<0.2
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3		-	-	<0.3	<0.3
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2		-	-	<0.2	<0.2
Total PAH	mg/kg	0.8		-	-	<0.8	<0.8

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE134396A.037 Water 11 Dec 2014 TS4	SE134396A.038 Material 10 Dec 2014 TP9 0.0-0.1	SE134396A.039 Soil 11 Dec 2014 TP13 0.9-1.0	SE134396A.040 Soil 11 Dec 2014 TP13 2.9-3.0
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 (continued)						
Surrogates						
d5-nitrobenzene (Surrogate)	%	-	-	-	**92**	**92**
2-fluorobiphenyl (Surrogate)	%	-	-	-	**80**	**80**
d14-p-terphenyl (Surrogate)	%	-	-	-	**100**	**98**
Moisture Content Method: AN002						
% Moisture	%	0.5	-	-	**9.5**	**11**

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil **Method: ME-(AU)-[ENV]AN420**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Naphthalene	LB070157	mg/kg	0.1	<0.1	0%	118%
2-methylnaphthalene	LB070157	mg/kg	0.1	<0.1	0%	NA
1-methylnaphthalene	LB070157	mg/kg	0.1	<0.1	0%	NA
Acenaphthylene	LB070157	mg/kg	0.1	<0.1	0%	118%
Acenaphthene	LB070157	mg/kg	0.1	<0.1	0%	120%
Fluorene	LB070157	mg/kg	0.1	<0.1	0%	NA
Phenanthrene	LB070157	mg/kg	0.1	<0.1	0%	117%
Anthracene	LB070157	mg/kg	0.1	<0.1	0%	110%
Fluoranthene	LB070157	mg/kg	0.1	<0.1	0%	116%
Pyrene	LB070157	mg/kg	0.1	<0.1	0%	113%
Benzo(a)anthracene	LB070157	mg/kg	0.1	<0.1	0%	NA
Chrysene	LB070157	mg/kg	0.1	<0.1	0%	NA
Benzo(b&j)fluoranthene	LB070157	mg/kg	0.1	<0.1	0%	NA
Benzo(k)fluoranthene	LB070157	mg/kg	0.1	<0.1	0%	NA
Benzo(a)pyrene	LB070157	mg/kg	0.1	<0.1	0%	112%
Indeno(1,2,3-cd)pyrene	LB070157	mg/kg	0.1	<0.1	0%	NA
Dibenzo(a&h)anthracene	LB070157	mg/kg	0.1	<0.1	0%	NA
Benzo(ghi)perylene	LB070157	mg/kg	0.1	<0.1	0%	NA
Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	LB070157	TEQ	0.2	<0.2	0%	NA
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	LB070157	TEQ (mg/kg)	0.3	<0.3	0%	NA
Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	LB070157	TEQ (mg/kg)	0.2	<0.2	0%	NA
Total PAH	LB070157	mg/kg	0.8	<0.8	0%	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
d5-nitrobenzene (Surrogate)	LB070157	%	-	84%	15%	78%
2-fluorobiphenyl (Surrogate)	LB070157	%	-	80%	21%	76%
d14-p-terphenyl (Surrogate)	LB070157	%	-	98%	8%	86%

TRH (Total Recoverable Hydrocarbons) in Soil **Method: ME-(AU)-[ENV]AN403**

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
TRH C10-C14	LB070157	mg/kg	20	<20	100%
TRH C15-C28	LB070157	mg/kg	45	<45	100%
TRH C29-C36	LB070157	mg/kg	45	<45	78%
TRH C37-C40	LB070157	mg/kg	100	<100	NA
TRH C10-C36 Total	LB070157	mg/kg	110	<110	NA
TRH C10-C40 Total	LB070157	mg/kg	210	<210	NA

TRH F Bands

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
TRH >C10-C16 (F2)	LB070157	mg/kg	25	<25	100%
TRH >C16-C34 (F3)	LB070157	mg/kg	90	<90	93%
TRH >C34-C40 (F4)	LB070157	mg/kg	120	<120	75%

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Volatile Petroleum Hydrocarbons in Soil **Method: ME-(AU)-[ENV]AN433/AN434/AN410**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
TRH C6-C10	LB070169	mg/kg	25	<25	0%	91%	89%
TRH C6-C9	LB070169	mg/kg	20	<20	0%	80%	89%

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Dibromofluoromethane (Surrogate)	LB070169	%	-	88%	0%	87%	80%
d4-1,2-dichloroethane (Surrogate)	LB070169	%	-	86%	3%	94%	89%
d8-toluene (Surrogate)	LB070169	%	-	119%	1%	123%	108%
Bromofluorobenzene (Surrogate)	LB070169	%	-	111%	7%	121%	101%

VPH F Bands

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Benzene (F0)	LB070169	mg/kg	0.1	<0.1	0%	NA	NA
TRH C6-C10 minus BTEX (F1)	LB070169	mg/kg	25	<25	0%	96%	131%

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN088	Orbital rolling for Organic pollutants are extracted from soil/sediment by transferring an appropriate mass of sample to a clear soil jar and extracting with 1:1 Dichloromethane/Acetone. Orbital Rolling method is intended for the extraction of semi-volatile organic compounds from soil/sediment samples, and is based somewhat on USEPA method 3570 (Micro Organic extraction and sample preparation). Method 3700.
AN403	Total Recoverable Hydrocarbons: Determination of Hydrocarbons by gas chromatography after a solvent extraction. Detection is by flame ionisation detector (FID) that produces an electronic signal in proportion to the combustible matter passing through it. Total Recoverable Hydrocarbons (TRH) are routinely reported as four alkane groupings based on the carbon chain length of the compounds: C6-C9, C10-C14, C15-C28 and C29-C36 and in recognition of the NEPM 1999 (2013), >C10-C16 (F2), >C16-C34 (F3) and >C34-C40 (F4). F2 is reported directly and also corrected by subtracting Naphthalene (from VOC method AN433) where available.
AN403	Additionally, the volatile C6-C9 fraction may be determined by a purge and trap technique and GC/MS because of the potential for volatiles loss. Total Petroleum Hydrocarbons (TPH) follows the same method of analysis after silica gel cleanup of the solvent extract. Aliphatic/Aromatic Speciation follows the same method of analysis after fractionation of the solvent extract over silica with differential polarity of the eluent solvents .
AN403	The GC/FID method is not well suited to the analysis of refined high boiling point materials (ie lubricating oils or greases) but is particularly suited for measuring diesel, kerosene and petrol if care to control volatility is taken. This method will detect naturally occurring hydrocarbons, lipids, animal fats, phenols and PAHs if they are present at sufficient levels, dependant on the use of specific cleanup/fractionation techniques. Reference USEPA 3510B, 8015B.
AN420	(SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols (etc) in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).
AN420	Carcinogenic PAHs may be expressed as Benzo(a)pyrene equivalents by applying the BaP toxicity equivalence factor (NEPM 1999, June 2013, B7). These can be reported as the individual PAHs and as a sum of carcinogenic PAHs. The sum is reported three ways, the first assuming all <LOR reults are zero, the second assuming all < LOR results are half the LOR and the third assuming all <LOR results are the LOR.
AN433/AN434/AN410	VOCs and C6-C9/C6-C10 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	This analysis is not covered by the scope of accreditation.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
^	Performed by outside laboratory.	NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here:
http://www.sgs.com.au/~/media/Local/Australia/Documents/ Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

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STATEMENT OF QA/QC PERFORMANCE

SE134396A R0

CLIENT DETAILS

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Project	**9623 - ESA - Old Canberra Brickworks**
Order Number	(Not specified)
Samples	40

LABORATORY DETAILS

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SGS Reference	SE134396A R0
Report Number	0000099912
Date Reported	09 Jan 2015

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS Environmental Services' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document and was supplied by the Client.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Extraction Date	Moisture Content	2 items
	PAH (Polynuclear Aromatic Hydrocarbons) in Soil	4 items
	TRH (Total Recoverable Hydrocarbons) in Soil	4 items
	Volatile Petroleum Hydrocarbons in Soil	4 items

SAMPLE SUMMARY

Sample counts by matrix	4 Soils	Type of documentation received	COC
Date documentation received	06/01/2015@12:34p	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	4.7°C
Sample container provider	SGS	Turnaround time requested	Three Days
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes		

HOLDING TIME SUMMARY

SE134396A R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Moisture Content

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP13 0.9-1.0	SE134396A.039	LB070170	11 Dec 2014	12 Dec 2014	25 Dec 2014	07 Jan 2015†	12 Jan 2015	08 Jan 2015
TP13 2.9-3.0	SE134396A.040	LB070170	11 Dec 2014	12 Dec 2014	25 Dec 2014	07 Jan 2015†	12 Jan 2015	08 Jan 2015

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP11 0.4-0.5	SE134396A.013	LB070157	11 Dec 2014	12 Dec 2014	25 Dec 2014	06 Jan 2015†	15 Feb 2015	09 Jan 2015
TP13 1.9-2.0	SE134396A.017	LB070157	11 Dec 2014	12 Dec 2014	25 Dec 2014	06 Jan 2015†	15 Feb 2015	09 Jan 2015
TP13 0.9-1.0	SE134396A.039	LB070157	11 Dec 2014	12 Dec 2014	25 Dec 2014	06 Jan 2015†	15 Feb 2015	09 Jan 2015
TP13 2.9-3.0	SE134396A.040	LB070157	11 Dec 2014	12 Dec 2014	25 Dec 2014	06 Jan 2015†	15 Feb 2015	09 Jan 2015

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP11 0.4-0.5	SE134396A.013	LB070157	11 Dec 2014	12 Dec 2014	25 Dec 2014	06 Jan 2015†	15 Feb 2015	09 Jan 2015
TP13 1.9-2.0	SE134396A.017	LB070157	11 Dec 2014	12 Dec 2014	25 Dec 2014	06 Jan 2015†	15 Feb 2015	09 Jan 2015
TP13 0.9-1.0	SE134396A.039	LB070157	11 Dec 2014	12 Dec 2014	25 Dec 2014	06 Jan 2015†	15 Feb 2015	09 Jan 2015
TP13 2.9-3.0	SE134396A.040	LB070157	11 Dec 2014	12 Dec 2014	25 Dec 2014	06 Jan 2015†	15 Feb 2015	09 Jan 2015

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP11 0.4-0.5	SE134396A.013	LB070169	11 Dec 2014	12 Dec 2014	25 Dec 2014	07 Jan 2015†	16 Feb 2015	09 Jan 2015
TP13 1.9-2.0	SE134396A.017	LB070169	11 Dec 2014	12 Dec 2014	25 Dec 2014	07 Jan 2015†	16 Feb 2015	09 Jan 2015
TP13 0.9-1.0	SE134396A.039	LB070169	11 Dec 2014	12 Dec 2014	25 Dec 2014	07 Jan 2015†	16 Feb 2015	09 Jan 2015
TP13 2.9-3.0	SE134396A.040	LB070169	11 Dec 2014	12 Dec 2014	25 Dec 2014	07 Jan 2015†	16 Feb 2015	09 Jan 2015

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	TP11 0.4-0.5	SE134396A.013	%	70 - 130%	72
	TP13 1.9-2.0	SE134396A.017	%	70 - 130%	80
	TP13 0.9-1.0	SE134396A.039	%	70 - 130%	80
	TP13 2.9-3.0	SE134396A.040	%	70 - 130%	80
d14-p-terphenyl (Surrogate)	TP11 0.4-0.5	SE134396A.013	%	70 - 130%	100
	TP13 1.9-2.0	SE134396A.017	%	70 - 130%	98
	TP13 0.9-1.0	SE134396A.039	%	70 - 130%	100
	TP13 2.9-3.0	SE134396A.040	%	70 - 130%	98
d5-nitrobenzene (Surrogate)	TP11 0.4-0.5	SE134396A.013	%	70 - 130%	86
	TP13 1.9-2.0	SE134396A.017	%	70 - 130%	90
	TP13 0.9-1.0	SE134396A.039	%	70 - 130%	92
	TP13 2.9-3.0	SE134396A.040	%	70 - 130%	92

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TP11 0.4-0.5	SE134396A.013	%	60 - 130%	90
	TP13 1.9-2.0	SE134396A.017	%	60 - 130%	112
	TP13 0.9-1.0	SE134396A.039	%	60 - 130%	107
	TP13 2.9-3.0	SE134396A.040	%	60 - 130%	106
d4-1,2-dichloroethane (Surrogate)	TP11 0.4-0.5	SE134396A.013	%	60 - 130%	84
	TP13 1.9-2.0	SE134396A.017	%	60 - 130%	83
	TP13 0.9-1.0	SE134396A.039	%	60 - 130%	80
	TP13 2.9-3.0	SE134396A.040	%	60 - 130%	79
d8-toluene (Surrogate)	TP11 0.4-0.5	SE134396A.013	%	60 - 130%	106
	TP13 1.9-2.0	SE134396A.017	%	60 - 130%	116
	TP13 0.9-1.0	SE134396A.039	%	60 - 130%	109
	TP13 2.9-3.0	SE134396A.040	%	60 - 130%	113
Dibromofluoromethane (Surrogate)	TP11 0.4-0.5	SE134396A.013	%	60 - 130%	73
	TP13 1.9-2.0	SE134396A.017	%	60 - 130%	74
	TP13 0.9-1.0	SE134396A.039	%	60 - 130%	73
	TP13 2.9-3.0	SE134396A.040	%	60 - 130%	71

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB070157.001		Naphthalene	mg/kg	0.1	<0.1
		2-methylnaphthalene	mg/kg	0.1	<0.1
		1-methylnaphthalene	mg/kg	0.1	<0.1
		Acenaphthylene	mg/kg	0.1	<0.1
		Acenaphthene	mg/kg	0.1	<0.1
		Fluorene	mg/kg	0.1	<0.1
		Phenanthrene	mg/kg	0.1	<0.1
		Anthracene	mg/kg	0.1	<0.1
		Fluoranthene	mg/kg	0.1	<0.1
		Pyrene	mg/kg	0.1	<0.1
		Benzo(a)anthracene	mg/kg	0.1	<0.1
		Chrysene	mg/kg	0.1	<0.1
		Benzo(a)pyrene	mg/kg	0.1	<0.1
		Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1
		Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1
		Benzo(ghi)perylene	mg/kg	0.1	<0.1
		Total PAH	mg/kg	0.8	<0.8
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	84
		2-fluorobiphenyl (Surrogate)	%	-	80
		d14-p-terphenyl (Surrogate)	%	-	98

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number	Parameter	Units	LOR	Result
LB070157.001	TRH C10-C14	mg/kg	20	<20
	TRH C15-C28	mg/kg	45	<45
	TRH C29-C36	mg/kg	45	<45
	TRH C37-C40	mg/kg	100	<100
	TRH C10-C36 Total	mg/kg	110	<110

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result
LB070169.001		TRH C6-C9	mg/kg	20	<20
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	88
		d4-1,2-dichloroethane (Surrogate)	%	-	86
		d8-toluene (Surrogate)	%	-	119

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134881.001	LB070157.009		Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthylene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluorene	mg/kg	0.1	<0.1	<0.1	200	0
			Phenanthrene	mg/kg	0.1	<0.1	<0.1	200	0
			Anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Chrysene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	200	0
			Carcinogenic PAHs (as BaP TEQ)- <LOR=0*	TEQ (mg/kg)	0.2	<0.2	<0.2	200	0
			Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR*	TEQ (mg/kg)	0.3	<0.3	<0.3	134	0
			Carcinogenic PAHs (as BaP TEQ)- <LOR=LOR/2*	TEQ (mg/kg)	0.2	<0.2	<0.2	175	0
			Total PAH	mg/kg	0.8	<0.8	<0.8	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.4	30	15
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.4	30	21
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	8

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE134396A.040	LB070169.008		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.5	3.5	30	0
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	3.9	4.1	30	3
			d8-toluene (Surrogate)	mg/kg	-	5.7	5.7	30	1
			Bromofluorobenzene (Surrogate)	mg/kg	-	5.3	5.0	30	7
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB070157.002		Naphthalene	mg/kg	0.1	4.7	4	60 - 140	118
		Acenaphthylene	mg/kg	0.1	4.7	4	60 - 140	118
		Acenaphthene	mg/kg	0.1	4.8	4	60 - 140	120
		Phenanthrene	mg/kg	0.1	4.7	4	60 - 140	117
		Anthracene	mg/kg	0.1	4.4	4	60 - 140	110
		Fluoranthene	mg/kg	0.1	4.6	4	60 - 140	116
		Pyrene	mg/kg	0.1	4.5	4	60 - 140	113
		Benzo(a)pyrene	mg/kg	0.1	4.5	4	60 - 140	112
	Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	78
		2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	76
		d14-p-terphenyl (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	86

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB070157.002		TRH C10-C14	mg/kg	20	40	40	60 - 140	100
		TRH C15-C28	mg/kg	45	<45	40	60 - 140	100
		TRH C29-C36	mg/kg	45	<45	40	60 - 140	78
	TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	40	40	60 - 140	100
		TRH >C16-C34 (F3)	mg/kg	90	<90	40	60 - 140	93
		TRH >C34-C40 (F4)	mg/kg	120	<120	20	60 - 140	75

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB070169.002		TRH C6-C10	mg/kg	25	<25	24.65	60 - 140	91
		TRH C6-C9	mg/kg	20	<20	23.2	60 - 140	80
	Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.4	5	60 - 140	87
		d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.7	5	60 - 140	94
		d8-toluene (Surrogate)	mg/kg	-	6.2	5	60 - 140	123
		Bromofluorobenzene (Surrogate)	mg/kg	-	6.0	5	60 - 140	121
	VPH F Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	7.25	60 - 140	96

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE134396A.01	LB070169.004		TRH C6-C10	mg/kg	25	<25	<25	24.65	89
3			TRH C6-C9	mg/kg	20	21	<20	23.2	89
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.0	3.6	5	80
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.4	4.2	5	89
			d8-toluene (Surrogate)	mg/kg	-	5.4	5.3	5	108
			Bromofluorobenzene (Surrogate)	mg/kg	-	5.1	4.5	5	101
		VPH F	Benzene (F0)	mg/kg	0.1	2.4	<0.1	-	-
		Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	7.25	131

MATRIX SPIKE DUPLICATES

SE134396A R0

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here:
http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

*	Non-accredited analysis.
-	Sample not analysed for this analyte.
^	Analysis performed by external laboratory.

IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.

①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to Analytical Report comments for further information.

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AU.SampleReceipt.Sydney (Sydney)

From: AU.Environmental.Sydney (Sydney)
Sent: Tuesday, 6 January 2015 12:34 PM
To: AU.SampleReceipt.Sydney (Sydney)
Subject: FW: Report Job SE134396, your reference 9623 - ESA - Old Canberra Brickworks
Attachments: 9623_COC_add analysis_20150106.pdf

SGS Ref: SE134396A
Due Date: 09/01/2015
TAT: 3 DAYS.

FYI

Tommy Pieszko
Environmental Services
Client Services Officer
Phone: +61 (0)2 8594 0465
Mobile: +61 (0)2 8594 0499

To provide your valuable feedback & help us to improve, please click here

-----Original Message-----
From: Ben Kendon [mailto:Ben@robsonenviro.com.au]
Sent: Tuesday, 6 January 2015 12:25 PM
To: AU.Environmental.Sydney (Sydney)
Cc: Blackman, Daniel (Sydney)
Subject: RE: Report Job SE134396, your reference 9623 - ESA - Old Canberra Brickworks

Daniel,

I have attached a revised COC for additional analysis of 4 samples for a 72hour TAT which are held by the lab.

Analysis Requested

#13 #39 #17 #40
TRH and PAH - TP11 (0.4-0.5); TP13 (0.9-1.0); TP13 (1.9-2.0); TP13(2.9-3.0).

Any issues please have the lab contact me.

Kind regards,

Ben Kendon

Ben Kendon
Senior Consultant

Robson Environmental
Phone: 02 6239 5656
Mobile: 0437 008 278
Fax: 02 6239 5669
E-mail: Ben@robsonenviro.com.au
Web: www.robsonenviro.com.au

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-----Original Message-----
From: AU.Environmental.Sydney@SGS.com [mailto:AU.Environmental.Sydney@SGS.com]
Sent: Tuesday, 6 January 2015 12:01 PM
To: Ben Kendon; Results
Subject: Report Job SE134396, your reference 9623 - ESA - Old Canberra Brickworks

Dear Ben,

Please find attached the report for SGS job SE134396, your reference 9623 - ESA - Old Canberra Brickworks.

-IMPORTANT INFORMATION ABOUT YOUR REPORT- To align with NEPM 1999 (2013), SGS Environmental has changed the way Silica Gel Clean-up of TRH extracts is reported. TPH Silica Gel has now become TRH - Silica. NEPM 1999(2013) seeks to clarify TRH and TPH in Schedule B3, 10.2.7.

If you have any questions or concerns, please don't hesitate to contact your SGS Client Services representative.

Regards,
Trent Ellerington

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All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx

Please refer to page 2 for additional analyses request. Thanks Ben Kendon 6/1/2015.

Robson ENVIRONMENTAL

Occupational Hygiene Health Safety & Environmental Consulting

CHAIN OF CUSTODY FORM

Job No.: 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
140 Gladstone Street
Fyshwick ACT 2609
ABN: 55 008 660 900

Contact: Ben Kendon
Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required YES NO

Job Name: ESA

SGS Job Ref: SY140911-1-IS

Required Turnaround Time: 24hr; 36hr; 48hr; 72hr & 5 to 7 Days

Doc No: BAR-F013 Revision No: 2
Date Issued: 5/11/13
Next Review Date: 05/11/15

To:
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax: (02) 8594 0499
Email:
ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
1	TP8 (0.0-0.1)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
.	TP8 (0.4-0.5)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
2	TP8 (0.9-1.0)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
3	TP8 (1.9-2.0)	10/12/2014		1 plastic bag	soil	ice	Asbestos (WA)	
4	TP8 (2.8-2.9)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA),E coli, Faecal Coliforms and Total Coliforms	
5, ~~BD~~ 38	TP9(0.0-0.1)	10/12/2014		1 glass jar, 1 plastic bag + ACM fragments	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
.	TP9(0.5-0.6)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
6	TP9(1.1-1.2)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
.	TP9 (1.9-2.0)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
7	TP9 (2.9-3.0)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA) and PAH	
8	TP9 (3.9-4.0)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
	TP10(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
BH Lab'd 12/12/14	TP10(0.4-0.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	

Relinquished by: RW	Date: 11/12/14		Time: 3pm	Received by:	Time: 12/12/14 9.00
Relinquished by:	Date:		Time:	Received by:	Time:
Relinquished by:	Date:		Time:	Received by:	Time:

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12 DEC 2014
SE139396A

page 1 of 4.

Robson

Occupational Hygiene
Health Safety &
Environmental Consulting

CHAIN OF CUSTODY FORM

Job No. : 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
140 Gladstone Street
Fyshwick ACT 2609
ABN: 58 008 680 900

Contact: Ben Kondon
Phone: (02) 6239 5656
Mobile: 0437 009 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required: YES NO

Job Name: Stage 1 ESA

SGS Job Ref: SY140911-1-IS

Required Turnaround Time: 24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

Doc No: EAR F013 Revision No. 1
Date Issued: 13/04/2012

To:
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax: (02) 8594 0499
Email:
ABN 44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
	TP10(0.9-1.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
10	TP10(1.9-2.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
	TP10(2.9-3.0)	11/12/2014		1 glass jar	soil	ice		Hold
11	TP10(3.9-4.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
	TP10(4.9-5.0)	12/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
12	TP11(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
13	TP11(0.4-0.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	TRH, PAH 72hr TAT.
14	TP12(0.0-0.1)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
15	TP12(0.4-0.5)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA)	
16	TP13(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP13(0.4-0.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
39	TP13(0.9-1.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, PAH	Hold 72hr TAT.
17	TP13(1.9-2.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	TRH, PAH = 72hr TAT
40	TP13(2.9-3.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		TRH, PAH = 72hr TAT.
18	TP13(3.5-3.6)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
19 Refused 12/12	TP14(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	

Relinquished by:RW	Date:11/12/14	Time:	Received by:	Time:	12/12/14 4.00
Relinquished by:	Date:	Time:	Received by:	Time:	
Relinquished by:	Date:	Time:	Received by:	Time:	

Robson	From: Robson Environmental Pty Ltd PO Box 112 Fyshwick ACT 2609 140 Gladstone Street Fyshwick ACT 2609 ABN: 58 008 660 930	Client Information:	Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609
Occupational Hygiene Health Safety & Environmental Consulting CHAIN OF CUSTODY FORM Job No. : 9623	Contact: Ben Kendon Phone: (02) 6239 5656 Mobile: 0437 008 278 Fax: (02) 6239 5669 Email: results@robsonenviro.com.au ben@robsonenviro.com.au	Site Address: Sampled by: AR Job Name: Stage 1 ESA SGS Job Ref: SY140911-1-IS	Old Canberra Brickworks Denman Street Yarralumla ACT 2600 ESDAT Files Required YES NO Required Turnaround Time: 24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

Doc No: EAR-F013 Revision No: 1
Date Issued: 13/04/2012

To:
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax (02) 8594 0499
Email:
ABN 44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
	TP14(0.4-0.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
20	TP14(0.9-1.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA) and PAH	
	TP14(1.9-2.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
21	TP14(2.9-3.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA) and PAH	
	TP14(4.4-4.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
22	TP14(5.4-5.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA)	
23	TP15(0.0-0.1)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP15(0.5-0.6)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
24	TP15(0.9-1.0)	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	
25	TP16(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
26	TP16(0.6-0.7)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA)	
27	TP17(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA) and CEC, organic carbon, clay content, iron and pH	
	TP17(0.4-0.5)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
28	TP17(0.9-1.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA)	
Rejected	TP17(1.9-2.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice		Hold
29 12/12/14	TP17(2.9-3.0)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	8 heavy metals and asbestos (WA),CEC, organic carbon, clay content, iron and pH	

Relinquished by:RW	Date:11/12/14	Time:	Received by:	Time:	12/12/14 9:00
Relinquished by:	Date:	Time:	Received by:	Time:	
Relinquished by:	Date:	Time:	Received by:	Time:	

page 3 of 4

Robson

Occupational Hygiene Health Safety & Environmental Consulting

CHAIN OF CUSTODY FORM

Job No. : 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
140 Gladstone Street
Fyshwick ACT 2609
ABN: 55 008 660 900

Contact: Ben Kendon
Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required YES NO

Job Name: Stage 1 ESA

SGS Job Ref: SY140911-1-IS

Required Turnaround Time: 24hr; 36hr; 48hr; 72hr & 5 to 7 Days

Doc No: EAR-F013 Revision No: 1
Date Issued: 13/04/2012

To:
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax: (02) 8594 0499
Email:
ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
30	TP18(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
31	TP18(0.6-0.7)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA)	
32	TP19(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
33	TP19(0.6-0.7)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA)	
34	QC7	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	
	QC8	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	Transfer to Envirolab COC
35	QC9	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	
	QC10	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	Transfer to Envirolab COC
36	TB4	11/12/2014		2 vials	water	ice	BTEX and TRH C6-C9	
37	TS4	11/12/2014		2 vials	water	ice	BTEX and TRH C6-C9	
Rh Revised 12/12/14								

Relinquished by: RW	Date: 11/12/14	Time:	Received by:	Time:	12/12/14 9:00
Relinquished by:	Date:	Time:	Received by:	Time:	
Relinquished by:	Date:	Time:	Received by:	Time:	

Page 4 of 4

SGS

SE137396A

Job:

	Matrix	250 JAR	125 JAR	BAG	1L UP P	500 UP P	250 ZnAcetate P	250 / 500 NaOH BP	125 / 250 UP P	125 / 250 Metal Total*	125 / 250 Metal Filtered*	125 HCl P	1L UP AG	500 / 1L H_2SO_4 AG	125 / 250 H_2SO_4 P	100 / 200 UP AG	40 NaThio GV	250 UP OPAQUE P	500 NaThio STERILE P	200 NaThio STERILE P	40 Clear Vial	Storage Location	Bottles Supplied By	Comment	Cooling Method
																							SGS		CP
~~35~~ 1-35	S	1		1																		S190-2 ASB	Full		Temp
36	W																2					WOSS	SGS	Full	4.7°C
~~37~~	W																				1	~~ASB~~	"		Good Order
38	M			1																		ASB	Client	—	(Y) / N
~~35~~	~~SL~~	~~4~~																							Clearly Labelled
39-40	S	1		1																		S190-2, ASB		Full	(Y) / N
																									Correct Pres.
																									(Y) / N
																									No Head-space
																									(Y) N / NA
																									Sufficient Vol
																									(Y) N
																									Doc Date
																									0661
																									Doc Type
																									COC
																									Complete Docs
																									(Y) N
																									Requested TAT
																									30 DAYS

~~No soils on hold~~

No soils on hold

SAMPLE RECEIPT ADVICE

SE134396A

CLIENT DETAILS

Contact	Ben Kendon
Client	Robson Environmental Pty Ltd
Address	140 Gladstone Street, FYSHWICK PO Box 112, FYSHWICK ACT 2609
Telephone	(02) 6239 5656
Facsimile	(02) 6239 5669
Email	ben@robsonlabs.com.au
Project	**9623 - ESA - Old Canberra Brickworks**
Order Number	(Not specified)
Samples	40

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
Samples Received	Fri 12/12/2014
Report Due	Fri 9/1/2015
SGS Reference	**SE134396A**

SUBMISSION DETAILS

This is to confirm that 40 samples were received on Friday 12/12/2014. Results are expected to be ready by Friday 9/1/2015. Please quote SGS reference SE134396A when making enquiries. Refer below for details relating to sample integrity upon receipt.

Sample counts by matrix	4 Soils	Type of documentation received	COC
Date documentation received	06/01/2015@12:34pm	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	4.7°C
Sample container provider	SGS	Turnaround time requested	Three Days
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes		

Samples will be held for one month for water samples and two months for soil samples from date of report, unless otherwise instructed.

COMMENTS

To the extent not inconsistent with the other provisions of this document and unless specifically agreed otherwise in writing by SGS , all SGS services are rendered in accordance with the applicable SGS General Conditions of Service accessible at http://www.sgs.com/en/Terms-and-Conditions/General-Conditions-of-Services-English.aspx as at the date of this document.
Attention is drawn to the limitations of liability and to the clauses of indemnification.

SAMPLE RECEIPT ADVICE

SE134396A

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	PAH (Polynuclear Aromatic Hydrocarbons) in Soil	TRH (Total Recoverable Hydrocarbons) in Soil	Volatile Petroleum Hydrocarbons in Soil
013	TP11 0.4-0.5	25	9	8
017	TP13 1.9-2.0	25	9	8

CONTINUED OVERLEAF

The above table represents SGS Environmental Services' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .

SAMPLE RECEIPT ADVICE

SE134396A

CLIENT DETAILS

Client Robson Environmental Pty Ltd

Project 9623 - ESA - Old Canberra Brickworks

SUMMARY OF ANALYSIS

No.	Sample ID	Moisture Content	PAH (Polynuclear Aromatic Hydrocarbons) in Soil	TRH (Total Recoverable Hydrocarbons) in Soil	Volatile Petroleum Hydrocarbons in Soil
039	TP13 0.9-1.0	1	25	9	8
040	TP13 2.9-3.0	1	25	9	8

The above table represents SGS Environmental Services' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 120902

Client:

Robson Environmental Pty Ltd
PO Box 112
Fyshwick
ACT 2609

Attention: Ben Kendon

Sample log in details:

Your Reference:	**9623**		
No. of samples:	2 soils		
Date samples received / completed instructions received	12/12/14	/	12/12/14

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	19/12/14	/	19/12/14
Date of Preliminary Report:	Not Issued		

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

PAHs in Soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	120902-1 QC8 10/12/2014 soil	120902-2 QC10 11/12/2014 soil
Date extracted	-	15/12/2014	15/12/2014
Date analysed	-	16/12/2014	16/12/2014
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1
Benzo(a)pyrene TEQ NEPM B1	mg/kg	<0.5	<0.5
Total Positive PAHs	mg/kg	NIL (+)VE	NIL (+)VE
Surrogate p-Terphenyl-d14	%	109	87

Acid Extractable metals in soil			
Our Reference:	UNITS	120902-1	120902-2
Your Reference	----------	QC8	QC10
Date Sampled	----------	10/12/2014	11/12/2014
Type of sample		soil	soil
Date digested	-	16/12/2014	16/12/2014
Date analysed	-	16/12/2014	16/12/2014
Arsenic	mg/kg	6	9
Cadmium	mg/kg	<0.4	<0.4
Chromium	mg/kg	28	14
Copper	mg/kg	17	29
Lead	mg/kg	21	52
Mercury	mg/kg	<0.1	<0.1
Nickel	mg/kg	16	36
Zinc	mg/kg	250	34

Moisture			
Our Reference:	UNITS	120902-1	120902-2
Your Reference	----------	QC8	QC10
Date Sampled	----------	10/12/2014	11/12/2014
Type of sample		soil	soil
Date prepared	-	15/12/2014	15/12/2014
Date analysed	-	16/12/2014	16/12/2014
Moisture	%	8.9	9.1

Asbestos ID - soils			
Our Reference:	UNITS	120902-1	120902-2
Your Reference	----------	QC8	QC10
Date Sampled	----------	10/12/2014	11/12/2014
Type of sample		soil	soil
Date analysed	-	18/12/2014	18/12/2014
Sample mass tested	g	742.90g	735.32g
Sample Description	-	Mustard coarse-grained soil & rocks	Brown fine-grained soil
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg
Trace Analysis	-	No asbestos detected	No asbestos detected
ACM >7mm Estimation*	g	--	--
ACM <7mm Estimation*	g	--	--
FA and AF Estimation*	g	--	--
Total Asbestos g/kg*	g/kg	<0.1	<0.1
ACM >7mm Estimation %(w/w)*	%	<0.01	<0.01
ACM <7mm Estimation %(w/w)*	%	<0.001	<0.001
FA and AF Estimation %(w/w)*	%	<0.001	<0.001
Total Asb Est w/w* Note#	%	<0.001	<0.001

Method ID	Methodology Summary
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 deg C for a minimum of 12 hours.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** # The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light Microscopy and Dispersion Staining Techniques.
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			15/12/2014	[NT]	[NT]	LCS-4	15/12/2014
Date analysed	-			15/12/2014	[NT]	[NT]	LCS-4	15/12/2014
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	87%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	100%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	91%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	91%
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	110%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	87%
Benzo(b,j+k) fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	[NT]	[NT]	LCS-4	95%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	104	[NT]	[NT]	LCS-4	101%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date digested	-			16/12/2014	[NT]	[NT]	LCS-6	16/12/2014
Date analysed	-			16/12/2014	[NT]	[NT]	LCS-6	16/12/2014
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	[NT]	[NT]	LCS-6	106%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	[NT]	[NT]	LCS-6	107%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	104%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	108%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	96%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	LCS-6	96%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	100%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	99%

Report Comments:

This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.
This is reported outside our scope of NATA accreditation.

Asbestos ID was analysed by Approved Identifier: Paul Ching
Asbestos ID was authorised by Approved Signatory: Paul Ching

INS: Insufficient sample for this test
NA: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

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

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

Robson ENVIRONMENTAL

Occupational Hygiene
Health Safety &
Environmental Consulting

CHAIN OF CUSTODY FORM

Job No. : 9623

From: Robson Environmental Pty Ltd
PO Box 112 Fyshwick ACT 2609
140 Gladstone Street
Fyshwick ACT 2609
ABN: 55 008 660 900

Contact: Ben Kendon
Phone: (02) 6239 5656
Mobile: 0437 008 278
Fax: (02) 6239 5669
Email: results@robsonenviro.com.au
ben@robsonenviro.com.au

Client Information: Capezio and Co
Unit 2/2 Yallourn Street
Fyshwick ACT 2609

Site Address: Old Canberra Brickworks
Denman Street
Yarralumla ACT 2600

Sampled by: AR

ESDAT Files Required **YES** NO

Job Name: Stage 1 ESA

Required Turnaround Time:
24hr; 36hr; 48hr; 72hr & **5 to 7 Days**

SGS Job Ref: SY140911-1-IS

Doc No: EAR-F013 Revision No: 1
Date Issued: 13/04/2012

To:
SGS
33 Maddox Street
Alexandria NSW 2015

Contact: Matthew
Phone: (02) 8594 0400
Mobile:
Fax: (02) 8594 0499
Email:
ABN:44 000 964 278

Lab ID	Sample ID	Date Sampled	Sample Location	No. of Sample Items	Sample Type	Sample Preservation (Ice, Acid, Ambient)	Analysis Required	Comments
	TP18(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP18(0.6-0.7)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	Heavy metals and asbestos (WA)	
	TP19(0.0-0.1)	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	TRH, BTEX, PAH, Speciated Phenols, OCP, PCB, 8 heavy metals and asbestos (WA)	
	TP19(0.6-0.7)	11/12/2014		1 glass jar, 1 plastic bag	soil	Ice	Heavy metals and asbestos (WA)	
120902	QC5 7	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	
1	QC6 8	10/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	Transfer to Envirolab COC
	QC7 9	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	
2	QC8 10	11/12/2014		1 glass jar, 1 plastic bag	soil	ice	PAH, 8 heavy metals and asbestos (WA)	Transfer to Envirolab COC
	TB4	11/12/2014		2 vials	water	ice	BTEX and TRH C6-C9	
	TS4	11/12/2014		2 vials	water	ice	BTEX and TRH C6-C9	
RH revised 12/12/14.								

Relinquished by: RW	Date: 11/12/14		Time:	Received by: P.Rog 12/12/14	Time: 16.15	
Relinquished by:	Date:		Time:	Received by:	Time:	
Relinquished by:	Date:		Time:	Received by:	Time:	

ENVIROLAB

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 120902

Date Received: 12/12/14
~~Time Received:~~ 16 15
Received by: PR
Temp: ~~Cool~~/Ambient
~~Cooling: Ice/Icepack~~
~~Security: Intact~~/Broken/None

Page 4 of 4

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

SAMPLE RECEIPT ADVICE

Client:

Robson Environmental Pty Ltd
PO Box 112
Fyshwick ACT 2609

ph: 02 6239 5656
Fax: 02 6239 5669

Attention: Ben Kendon

Sample log in details:

Your reference:	**9623**
Envirolab Reference:	**120902**
Date received:	12/12/14
Date results expected to be reported:	**19/12/14**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	2 soils
Turnaround time requested:	Standard
Temperature on receipt (°C)	19.2
Cooling Method:	Ice
Sampling Date Provided:	YES

Comments:

If there is sufficient sample after testing, samples will be held for the following time frames from date of receipt of samples:
Water samples - 1 month
Soil and other solid samples - 2 months
Samples collected in canisters - 1 week. Canisters will then be cleaned.
All other samples are not retained after analysis
If you require samples to be retained for longer periods then retention fees will apply as per our pricelist.

Contact details:

Please direct any queries to Aileen Hie or Jacinta Hurst
ph: 02 9910 6200 fax: 02 9910 6201
email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au

Appendix G

Asbestos Airborne Fibre Monitoring Results

Robson ENVIRONMENTAL
Effective Environmental Solutions

140 Gladstone Street
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W: www.robsonenviro.com.au

Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 13/11/2014 **Report Issued:** 13/11/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Background air monitoring (Baseline monitoring)

Asbestos Removalist: none

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-1	Lunchroom	0748	1522	1000	100	0.5	< 0.01
9623-2	Perimeter fence south of work area	0803	1520	1000	100	1	< 0.01
9623-3	Perimeter fence southeast of work area	0805	1524	1000	100	1	< 0.01
9623-4	Perimeter fence east of work area	0807	1526	1000	100	0	< 0.01
9623-5	Perimeter fence northeast of work area	0809	1529	1000	100	1	< 0.01
9623-6	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

Robson Approved Signatory
Ben Kendon

NATA
No. 3181

NATA Approved Counter
Ben Kendon

Accredited for compliance with ISO/IEC 17025

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 14/11/2014 **Report Issued:** 14/11/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Background air monitoring (Baseline monitoring)

Asbestos Removalist: none

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-7	Perimeter fence south of work area	0830	1410	2000	100	1	< 0.01
9623-8	Site office	0835	1409	2000	100	4	< 0.01
9623-9	Perimeter fence south east of work area	0840	1411	2000	100	2	< 0.01
9623-10	Perimeter fence east of work area	0841	1413	2000	100	1	< 0.01
9623-11	Perimeter fence north east corner of work area	0843	1415	2000	100	2	< 0.01
9623-12	Perimeter fence west of work area	0856	1417	2000	100	2	< 0.01
9623-13	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

Robson Approved Signatory
Leo Menssen

NATA
No. 3181

NATA Approved Counter
Leo Menssen

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 17/11/2014 **Report Issued:** 17/11/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Background air monitoring (Baseline monitoring)

Asbestos Removalist: none

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-14	Crib room	0708	1530	1000	100	1	< 0.01
9623-15	Site office	0709	1515	1000	100	3	< 0.01
9623-16	South of removal area	0713	1517	1000	100	1	< 0.01
9623-17	East of removal area	0718	1519	1000	100	1	< 0.01
9623-18	North of removal area	0721	1521	1000	100	0	< 0.01
9623-19	West of removal area	0725	1526	2000	100	0	< 0.01
9623-20	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

Robson Approved Signatory
Leo Menssen

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Leo Menssen

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 18/11/2014 **Report Issued:** 18/11/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Background air monitoring (Baseline monitoring)

Asbestos Removalist: none

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-21	Lunchroom	0710	1501	2000	100	0	< 0.01
9623-22	Site office	0712	1504	2000	100	1.5	< 0.01
9623-23	South boundary of removal area	0723	1506	2000	100	0	< 0.01
9623-24	East boundary of removal area	0720	1508	2000	100	0	< 0.01
9623-25	North boundary of removal area	0728	1510	2000	100	0	< 0.01
9623-26	West boundary of removal area	0725	1516	2000	100	0	< 0.01
9623-27	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

Robson Approved Signatory
Andrew Roberts

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No. 3181

NATA Approved Counter
Andrew Roberts

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 19/11/2014 **Report Issued:** 19/11/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Background air monitoring (Baseline monitoring)

Asbestos Removalist: none

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-28	Crib room	0830	1250	2000	100	0	< 0.01
9623-29	Site office	0832	1452	2000	100	3	< 0.01
9623-30	South boundary of work area	0835	1455	2000	100	2	< 0.01
9623-31	East boundary of work area	0846	1457	2000	100	0	< 0.01
9623-32	North boundary of work area	0842	1500	2000	100	0	< 0.01
9623-33	West boundary of work area	0845	1504	2000	100	0	< 0.01
9623-34	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

Robson Approved Signatory
Andrew Roberts

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Andrew Roberts

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 20/11/2014 **Report Issued:** 20/11/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Removal area set up

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-35	Crib room	0700	1553	1000	100	2	< 0.01
9623-36	Site office	0705	1555	1000	100	2	< 0.01
9623-37	South boundary of work area	0715	1534	1000	100	0	< 0.01
9623-38	East boundary of work area	0719	1537	1000	100	0	< 0.01
9623-39	North boundary of work area	0723	1544	1000	100	1	< 0.01
9623-40	West boundary of work area	0845	1541	1000	100	0	< 0.01
9623-41	Bob cat cabin (Pump failure)	0745		-	100	1.5	-
9623-42	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

Robson Approved Signatory
Ben Kendon

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Ben Kendon

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 21/11/2014 **Report Issued:** 21/11/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Removal area set up and removal of vegetation

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-43	Crib room	0709	1533	1000	100	0	< 0.01
9623-44	Site office	0728	1535	1000	100	3	< 0.01
9623-45	South boundary of work area	0741	1520	1000	100	3	< 0.01
9623-46	East boundary of work area	0750	1510	1000	100	2	< 0.01
9623-47	North boundary of work area	0753	1512	1000	100	2	< 0.01
9623-48	West boundary of work area	0756	1515	1000	100	0	< 0.01
9623-49	Bobcat cabin	0807	1450	1000	100	7.5	<0.01
9623-50	Change/ Clean decon	0813	1523	1000	100	2	<0.01
9623-51	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

Robson Approved Signatory
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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 24/11/2014 **Report Issued:** 24/11/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Removal area set up and removal of vegetation

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-52	Crib room	0757	1450	1000	100	0	< 0.01
9623-53	Site office	0754	1459	1000	100	0	< 0.01
9623-54	Bobcat cabin	0835	1448	1000	100	3	< 0.01
9623-55	South boundary of work area	0807	1502	1000	100	0	< 0.01
9623-56	East boundary of work area	0812	1427	1000	100	0	< 0.01
9623-57	North boundary of work area	0817	1429	1000	100	0	< 0.01
9623-58	West boundary of work area	0827	1432	1000	100	0	< 0.01
9623-59	Change/ Clean decon	0840	1445	1000	100	0	< 0.01
9623-60	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

Robson Approved Signatory
Anne Robson

NATA
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NATA Approved Counter
Anne Robson

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 25/11/2014 **Report Issued:** 25/11/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Removal area set up and removal of vegetation

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-61	Lunch room	0702	1521	1000	100	0	< 0.01
9623-62	Site office	0704	1523	1000	100	0	< 0.01
9623-63	West boundary of removal area	0709	1508	1000	100	0	< 0.01
9623-64	North boundary of Exclusion area	0713	1510	1000	100	0	< 0.01
9623-65	East boundary of removal area	0715	1513	1000	100	0	< 0.01
9623-66	South east boundary of Exclusion area	0718	1515	1000	100	0	< 0.01
9623-67	South boundary of removal area	0720	1516	1000	100	3	< 0.01
9623-68	Bobcat cabin	0830	1518	1000	100	4.5	< 0.01
9623-69	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

Robson Approved Signatory
Anne Robson

NATA
No. 3181

NATA Approved Counter
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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 26/11/2014 **Report Issued:** 26/11/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Removal area set up and removal of vegetation

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-70	Lunch room	0729	1511	1000	100	0	< 0.01
9623-71	Site office	0730	1512	1000	100	3	< 0.01
9623-72	West boundary of removal area	0747	1530	1000	100	0	< 0.01
9623-73	North boundary of removal area	0746	1528	1000	100	0	< 0.01
9623-74	East boundary of removal area	0745	1532	1000	100	0	< 0.01
9623-75	South east boundary of removal area	0731	1515	1000	100	0	< 0.01
9623-76	Bobcat cabin	0732	1517	1000	100	2	< 0.01
9623-77	Hitachi excavator cabin	0720	1535	1000	100	0	< 0.01
9623-78	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

Robson Approved Signatory
Anne Robson

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 27/11/2014 **Report Issued:** 27/11/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Removal of vegetation

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-79	Lunch room	0717	1505	1000	100	0	< 0.01
9623-80	Site office	0719	1507	1000	100	2	< 0.01
9623-81	West boundary of removal area	0730	1520	1000	100	0	< 0.01
9623-82	North boundary of removal area	0727	1522	1000	100	0	< 0.01
9623-83	East boundary of removal area	0724	1512	1000	100	0	< 0.01
9623-84	South boundary of removal area	0720	1510	1000	100	1	< 0.01
9623-85	Excavator cabin (Hitachi)	0705	1525	1000	100	0	< 0.01
9623-86	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

Robson Approved Signatory
Andrew Roberts

NATA
No. 3181

NATA Approved Counter
Andrew Roberts

Accredited for compliance with ISO/IEC 17025

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 28/11/2014 **Report Issued:** 28/11/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Removal of vegetation and ACM impacted soils

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-87	Lunch room	0725	1502	1000	100	0	< 0.01
9623-88	Site office	0720	1500	1000	100	1	< 0.01
9623-89	West boundary of removal area	0735	1512	1000	100	0	< 0.01
9623-90	North boundary of removal area	0738	1514	1000	100	0	< 0.01
9623-91	East boundary of removal area	0729	1506	1000	100	2	< 0.01
9623-92	South boundary of removal area	0715	1505	1000	100	2	< 0.01
9623-93	Excavator cabin (Hitachi)	0712	1538	1000	100	2	< 0.01
9623-94	Decontamination Unit	0907	1540	2000	100	2	< 0.01
9623-95	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 1/12/2014 **Report Issued:** 1/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Removal of vegetation and ACM impacted soils

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-96	Lunch room	0708	1435	1000	100	0	< 0.01
9623-97	Site office	0711	1423	1000	100	0	< 0.01
9623-98	West boundary of removal area	0723	1425	1000	100	1	< 0.01
9623-99	North boundary of removal area	0727	1427	1000	100	0	< 0.01
9623-100	East boundary of removal area	0715	1431	1000	100	1	< 0.01
9623-101	South boundary of removal area	0713	1428	1000	100	2	< 0.01
9623-102	Decontamination Unit	0720	1440	2000	100	0	< 0.01
9623-103	Excavator cabin (Hitachi)	0702	1414	1000	100	0	< 0.01
9623-104	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 2/12/2014 **Report Issued:** 2/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Removal of vegetation and ACM impacted soil

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-105	Lunch room	0750	1450	1000	100	2	< 0.01
9623-106	Site office	0750	1442	1000	100	1	< 0.01
9623-107	West boundary of removal area	0808	1455	1000	100	0	< 0.01
9623-108	North boundary of removal area	0805	1452	1000	100	0	< 0.01
9623-109	East boundary of removal area	0758	1447	1000	100	8	< 0.01
9623-110	South boundary of removal area	0748	1437	1000	100	0	< 0.01
9623-111	Decontamination Unit	0752	1444	2000	100	4	< 0.01
9623-112	Excavator cabin (Hitachi)	0745	1439	1000	100	1	< 0.01
9623-113	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 3/12/2014 **Report Issued:** 3/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Stockpiling of ACM materials

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-114	Lunch room	0735	1428	1000	100	2.5	< 0.01
9623-115	Site office	0730	1430	1000	100	4.5	< 0.01
9623-116	West boundary of removal area	0735	1421	1000	100	1.5	< 0.01
9623-117	North boundary of removal area	0742	1422	1000	100	0	< 0.01
9623-118	East boundary of removal area	0734	1423	1000	100	0	< 0.01
9623-119	South boundary of removal area	0715	1425	1000	100	0	< 0.01
9623-120	Decontamination Unit	0711	1426	2000	100	3	< 0.01
9623-121	Excavator cabin (Hitachi)	0708	1417	1000	100	1	< 0.01
9623-122	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 4/12/2014 **Report Issued:** 4/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Background air monitoring during soil sampling

Asbestos Removalist: None

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-123	Lunch room	0746	1506	1000	100	2.5	< 0.01
9623-124	Site office	0748	1507	1000	100	1	< 0.01
9623-125	West boundary of removal area	0815	1502	1000	100	0	< 0.01
9623-126	North boundary of removal area	0817	1500	1000	100	1	< 0.01
9623-127	East boundary of removal area	0810	1510	1000	100	0	< 0.01
9623-128	South boundary of removal area	0808	1511	1000	100	0	< 0.01
9623-129	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 8/12/2014 **Report Issued:** 8/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Asbestos in soil removal

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-130	Lunch room	0719	1439	1000	100	0	< 0.01
9623-131	Site office	0721	1441	1000	100	2	< 0.01
9623-132	West boundary of removal area	0725	1450	1000	100	2	< 0.01
9623-133	North boundary of removal area	0730	1448	1000	100	1	< 0.01
9623-134	East boundary of removal area	0723	1443	1000	100	1	< 0.01
9623-135	South boundary of removal area	0714	1443	1000	100	0	< 0.01
9623-136	Excavator cabin (Hitachi)	0707	1438	1000	100	1	< 0.01
9623-137	Decontamination Unit	0717	1440	1000	100	1	< 0.01
9623-138	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

Robson Approved Signatory
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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 9/12/2014 **Report Issued:** 9/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Asbestos in soil removal and soil sampling

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-139	Site Office	0705	1447	1000	100	3	< 0.01
9623-140	Lunchroom	708	1449	1000	100	0	< 0.01
9623-141	West boundary of removal area	0724	1504	1000	100	0	< 0.01
9623-142	North boundary of removal area	0726	1503	1000	100	1	< 0.01
9623-143	East boundary of removal area	0714	1454	1000	100	0	< 0.01
9623-144	South boundary of removal area	0714	1451	1000	100	1	< 0.01
9623-145	Decontamination Unit	0719	1456	1000	100	3	< 0.01
9623-146	Excavator cabin (Hitachi)	0709	1445	1000	100	1	< 0.01
9623-147	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Ben Kendon

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 10/12/2014 **Report Issued:** 10/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Asbestos removal and soil sampling

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-148	Lunch room	0707	1529	1000	100	0	< 0.01
9623-149	Site office	0709	1527	1000	100	0	< 0.01
9623-150	West boundary of removal area	0729	1535	1000	100	1	< 0.01
9623-151	North boundary of removal area	0730	1540	1000	100	1	< 0.01
9623-152	East boundary of removal area	0715	1532	1000	100	2	< 0.01
9623-153	South boundary of removal area	0713	1531	1000	100	0	< 0.01
9623-154	Decontamination Unit	0725	1525	1000	100	4	< 0.01
9623-155	Excavator cabin (Hitachi)	0721	1533	1000	100	0	< 0.01
9623-156	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 11/12/2014 **Report Issued:** 11/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Soil sampling

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-157	Site office	0700	1453	1000	100	2	< 0.01
9623-158	Lunch room	0701	1455	1000	100	2	< 0.01
9623-159	West boundary of removal area	0706	1502	1000	100	0	< 0.01
9623-160	North boundary of removal area	0707	1500	1000	100	1	< 0.01
9623-161	East boundary of removal area	0718	1457	1000	100	0	< 0.01
9623-162	South boundary of removal area	0722	1456	1000	100	2	< 0.01
9623-163	Decontamination Unit	0724	1449	1000	100	0	< 0.01
9623-164	Excavator cabin (Hitachi)	Fault	Fault	Fault	100	1*	N/A
9623-165	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

Fault = Air monitor battery failure
***= Fibre count only**

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 12/12/2014 **Report Issued:** 12/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Trenching

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-166	Site office	0703	1502	1000	100	0	< 0.01
9623-167	Lunch room	0704	1505	1000	100	0	< 0.01
9623-168	West boundary of removal area	0709	1513	1000	100	0	< 0.01
9623-169	North boundary of removal area	0711	1511	1000	100	0	< 0.01
9623-170	East boundary of removal area	0707	1505	1000	100	1	< 0.01
9623-171	South boundary of removal area	0705	1507	1000	100	0	< 0.01
9623-172	Decontamination Unit	0713	1515	1000	100	0	< 0.01
9623-173	Excavator cabin (2nd Hitachi)	0718	1503	1000	100	0	<0.01
9623-174	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 15/12/2014 **Report Issued:** 15/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Wood Chipping

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-175	Site office	0702	1609	1000	100	1	< 0.01
9623-176	Lunch room	0710	1611	1000	100	1	< 0.01
9623-177	West boundary of removal area	0719	1617	1000	100	0	< 0.01
9623-178	North boundary of removal area	0721	1616	1000	100	0	< 0.01
9623-179	East boundary of removal area	0715	1628	1000	100	3	< 0.01
9623-180	South boundary of removal area	0712	1612	1000	100	0	< 0.01
9623-181	Decontamination Unit	0740	1603	1000	100	1	< 0.01
9623-182	Excavator cabin (Wood chipping company)	0726	1608	1000	100	3	<0.01
9623-183	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Andrew Roberts

NATA
No. 3181

NATA Approved Counter
Andrew Roberts

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 16/12/2014 **Report Issued:** 16/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Background air monitoring

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-184	Site office	0714	1510	1000	100	5	< 0.01
9623-185	Lunch room	0716	1509	1000	100	0	< 0.01
9623-186	West boundary of removal area	0719	1520	1000	100	0	< 0.01
9623-187	North boundary of removal area	0721	1522	1000	100	1	< 0.01
9623-188	East boundary of removal area	0734	1514	1000	100	0	< 0.01
9623-189	South boundary of removal area	0740	1515	1000	100	0	< 0.01
9623-190	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 17/12/2014 **Report Issued:** 17/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Surface sealing and mulch distribution

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-191	Site office	0727	1509	2000	100	7	< 0.01
9623-192	Lunch room	0730	1505	2000	100	2	< 0.01
9623-193	West boundary of work area	0737	1555	2000	100	2	< 0.01
9623-194	North boundary of work area	0740	1558	2000	100	0	< 0.01
9623-195	East boundary of work area	0745	1549	2000	100	6	< 0.01
9623-196	South boundary of work area	0746	1546	2000	100	10	< 0.01
9623-197	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Respirable Fibre Estimation Test Report

Report No.: 9623 **Sampling Date:** 18/12/2014 **Report Issued:** 18/12/2014

Monitoring Location: Canberra Brickworks Remediation Project, Denman Street Yarralumla ACT 2600 (Block 1 Section 102 Yarralumla)

Client Name & Address: Capezio and Co Unit 2/2 Yallourn Street Fyshwick ACT 2609

Work in Progress: Mulch distribution

Asbestos Removalist: AAC

Test Specification(s) Employed: NOHSC: Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)], & In-House Procedure No. 1

Sample No.	Sampling Location	Time On	Time Off	Av. Flowrate	No. of Fields Counted	No. of Fibres Counted	Airborne Fibre Conc. (fibres/mL)
9623-198	Site office	0705	1334	2000	100	13	< 0.01
9623-199	Lunch room	0708	1335	2000	100	2	< 0.01
9623-200	West boundary of work area	0714	1338	2000	100	0	< 0.01
9623-201	South boundary of work area	0716	1340	2000	100	0	< 0.01
9623-202	East boundary of work area	0720	1343	2000	100	0	< 0.01
9623-203	North boundary of work area	0722	1345	2000	100	2	< 0.01
9623-204	Field blank	-	-	-	100	0	-

Field blanks and samples taken in direct flow of negative air units are reported as a fibre count only

The Detection Limit of the analytical method is 0.01 fibres/mL
The *NOHSC: 2002 (2005)* recommended Control Level for all forms of asbestos is 0.01 fibres/mL
Worksafe Australia's recommended Exposure Standard for all forms of asbestos is 0.1 fibres/mL

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Appendix H

Robson Standard Operating Procedures

(SOP003 and SOP009)

Document Approval

Document Owner	EAR Manager
Checked By	Managing Director
Approved By	Managing Director

History of Amendments

Revision Number	Date	Clause	Summary of Amendments
0	17/08/2010		Original
1	30/08/2012		Minor Changes Throughout Document
2	6/06/2014		Minor updates to header and footer only

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1 INTRODUCTION

1.1 Purpose

The purpose of this Standard Operating Procedure (SOP) is to document standard protocols for Robson environmental scientists, engineers and technicians for the sampling, field analysis, containment and preservation of soil samples. It is considered that following the recommended protocols will assist with the following:

- To ensure that the samples are representative of the soil medium from where they are collected;
- To preserve the representative nature of the sample until analytical determinations and/or measurements are made;
- To provide accurate and consistent determination of chemical, physical and biological indicators of the soil sampled; and
- To provide representative samples to facilitate observation and logging of the subsurface conditions.

1.2 Scope

The scope of this SOP is the collection and handling of soil samples for field and/or laboratory analysis of chemical, physical and/or biological properties. The procedures apply to the preparation and fieldwork for baseline assessments and contaminated site assessments. The SOP is applicable to the Project Manager designing and supervising the sampling program, and for environmental scientists, engineers and technicians implementing the sampling program in the field.

2 PREPARATION AND EQUIPMENT

2.1 Preparation

- Review job proposal and Sampling and Analysis Quality Plan (SAQP). If a SAQP is required then this should have been prepared by the Project Manager prior to the sampling event;
- Contact the laboratory to confirm that they are able to undertake required analysis, that they have capacity to undertake the analysis within the required timeframe, and to establish any specific sample size / preservation requirements;
- Organise site information including the following:
  - Site access including permissions, directions to the site and site access roads, site access keys,
  - Contact names, addresses and phone numbers;
  - Site map showing sampling locations;
- Organise and check equipment. This includes the following:
  - Test and recharge/replace batteries as necessary;
  - Check the instruments' ability to calibrate and function properly;
  - Inspect the equipment for defects, loose or frayed wires and that cables are in good condition etc;
  - Check that all equipment is properly decontaminated and stored for transport;
- Organise sampling equipment. This could include the following items:
  - Field sheets, writing equipment, waterproof markers,
  - Calculator, stopwatch, camera and telephone;
  - Instruments including photoionisation detector (PID) and Lower Explosive Limit (LEL) meter;
  - Measuring wheel;
  - Plastic sheet or ground cover;
  - Decontamination equipment include non-phosphate cleaner (e.g. Decon 90), scrubbing brushes, wash and rinse buckets, wastewater containers, deionised / demineralised water and potable tap water;
  - Sample collection devices such as trowels, hand augers, stainless steel mixing bowls, paper towelling and zip lock plastic bags;
  - Sample jars and bags for analysis required (plus extras for replacements if needed), eskies, ice, ice blocks, bubble wrap and 'Fragile' adhesive tape;
  - Tools including wrench, screw driver, pliers, knife, duct tape and hammer; and
  - Personal Protective equipment including disposable gloves, leather gloves, safety glasses, safety mask/splash shield, overalls, hard hat, steel cap boots, rubber boots with steel caps, high visibility clothing, first aid kit; filter marks (and that cartridges are within use by date), ear muffs / plugs;

- Antiseptic handwash;
- Suitable bags for disposal of generated wastes; and
- Material safety data sheets (MSDS) for all chemicals brought onto site.

2.2 Preparatory Work On Site

- Obtain all necessary permits required prior to intrusive works (eg DBYD and underground services clearance, hot works permits, AIP Work Clearance for Contractors form);
- Where necessary, contact the Client or site contact to confirm arrangements, identify specific site issues and / or undertake site inductions;
- Induct all Robson personnel and sub-contractors onto the site using the pre-prepared and site specific Site Safety Management Plan (SSMP);
- Mark out the proposed sample locations. If the sample locations have been pre-identified in the office, then their location in the field is generally identified using either a GPS or by measurement from an obvious reference point using a measuring wheel or tape measure. In specified circumstances, locations may need to be identified using a registered surveyor – if this is required then the Project Manager should have already made appropriate arrangements. Confirm that the locations correlate with those on the sampling plan. Adjust if necessary and record;
- If the sampling locations are to be determined in the field then ensure that their locations and density meets the specific requirements of the assessment. Measure the position of these locations either relative to an obvious and permanent reference point or with a GPS;
- Where necessary, confirm that required materials and / or equipment has been delivered to the site (eg drums, sampling consumables etc); and
- Clear proposed sample location for underground utilities and services. This will require engagement of a Telstra approved underground services locator. The Robson site supervisor should communicate one on one with the underground services locator about each proposed sample location. Note that depending upon the site, the Client may already have removed all services or already had all underground services located.

3 CALIBRATION AND USE OF PID AND LEL

3.1 PID Screening

Each soil sample collected should be screened in the field with a hand held Photo-ionisation Detector (PID) for the presence of volatile organic compounds (VOCs). The results of the PID screening provide an indication of the potential for hydrocarbon impact. Robson own a MiniRae® 2000 and MiniRae® 3000 PID which have a 10.6 electron volt (eV) self cleaning lamp with a total detection range of 0 parts per million (ppm) to 10,000 ppm.

3.1.1 PID Screening of Soil Samples

Use consistency with the methods for screening, particularly the sample containers used (eg size and type of zip lock bag, amount of soil in the container and the amount of time that the sample sits before screening with the PID). Note that the PID may be subject to poor performance in the presence of high humidity or when screening moist / wet samples.

The following PID screening procedures should be used for the MiniRae® 2000. Please note that the procedures are the same for the MiniRae® 3000 however the screen instructions and buttons do vary slightly::

- The PID should be calibrated daily prior to use. Further guidance regarding the calibration of the PID is provided in **Section 3.1.2**. Check that the PID maintenance register indicates recent service. The battery should also be recharged prior to use. A fully charged battery runs the PID continuously for approximately 10 hours;
- Allow the PID unit to equilibrate with the surrounding environmental temperature;
- Start up the PID unit. To turn on, press the **MODE** key for 1 second and release. The audio buzzer will beep once and the air pump will turn on. A range of LCD displays are then shown during the start up process. Once the start up process is complete, the unit will display the message 'Ready...'. Pressing the **Y/+** button will now allow the unit to take a PID measurement;
- Attached a water trap filter onto the PID intake tube (to prevent water and dust from being sucked into the sensor manifold which could cause extensive damage to the monitor);
- Screen an empty zip lock bag with the PID prior to use to confirm that the bag type does not release VOCs that may be picked up by the PID;
- The soil sample to be screened should be placed in a clean zip lock bag. Ensure that enough air space (head space) is present above the soil. The zip lock should then be sealed;
- Shake the sample container to thoroughly mix the soil sample with the air in the head space.
- Let the sample equilibrate – it is normally sufficient to allow the sample to sit for a couple of minutes prior to screening. Do not allow the samples to sit in the sun;
- Open a small section of the zip lock sufficient to allow insertion of the tip of the PID intake tube. Alternatively, puncture the side of the upper part of the bag with the tip of the PID. Insert the intake tube through the opening and into the head space;

- Screen the sample for at least 5 seconds. Record the highest PID reading registered on the field form titled 'Field Screening of Soil / Materials'. Also provide a qualitative description of any odours noted;
- Ensure that dirt and moisture are not sucked into the PID probe. Do not ever immerse the intake tube in liquids;
- When the display shows a flashing message 'Bat', the battery requires recharging;
- Following a series of 0 ppm readings, verify that the PID unit is actually working by screening a sample with known volatiles, or by testing with the standard reference span gas used for calibration; and
- To turn off the PID, press and hold the **MODE** key for 5 seconds. The monitor will beep once per second during the power-down sequence. The message 'OFF!.." flashes on the LCD display and then the display will go blank indicating that the monitor is turned off. Detach the water trap filter.

3.1.2 Calibration of the MiniRae® 2000/ MiniRae® 3000 PID Unit

Calibration of the MiniRae® 2000/ MiniRae® 3000 PID unit is a two point process. That is, calibration firstly involves setting the zero point for the sensor by reference against fresh air which contains no detectable VOC (0.0 ppm). The sensor is then set against a second point of reference using a standard reference gas of known concentration (typically Span Gas – with an Isobutylene concentration of 100 ppm).

During calibration, be sure to complete the PID section of the form 'Calibration Register (Field Equipment)'.

Once the PID unit has been turned on, calibration is undertaken via entering the Programming Mode of the unit. To enter the programming mode, press and hold down simultaneously both the **N/-** and **MODE** keys for 3 seconds. Press the **N/-** key to scroll to the next menu item of the programming mode, and the **Y/-** key to select the displayed menu item.

<u>Fresh Air Calibration</u>

- Undertake the fresh air calibration in an area where no odours are noted. If in doubt, attach an charcoal vapour zeroing filter onto the PID intake tube. In the 'Fresh air Cal?' sub-menu of programming mode press the **Y/-** key. The LCD display will then read 'zero in progress', followed by 'wait....', and a countdown timer; and
- After about 15 seconds the display will read 'update data...zeroed...reading – X.X ppm...'. Press any key or wait 20 seconds for the monitor to return back to the 'Fresh air Cal?' sub-menu. Remove the charcoal vapour zeroing filter from the PID intake tube.

Reference Point Calibration

- Now undertake the second reference point calibration using the span gas. Press the **N/-** key to scroll from the 'Fresh air Cal?' sub-menu to the 'Span Cal?' sub-menu;
- Attach the PID intake tube to a cylinder of standard reference gas (Span Gas – with an Isobutylene concentration of 100 ppm) which has been fitted with a 500 cc/minute flow-limiting regulator;
- Press the **Y/-** key to start the calibration. The display shows the gas name and the span value of the corresponding gas. The display will then read 'Apply gas now!'. Turn on the valve of the span gas;
- The unit will then perform the calibration – during this period the display will read 'wait....30' with a count down timer of the remaining seconds until calibration is complete. When the count down timer reaches '0', the display reads the calibrated value. This should be very close to the known concentration of the span reference gas;
- The unit will then read 'Update Data Span Cal Done! Turn Off Gas'. Turn off the flow of the span reference gas and disconnect from the PID unit;
- Press any key to return back to the 'Span Gas Cal?' sub-menu; and
- To exit the Programming Mode (that is, return to screening operation), press the **MODE** key once at any of the programming menu displays.

3.2 LEL Screening

LEL refers to the Lower Explosive Limit which is the explosive limit of a gas or a vapour is the lowest concentration (percentage) of a gas or a vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat). At concentrations in air below the LEL there is not enough fuel to continue an explosion. That is, concentrations lower than LEL are 'too lean' to burn. Each combustible gas has its own LEL concentration; this information can be sourced from the MSDS for the chemicals of concern.

Robson uses the Industrial Scientific 'MX6 Ibrid'™ multi-gas monitor for the screening of levels of oxygen, toxic and combustible gas, and VOCs. The following information is sourced from the LEL operation manual titled Industrial Scientific (2009) '*MX6 iBrid Multi-Gas Monitor Operation Guide*'.

3.2.1 Use of the MX6 Ibrid™ LEL Unit

The following LEL screening procedures should be used:

- Prior to each day's use, a zero calibration and a functional 'bump test' should be performed on the LEL. If the LEL does not pass the bump test, then a full calibration is required. Further information regarding zero calibration and a bump test is provide below in **Section 3.2.2**;
- Start up the LEL unit. To turn on, locate, press and hold the centre **ENTER** navigation button for at least 3 seconds. A series of LCD displays are then shown during the start up process. Once the start up process is complete, the unit will display the Normal Operation Mode screen. The screen layout is dependent upon the number of sensors that are actually installed;

- On the Normal Operation Mode screen, sensor names are displayed in solid black text, and blinking black text during alarm conditions. In addition, the sensor readings are displayed as solid black numbers during normal operation, and solid red numbers during alarm conditions;
- To turn off the LEL, press and hold the centre **ENTER** key for more than 2 seconds. A confirmation screen is displayed to provide verification of the shut down.

The LEL is powered by an internal rechargeable battery which should be fully recharged before use. Follow these steps to charge the battery:

- Insert the power cord of the charging cradle into a power point;
- Place the LEL in the cradle; and
- Confirm that the LCD on the LEL shows that the battery is charging.

The battery status can be confirmed by accessing the Battery Status screen. To do this from the Normal Operation Mode screen, press and release the centre **ENTER** button. Under the Main Menu, use the arrow buttons to highlight the VIEW option, and then highlight the Battery option under the VIEW option. The Battery Status screen then shows the approximate percentage (%) of battery charge remaining. Note that if the battery life remaining is less than 1 hour, the battery icon flashes on the Normal Operation Mode screen and an audible low battery alarm is emitted. If the running time is less than 10 minutes, then the LEL notifies of impending unit shut down by showing 'Low Battery' on the lower central part of the screen.

Verify the calibration of the combustible gas sensor after any incident where the combustible gas content has caused the instrument to display an over-range condition.

Sensor openings and water barriers must be kept clean. Obstruction of the sensor openings and/or contamination of the water barriers may cause readings to be lower than actual gas concentrations.

3.2.2 Zero Calibration and LEL Bump Test and Calibration Unit

Prior to each day's use, a zero calibration and a functional 'bump test' on the LEL should be performed. The zero calibration involves exposing the LEL to a fresh air environment, whereas the Bump Test involves brief exposure of the LEL to a concentration of gas(es) in excess of the lowest alarm set point for each sensor for the purpose of verifying sensor and alarm operation. Note that the bump test is not intended to be a measure of the accuracy of the instrument. If the LEL does not pass the bump test, then a full calibration is required.

The following describes the procedure for undertaking a zero calibration:

- Zero calibrate instrument in fresh air environment. Attach the RAE system zero filter shown below in Figure 1, and remove the black cap on the end;

Figure 1: Zero Calibration Set Up

- Press **ENTER**, **SENSOR**, **ZERO ALL** and then **OK**. The instrument will run through a series of check and beep when complete. Make sure that you reattach the black cap to zero filter when finished.

The following describes the procedure for undertaking a Bump Test:

- Access the Main Menu from the Normal Operation Mode screen by pressing and then releasing the centre **ENTER** button. Under the Main Menu, use the arrow buttons to highlight the Sensor option, and then highlight the Bump Test option under the Sensor option;
- If the Bump Test option is selected a confirmation screen is shown displaying 'Bump Test All Sensors?'. If **OK** is selected then all the installed sensors are bump tested, starting with the first sensor. If **CANCEL** is selected, then the LEL returns to the Normal Operation Mode screen;
- If the user has selected **OK**, then a screen advises the user to apply a specific gas to the LEL. The user must then apply the gas and select **START** before the bump times out.
    - If the user selects **START**, the bump test is started for this sensor. Attach the grey Industrial Scientific gas cylinder to the inlet on instrument as shown below in Figure 2, making sure to use the tubing supplied with the MX6 because it has a flow regulator to adjust gas delivery (Figure 3). The sensor must reach a gas reading of 50% or greater of the applied gas concentration within 60 seconds to pass. Once the sensor has done so, the word 'pass' is displayed for 3 seconds before the instrument moves on to the next sensor.

Figure 2: Bump Test Set Up

Figure 3: Supplied Tubing

    - If the user selects **SKIP**, then the bump test for this gas is not done and the instrument moves on to the next sensor in the list to be tested;
- After all the sensors installed on the LEL instrument have been bump tested, the LEL instrument will beep and give a pass or fail reading for each sensor. The user must

acknowledge this screen by selecting **OK** to return to the main Normal Operation Mode screen;

- If a sensor fails, the instrument will ask to whether to continue or to calibrate the failed sensor(s). If **CANCEL** is selected then the sensor is not calibrated and the LEL instrument moves on to the next sensor on the list. If the user selected **OK**, then the LEL calibrates the failing sensor. This step is repeated until the user has chosen to calibrate all failed sensors.

Calibration of the LEL is undertaken using the following procedure:

- To calibrate press **ENTER**, **SENSOR** and then **CALIBRATE**. Attach a RAE zero filter (Figure 4). Select **OK** to confirm calibration. The screen will show the message 'sensor zeroing', followed by an O_2 calibration;

Figure 4: Zero Filter Set Up

- When screen prompt appears to calibrate isobutylene, attach the yellow RAE gas cylinder to the inlet on the top of the instrument using the tubing supplied (Figure 5).

Figure 5: Isobutylene Calibration

The calibration will automatically begin when the instrument detects the gas (5 minute timeout period to attach gas supply). When the isobutylene sensor calibration is complete, a prompt to skip or abort the H_2S sensor will appear. Turn off the canister valve and detach from inlet;

- Attach the grey Industrial Scientific mixture gas cylinder (Figure 6).

Figure 6: CO, H_2S & LEL% Calibration

The instrument will automatically start calibrating the remaining sensors. Select **SKIP** to skip a sensor or **ABORT** to abort the calibration; and

- When the calibration is complete the instrument will show a 'pass', 'marginal' or 'fail' reading for each sensor. The screen will automatically revert to the main Normal Operation Mode screen if no options are selected.

4 TYPES OF SOIL SAMPLES AND SAMPLE COLLECTION

4.1 Soil Sample Types

Soil samples are commonly obtained from one or more of the following:

- Surface sampling;
- Test pits; and/or
- Boreholes.

From the various sampling methods, two main types of soil samples are collected:

- Disturbed samples – these are samples where the soil has been disturbed loosing its' natural soil structure, physical properties and/or moisture. Disturbed samples are generally collected from grab sampling methods such as during auger or hammer drilling, when sampling from test pits or from the walls/base of excavations or from stockpiles;
- Undisturbed samples – these are samples where the sampled soil remains more-or-less in its' undisturbed state, retaining its' natural soil structure, physical properties and/or moisture. Undisturbed samples can be collected by push tube sampling methods or during core drilling.

A number of different excavation and boring methods are available, however the choice of method requires consideration of the following:

- Objective of assessment and depth of assessment works;
- Site access, ground conditions and acceptable site disturbance;
- Nature of potential contaminants and sample volume required; and
- Type of sample required (e.g. disturbed or undisturbed).

In addition to the above, samples can either be discrete samples or composite samples. Discrete samples are samples collected over a discrete sampling interval which are representative of that interval, but based on observations may also be representative of the surrounding soils. Composite samples comprise a sample which is made up of several sub-samples from a range of locations, material types or depth intervals. Though compositing does have benefits in certain situations (e.g. potential lower screening costs of larger areas), as a general rule Robson does not recommend the collection of composite samples for the following reasons:

- The composite sample is representative only of the composite sample. That is, actual contaminant concentrations may be higher than laboratory results in some sub-samples and lower in other sub-samples;
- The physical mixing process to form the composite sample may inadvertently release some of the volatile contaminants (if present); and
- If a contaminant concentration exceeds the adjusted assessment criteria (that is, the adjusted criteria is the soil criteria divided by the number of samples comprising the composite), then each of the discrete samples making up the composite should be

analysed. This prolongs the duration of the assessment and increases the analytical costs.

4.2 Techniques to Prevent Sample Contamination

Sample contamination can be caused by poor sampling-handling, atmospheric input, poorly cleaned equipment, inadequate training, and the use of equipment not designed for the analytes targeted for the study. Contamination from these sources can be prevented or minimised by using sound field practices including:

- Being aware of and recording potential sources of contamination at each sample site and sample location;
- Wearing appropriate disposable, powderless nitrile gloves, changing them before sample collection, and avoid touching potentially contaminated surfaces / items before sampling;
- Using equipment constructed of relatively inert materials in respect to the analytes being tested for;
- Using correct sample-handling procedures including the minimisation of the number of sample handling steps, and being trained prior to sampling;
- Collecting samples in enclosed chambers where possible to minimise contamination from atmospheric sources;
- Following a prescribed order for collecting samples (that is, going from less contaminated locations (or least likely) to more contaminated locations (or most likely); and
- Minimise usage and contact of extraneous contaminants (eg sun lotion, insect repellents, perfumes, cosmetics, fuels, chemicals etc) with sample bottles.

4.3 Equipment Decontamination

All equipment (with the exception of new, disposable equipment) that is used for the collection of samples has to be decontaminated before and after use. The general decontamination steps include the following:

- Decontaminate equipment away from the sample locations to reduce the potential for cross-contamination;
- If possible, disassemble the equipment to be washed;
- Prior to wash, remove soil adhering to the sampling equipment by scraping, brushing or wiping with disposable towels;
- Use a phosphate-free detergent solution (e.g. Decon 90) to wash the equipment. Bleach may be required to sterilise equipment when sampling for microbiological parameters. A solvent wash (e.g. acetone) may be required when investigation the presence of organic contaminants. A dilute acid wash may be required for inorganic compounds. The requirement for a bleach, solvent or dilute acid wash is determined on a site–specific basis (depending upon analytes of concern and laboratory requirements) and if required should be outlined in the SAQP;
- Wash the equipment by scrubbing with an inert brush;

- After the detergent wash, wash and rinse the equipment with contaminant free tap water and then follow with a rinse of distilled or deionised water;
- Equipment should be air dried before its next use or storage; and
- For quality control purposes, at least one equipment wash blank (rinsate sample) per day of sampling must be taken using deionised water only.

Decontamination of large equipment using the procedure provided above may not be possible. In such cases the equipment should be decontaminated using the following procedure:

- Prior to washing, remove soil and foreign material adhering to augers, drill rod or other large equipment by scraping, brushing or wiping;
- Thoroughly pressure wash equipment with tap water and phosphate-free detergent. Where high pressure washing is not possible, then the sampling equipment should be washed and scrubbed thoroughly with potable water and phosphate free detergent;; and
- If the equipment is still contaminated by grease, tar or similar material, then steam clean.

The Robson field staff should document all decontamination procedures used.

4.4 Sample Containers, Preservation, Storage, Labelling and Shipment

The following containers are used for soil samples:

- Major analytes (including leachability testing) - laboratory supplied 125 m or 250 mL unpreserved glass jars with screw top Teflon lined lids for soil samples;
- Microbiological analysis – laboratory supplied 125 mL plastic container, $Na_2S_2O_3$ washed and sterilised;
- Asbestos fibres in soil – One zip lock plastic bag containing approximately 500 mL of soil sample. This bag should then be placed into another bag (that is, double bagged);
- Potential asbestos containing material (ACM) e.g. fibre board – collect piece of potential ACM and store in zip lock plastic bag. This bag should then be placed into another bag (that is, double bagged); and
- PID Screening of soil – One zip lock plastic bag containing approximately 100 g of soil sample.

Decisions concerning the number and types of sample containers required, preservation methods, labelling, holding times and transportation should be made during the planning phase and outlined in the SAQP and discussed in the briefing prior to the fieldwork.

Open only one sample container immediately before filling. Once filled, immediately place the glass jar in the cooling container on ice. Plastic zip lock bags containing asbestos samples do not require preservation with ice – they do however need to be double bagged as discussed above.

Plastic zip lock bags containing soil samples for PID screening should be stored out of direct sunlight until screening is complete. Specific guidance regarding the screening of samples with the PID is provided in **Section 3.1.1**.

Where possible, sample bottles should be labelled before collecting the sample. If this is not possible, use appropriate care to ensure that samples do not become confused. Use waterproof labels. Labels should include the following information:

- A unique sample identifier;
- Project number;
- Date and time sample collected; and
- Sample collector's initials and name of company (Robson).

Where possible, the nomenclature for the unique sample identifiers should be based upon the feature being sampled and the sample depth. Examples of features and appropriate nomenclature follow:

- Borehole (BH) – example BH1 (0.0-0.3);
- Test Pit (TP) – example TP1 (0.0-0.3);
- Stockpile (SP) – example SP1 (0.2);
- Excavation (EX) – example EX1 (0.5);
- Tank excavation (TE) – example TE1 (3.2);
- Fuel line (FL) – example FL1 (0.2);
- Vent Line (VL) – example VL1 (0.2);
- Bowser (B) – example B1 (0.2);
- Imported Fill (IF) – example IF1 (0.2);
- Backfill (BF) – example BF1 (0.2);
- Duplicate or triplicates for QA/QC purposes – example QC1;
- Rinsate blank (R) – example R1;
- Trip blank (TB) – example TB1;
- Field Blank (FB) – example FB1; and
- Spike sample (Spike) – example Spike1.

Table A on page 18 includes a summary of the recommended sample containers, preservation and holding times for a variety of commonly assessed contaminants and parameters. Remember that collecting insufficient sample may result in higher detection limits, or impact upon the analytical screens which can be performed by the laboratory (e.g. insufficient sample to allow analysis).

Once the jar is filled, immediately place the jar in an ice cooled container (e.g. Esky). A combination of frozen reusable ice blocks and crushed ice (human consumption grade) should be used with the aim of preserving the samples in the esky at a temperature between 1°C and 4°C.

Shipping precautions should include the following:

- Re-check that the lids on the jars are tight and properly sealed;

- To prevent breakage or damage to the samples during transportation, it is advisable to wrap the sample jars in bubble warp before placing them in the cooling container (e.g. esky);
- Make an effort to minimise delays between sample collecting and shipment to the laboratory; and
- To ensure careful handling during transportation, 'Fragile' adhesive taping should be wrapped around the container is clearly visible locations.

Sample tracking, security and chain of custody (COC) procedures provide a legal record of sample transport, possession and handling. Complete a COC record for each sampling event. The following information should be clearly written on each COC sheet:

- Job number and project;
- Page number and number of COC sheets in the batch;
- Sampler's name and project manager contact details;
- Sample identification, date of sampling; sample medium (eg water), container information, number of containers and sample preservation;
- Requested analysis, turn around time and limits of laboratory reporting;
- Name of person relinquishing samples to courier or laboratory; and
- Laboratory address and date delivered to laboratory.

Table A: Summary of Soil Sample Preservation and Holding Times

Parameter	Minimum Sample Volume	Sample Preservation	Holding Time
BTEX, TPH, OCP, OPP, PCB, PAH, Phenol, SVOC, VOC, VHC, TOC	20g	4°C	14 days
Metals	20g	4°C	6 mths, Hg and speciated chromium 28 days
TCLP Analysis	100g	4°C	14 days for organics, 6 mths for metals, 28 days for Hg and speciated chromium
Acid Sulphate Soils	20g	4°C Freeze	24 hrs 7 days
Microbiological	125ml	4°C, Sterile, $Na_2S_2O_3$	24 hrs

Asbestos	30g	Nil	Indefinite

The COC form must accompany the samples submitted to the laboratory to ensure sample traceability. The samples should be transported to the analysing laboratory as soon as possible after collection. Each time the samples change possession, whoever relinquishes and whoever receives the samples must sign, date and time the COC documentation form.

4.5 Sample Jar Filling

Use extra caution when collecting samples that have a medium to high potential to volatilise. Samples for volatile analysis should not be homogenised, combined or composite samples made prior to analysis due to the potential for loss of volatile matter. To prevent loss of volatiles, the soil should be placed in the jar as quickly as possible and filled to the top. Take care to fully fill jars leaving no head-space. Once the jar is filled, immediately screw the cap on tightly. Threads on the jar and lid may need to be cleaned to ensure a tight seal when closed.

4.6 Observation and Recording Information

All daily sampling activities should be recorded on the field sheets, including significant events, sampling locations and numbers, observations, measurements and weather conditions. All entries should be dated and signed.

Field sheets which should be completed during field activities relating to soil sampling include the following:

- Daily Site Activities Sheet;
- Field Observation Form;
- Site sketches;
- Field Screening of Soil / Materials;
- Borehole and/or test pit log;
- Chain of Custody (COC);
- Field QA/QC Register;
- Calibration Register;
- Photographic Log; and
- Survey sheet.

Before sampling complete site information details on the Daily Site Activities Sheet and the Field Observation Form, including the date and time of day. In the comments section note any conditions that may indicate potential for soil contamination to be present (e.g. visual and/or olfactory indicators of contamination, stressed vegetation, location and condition of nearby areas of environmental concern (e.g. tanks, sumps, drains, fill, stockpiles etc), indicators of previous environmental assessments (e.g. boreholes, monitoring wells), ground condition and type of cover.

When recording measurements, write down the unit of measurement immediately the reading is taken. It is best practice to always check the units displayed at the time of measurement and record readings with their unit of measure on the data sheet. The unit of measurement is always displayed on the screen. It is essential for data quality and assurance to record the measurement in the units which the meter is displaying. Some instruments freely switch between units (auto range), so it is good practice to check it each time a reading is recorded. Never convert units in the field. If necessary the units can be later converted in the office at a time when the data is being prepared for a report.

Take photographs of each sample location. Where possible try to show the intersected geology (e.g. test pit wall) or other specific point of interested (e.g. zones of contamination) and include a scale indicator (e.g. shovel).

Check that the field sheets are filled out completely at each sample location prior to moving on to the next sample location.

It is neither required nor advocated that smelling of samples is necessary. That is, do not 'stick your nose' in or over the sample. If odours are noticed however, then make a record of such and where possible indicate pungency and type of odour.

4.7 Protecting the Environment

It is the Robson field staff members responsibility to ensure that all excavations and boreholes etc are left in a safe condition. Failure to do so could results in Robson and the field staff member being held liable for an accident. It is generally the subcontractors responsibility to backfill excavations and unless otherwise instructed, the Robson field staff member should confirm that the excavations are backfilled. Excavations left open should be clearly barricaded. Use barricades at least 1 m high, brightly coloured and with warning signs. If boreholes are to be left open they should be capped or covered or well protected.

Other factors to be implemented to protect the site include:

- Barricade or demarcate the work area to restrict entry;
- Minimise dust generation;
- Put all rubbish generated into a rubbish bin or remove from site and dispose of appropriately;
- Disturb the site as little as possible during sampling operations;
- Label all waste containers (empty solution bottles can be used for this purpose marked with permanent pen as 'Waste');
- Pour all waste from chemical and physical testing into a waste bottle;
- At contaminated sites, treatment and disposal of contaminated soil cuttings require care to avoid risks to occupational health and safety or pollution of surface water, land or uncontaminated groundwater. Drums and containers used for the storage of such waste awaiting disposal should be clearly labelled as contaminated soil with the name and contact details of Robson and the Project Manager; and
- Dispose of the waste material through an accredited / approved waste disposal service.

5 SOIL SAMPLING METHODS

5.1 Surface Grab Samples

Surface soil is generally classified as soil between the ground surface and a depth of 0.2 m below the ground surface. Grab samples (e.g. from the surface or from the walls / base of excavations) can be collected using a trowel, shovel or similar. The general procedure for the collection of surface grab samples is as follows:

- Ensure all equipment to be used for sampling has been decontaminated;
- Remove surface vegetation, leaves and other surface debris not designated for sampling from the vicinity of the area to be sampled;
- Label sample jars, bottles and bags;
- Collect the sample and place in appropriate sample container. Also collect a sample and place in a zip lock bag for PID head space screening. Screen sample with PID in accordance with **Section 3.1**;
- Clean the outside of the sample jar and thread to remove excess soil. Replace lid tightly. Place jar in ice cooled esky;
- Lithologically log the sample and make notes regarding obvious visual and/or olfactory indicators of contamination. Guidance regarding logging is provided in **Section 6**; and
- Either discard or decontaminate all items which came into contact with the sample before proceeding onto the next sampling location.

5.2 Hand Augering

The general procedure for the collection of soil samples using a hand auger is as follows:

- Ensure all equipment to be used for sampling has been decontaminated;
- Ensure that the sample location is clear of underground utilities, and overhead obstructions, utilities and services etc;
- Remove surface vegetation, leaves and other surface debris not designated for sampling from the vicinity of the area to be sampled;
- Lay out plastic sheeting adjacent to the sampling location to prevent direct contact with the ground surface;
- Label sample jars, bottles and bags;
- Auger to the desired sampling depth or the auger is full of soil. Remember to proceed cautiously and only hand auger at a force that would not cause damage to services if encountered. Carefully remove the auger from the hole. If the desired depth has not been reached, continuing augering and emptying the auger as needed. Emptied soils should be deposited in the plastic ground sheet to facilitate refilling the hole and to prevent contamination of the surrounding area. Depending upon the borehole depth, additional solid stem flights may need to be attached to the auger;
- Before sampling off the auger stem, remove the outer centimetre or so of the soil to reduce the potential for cross-contamination from fall-in from the upper portions of the hole, or smearing effects when withdrawing the auger from the hole;

- Collect the sample off the auger by collecting in a stainless steel pan or bowl. Once the soil is in the pan it should be mixed thoroughly and then placed in appropriate sample container. Also, a portion of the sample should be placed into a zip lock bag for PID head space screening. Screen sample with PID in accordance with **Section 3.1**;
- Clean the outside of the sample jar and thread to remove excess soil. Replace lid tightly and place jar in ice cooled esky;
- Lithologically log the sample and the boring and make notes regarding obvious visual and/or olfactory indicators of contamination. Guidance regarding logging is provided in **Section 6**; and
- Either discard or decontaminate all items which came into contact with the sample before drilling and sampling at a deeper depth or before proceeding onto the next sampling location.

5.3 Trenches and Test Pits

The general procedure for the collection of soil samples from trenches or test pits is as follows:

- Where possible, ensure the excavator bucket or backhoe and all equipment to be used for sampling has been decontaminated;
- Ensure that the sample location is clear of underground utilities, and overhead obstructions, utilities and services etc;
- Barricade the work area to restrict entry of unauthorised people. Ensure that trenches and test pits are not left unattended while they are open. Keep equipment and personnel at least 0.6 m away from the excavations edge. Do not enter excavations greater than 1 m in depth;
- Remove surface vegetation, leaves and other surface debris not designated for sampling from the vicinity of the area to be sampled;
- Lay out plastic sheeting adjacent to the sampling location to prevent direct contact with the ground surface;
- Label sample jars, bottles and bags;
- Excavate to the desired sampling depth or until the bucket/backhoe is full of soil. If the desired depth has not been reached, continuing excavating and emptying the bucket as needed. Emptied soils should be deposited in a stockpile adjacent to the hole to prevent contamination of the surrounding area. In extreme cases, the excavated soil should be placed on plastic sheeting or an impermeable surface, with obviously impacted soil (eg stained or odorous material) being segregated from non-impacted soil. Bunding with hay bales and other sediment controls may also be necessary;
- To reduce the potential for cross contamination, the soil sample should be collected from the middle of the excavator bucket as this soil is less likely to have come into contact with the surface of the bucket itself. Also, a portion of the sample should be placed into a zip lock bag for PID head space screening. Screen sample with PID in accordance with **Section 3.1**;
- Clean the outside of the sample jar and thread to remove excess soil. Replace lid tightly and place bottle in ice cooled esky;

- Lithologically log the sample and the trench / test pit and make notes regarding obvious visual and/or olfactory indicators of contamination. Guidance regarding logging is provided in **Section 6**;
- Either discard or decontaminate all items which came into contact with the sample before excavating and sampling at a deeper depth or before proceeding onto the next sampling location;
- Depending upon Client requirements, backfill the trench / test pit with the removed soil material and reinstate surface coverings. The backfill material should be compacted with the available plant (e.g. excavator) to reduce site hazards and obstructions.

5.4 Sampling Using Drilling Rigs

The general procedure for the drilling and sampling of bore holes with a drilling rig is as follows:

- Ensure all equipment to be used for sampling has been decontaminated;
- Check that the plant equipment register indicates recent service. Also, check that the persons undertaking the drilling have adequate qualifications, licences and experience;
- Ensure that the sample location is clear of underground utilities, and overhead obstructions, utilities and services etc. Verify the location of overhead structures and services; do not drill within certain distances of services as per state/territory requirements;
- Remove surface vegetation, leaves and other surface debris not designated for sampling from the vicinity of the area to be sampled;
- Lay out plastic sheeting adjacent to the sampling location to prevent direct contact with the ground surface;
- Label sample jars, bottles and bags;
- Hand auger or use Non-Destructive Drilling (NDD) for the first 1.2 m (or greater depending upon Client requirements), to confirm the absence of underground services;
- Drill to the desired sampling depth or the auger/core barrel/SPT tube is full. Carefully remove the auger/core barrel/SPT tube from the hole. If the desired depth has not been reached, continuing drilling and emptying the auger/core barrel/SPT tube as needed. Emptied soils should be deposited in the plastic ground sheet to facilitate refilling the hole and to prevent contamination of the surrounding area. Cores should be placed in core trays;
- Collect the soil sample from the drilling device. Specific techniques for sampling from the different drilling methods are discussed below in **Sections 5.4.1 to 5.4.4**. Also, a portion of the sample should be placed into a zip lock bag for PID head space screening. Screen sample with PID in accordance with **Section 3.1**;
- Clean the outside of the sample jar and thread to remove excess soil. Replace lid tightly and place bottle in ice cooled esky;
- Lithologically log the sample and the boring and make notes regarding obvious visual and/or olfactory indicators of contamination. Guidance regarding logging is provided in **Section 6**; and

- Either discard or decontaminate all items which came into contact with the sample before drilling and sampling at a deeper depth or before proceeding onto the next sampling location; and
- Ensure that the drilling mast is lowered before moving to new sample locations.

5.4.1 Auger Drilling

Issues specific to collection of soil samples when auger drilling include the following:

- Before sampling off the auger stem, remove the outer centimetre or so of the soil to reduce the potential for cross-contamination from fall-in from the upper portions of the hole, or smearing effects when withdrawing the auger from the hole; and
- Collect the sample off the auger by collecting in a stainless steel pan and then placed in appropriate sample container. Also, a portion of the sample should be placed into a zip lock bag for PID head space screening.

5.4.2 Hammer Drilling

Soil cuttings brought to the surface during hammer drilling can be collected for future reference and/or laboratory analysis, however undertaking chemical analysis of such samples is not normally recommended for the following reasons:

- Loss of volatile compounds. The drilling process requires the injection of compressed air, plus can generate high temperatures at the drill bit, both of which can cause volatilisation of volatile compounds. As a result, analytical results may not be representative of in-situ contaminant concentrations;
- Possibility of cross contamination. Relatively uncontaminated material from depth may come into contact with shallow contaminated material when being brought to the surface;
- The sampling interval is not accurately known as there is a time lag between the cutting of soil at the drill bit face and when the sample is ejected to the surface; and
- Hammer drilling through dry soil and rocks may result in significant dust generation, which could result in an unsafe work environment, contaminant dispersal etc. Dust mitigation measures should therefore be implemented including the use of cyclones, wet hessian sacks covering the outlet pipe, or similar.

5.4.3 Core Drilling

Issues specific to collection of soil samples when core drilling include the following:

- Core barrels typically range in length from 0.5 m to 3.0 m. The core barrel is recovered after each interval is drilled;
- Representative sub-samples of the soil core can be transferred to appropriate sample containers for laboratory analysis or the entire length of core can be placed in core trays should it be necessary to retain them. If placing in core trays, then the core should be placed ‘deep’ end down in the core tray and the core tray labelled with hole number, depth interval, missing sections due to lack of core recovery etc. In addition, should

portions of the core be removed for analysis, then blocks indicating the length and depth interval of the portion removed should be appropriately located within the core tray;

- If it is possible that future sampling of stored core for laboratory analysis may be required, then the core tray should be made of or lined with an inert material to reduce the potential for cross contamination; and
- Core barrels are commonly rusty and have been used on numerous occasions for the collection of contaminated soil samples. As the core sample comes into direct contact with the core barrel it is therefore imperative that the core barrel components are decontaminated prior to use, and between each sample.

5.4.4 SPT and Push Tube Sampling

Issues specific to collection of soil samples when SPT (standard penetration test) drilling or push tube sampling include the following:

- SPT splits are commonly rusty and have been used on numerous occasions for the collection of contaminated soil samples. As the soil samples come into direct contact with the splits it is therefore imperative that the splits and sample catcher are decontaminated prior to use, and between each sample;
- Allow the driller to remove the SPT tube from the borehole and open the split spoon. If using PVC tubes for sample collection, the driller when then cut open the tubes;
- Collect representative soil sample directly from the splits or the PVC tube;
- In some situations where the soils are loose and/or granular, it may not be possible to recover a sample from the splits or tube. In such situations, an idea of the composition of the penetrated soils can be obtained by close inspection of the inside of the splits as a small amount of soil tends to stick onto the split/tube surface; and
- Duplicate samples can be collected from the recovered soil sample by slicing segments of the recovered core into longitudinal sections over the one sampling interval, and transferring the soil from each side to separate containers.

6 LOGGING OF SOIL

Soils should be logged based on visual inspection of the soil sample, soil cuttings and/or exposed in the base and walls of an excavation. In addition, when drilling the environmental scientist should liaise with the drilling to obtain as much possible information as possible regarding the drillers interpretation of the subsurface conditions encountered.

The aim of effective and accurate logging is to ensure that:

- All observable and significant properties of a soil are described and noted;
- Consistent terms and meanings are used to described soils; and
- The properties of the soil are described in the same relative order.

Logging the physical properties of soils should be undertaken using the Unified Soil Classification System (USCS). Soil should be described in the following order:

- USCS classification symbol and ground name, which is based on grain size and physical properties (e.g. clays, silts). Where several components are present, the major component forms the root name and the minor component is used as the modifying adjective (e.g. sandy CLAY – the major constituent is clay and the minor constituent is sand). Recommended USCS classifications are provided in **Table B**;
- Colour. The colour of the soil is described in the moist condition using the colours of the Maunsell Colour Chart. These may be modified by adjective such as 'light' or 'dark'. Borderline colours can be described as a combination of colours. Additional information regarding colour is provided in **Table C**;
- Particle size range or plasticity. Use the descriptors provided in **Table D** based upon particle size;
- Consistency. Indicate whether the soil is cohesive or not;
- Moisture content. Indicate whether the soil is dry, moist or wet;
- Structure. The soil may consist of separate zones differing in colour, grain size or other properties. The patterns of such zones should be described using the following terms:
    - 'Layer' – zone is continuous across the exposure or sample;
    - 'Lens' – a discontinuous layer of different material, with a lenticular shape;
    - 'Pocket' – an irregular inclusion of different material;
- Additional comments indicating soil characteristics such as odours (see **Tables E and F**), evidence of soil contamination, water seepage (both in and out). The abundance of inclusions can also be described based upon criteria outlined in **Table G**; and
- Interpretation of geologic origin (e.g. residual, alluvium, fill material).

With regard to depths, it is important to record the upper and lower limits (in metres) of the various layers, soil horizons and types of fill materials encountered. With regards to odours, it is neither required or advocated that smelling of samples is necessary. That is, do not 'stick your nose' in or over the sample. If odours are noticed however, then make a record of such and where possible indicate pungency and type of odour. Suggested odour descriptions and odour strength are provided below in **Tables E** and **F** respectively.

Table B: Unified Soil Classification System

Major Divisions			Group Symbol	Typical Group Name
Coarse Grained Soils (More than half of material is individual grains visible to the naked eye)	Gravelly Soil (more than half of coarse fraction is larger than 2.36 mm)	Clean Gravel (will not leave a stain on wet palm)	GW	Well graded gravel, fine to coarse gravel
			GP	Poorly graded gravel, predominantly one size or range of sizes with some intermediate sizes missing
		Dirty Gravels (will leave a stain on wet palm)	GM	Silty gravel
			GC	Clayey gravel
	Sandy Soils (more than half of coarse fraction is smaller than 2.36 mm)	Clean Sands (will not leave a stain on wet palm)	SW	Well graded sand, fine to coarse sand
			SP	Poorly graded sand, fine to coarse sand
		Dirty Sand (will leave a stain on wet palm)	SM	Silty sand
			SC	Clayey sand
Fine Grained Soils (More than half of material is individual grains not visible to the naked eye)	Silt and Clay (Liquid limit less than 50)	Inorganic	ML	Silt
			CL	Clay of low to medium plasticity
		Organic	OL	Organic silt or organic clay of low plasticity
	Silt and Clay (Liquid limit greater than 50)	Inorganic	MH	Silt of high plasticity
			CH	Clay of high plasticity
		Organic	OH	Organic clays of medium to high plasticity
Highly Organic Soils			Pt	Peat, muck and other highly organic soils

Table C: Soil Colours

Soil Colour	Potential History or Behaviour
Red	Well drained
Yellow or grey	Poorly drained
Dark soils	Higher levels of organic matter
Bluish or greenish grey (grey colours)	Water logged soils

Notes: Sourced from Australian Standard AS4482.1-2005 '*Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-Volatile and Semi-Volatile Compounds*'.

Table D: Particle Size or Plasticity

Term		Grain Size / Description
Boulders		Greater than 200 mm
Cobbles		50 mm to 200 mm
Gravels	Coarse	20 mm to 50 mm
	Medium	6 mm to 20 mm
	Fine	2.36 mm to 6 mm
Sands	Coarse	0.6 mm to 2.36 mm
	Medium	0.2 mm to 0.6 mm
	Fine	0.075 mm to 0.2 mm
Non plastic		A 3 mm thread cannot be rolled at any water content
Low Plasticity		A thread can be barely rolled
Medium Plasticity		A thread is easy to roll
High Plasticity		A thread is easy to roll and can be rerolled several times

Table E: Odour Descriptions

Odour Description	Contaminant Indicated
Characteristic sharp, pungent	Ammonia
Petroleum products	Petrol, diesel, oil
Compost	Decayed organic matter
Putrefied	Putrescible waste
Rotten egg smell (sulphurous)	Anaerobic or acid sulphate conditions
Acidic	Mineral or organic acid
Caustic	Caustic material
Septic	Decaying organic matter, sewage
Sweet, solvent type	Ketone
Aromatic	Benzene

Notes: Sourced from Australian Standard AS4482.1-2005 '*Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-Volatile and Semi-Volatile Compounds*'.

Table F: Description of Odour Strength

Strength	Decsription
Weak	Just detectable; location difficult to determine
Distinct	Detectable immediately adjacent to source, bearable at source
Strong	Detectable 20 m from source, bearable at source
Very Strong	Detectable at distances greater than 20 m from source, pungent at source

Notes: Sourced from Australian Standard AS4482.1-2005 '*Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-Volatile and Semi-Volatile Compounds*'.

Table G: Abundance Classes

Description	Visual Estimate (%)
Very few	Less than 2%
Few	2% to 10%
Common	10% to 20%
Many	20% to 50%
Abundant	50% to 90%
Profuse	Greater than 90%

Notes: Sourced from Australian Standard AS4482.1-2005 '*Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-Volatile and Semi-Volatile Compounds*'.

7 FIELD QUALITY ASSURANCE / QUALITY CONTROL

A primary task of any environmental assessment is the implementation of a quality assurance / quality control (QA/QC) program to ensure that the field work program and analytical results obtained are of the highest quality. The requirements of the field QA/QC program should be determined prior to initiating the sampling works using the Data Quality Objective (DQO) process, and then outlines in the SAQP and discussed in the briefing prior to the fieldwork.

On short duration projects (e.g. one round of sampling), the review of the QA/QC process is often undertaken once the analytical results are available. In such cases, review of the QA/QC data is undertaken to assess the integrity of the data. On large projects extending over periods of months or years involving numerous rounds of sampling and or different phases of assessment works, the results of the QA/QC program should be monitored on a continual basis to ensure the integrity of the collected data, and/or to determine the necessity for corrective actions (if required).

7.1 Quality Assurance

Quality Assurance (QA) refers to the procedures to be implemented during the field work. The QA procedures for soil sampling are documented in this SOP. All personnel undertaking soil sampling should be familiar with the contents of this SOP and should carry it in the field with them at all times.

7.2 Quality Control

In essence, the purpose of quality control (QC) samples is to determine the accuracy and precision of the field sampling, transportation and laboratory analysis, and thereby assess whether the results are representative of the waters sampled. All QA/QC samples must be collected, handled and processed in the same exact manner as the other samples being collected.

7.2.2 Field Duplicate Samples

Duplicates are two independent samples which are collected as close as possible to the same point in space and time and are subjected to the same filtering, preservation, holding and analysis methods. These samples are stored in separate containers and analysed independently. Duplicates are used to assess the precision of the field sampling techniques and analytical processes. In addition, a triplicate is a version of a duplicate sample but is sent to a secondary laboratory to confirm the accuracy of the results of the primary laboratory.

Field duplicates and triplicates should be sampled at a rate of one duplicate per 10 primary samples (or parts thereof). If submitted to the primary laboratory, the field duplicate should be labelled with a unique identifier with no reference whatsoever to the corresponding primary sample of the duplicate pair. The field duplicate should be analysed for the same parameters and analytes as the corresponding primary sample of the duplicate pair.

Where possible, duplicate samples should be collected from samples that are known or suspected to be contaminated or contain detectable concentrations of contaminants of concern. In addition, where possible duplicate samples should be collected from over a range of contaminant concentrations so as to enable assessment over the low, middle and high range of contaminant concentrations.

For non-volatiles, the sample is to be homogenised in the field to help ensure a representative sample is place in each of the primary / duplicate / triplicate jars. For volatile and semi-volatile analytes, no mixing shall be undertaken in the filed. Instead, representative duplicates / triplicates shall be prepared by adding incremental portions of the original sample into each jar.

The requirements of the duplicate sampling should be kept in mind during the project to ensure that suitable duplicate samples and a sufficient number of duplicate samples are collected.

7.2.3 Blank Samples

A blank is a sample comprised of deionised water that is carried through all or part of the sampling process. Blanks include the following:

- Trip blanks which are used to monitor potential contamination during transport and storage. They are sent from the laboratory with empty containers and remain unopened with the other samples throughout sampling and transport. As a minimum, one trip blank per day of sampling (or part thereof) should be taken; and
- Rinsate blanks which are used to monitor potential cross-contamination between sample locations and for potential influences from sampling equipment. The rinsate blank is taken from the final rinse of equipment after decontamination. The rinsate blanks should be analysed for the same analytes as the samples. As a minimum, one rinsate blank per day (or part thereof) should be taken.

8 REFERENCES

Australian Standard AS1726-1993 '*Geotechnical Site Investigations*'.

Australian Standard AS4482.1-2005 '*Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-volatile and semi-volatile compounds*'.

Australian Standard AS4482.2-1999 '*Guide to the Sampling and Investigation of Potentially Contaminated Soil. Part 2: Volatile Substances*'.

EPA Victoria (2009) '*Sampling and Analysis of Waters, Wastewaters, Soils and Wastes*' (EPA Victoria, Industrial Waste Resource Guidelines (IWRG) 701, June 2009).

Industrial Solutions (2009) '*MX6 iBrid Multi-Gas Monitor Operation Guide*'.

RAE Systems (2005) '*MiniRae 2000 Portable VOC Monitor. Operation and Maintenance Manual*'.

9 ABBREVIATIONS

ACM	Asbestos Containing Material
AS	Australian Standard
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
$C_6 – C_9$	Total Petroleum Hydrocarbon fractions
COC	Chain Of Custody
DQO	Data Quality Objectives
eV	Electron Volts
MSDS	Material Safety Data Sheet
NDD	Non-Destructive Drilling
OCP	Organochlorine Pesticide
OPP	Organophosphate Pesticide
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PID	Photoionisation Detector
PPE	Personal Protective Equipment
ppm	Parts Per Million
SAQP	Sampling and Analysis Quality Plan
SOP	Standard Operating Procedure
SPT	Standard Penetration Test
SSMP	Site Safety Management Plan
SVOC	Semi Volatile Organic Compounds
TPH	Total Petroleum Hydrocarbon
QA	Quality Assurance
QC	Quality Control
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbon
USCS	Unified Soil Classification System
VHC	Volatile Halogenated Compounds
VOC	Volatile Organic Compounds

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1 INTRODUCTION

1.1 Purpose

The purpose of this Standard Operating Procedure (SOP) is to document the standard protocols for Robson environmental scientists, engineers and technicians for the assessment of asbestos-contaminated soil stockpiles. The SOP methodologies are sourced from the ACT EPA endorsed guideline:

- Western Australia Department of Health (DOH) (2009) '*Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*'.

It is considered that following the recommended protocols will provide a method for determining the asbestos concentration in a soil stockpile via:

- Ensuring that the samples are representative of the soil medium from where they are collected;
- Preserving the representative nature of the sample until analytical determinations and/or measurements are made;
- Providing representative samples to facilitate observation and logging of the subsurface conditions; and
- Providing accurate and consistent determination of the physical presence of asbestos in the soil sampled.

1.2 Scope

The scope of this SOP is the collection and handling of soil samples for field and/or laboratory analysis, to facilitate the assessment of asbestos-contaminated soil stockpiles. The procedures apply to the preparation and fieldwork for baseline assessments and contaminated site assessments. The SOP is applicable to the Project Manager designing and supervising the sampling program, and for environmental scientists, engineers and technicians implementing the sampling program in the field.

1.3 Nature of Asbestos Contamination

For the purpose of this SOP, the nature of asbestos contamination is divided into three (3) groups:

- Asbestos Containing Material (ACM) – Products or materials that contain asbestos in an inert bound matrix such as cement or resin (e.g. asbestos sheeting or vinyl tiles). Taken to be sound material though possibly as broken or fragmented pieces will not fit through a 7 mm by 7 mm sieve. Can often be detected visually;
- Fibrous asbestos (FA) – Encompasses friable asbestos material (e.g. severely weathered ACM), or asbestos in the form of loose fibrous material such as insulation products. Further defined as ACM that is in a degraded form that can be broken or crumbled by hand pressure. Can often be detected visually; and
- Asbestos Fines (AF) – Free fibres of asbestos, small fibre bundles and also ACM fragments that can pass through a 7 mm by 7 mm sieve.

Both FA and AF have the potential to generate or be associated with free asbestos fibres, which can cause considerable inhalation risk if made airborne.

2 PREPARATION AND EQUIPMENT

2.1 Preparation

- Review Sampling and Analysis Quality Plan (SAQP). If a SAQP is required then this should have been prepared by the Project Manager prior to the sampling event;
- Contact the laboratory to confirm that they are able to undertake required analysis, that they have capacity to undertake the analysis within the required timeframe, and to establish any specific sample size / preservation requirements;
- Organise site information including the following:
  - Site access including permissions, directions to the site and site access roads, site access keys,
  - Contact names, addresses and phone numbers;
  - Site map showing sampling locations;
- Organise and check equipment. This includes the following:
  - Test and recharge/replace batteries for the weighing scales the s necessary;
  - Check the instruments' ability to function properly;
  - Inspect the equipment for defects, loose or frayed wires and that cables are in good condition etc;
  - Check that all equipment is properly stored for transport;
- Organise sampling equipment. This could include the following items:
  - Field sheets, writing equipment, waterproof markers,
  - Calculator, camera and telephone;
  - Weighing scales;
  - $\leq$ 7 mm sieve and 10 L bucket;
  - Measuring wheel;
  - Plastic sheet or ground cover;
  - Air monitoring equipment including pumps, cowls, flow meter and tubing, jeweller's screwdriver, and air monitoring site sheets;
  - Decontamination equipment include non-phosphate cleaner (e.g. Decon 90), scrubbing brushes, wash and rinse buckets, wastewater containers, deionised / demineralised water and potable tap water;
  - Sample collection devices such as trowels, hand augers, stainless steel mixing bowls, paper towelling, zip lock plastic bags and bulk sample bags;
  - Sample bags to dispatch samples to laboratories for asbestos analysis (plus extras for replacements if needed), packing box and 'Fragile' adhesive tape;
  - Tools including wrench, screw driver, pliers, knife, duct tape and hammer; and
  - Personal Protective equipment including disposable gloves, leather gloves, safety glasses, filter marks (and that cartridges are within use by date), disposable tyvek coveralls, hard hat, steel cap boots, rubber boots with steel caps, high visibility clothing, first aid kit; ear muffs / plugs;

- Antiseptic handwash;
- Suitable bags for disposal of generated wastes; and
- Material safety data sheets (MSDS) for all chemicals brought onto site.

2.2 Preparatory Work on Site

- Obtain all necessary permits required prior to intrusive works (eg hot works permits, AIP Work Clearance for Contractors form);
- Where necessary, contact the Client or site contact to confirm arrangements, identify specific site issues and / or undertake site inductions;
- Induct all Robson personnel and sub-contractors onto the site using the pre-prepared and site specific Site Safety Management Plan (SSMP);
- Set up air monitoring pumps (guidance regarding this is provided in **Section X**);
- Assess the volume of the soil stockpile. This facilitates determination of the number of sampling locations required, based on a minimum sampling rate of 1 location per 70 m^3 or part thereof; and
- Visually assess the surface of the stockpile for ACM. If present, then such areas should be focussed as a sampling location for bulk sample sieve analysis. Locations are generally identified using either a GPS or by measurement from an obvious reference point using a measuring wheel or tape measure. In specified circumstances, locations may need to be identified using a registered surveyor – if this is required then the Project Manager should have already made appropriate arrangements. Record the observations, locations and rationale for selection of locations.

2.3 Use of Weighing Scales

2.3.1 D.Line 5 kg Weighing Scale

- Press **ON/TARE** button. Allow approximately 2 seconds for unit start up. Confirm that the unit is reading in metric gram (g) units. If the unit is reading in imperial ounces (oz) press the **kg/lb** button and then confirm that the unit is reading in metric g units;
- If it is required to find a tare weight and zero the scales (eg to take into account the weight of a sample bag or similar holding vessel), then whilst the empty sample bag or similar holding vessel is on the scale quickly press the **ON/TARE** button and the LCD screen should then read 0 g; and
- The unit will automatically turn itself off after approximately 1 minute without use. If it is required to turn the unit off manually, then press the **ON/TARE** button for approximately 2 seconds until the LCD display is blank.

2.3.2 ACS-3S 30 kg Weighing Scale

The ACS-3S scale has the following basic data:

- Maximum capacity of 30 kg;
- A resolution of either 2 g, 5 g or 10 g; and
- A working temperature of -5°C to 35°C.

To operate the scale:

- Make the pan of the scale horizontal be adjusting the base foot and watching the spirit level;
- To turn the scale on, press the **ON/ZERO** button. The unit will then go through a start up process and the 'ZERO' lamp will light up. The unit is now working;
- If it is required to find a tare weight and zero the scales prior to weighing an object (eg to take into account the weight of a sample bag or similar holding vessel), then whilst the empty sample bag or similar holding vessel is on the scale press the **TARE** button and the LCD screen should then read 0 g/kg, and the TARE lamp should come on. If the sample bag or similar holding vessel is then removed at this time then the unit will read a negative weight. Pressing the **TARE** button again will now zero the scale;
- To zero the unit at any time press the **ZERO** button. The ZERO lamp will now light up. The ZERO lamp will turn off when a weight is put on the scale;
- To weigh an item (with or without Tare), place the object on the scale, the ZERO lamp will turn off, and the weight of the object is shown on the LCD display. The lamp for the applicable unit (g or kg) will also turn on;
- If the applied weight is greater than the capacity of the scale (that is, greater than 30 kg) then an audible buzzer will sound and the LCD display will show '-----'. Note that overloading can damage the scale;
- To change the units (e.g. from kg to g, or vice versa), press the SET (0-9) button for 3 seconds. The LCD display will read 'rAngE'. Press the SET (0-9) button again and the LCD display should read 'UnItS'. Now press the TARE button, and the LCD display should read H9 – select H9 (if kg units are required) by pressing the TARE button, otherwise press the SET (0-9) button again. The LCD display should now read 9 – select 9 (if g units are required) by pressing the TARE button. Once the appropriate unit has been selected, confirm this by checking that the appropriate kg or g lamp is turned on;
- To change the increments of measure (e.g. from 2g to 5g or 10g, or vice versa), press the SET (0-9) button for 3 seconds. The LCD display will read 'rAngE'. Press the SET (0-9) button six (6) times so that the LCD display reads 'd'. Now press the TARE button, and the LCD display should read either 2, 5 or 10 (depending upon current selection). Press the SET (0-9) button until the desired increment is showing on the LCD display, and press the TARE button to select. Once the appropriate increment has been selected, confirm this by weighing an object; and
- The unit will automatically turn itself off after approximately 10 minute without use. If it is required to turn the unit off manually, then press the **OFF** button for approximately 1 second until the LCD display is blank.

2.4 Use of Air Monitoring Pumps

- Select the number of pumps required from the Robson store – only select those labelled '3' or greater;
- Complete the following details on the Air Monitoring Site Sheet – Job location, pump number (a sheet is required for each pump), cowl number, date, air pump sample location, brief description of work in progress, removal contractor, flow meter number and air sampler initials. In addition, fill in the Ref No. field with the project job number

(e.g. 530201), and the SLIDE No. field with the project job number and the sequential number of the cowl for that project (e.g. 530201-176 if this is the 176th cowl used for air monitoring during the project);

- Attach one end of the long clear flexible plastic tube onto the inlet valve of the air monitoring pump. Then attach the other end of the flexible plastic tube to the outlet valve of the cowl. Remove the cowl inlet cap and store in a safe location as it needs to be refitted to the cowl at the end of the air monitoring session;
- Calibrate the flow of the air monitoring pump.
    - Attach the inlet cowl cap of the flow meter unit (itself attached to the flow meter via a short piece of clear flexible plastic tube) onto the cowl body (which itself is attached to one end of the long clear flexible plastic tube);
    - To turn the pump on, use the jeweller's screwdriver to slide the recessed on/off switch up into the on position. The pump should now make an audible pumping sound;
    - Test the seal of the hoses by very briefly sealing the inlet with the palm of a hand. The pump speed should noticeably increase as well as feeling a suction effect on the palm;
    - Use the jeweller's screwdriver to adjust the pumping rate of the air monitoring pump. Turning the adjustment screw clockwise increase the pumping rate, whilst turn the adjusting screw ant-clockwise reduces the pumping rate;
    - Use the position of the lower bead in the flow meter to set the air monitoring pump to the desired pumping rate. As a guide, the pumping rate is normally set between 1000 millilitres per minute (mL/min) to 2000 mL/min, with the lower rate being used for dustier sites. Fill in the IFR field of the Air Monitoring Site Sheet with the pumping rate, and fill in the ON field with the time that the pump was turned on (use 24 hour time convention);
    - Once the air monitoring pump is set at the required flow rate, remove the inlet cowl cap (attached to the flow meter) from the cowl body. The air pump is now ready for use;
- At the air monitoring location, place the cowling in position either on a stand or tape the hose to a convenient fixture ensuring that the cowl is pointed down and at a height of approximately 1.6 m above ground level. Place the pump in a plastic bag for protection if it looks like it may rain. At least four (4) air monitoring pumps should be used, with one (1) being placed on each boundary of the work area;
- The pump(s) should run for a minimum of 1 hour but preferably for the entire working shift;
- At the end of the monitoring period the flow rate of the pump(s) must be checked. Re-attach the inlet cowl cap of the flow meter unit to the cowl body attached to one end of the long clear flexible plastic tube, and then measure the flow rate using the lower bead of the flow meter. This flow rate is then recorded in the FFR field of the Air Monitoring Site Sheet. If the IFR and FFR flow rate readings are within 10%, then tick the OK field, otherwise tick the REJECT field. Also record the time that the air monitoring pump is turned off in the OFF field;
- To turn the pump off, use the jeweller's screwdriver to slide the recessed on/off switch down into the off position; and

- Attach the cowl inlet cap (which had been stored in a safe location) back onto the cowl body, and then remove the cowl unit from the long clear flexible plastic tube. The cowl unit and the Air Monitoring Site Sheet for each air monitoring pump location should then be passed onto the Robson Laboratory Services for processing. Note that the cowling should not be subjected to rough handling as fibre loss from the filter may otherwise occur.

Note that for quality assurance / quality control (QA/QC) purposes, a blank cowl should be used each day that air monitoring is being conducted. The blank cowl is not attached to any pump but should sit with its' inlet cap removed in the car or samplers field bag to monitor ambient conditions. And the end of the monitoring session replace the inlet cap and then the blank cowl (and its' associated Air Monitoring Site Sheet) should be passed onto the Robson Laboratory Services for processing along with the primary air monitoring sample cowls.

3 ASSESSMENT AND REMEDIATION CRITERIA

3.1 Soil Assessment and Remediation Criteria

Assessment and remediation criteria are defined as threshold levels of asbestos in the soil acceptable for a designated site use and are sourced from the ACT EPA endorsed guideline:

- Western Australia Department of Health (DOH) (2009) '*Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*'.

The adopted criteria are summarised below in Table 1.

Table 1: Assessment and Remediation Criteria for Asbestos in Soil

Land Use	Criteria
All site uses	0.001% w/w asbestos for FA and AF
Residential use, day care centres, pre-schools etc (that is, HIL A land use scenarios)	0.01% w/w asbestos for ACM
Residential use, minimal access to soil (that is, HIL D land use scenarios)	0.04% w/w asbestos for ACM
Parks, recreational open spaces, playing fields, secondary schools etc (that is, HIL E land use scenarios)	0.02% w/w asbestos for ACM
Commercial / Industrial (that is, HIL F land use scenarios)	0.05% w/w asbestos for ACM

Notes to Table 1:
ACM – Asbestos Containing Material
FA – Fibrous Asbestos
AF – Asbestos Fines
HIL – Health-Based Investigation Levels. Land use scenarios sourced from National Environment Protection Council (NEPC, 1999) '*National Environment Protection (Assessment of Site Contamination) Measure 1999*'.
w/w – weight/weight, by weight.

In addition to the above, during remediation of any asbestos contamination the top 0.1 m of soil should also be made completely free of visible asbestos.

3.2 Air Quality Criteria

The asbestos air-quality limit for contaminated sites is 0.01 fibre per millimetre (f/ml) using the membrane filter methods, as endorsed by the Health Council (2005) guideline '*Management of Asbestos in the Non-Occupational Environment*'.

Nuisance dust monitoring may also be necessary and can be used to complement asbestos air-quality sampling, especially since it allows for more immediate responses to dust management measures. For nuisance dust, the 24 hour guidance goal of 50 µg/m^3 for PM10 (particulate matter with an equivalent aerodynamic diameter of 10 µm or less - sourced from the NEPC (2003) '*National Environment Protection (Ambient Air Quality) Measure*') should be used.

4 TYPES OF SOIL SAMPLES AND SAMPLE COLLECTION

4.1 Soil Sample Types

Soil samples are commonly obtained from one or more of the following:

- Surface sampling;
- Test pits; and/or
- Boreholes.

From the various sampling methods, two main types of soil samples are collected:

- Disturbed samples – these are samples where the soil has been disturbed loosing its' natural soil structure, physical properties and/or moisture. Disturbed samples are generally collected from grab sampling methods such as during auger or hammer drilling, when sampling from test pits or from the walls/base of excavations or from stockpiles;
- Undisturbed samples – these are samples where the sampled soil remains more-or-less in its' undisturbed state, retaining its' natural soil structure, physical properties and/or moisture. Undisturbed samples can be collected by push tube sampling methods or during core drilling.

A number of different excavation and boring methods are available, however the choice of method requires consideration of the following:

- Objective of assessment and depth of assessment works;
- Site access, ground conditions and acceptable site disturbance;
- Nature of potential contaminants and sample volume required; and
- Type of sample required (e.g. disturbed or undisturbed).

In addition to the above, samples can either be discrete samples or composite samples. Discrete samples are samples collected over a discrete sampling interval which are representative of that interval, but based on observations may also be representative of the surrounding soils. Composite samples comprise a sample which is made up of several sub-samples from a range of locations, material types or depth intervals. Though compositing does have benefits in certain situations (e.g. potential lower screening costs of larger areas), as a general rule Robson does not recommend the collection of composite samples for the following reasons:

- The composite sample is representative only of the composite sample. That is, actual contaminant concentrations may be higher than laboratory results in some sub-samples and lower in other sub-samples;
- The physical mixing process to form the composite sample may inadvertently release some of the volatile contaminants (if present); and
- If a contaminant concentration exceeds the adjusted assessment criteria (that is, the adjusted criteria is the soil criteria divided by the number of samples comprising the composite), then each of the discrete samples making up the composite should be analysed. This prolongs the duration of the assessment and increases the analytical costs.

4.2 Techniques to Prevent Sample Contamination

Sample contamination can be caused by poor sampling-handling, atmospheric input, poorly cleaned equipment, inadequate training, and the use of equipment not designed for the analytes targeted for the study. Contamination from these sources can be prevented or minimised by using sound field practices including:

- Being aware of and recording potential sources of contamination at each sample site and sample location;
- Wearing appropriate disposable, powderless nitrile gloves, changing them before sample collection, and avoid touching potentially contaminated surfaces / items before sampling;
- Using equipment constructed of relatively inert materials in respect to the analytes being tested for;
- Using correct sample-handling procedures including the minimisation of the number of sample handling steps, and being trained prior to sampling;
- Collecting samples in enclosed chambers where possible to minimise contamination from atmospheric sources;
- Following a prescribed order for collecting samples (that is, going from less contaminated locations (or least likely) to more contaminated locations (or most likely); and
- Minimise usage and contact of extraneous contaminants (e.g. sun lotion, insect repellents, perfumes, cosmetics, fuels, chemicals etc) with sample bottles.

4.3 Equipment Decontamination

All equipment (with the exception of new, disposable equipment) that is used for the collection of samples has to be decontaminated before and after use. The general decontamination steps include the following:

- Decontaminate equipment away from the sample locations to reduce the potential for cross-contamination;
- If possible, disassemble the equipment to be washed;
- Prior to wash, remove soil adhering to the sampling equipment by scraping, brushing or wiping with disposable towels;
- Use a phosphate-free detergent solution (eg Decon 90) to wash the equipment. Bleach may be required to sterilise equipment when sampling for microbiological parameters. A solvent wash (e.g. acetone) may be required when investigation the presence of organic contaminants. A dilute acid wash may be required for inorganic compounds. The requirement for a bleach, solvent or dilute acid wash is determined on a site–specific basis (depending upon analytes of concern and laboratory requirements) and if required should be outlined in the SAQP;
- Wash the equipment by scrubbing with an inert brush;
- After the detergent wash, wash and rinse the equipment with contaminant free tap water and then follow with a rinse of distilled or deionised water;
- Equipment should be air dried before its next use or storage; and

- For quality control purposes, at least one equipment wash blank (rinsate sample) per day of sampling must be taken using deionised water only.

Decontamination of large equipment using the procedure provided above may not be possible. In such cases the equipment should be decontaminated using the following procedure:

- Prior to washing, remove soil and foreign material adhering to augers, drill rod or other large equipment by scraping, brushing or wiping;
- Thoroughly pressure wash equipment with tap water and phosphate-free detergent. Where high pressure washing is not possible, then the sampling equipment should be washed and scrubbed thoroughly with potable water and phosphate free detergent;; and
- If the equipment is still contaminated by grease, tar or similar material, then steam clean.

The Robson field staff should document all decontamination procedures used.

4.4 Sample Containers, Preservation, Storage, Labelling and Shipment

The following containers are used for soil samples:

- Major analytes (including leachability testing) - laboratory supplied 125 m or 250 mL unpreserved glass jars with screw top Teflon lined lids for soil samples;
- Microbiological analysis – laboratory supplied 125 mL plastic container, $Na_2S_2O_3$ washed and sterilised;
- Asbestos fibres in soil – One zip lock plastic bag containing approximately 500 ml of soil sample. This bag should then be placed into another bag (that is, double bagged);
- Potential asbestos containing material (ACM) e.g. fibre board – collect piece of potential ACM and store in zip lock plastic bag. This bag should then be placed into another bag (that is, double bagged); and
- PID Screening of soil – One zip lock plastic bag containing approximately 100 g of soil sample.

Decisions concerning the number and types of sample containers required, preservation methods, labelling, holding times and transportation should be made during the planning phase and outlined in the SAQP and discussed in the briefing prior to the fieldwork.

Open only one sample container immediately before filling. Once filled, immediately place the glass jar in the cooling container on ice. Plastic zip lock bags containing asbestos samples do not require preservation with ice – they do however need to be double bagged as discussed above.

Plastic zip lock bags containing soil samples for PID screening should be stored out of direct sunlight until screening is complete. Specific guidance regarding the screening of samples with the PID is provided in **Section 3.1.1**.

Where possible, sample bottles should be labelled before collecting the sample. If this is not possible, use appropriate care to ensure that samples do not become confused. Use waterproof labels. Labels should include the following information:

- A unique sample identifier;

- Project number;
- Date and time sample collected; and
- Sample collector's initials and name of company (Robson).

Where possible, the nomenclature for the unique sample identifiers should be based upon the feature being sampled and the sample depth. Examples of features and appropriate nomenclature follow:

- Borehole (BH) – example BH1 (0.0-0.3);
- Test Pit (TP) – example TP1 (0.0-0.3);
- Stockpile (SP) – example SP1 (0.2);
- Excavation (EX) – example EX1 (0.5);
- Tank excavation (TE) – example TE1 (3.2);
- Fuel line (FL) – example FL1 (0.2);
- Vent Line (VL) – example VL1 (0.2);
- Bowser (B) – example B1 (0.2);
- Imported Fill (IF) – example IF1 (0.2);
- Backfill (BF) – example BF1 (0.2);
- Duplicate or triplicates for QA/QC purposes – example QC1;
- Rinsate blank (R) – example R1;
- Trip blank (TB) – example TB1;
- Field Blank (FB) – example FB1; and
- Spike sample (Spike) – example Spike1.

Table A on page 18 includes a summary of the recommended sample containers, preservation and holding times for a variety of commonly assessed contaminants and parameters. Remember that collecting insufficient sample may result in higher detection limits, or impact upon the analytical screens which can be performed by the laboratory (e.g .insufficient sample to allow analysis).

Once the jar is filled, immediately place the jar in an ice cooled container (e.g. Esky). A combination of frozen reusable ice blocks and crushed ice (human consumption grade) should be used with the aim of preserving the samples in the esky at a temperature between 1°C and 4°C.

Shipping precautions should include the following:

- Re-check that the lids on the jars are tight and properly sealed;
- To prevent breakage or damage to the samples during transportation, it is advisable to wrap the sample jars in bubble warp before placing them in the cooling container (e.g .esky);
- Make an effort to minimise delays between sample collecting and shipment to the laboratory; and

- To ensure careful handling during transportation, 'Fragile' adhesive taping should be wrapped around the container is clearly visible locations.

Sample tracking, security and chain of custody (COC) procedures provide a legal record of sample transport, possession and handling. Complete a COC record for each sampling event. The following information should be clearly written on each COC sheet:

- Job number and project;
- Page number and number of COC sheets in the batch;
- Sampler's name and project manager contact details;
- Sample identification, date of sampling; sample medium (e.g. water), container information, number of containers and sample preservation;
- Requested analysis, turn around time and limits of laboratory reporting;
- Name of person relinquishing samples to courier or laboratory; and
- Laboratory address and date delivered to laboratory.

Table A: Summary of Soil Sample Preservation and Holding Times

Parameter	Minimum Sample Volume	Sample Preservation	Holding Time
BTEX, TPH, OCP, OPP, PCB, PAH, Phenol, SVOC, VOC, VHC, TOC	20g	4°C	14 days
Metals	20g	4°C	6 mths, Hg and speciated chromium 28 days
TCLP Analysis	100g	4°C	14 days for organics, 6 mths for metals, 28 days for Hg and speciated chromium
Acid Sulphate Soils	20g	4°C Freeze	24 hrs 7 days
Microbiological	125ml	4°C, Sterile, $Na_2S_2O_3$	24 hrs
Asbestos	500ml	Nil	Indefinite

The COC form must accompany the samples submitted to the laboratory to ensure sample traceability. The samples should be transported to the analysing laboratory as soon as possible after collection. Each time the samples change possession, whoever relinquishes and whoever receives the samples must sign, date and time the COC documentation form.

4.5 Sample Jar Filling

Use extra caution when collecting samples that have a medium to high potential to volatilise. Samples for volatile analysis should not be homogenised, combined or composite samples made prior to analysis due to the potential for loss of volatile matter. To prevent loss of volatiles, the soil should be placed in the jar as quickly as possible and filled to the top. Take care to fully fill jars leaving no head-space. Once the jar is filled, immediately screw the cap on tightly. Threads on the jar and lid may need to be cleaned to ensure a tight seal when closed.

4.6 Observation and Recording Information

All daily sampling activities should be recorded on the field sheets, including significant events, sampling locations and numbers, observations, measurements and weather conditions. All entries should be dated and signed.

Field sheets which should be completed during field activities relating to soil sampling include the following:

- Daily Site Activities Sheet;
- Field Observation Form;
- Site sketches;
- Field Screening of Soil / Materials;
- Borehole and/or test pit log;
- Chain of Custody (COC);
- Field QA/QC Register;
- Calibration Register;
- Photographic Log; and
- Survey sheet.

Before sampling complete site information details on the Daily Site Activities Sheet and the Field Observation Form, including the date and time of day. In the comments section note any conditions that may indicate potential for soil contamination to be present (e.g. visual and/or olfactory indicators of contamination, stressed vegetation, location and condition of nearby areas of environmental concern (e.g. tanks, sumps, drains, fill, stockpiles etc), indicators of previous environmental assessments (e.g. boreholes, monitoring wells), ground condition and type of cover.

When recording measurements, write down the unit of measurement immediately the reading is taken. It is best practice to always check the units displayed at the time of measurement and record readings with their unit of measure on the data sheet. The unit of measurement is always displayed on the screen. It is essential for data quality and assurance to record the measurement in the units which the meter is displaying. Some instruments freely switch between units (auto range), so it is good practice to check it each time a reading is recorded. Never convert units in the field. If necessary the units can be later converted in the office at a time when the data is being prepared for a report.

Take photographs of each sample location. Where possible try to show the intersected geology (eg test pit wall) or other specific point of interested (e.g. zones of contamination) and include a scale indicator (e.g. shovel).

Check that the field sheets are filled out completely at each sample location prior to moving on to the next sample location.

It is neither required nor advocated that smelling of samples is necessary. That is, do not 'stick your nose' in or over the sample. If odours are noticed however, then make a record of such and where possible indicate pungency and type of odour.

4.7 Protecting the Environment

It is the Robson field staff members responsibility to ensure that all excavations and boreholes etc are left in a safe condition. Failure to do so could results in Robson and the field staff member being held liable for an accident. It is generally the subcontractors responsibility to backfill excavations and unless otherwise instructed, the Robson field staff member should confirm that the excavations are backfilled. Excavations left open should be clearly barricaded. Use barricades at least 1 m high, brightly coloured and with warning signs. If boreholes are to be left open they should be capped or covered or well protected.

Other factors to be implemented to protect the site include:

- Barricade or demarcate the work area to restrict entry;
- Minimise dust generation;
- Put all rubbish generated into a rubbish bin or remove from site and dispose of appropriately;
- Disturb the site as little as possible during sampling operations;
- Label all waste containers (empty solution bottles can be used for this purpose marked with permanent pen as 'Waste');
- Pour all waste from chemical and physical testing into a waste bottle;
- At contaminated sites, treatment and disposal of contaminated soil cuttings require care to avoid risks to occupational health and safety or pollution of surface water, land or uncontaminated groundwater. Drums and containers used for the storage of such waste awaiting disposal should be clearly labelled as contaminated soil with the name and contact details of Robson and the Project Manager; and
- Dispose of the waste material through an accredited / approved waste disposal service.

5 SOIL SAMPLING METHODS

5.1 Assessment of Stockpiles

Soil stockpiles of unknown quality should be assessed for asbestos contamination. If the stockpile originated from areas not likely to be contaminated (for example, no indication of building activity or waste, then the assessment can consist of a close visual examination over the whole stockpile surface. In the event that any asbestos is found or the soil came from suspect areas or contains indicators of building activity or waste, then the stockpiles should normally be considered as being contaminated.

Surface soil is generally classified as soil between the ground surface and a depth of 0.2 m below the ground surface. Grab samples (e.g. from the surface or from the walls / base of excavations) can be collected using a trowel, shovel or similar. The general procedure for the collection of surface grab samples is as follows:

- Ensure all equipment to be used for sampling has been decontaminated;

5.2 Surface Grab Samples

Surface soil is generally classified as soil between the ground surface and a depth of 0.2 m below the ground surface. Grab samples (e.g. from the surface or from the walls / base of excavations) can be collected using a trowel, shovel or similar. The general procedure for the collection of surface grab samples is as follows:

- Ensure all equipment to be used for sampling has been decontaminated;
- Remove surface vegetation, leaves and other surface debris not designated for sampling from the vicinity of the area to be sampled;
- Label sample jars, bottles and bags;
- Collect the sample and place in appropriate sample container. Also collect a sample and place in a zip lock bag for PID head space screening. Screen sample with PID in accordance with **Section 3.1**;
- Clean the outside of the sample jar and thread to remove excess soil. Replace lid tightly. Place jar in ice cooled esky;
- Lithologically log the sample and make notes regarding obvious visual and/or olfactory indicators of contamination. Guidance regarding logging is provided in **Section 6**; and
- Either discard or decontaminate all items which came into contact with the sample before proceeding onto the next sampling location.

5.3 Hand Augering

The general procedure for the collection of soil samples using a hand auger is as follows:

- Ensure all equipment to be used for sampling has been decontaminated;
- Ensure that the sample location is clear of underground utilities, and overhead obstructions, utilities and services etc;
- Remove surface vegetation, leaves and other surface debris not designated for sampling from the vicinity of the area to be sampled;
- Lay out plastic sheeting adjacent to the sampling location to prevent direct contact with the ground surface;
- Label sample jars, bottles and bags;
- Auger to the desired sampling depth or the auger is full of soil. Remember to proceed cautiously and only hand auger at a force that would not cause damage to services if encountered. Carefully remove the auger from the hole. If the desired depth has not been reached, continuing augering and emptying the auger as needed. Emptied soils should be deposited in the plastic ground sheet to facilitate refilling the hole and to

prevent contamination of the surrounding area. Depending upon the borehole depth, additional solid stem flights may need to be attached to the auger;

- Before sampling off the auger stem, remove the outer centimetre or so of the soil to reduce the potential for cross-contamination from fall-in from the upper portions of the hole, or smearing effects when withdrawing the auger from the hole;
- Collect the sample off the auger by collecting in a stainless steel pan or bowl. Once the soil is in the pan it should be mixed thoroughly and then placed in appropriate sample container. Also, a portion of the sample should be placed into a zip lock bag for PID head space screening. Screen sample with PID in accordance with **Section 3.1**;
- Clean the outside of the sample jar and thread to remove excess soil. Replace lid tightly and place jar in ice cooled esky;
- Lithologically log the sample and the boring and make notes regarding obvious visual and/or olfactory indicators of contamination. Guidance regarding logging is provided in **Section 6**; and
- Either discard or decontaminate all items which came into contact with the sample before drilling and sampling at a deeper depth or before proceeding onto the next sampling location.

5.4 Trenches and Test Pits

The general procedure for the collection of soil samples from trenches or test pits is as follows:

- Where possible, ensure the excavator bucket or backhoe and all equipment to be used for sampling has been decontaminated;
- Ensure that the sample location is clear of underground utilities, and overhead obstructions, utilities and services etc;
- Barricade the work area to restrict entry of unauthorised people. Ensure that trenches and test pits are not left unattended while they are open. Keep equipment and personnel at least 0.6 m away from the excavations edge. Do not enter excavations greater than 1 m in depth;
- Remove surface vegetation, leaves and other surface debris not designated for sampling from the vicinity of the area to be sampled;
- Lay out plastic sheeting adjacent to the sampling location to prevent direct contact with the ground surface;
- Label sample jars, bottles and bags;
- Excavate to the desired sampling depth or until the bucket/backhoe is full of soil. If the desired depth has not been reached, continuing excavating and emptying the bucket as needed. Emptied soils should be deposited in a stockpile adjacent to the hole to prevent contamination of the surrounding area. In extreme cases, the excavated soil should be placed on plastic sheeting or an impermeable surface, with obviously impacted soil (e.g. stained or odorous material) being segregated from non-impacted soil. Bunding with hay bales and other sediment controls may also be necessary;
- To reduce the potential for cross contamination, the soil sample should be collected from the middle of the excavator bucket as this soil is less likely to have come into

contact with the surface of the bucket itself. Also, a portion of the sample should be placed into a zip lock bag for PID head space screening. Screen sample with PID in accordance with **Section 3.1**;

- Clean the outside of the sample jar and thread to remove excess soil. Replace lid tightly and place bottle in ice cooled esky;
- Lithologically log the sample and the trench / test pit and make notes regarding obvious visual and/or olfactory indicators of contamination. Guidance regarding logging is provided in **Section 6**;
- Either discard or decontaminate all items which came into contact with the sample before excavating and sampling at a deeper depth or before proceeding onto the next sampling location;
- Depending upon Client requirements, backfill the trench / test pit with the removed soil material and reinstate surface coverings. The backfill material should be compacted with the available plant (eg excavator) to reduce site hazards and obstructions.

5.5 Sampling Using Drilling Rigs

The general procedure for the drilling and sampling of bore holes with a drilling rig is as follows:

- Ensure all equipment to be used for sampling has been decontaminated;
- Check that the plant equipment register indicates recent service. Also, check that the persons undertaking the drilling have adequate qualifications, licences and experience;
- Ensure that the sample location is clear of underground utilities, and overhead obstructions, utilities and services etc. Verify the location of overhead structures and services; do not drill within certain distances of services as per state/territory requirements;
- Remove surface vegetation, leaves and other surface debris not designated for sampling from the vicinity of the area to be sampled;
- Lay out plastic sheeting adjacent to the sampling location to prevent direct contact with the ground surface;
- Label sample jars, bottles and bags;
- Hand auger or use Non-Destructive Drilling (NDD) for the first 1.2 m (or greater depending upon Client requirements), to confirm the absence of underground services;
- Drill to the desired sampling depth or the auger/core barrel/SPT tube is full. Carefully remove the auger/core barrel/SPT tube from the hole. If the desired depth has not been reached, continuing drilling and emptying the auger/core barrel/SPT tube as needed. Emptied soils should be deposited in the plastic ground sheet to facilitate refilling the hole and to prevent contamination of the surrounding area. Cores should be placed in core trays;
- Collect the soil sample from the drilling device. Specific techniques for sampling from the different drilling methods are discussed below in **Sections 5.4.1 to 5.4.4**. Also, a portion of the sample should be placed into a zip lock bag for PID head space screening. Screen sample with PID in accordance with **Section 3.1**;

- Clean the outside of the sample jar and thread to remove excess soil. Replace lid tightly and place bottle in ice cooled esky;
- Lithologically log the sample and the boring and make notes regarding obvious visual and/or olfactory indicators of contamination. Guidance regarding logging is provided in **Section 6**; and
- Either discard or decontaminate all items which came into contact with the sample before drilling and sampling at a deeper depth or before proceeding onto the next sampling location; and
- Ensure that the drilling mast is lowered before moving to new sample locations.

5.4.1 Auger Drilling

Issues specific to collection of soil samples when auger drilling include the following:

- Before sampling off the auger stem, remove the outer centimetre or so of the soil to reduce the potential for cross-contamination from fall-in from the upper portions of the hole, or smearing effects when withdrawing the auger from the hole; and
- Collect the sample off the auger by collecting in a stainless steel pan and then placed in appropriate sample container. Also, a portion of the sample should be placed into a zip lock bag for PID head space screening.

5.4.2 Hammer Drilling

Soil cuttings brought to the surface during hammer drilling can be collected for future reference and/or laboratory analysis, however undertaking chemical analysis of such samples is not normally recommended for the following reasons:

- Loss of volatile compounds. The drilling process requires the injection of compressed air, plus can generate high temperatures at the drill bit, both of which can cause volatilisation of volatile compounds. As a result, analytical results may not be representative of in-situ contaminant concentrations;
- Possibility of cross contamination. Relatively uncontaminated material from depth may come into contact with shallow contaminated material when being brought to the surface;
- The sampling interval is not accurately known as there is a time lag between the cutting of soil at the drill bit face and when the sample is ejected to the surface; and
- Hammer drilling through dry soil and rocks may result in significant dust generation, which could result in an unsafe work environment, contaminant dispersal etc. Dust mitigation measures should therefore be implemented including the use of cyclones, wet hessian sacks covering the outlet pipe, or similar.

5.4.3 Core Drilling

Issues specific to collection of soil samples when core drilling include the following:

- Core barrels typically range in length from 0.5 m to 3.0 m. The core barrel is recovered after each interval is drilled;

- Representative sub-samples of the soil core can be transferred to appropriate sample containers for laboratory analysis or the entire length of core can be placed in core trays should it be necessary to retain them. If placing in core trays, then the core should be placed 'deep' end down in the core tray and the core tray labelled with hole number, depth interval, missing sections due to lack of core recovery etc. In addition, should portions of the core be removed for analysis, then blocks indicating the length and depth interval of the portion removed should be appropriately located within the core tray;
- If it is possible that future sampling of stored core for laboratory analysis may be required, then the core tray should be made of or lined with an inert material to reduce the potential for cross contamination; and
- Core barrels are commonly rusty and have been used on numerous occasions for the collection of contaminated soil samples. As the core sample comes into direct contact with the core barrel it is therefore imperative that the core barrel components are decontaminated prior to use, and between each sample.

5.4.4 SPT and Push Tube Sampling

Issues specific to collection of soil samples when SPT (standard penetration test) drilling or push tube sampling include the following:

- SPT splits are commonly rusty and have been used on numerous occasions for the collection of contaminated soil samples. As the soil samples come into direct contact with the splits it is therefore imperative that the splits and sample catcher are decontaminated prior to use, and between each sample;
- Allow the driller to remove the SPT tube from the borehole and open the split spoon. If using PVC tubes for sample collection, the driller when then cut open the tubes;
- Collect representative soil sample directly from the splits or the PVC tube;
- In some situations where the soils are loose and/or granular, it may not be possible to recover a sample from the splits or tube. In such situations, an idea of the composition of the penetrated soils can be obtained by close inspection of the inside of the splits as a small amount of soil tends to stick onto the split/tube surface; and
- Duplicate samples can be collected from the recovered soil sample by slicing segments of the recovered core into longitudinal sections over the one sampling interval, and transferring the soil from each side to separate containers.

6 LOGGING OF SOIL

Soils should be logged based on visual inspection of the soil sample, soil cuttings and/or exposed in the base and walls of an excavation. In addition, when drilling the environmental scientist should liaise with the drilling to obtain as much possible information as possible regarding the drillers interpretation of the subsurface conditions encountered.

The aim of effective and accurate logging is to ensure that:

- All observable and significant properties of a soil are described and noted;
- Consistent terms and meanings are used to described soils; and
- The properties of the soil are described in the same relative order.

Logging the physical properties of soils should be undertaken using the Unified Soil Classification System (USCS). Soil should be described in the following order:

- USCS classification symbol and ground name, which is based on grain size and physical properties (e.g. clays, silts). Where several components are present, the major component forms the root name and the minor component is used as the modifying adjective (e.g. sandy CLAY – the major constituent is clay and the minor constituent is sand). Recommended USCS classifications are provided in **Table B**;
- Colour. The colour of the soil is described in the moist condition using the colours of the Maunsell Colour Chart. These may be modified by adjective such as 'light' or 'dark'. Borderline colours can be described as a combination of colours. Additional information regarding colour is provided in **Table C**;
- Particle size range or plasticity. Use the descriptors provided in **Table D** based upon particle size;
- Consistency. Indicate whether the soil is cohesive or not;
- Moisture content. Indicate whether the soil is dry, moist or wet;
- Structure. The soil may consist of separate zones differing in colour, grain size or other properties. The patterns of such zones should be described using the following terms:
    - 'Layer' – zone is continuous across the exposure or sample;
    - 'Lens' – a discontinuous layer of different material, with a lenticular shape;
    - 'Pocket' – an irregular inclusion of different material;
- Additional comments indicating soil characteristics such as odours (see **Tables E and F**), evidence of soil contamination, water seepage (both in and out). The abundance of inclusions can also be described based upon criteria outlined in **Table G**; and
- Interpretation of geologic origin (e.g. residual, alluvium, fill material).

With regard to depths, it is important to record the upper and lower limits (in metres) of the various layers, soil horizons and types of fill materials encountered. With regards to odours, it is neither required or advocated that smelling of samples is necessary. That is, do not 'stick your nose' in or over the sample. If odours are noticed however, then make a record of such and where possible indicate pungency and type of odour. Suggested odour descriptions and odour strength are provided below in **Tables E** and **F** respectively.

Table B: Unified Soil Classification System

Major Divisions			Group Symbol	Typical Group Name
Coarse Grained Soils (More than half of material is individual grains visible to the naked eye)	Gravelly Soil (more than half of coarse fraction is larger than 2.36 mm)	Clean Gravel (will not leave a stain on wet palm)	GW	Well graded gravel, fine to coarse gravel
			GP	Poorly graded gravel, predominantly one size or range of sizes with some intermediate sizes missing
		Dirty Gravels (will leave a stain on wet palm)	GM	Silty gravel
			GC	Clayey gravel
	Sandy Soils (more than half of coarse fraction is smaller than 2.36 mm)	Clean Sands (will not leave a stain on wet palm)	SW	Well graded sand, fine to coarse sand
			SP	Poorly graded sand, fine to coarse sand
		Dirty Sand (will leave a stain on wet palm)	SM	Silty sand
			SC	Clayey sand
Fine Grained Soils (More than half of material is individual grains not visible to the naked eye)	Silt and Clay (Liquid limit less than 50)	Inorganic	ML	Silt
			CL	Clay of low to medium plasticity
		Organic	OL	Organic silt or organic clay of low plasticity
	Silt and Clay (Liquid limit greater than 50)	Inorganic	MH	Silt of high plasticity
			CH	Clay of high plasticity
		Organic	OH	Organic clays of medium to high plasticity
Highly Organic Soils			Pt	Peat, muck and other highly organic soils

Table C: Soil Colours

Soil Colour	Potential History or Behaviour
Red	Well drained
Yellow or grey	Poorly drained
Dark soils	Higher levels of organic matter
Bluish or greenish grey (gley colours)	Water logged soils

Notes: Sourced from Australian Standard AS4482.1-2005 '*Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-Volatile and Semi-Volatile Compounds*'.

Table D: Particle Size or Plasticity

Term		Grain Size / Description
Boulders		Greater than 200 mm
Cobbles		50 mm to 200 mm
Gravels	Coarse	20 mm to 50 mm
	Medium	6 mm to 20 mm
	Fine	2.36 mm to 6 mm
Sands	Coarse	0.6 mm to 2.36 mm
	Medium	0.2 mm to 0.6 mm
	Fine	0.075 mm to 0.2 mm
Non plastic		A 3 mm thread cannot be rolled at any water content
Low Plasticity		A thread can be barely rolled
Medium Plasticity		A thread is easy to roll
High Plasticity		A thread is easy to roll and can be rerolled several times

Table E: Odour Descriptions

Odour Description	Contaminant Indicated
Characteristic sharp, pungent	Ammonia
Petroleum products	Petrol, diesel, oil
Compost	Decayed organic matter
Putrefied	Putrescible waste
Rotten egg smell (sulphurous)	Anaerobic or acid sulphate conditions
Acidic	Mineral or organic acid
Caustic	Caustic material
Septic	Decaying organic matter, sewage
Sweet, solvent type	Ketone
Aromatic	Benzene

Notes: Sourced from Australian Standard AS4482.1-2005 '*Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-Volatile and Semi-Volatile Compounds*'.

Table F: Description of Odour Strength

Strength	Description
Weak	Just detectable; location difficult to determine
Distinct	Detectable immediately adjacent to source, bearable at source
Strong	Detectable 20 m from source, bearable at source
Very Strong	Detectable at distances greater than 20 m from source, pungent at source

Notes: Sourced from Australian Standard AS4482.1-2005 '*Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-Volatile and Semi-Volatile Compounds*'.

Table G: Abundance Classes

Description	Visual Estimate (%)
Very few	Less than 2%
Few	2% to 10%
Common	10% to 20%
Many	20% to 50%
Abundant	50% to 90%
Profuse	Greater than 90%

Notes: Sourced from Australian Standard AS4482.1-2005 '*Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-Volatile and Semi-Volatile Compounds*'.

7 FIELD QUALITY ASSURANCE / QUALITY CONTROL

A primary task of any environmental assessment is the implementation of a quality assurance / quality control (QA/QC) program to ensure that the field work program and analytical results obtained are of the highest quality. The requirements of the field QA/QC program should be determined prior to initiating the sampling works using the Data Quality Objective (DQO) process, and then outlines in the SAQP and discussed in the briefing prior to the fieldwork.

On short duration projects (e.g. one round of sampling), the review of the QA/QC process is often undertaken once the analytical results are available. In such cases, review of the QA/QC data is undertaken to assess the integrity of the data. On large projects extending over periods of months or years involving numerous rounds of sampling and or different phases of assessment works, the results of the QA/QC program should be monitored on a continual basis to ensure the integrity of the collected data, and/or to determine the necessity for corrective actions (if required).

7.1 Quality Assurance

Quality Assurance (QA) refers to the procedures to be implemented during the field work. The QA procedures for soil sampling are documented in this SOP. All personnel undertaking soil sampling should be familiar with the contents of this SOP and should carry it in the field with them at all times.

7.2 Quality Control

In essence, the purpose of quality control (QC) samples is to determine the accuracy and precision of the field sampling, transportation and laboratory analysis, and thereby assess whether the results are representative of the waters sampled. All QA/QC samples must be collected, handled and processed in the same exact manner as the other samples being collected.

7.2.2 Field Duplicate Samples

Duplicates are two independent samples which are collected as close as possible to the same point in space and time and are subjected to the same filtering, preservation, holding and analysis methods. These samples are stored in separate containers and analysed independently. Duplicates are used to assess the precision of the field sampling techniques and analytical processes. In addition, a triplicate is a version of a duplicate sample but is sent to a secondary laboratory to confirm the accuracy of the results of the primary laboratory.

Field duplicates and triplicates should be sampled at a rate of one duplicate per 10 primary samples (or parts thereof). If submitted to the primary laboratory, the field duplicate should be labelled with a unique identifier with no reference whatsoever to the corresponding primary sample of the duplicate pair. The field duplicate should be analysed for the same parameters and analytes as the corresponding primary sample of the duplicate pair.

Where possible, duplicate samples should be collected from samples that are known or suspected to be contaminated or contain detectable concentrations of contaminants of concern. In addition, where possible duplicate samples should be collected from over a range of contaminant concentrations so as to enable assessment over the low, middle and high range of contaminant concentrations.

For non-volatiles, the sample is to be homogenised in the field to help ensure a representative sample is place in each of the primary / duplicate / triplicate jars. For volatile and semi-volatile analytes, no mixing shall be undertaken in the filed. Instead, representative duplicates / triplicates shall be prepared by adding incremental portions of the original sample into each jar.

The requirements of the duplicate sampling should be kept in mind during the project to ensure that suitable duplicate samples and a sufficient number of duplicate samples are collected.

7.2.3 Blank Samples

A blank is a sample comprised of deionised water that is carried through all or part of the sampling process. Blanks include the following:

- Trip blanks which are used to monitor potential contamination during transport and storage. They are sent from the laboratory with empty containers and remain unopened with the other samples throughout sampling and transport. As a minimum, one trip blank per day of sampling (or part thereof) should be taken; and
- Rinsate blanks which are used to monitor potential cross-contamination between sample locations and for potential influences from sampling equipment. The rinsate blank is taken from the final rinse of equipment after decontamination. The rinsate blanks should be analysed for the same analytes as the samples. As a minimum, one rinsate blank per day (or part thereof) should be taken.

8 REFERENCES

Australian Standard AS1726-1993 '*Geotechnical Site Investigations*'.

Australian Standard AS4482.1-2005 '*Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-volatile and semi-volatile compounds*'.

Australian Standard AS4482.2-1999 '*Guide to the Sampling and Investigation of Potentially Contaminated Soil. Part 2: Volatile Substances*'.

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Industrial Solutions (2009) '*MX6 iBrid Multi-Gas Monitor Operation Guide*'.

National Environment Protection Council (NEPC, 1999) '*National Environment Protection (Assessment of Site Contamination) Measure 1999*'.

RAE Systems (2005) '*MiniRae 2000 Portable VOC Monitor. Operation and Maintenance Manual*'.

Western Australia Department of Health (2009) '*Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*'.

9 ABBREVIATIONS

ACM	Asbestos Containing Material
AF	Asbestos Fines
AS	Australian Standard
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
$C_6 – C_9$	Total Petroleum Hydrocarbon fractions
COC	Chain Of Custody
DQO	Data Quality Objectives
eV	Electron Volts
FA	Fibrous Asbestos
f/mL	Fibres per millimetre
HIL	Health-Based Investigation Levels
MSDS	Material Safety Data Sheet
NDD	Non-Destructive Drilling
OCP	Organochlorine Pesticide
OPP	Organophosphate Pesticide
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PID	Photoionisation Detector
PPE	Personal Protective Equipment
ppm	Parts Per Million
SAQP	Sampling and Analysis Quality Plan
SOP	Standard Operating Procedure
SPT	Standard Penetration Test
SSMP	Site Safety Management Plan
SVOC	Semi Volatile Organic Compounds
TPH	Total Petroleum Hydrocarbon
QA	Quality Assurance
QC	Quality Control
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbon
USCS	Unified Soil Classification System
VHC	Volatile Halogenated Compounds
VOC	Volatile Organic Compounds
w/w	Weight/weight, by weight.

Status

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Rev	Description	Date	Drawn By
I	STOCKPILES ADDED	11.03.2022	RT
H	DRAFT EDP	08.07.2021	RT
G	EDP SUBMISSION	08.06.2021	RT
F	EIS SUBMISSION	07.05.2021	RT
E	90% EDP FOR INFORMATION	22.03.2021	RT
D	REVISED TEMPORARY CUT-OFF DRAINS	12.06.2020	DA
C	BOUNDARIES AND ROAD AL-04 REVISED	20.12.2019	DA

LEGEND

- HOLDING LEASE BOUNDARY
- PROPOSED BLOCK BOUNDARY
- EXISTING TREE TO BE REMOVED
- EXISTING TREE TO RETAINED
- 580.0 PROPOSED CONTOUR
- 580.0 EXISTING CONTOUR
- SITE OFFICE / ABLUTIONS
- SEDIMENT CONTROL FENCE
- SEDIMENT CONTROL POND
- CUT OFF DRAIN
- STOCKPILE LOCATION OF EXCAVATED NATURAL MATERIAL. SEED AND STABILISE AS REQUIRED

EARTHWORKS AND SITE GRADING TO CONFORM TO THE REQUIREMENTS OF THE FOLLOWING ACT GOVERNMENT STANDARDS AND SPECIFICATIONS AND THEIR REFERENCE STANDARDS.

- M1S02
- MITS00C
- MITS02A, MITS02B, MITS02C

Scales

0 20 30 40 50m

1:1000 @ A1

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Client Logo

DOMAGROUP

Original Size	A1	Drawn By DA	Drafting Check DCA
Date Plotted	11-Mar-22	Designed By AE	Design Check
Coordinate System	STROMLO GRID	Approved BC	Approved Date
Height Datum	AHD	Approved Signature	

Project Name and Location

THE CANBERRA BRICKWORKS

BLOCKS 1,7 & 20 SECTION 102

Drawing Title

DRAFT EDP - ENVIRONMENTAL MANAGEMENT AND PROTECTION PLAN

Project Number	Type	Discipline	Drg No.	Sub-No.	Rev
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CANBERRA BRICKWORKS AND ENVIRONS

Ecological Assessment

FINAL

December 2014

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Ecological Assessment

FINAL

December 2014

Prepared by
Umwelt (Australia) Pty Limited

on behalf of
Land Development Agency

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Report No.	**8043/R03/V3**
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APPENDIX

1 Floristic Survey Data

1.0 Introduction

Umwelt (Australia) Pty Limited (Umwelt) was engaged by the ACT Land Development Agency (LDA) to conduct a range of ecological surveys in summer 2013 for the Canberra Brickworks and Environs future urban development area.

1.1 Background

The Canberra Brickworks and Environs are located on the southern edge of Yarralumla and north-western edge of Deakin in Canberra's inner south and include the intersection of Cotter Road, Yarra Glen and Adelaide Avenue. The project area contains both Commonwealth and Territory land as well as a range of historically significant infrastructure. The project area comprises approximately 47 hectares as shown in **Figure 1.1**. The LDA propose to develop part of this area for residential purposes.

The project area contains known matters of national environmental significance (MNES) protected under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The south of the project area, adjacent to Cotter Road and Dudley Street, contains habitat for both the critically endangered golden sun moth (*Synemon plana*) and the endangered ecological community 'Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory' (hereafter referred to as natural temperate grassland). These areas may also contain habitat for the vulnerable perunga grasshopper (*Perunga ochracea*) protected under the Territory's *Nature Conservation Act 1980* (NC Act).

The ecological values of the project area have been subject to a number of assessments in the past, which have identified these MNES and monitored their condition over numerous seasons.

1.1.1 Previous Studies

Three reports pertaining to the project area were used as background for the project. These are briefly described below.

Table 1.1 – Summary of Previous Studies

Report Name	Summary
Rowell, A., 2010. Preliminary Assessment of Ecological Values of Land in Yarralumla, Curtin and Deakin, ACT, Prepared for the National Capital Authority, Canberra.	This was a preliminary assessment for threatened species and communities listed under the EPBC and NC Acts. The scope of works were to map vegetation communities, habitat for golden sun moth, survey for presence of golden sun moth, and make recommendations for future surveys. The study confirmed the presence of golden sun moth and patches of diverse natural temperate grassland within the project area. It also identified the presence of golden sun moth in the North Curtin Horse Paddocks, which had not previously been identified.

Report Name	Summary
Rowell, A., 2011. Yarralumla Brickworks Site and Surrounds, Golden Sun Moth and Natural Temperate Grassland Survey, Prepared for Land Development Agency, Canberra.	As previous surveys had identified the presence of golden sun moth at the Yarralumla Brickworks, the aim of the 2010-2011 survey and report was to investigate the larger subject site, and determine the extent of occupancy of golden sun moth, its relative abundance, breeding sites and habitat quality. The site was also assessed for the extent of the threatened grassland community, and its potential as habitat for other threatened species. The study confirmed the presence of 1.5 hectares of natural temperate grassland, and about 5 hectares of golden sun moth habitat in both native and exotic dominated vegetation. The grassland and moth population were considered likely to be viable in the medium term.
Rowell, A., 2012. Environmental Assessment of Blocks for Proposed Diplomatic Subdivision (Stirling Ridge, Near Old Canberra Brickworks, and Land adjacent to Federal Golf Club), Prepared for the National Capital Authority, Canberra.	This project included assessment of three sites, including the Canberra Brickworks. The scope of the study was to map vegetation community extent and quality, and survey and map habitat for threatened fauna including golden sun moth, perunga grasshopper and woodland birds. Floristic value scores were calculated for the natural temperate grassland which has been used in Umwelt's assessment. Two locally uncommon flora species were also identified and discussed. No threatened bird species were recorded, nor was habitat identified. Potential for perunga grasshopper was discussed, however the species was not identified during targeted surveys. Golden sun moth were found in very low numbers, however it was noted that it was a poor season for observations across Canberra and this may have also affected results of surveys for the Brickworks site. Mapping prepared from this survey was used for Umwelt's report.

1.1.2 Current Site Context

The project area is located within an urban environment, with established urban areas to the north (Yarralumla) and south (Deakin), with a number of major roads traversing the site (Cotter Road and Adelaide Avenue).

The project area is currently managed as a combination of open space, and road reserve, with management including regular slashing to manage grass height and fuel load.

A number of pressures exist on the site, including ongoing management, public access and walking tracks, road upgrades and increasing traffic numbers, all of which impact upon the long term viability of the site.

The golden sun moth habitat and natural temperate grassland within the project area are one of a small number of such remnants in Central Canberra, only one of which is protected – York Park in Barton (Rowell, 2012). The presence of this critically endangered species and endangered ecological community represent ecological value retained within the urban environment.

1.1.3 Project Area and Survey Effort

The survey area was determined through a number of considerations. Habitat mapped by Rowell (2012) formed the basis for targeted surveys and provided the polygons for habitat mapping.

Site reconnaissance visits were also undertaken early in the season to determine whether any additional areas of habitat, previously unidentified, were present on the site. This particularly targeted south of Adelaide Avenue in Deakin, and around the historic brickworks area. No additional areas of habitat were identified, therefore surveys focussed on areas mapped by Rowell (2012).

1.2 Scope of Work

Umwelt were engaged by the LDA to complete the following defined scope of work:

- conduct of ecological surveys targeting:
  - golden sun moth;
  - natural temperate grassland endangered ecological community; and
  - perunga grasshopper.
- preparation of a brief report summarising the methodologies and outcomes of the surveys.

The methodology applied for this assessment and results are detailed in the following sections.

Figure 1.1 – Project Area

2.0 Perunga Grasshopper

2.1 Background

Perunga Grasshopper (*Perunga ochracea*) is a short-winged, flightless grasshopper, with adults ranging from 15-20 mm long (males) to 26-35 mm long (females). Colours are variable, often ranging from brown to grey in dry years, to green in wet years. In the Canberra region, the species is distinguished by the presence on the dorsal surface of a pale 'X'. The species is listed as vulnerable under the ACT's NC Act. It is not listed under the EPBC Act.

Nymphs hatch in autumn and develop over winter and early spring from eggs laid in the soil, and adults are present from mid spring to late summer (ACT Government, 2006)[1].

Potential perunga grasshopper habitat was mapped by Rowell in (2012)[2] for the project area based on the presence of suitable vegetation. This potential habitat consisted of approximately 1.3 hectares of natural temperate grassland dominated by *Rytidosperma* spp., *Themeda triandra* and *Austrostipa bigeniculata*. Rowell (2012) undertook limited surveys for perunga grasshopper, but did not identify any individuals. Further survey was recommended.

Figure 2.1 – Perunga Grasshopper
(Copyright: ACT Government, Territory and Municipal Services[3])

[1] ACT Government (2006). *Perunga Grasshopper (Perunga ochracea): A vulnerable species. Information Sheet.* Environment ACT, Canberra
[2] Rowell, A. (2012). *Environmental Assessment of Blocks for Proposed Diplomatic Subdivision (Stirling Ridge, Near Old Canberra Brickworks, and Land adjacent to Federal Golf Club)*. Prepared for the National Capital Authority, Canberra.
[3] http://www.tams.act.gov.au/parks-recreation/plants_and_animals/urban_wildlife/local_wildlife/ kangaroos/conservation-impacts-of-grazing-by-eastern-grey-kangaroos

2.2 Methodology

Extensive literature review revealed that there is no formally established survey method for perunga grasshopper. Generally, this species is recorded opportunistically as part of survey for grassland/woodland vegetation or other fauna such as golden sun moth (*Synemon plana*) and striped legless lizard (*Delma impar*).

ACT Government (1999)[4] developed an action plan for the perunga grasshopper in accordance with Section 21 of the *Nature Conservation Act 1980*. The action plan states that 'perunga grasshopper is a cryptic grasshopper which is difficult to see unless first disturbed. When disturbed, the species appears to actively seek shelter, jumping once or twice before burying itself into a grass tussock. It is a powerful jumper, covering distances of a metre or more.' Using species habitat, ecology, and behavioural information included in the action plan, a survey methodology was developed, along with advice and peer review from local biologist and grassland specialist Alison Rowell.

Due to the lack of detailed knowledge about the climatic conditions required to survey for perunga grasshopper, climatic conditions for golden sun moth survey guidelines (DEWHA 2009)[5] were considered and modified to suit perunga grasshopper based on experience of observed preferred conditions. Target conditions under which perunga were considered most likely to be active and detectable were as follows:

- mild to warm day (above 15°C by 10.00 am);
- survey undertaken in warmest part of day (between 11.00 am and 3.00 pm); and
- dry tussocks at the time of survey (i.e. no survey in wet/moist conditions).

Surveys were timed for early November (earlier than standard grassland fauna surveys) to avoid confusion associated with activity of more common grasshoppers. Perunga grasshopper is active earlier than most other grasshoppers as they overwinter as nymphs rather than eggs.

Targeted searches were undertaken within potential habitat across three survey efforts (days) of 2 hours per day.

Two 20 x 20 metre quadrats were established within potential habitat areas, and within these, linear transects were walked with a five metre spacing between transects. Transects were walked slowly, observing grasshoppers being flushed from tussocks.

In the remainder of potential habitat and areas of marginal habitat, meander paths at approximately 10 metre spacing were walked slowly, observing grasshoppers being flushed from tussocks.

This methodology is illustrated in **Figure 2.1**.

[4] ACT Government (1999). *Perunga Grasshopper (Perunga ochracea): A vulnerable species. Action Plan No. 21.* Environment ACT, Canberra

[5] DEWHA (2009). *Significant Impact Guidelines for the Critically Endangered Golden Sun Moth (Synemon plana). EPBC Act Policy Statement 3.12.* Department of Environment, Water, Heritage and the Arts, Canberra.

2.3 Observations

An initial survey was undertaken on 30 October 2013 by an Umwelt ecologist and Alison Rowell, to confirm survey methodology, with subsequent surveys by Umwelt on 5 and 14 November 2013. Each survey repeated the same methodology.

All survey days met climatic condition requirements. Weather conditions at the time of survey and survey results are summarised in **Table 2.1**.

Table 2.1 – Perunga Grasshopper Survey Effort and Conditions

Survey Date and Time	Weather Conditions	Observations
30/10/2013 11 am – 2 pm	Temp: Max 22.1°C Rainfall: 0 mm Wind: NNW 17 km/hr Sunny	No observations
5/11/2013 12 pm – 2 pm	Temp: Max 20.9°C Rainfall: 0 mm Wind: SE 13 km/hr Sunny	No observations
14/11/2013 12 pm – 2 pm	Temp: Max 22°C Rainfall: 2 mm (rained after survey) Wind: WNW 24 km/hr Partly Cloudy	No observations

Note: Weather observations are from the Canberra Airport and may differ slightly from actual conditions on site, particularly wind speed.

No perunga grasshoppers were observed during the survey, or during any subsequent visits to the project area.

Figure 2.2 – Perunga Grasshopper Survey Effort

3.0 Golden Sun Moth

3.1 Background

Golden sun moth inhabit natural temperate grasslands and open grassy woodlands where the ground layer is dominated by wallaby grass. They have also been found to have a tolerance for degraded grasslands dominated by exotic Chilean Needlegrass (*Nassella neesiana*), which is listed as a priority weed species in the ACT and a Weed of National Significance (WoNS).

Within the local area, golden sun moth populations occur at a number of sites in Yarralumla and surrounding areas in the Inner South, such as Black Street and Stirling Park Ridge in Yarralumla; Yarralumla Equestrian Park to the west of the site; and the North Curtin Horse Paddocks to the south. The species is known to be able to successfully persist within small fragmented areas of habitat, including within urban areas (Hogg 2010).

Within the project area, golden sun moth occur in association with natural temperate grassland. The native dominated grassland and road verges with a high component of Chilean needlegrass are also considered habitat. No suitable habitat was identified to the south of Adelaide Avenue, in Deakin.

Figure 3.1 – Golden Sun Moth in the Project Area
(Source: Umwelt)

3.2 Methodology

There are established survey guidelines for golden sun moth under the EPBC Act. These guidelines have been utilised in the conduct of this survey, and are discussed below.

As per the EPBC Act Golden Sun Moth survey guidelines (DEWHA 2009), survey is required to be undertaken over a period of four (4) non-consecutive days, with survey days targeted based on suitable climatic conditions.

The following survey parameters were used for selecting appropriate days to undertake monitoring:

- a warm to hot day (above 20°C by 10:00 am);
- the warmest part the day (i.e. between 10:00 am and 2:00 pm);
- clear or mostly cloudless sky;
- still or relatively still wind conditions during the survey period;
- ≥ 2 days since rain; and
- staggered to increase the likelihood of detection given the short adult life span (1-4 days between surveys).

Reconnaissance visits were undertaken for the project area prior surveys commencing to confirm whether golden sun moth had begun to actively fly.

Once flying was confirmed, two transects were established in the natural temperate grassland areas, and meandering searches were undertaken throughout all other areas of known habitat. For each transect, the location of each observation was recorded. Climatic conditions and results of the golden sun moth surveys are shown in **Table 3.2**.

3.3 Observations

Golden sun moths were observed throughout the project area during all survey days, however moth numbers varied throughout the survey period. Generally, moths were observed at low densities, with most observations being made in the Denman Street Road Reserve, the Uniting Church, north of Cotter Road, and the Cotter Road median.

Over the period when surveys were being conducted, a number of the areas of habitat were slashed very low, removing the vegetative cover for moths. In these areas, moths were observed at higher densities immediately following slashing, potentially due to the removal of cover and from the disturbance. This disturbance is likely to have influenced the survey results and may have affected the survival rates of adults and potentially also breeding success for the season (discussed further in **Section 5.2**).

Table 3.1 identifies locations of moth observations and should be cross referenced with **Table 3.2** and **Figure 3.1**. **Figure 3.1** shows an average of observations across the four days of survey to indicate areas of highest moth density.

Table 3.1 – Key to Observations (reference Table 3.2 and Figure 3.1)

i	Transect 1	ii	Transect 2
iii	Denman Street Road Reserve	iv	South of Dudley Street
v	North of Cotter Road	vi	Cotter Road Median
vii	Uniting Church		

Table 3.2 – Golden Sun Moth Survey Effort and Conditions

Survey Date and Time	Weather Conditions *	Observations							Notes
		i	ii	iii	iv	v	vi	vii	
14/11/2013; 12 pm – 2 pm	Temp: Max 22°C Rainfall: 2 mm (after survey) Wind: WNW 24 km/hr Partly Cloudy	-	-	-	-	-	-	-	Reconnaissance survey. No GSM observed.
26/11/2013; 10 am – 11.30 am	Temp: Max 20°C Rainfall: 0 mm Wind: NNW 11 km/hr Sunny	2	-	5	-	1	3	5	16 moths observed in 1.5 hours.
28/11/2013; 10 am – 11.30 am	Temp: Max 25°C Rainfall: 0 mm Wind: NW 20km/hr Sunny	1	-	-	-	2	4	8	North of Cotter Road (site v) had just been slashed at the time of survey. The Uniting Church (site vii) was being slashed at the time of survey. 15 moths observed in 1.5 hours.
4/12/2013; 9.50 am – 10.35 am	Temp: Max 25.3°C Rainfall: 0 mm Wind: NNW 20km/hr Cloudy but warm	-	-	1	2	2	1	-	No moths observed in recently slashed area of Uniting Church, and this area of habitat was being used as a parking area during survey. 6 moths observed in 40 minutes.
12/12/2013; 10.30 am – 11.10 am	Temp: Max 22°C Rainfall: 0 mm Wind: WSW 17km/hr Sunny, light breeze	-	1	2	-	8	3	3	The Cotter Road Median (site vi) had been slashed very recently and the majority of cover removed. 17 moths observed in 40 minutes.

Note: Weather observations are from the Canberra Airport and may differ slightly from actual conditions on site, particularly wind speed.

Figure 3.2 – Golden Sun Moth Survey

3.4 Interpretation of Results

Due to the normal seasonal variation of golden sun moth observations due to prevailing weather among other factors, and variation in survey effort between years, it is difficult to determine the cause, if any or trends in population numbers with only 4 years of data. Observations relevant to the preceding years include:

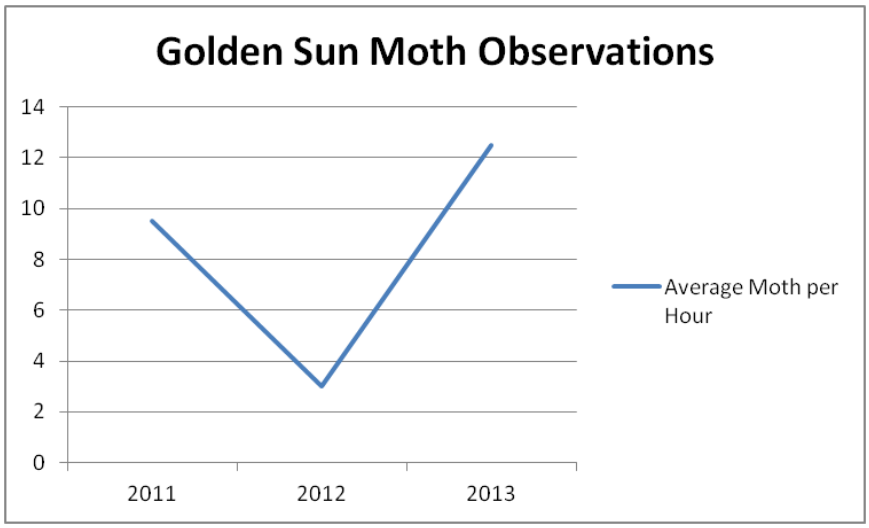
- Wet, or mild summers generally result in low moth numbers and these conditions were experienced in 2010 and 2011. In 2009, very high numbers were observed, however in 2010, following poisoning of Chilean needlegrass, very low numbers were observed.

- Slashing during surveys in 2013 resulted in higher observations during these events, likely due to the loss of cover.

Results from the 2009 surveys (Rowell, 2010) have been excluded from **Graph 3.1** due to the extremely high numbers of moths observed, which have not been observed again in following years. As this was the first season we have records for, we cannot conclude whether this site had a very high population until the removal of Chilean needlegrass in 2010, or whether this was a unique year with an unusually high number of observations.

The following graph is not considered to provide a statistically accurate representation of population trends on site, due to the low number of samples, however does illustrate seasonal variability and generally very low numbers.

Graph 3.1 – Averaged Golden Sun Moth Observations (per hour) from 2011 - 2013



4.0 Natural Temperate Grassland

4.1 Background

Natural Temperate Grassland of the Southern Tablelands of New South Wales and the Australian Capital Territory' (natural temperate grassland) occurs across temperate lowland areas of south-eastern Australia where tree growth is limited (ACT Government, 2005)[6]. Distribution is generally between altitudes 560 metres and 1200 metres on open plains and in valleys with cold air drainage. The grassland is dominated by dense to open tussock grasses such as wallaby grass (*Rytidosperma* spp.), spear grass (*Austrostipa* spp.), red anther wallaby grass (*Bothriochloa macra*), poa tussock (*Poa* sp.), kangaroo grass (*Themeda australis*) in addition to a diversity of native, herbaceous forbs (DoE, 2013)[7].

In the region, there are very small, scattered remnants of the community through central Canberra, with the majority of extant grassland retained within Gungahlin, and the Majura and Jerrabomberra Valleys.

Natural temperate grassland in the project area has been mapped and monitored for a number of years (Rowell 2010, 2011, 2012). The community exists in a range of condition-states throughout the project area. A low-lying area of natural temperate grassland near Dudley Street is dominated by Kangaroo Grass (*Themeda triandra*), and a band of natural temperate grassland between Denman and Dudley Streets is dominated by spear-grasses and wallaby grasses (*Austrostipa* spp. and *Rytidosperma* spp.). The strips on the verges of Dudley and Denman Streets dominated by *Rytidosperma* are weedier and less diverse than the core area of grassland, presumably due to increased disturbance and more frequent mowing of the roadsides.

No natural temperate grassland occurs in the project area south of Adelaide Avenue in Deakin.

[6] ACT Government (2005). *Action Plan No. 28, A Vision Splendid of the Grassy Plains Extended, ACT Lowland Native Grassland Conservation Strategy*. Canberra: Environment ACT

[7] Department of the Environment (2013). *Species Profile and Threats Database.* Accessed online: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Figure 4.1 – *Rytidosperma/Austrostipa* Dominated Natural Temperate Grassland in the Project Area
(Source: Umwelt)

Figure 4.2 – *Themeda* Dominated Natural Temperate Grassland in the Project Area
(Source: Umwelt)

4.2 Background and Methodology

Umwelt surveyed natural temperate grassland areas on 28 November 2013. The survey focused on two components:

1. Validating the distribution of natural temperate grassland across the project area, including areas mapped as NTG by Rowell (2012), and determining their botanical significance rating (ACT Government 2006)[8].

The Botanical Significance Rating (BSR) is considered an appropriate methodology for this assessment, as the National Recovery Plan for Natural Temperate Grassland suggests that individual States and Territories are tasked with developing appropriate guidelines for grassland assessment. BSR categories are defined in **Table 4.1** with results shown in **Figure 4.2**.

2. Assessing species richness and floristic values at two 20 x 20 metre plot locations surveyed by Rowell (2012) using 20 x 20 metre plot-based assessment and utilising the 'Floristic Values Score' method developed by Rehwinkel (2007)[9].

This method gives value to sites containing 'significant' species which indicate higher condition grassland. **Table 4.2** presents historical and current FVS ratings for the project area.

Table 4.1 – Botanical Significance Rating Definitions for Natural Temperate Grassland in the ACT

Degree of disturbance	Ground layer species	Examples of characteristic species	Typical flora of the ground layer	BSR rating
Very low	Disturbance sensitive species	*Diuris* spp., *Caladenia* spp., *Thelymitra* spp.	Native species include orchids, lilies and other highly sensitive species, as well as more tolerant species.	1
Low	Moderately disturbance tolerant species	*Dichopogon* spp., *Bulbine bulbosa*, *Craspedia variabilis*, *Cryptandra amara*, *Themeda triandra*, *Pimelea* spp., *Wurmbea dioica*.	Species present include those moderately tolerant of disturbance, as well as more tolerant species.	2
Moderate	Disturbance tolerant species	*Chrysocephalum apiculatum*, *Convolvulus angustissimus*, *Plantago varia*, *Asperula conferta*, *Glycine* spp., *Hibbertia obtusifolia*.	Native species include those commonly found in a range of sites that have been subject to moderate disturbance; sensitive species are rarely present.	3, 4
High	Disturbance tolerant native grasses	*Poa* spp., *Rytidosperma* spp., *Austrostipa* spp., *Bothriochloa macra*, *Microlaena stipoides*.	Site may contain a variety of native grass species but few or no native forbs are present.	5[1]

[8] ACT Government (2006). *National Recovery Plan for Natural Temperate Grassland of the Southern Tablelands (NSW and ACT): An Endangered Ecological Community,* Environment ACT, Canberra.
[9] Rehwinkel R (2007). *A Method to Assess Grassy Ecosystem Sites: Using Floristic Information to Assess a Sites Quality*. Version 2, November 2007. NSW Department of Environment and Climate Change, Queanbeyan

Degree of disturbance	Ground layer species	Examples of characteristic species	Typical flora of the ground layer	BSR rating
Very high	Exotic species	Perennial and annual* weeds, introduced or adventitious species.	Either dominated by perennial exotic species or a low cover and diversity of native species, of which most are native grasses.	E[1]

[1] Not considered part of the natural temperate grassland endangered ecological community.

4.3 Results

Results from the floristic survey are shown in **Appendix 1**. Considering the definitions provided in **Table 4.1**, the BSR of natural temperate grassland remnants across the project area were determined, and are shown in **Figure 4.1**. All areas are considered to be moderately disturbed, with a BSR of 3 or 4. Areas with a BSR of 5 or E were not mapped as they are not considered part of the natural temperate grassland endangered ecological community.

The patches of natural temperate grassland within the project area were confirmed to be small, however relatively diverse, with moderate to high floristic value scores (FVS) (Rehwinkel, 2007).

Two locally uncommon species were found within the *Rytidosperma* patch, Swainson's purple-pea (*Swainsona sericea*) and native storksbill (*Pelargonium australe*). While not threatened under Commonwealth or ACT legislation, Swainson's purple-pea is listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995*. Both species are considered to be an indicator of diversity within the patch.

The following **Table 4.2** summarises the quality of natural temperate grassland as determined by Rowell (2012) and information collected as part of this study.

Table 4.2 – Diversity within Natural Temperate Grassland Quadrats

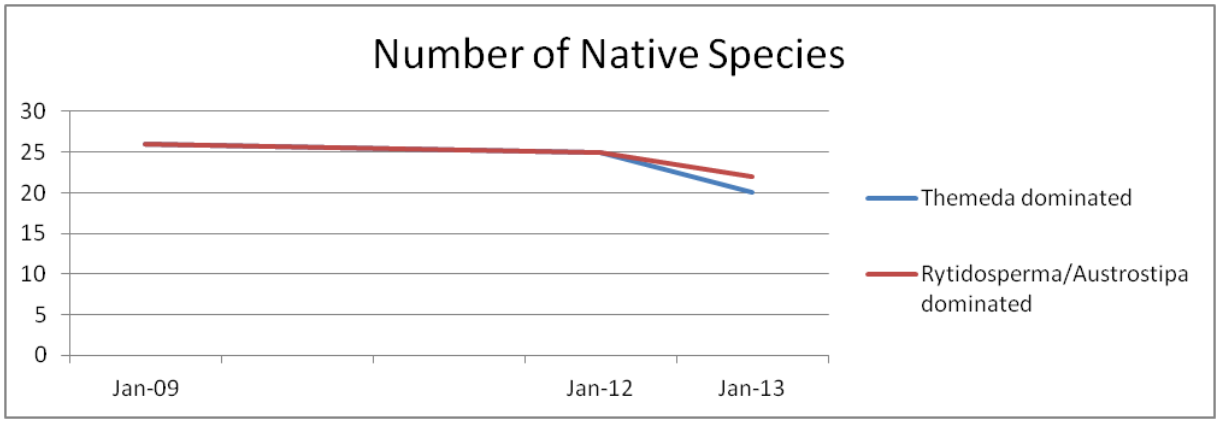
Quadrat	Number of Native Species			Number of Exotic Species			Floristic Value Score		
	Dec 2009	Jan 2012	Nov 2013	Dec 2009	Jan 2012	Nov 2013	Dec 2009	Jan 2012	Nov 2013
Themeda dominated	26	25	20	13	6	5	27	29	19
Rytidosperma/Austrostipa dominated	26	25	22	11	12	18	14	15	12

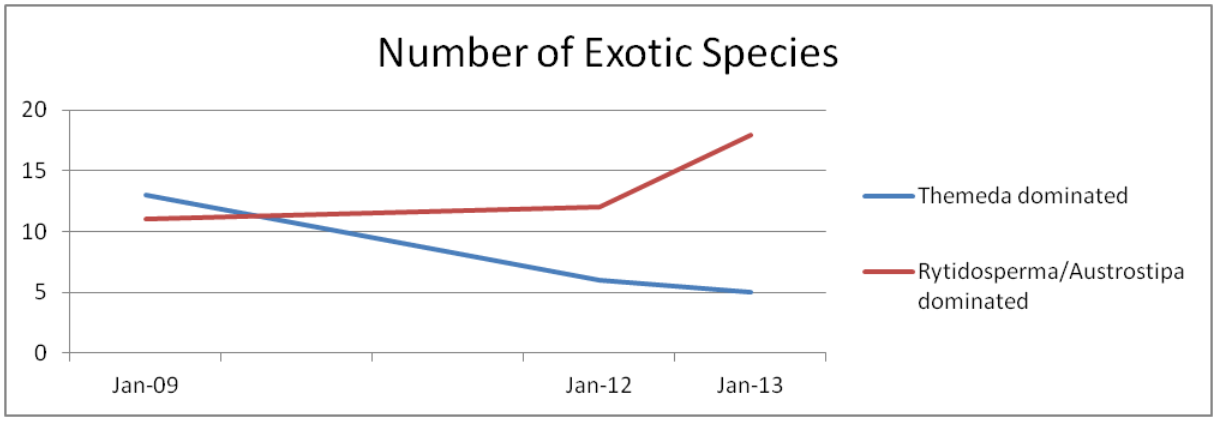
Figure 4.3 – Natural Temperate Grassland Survey

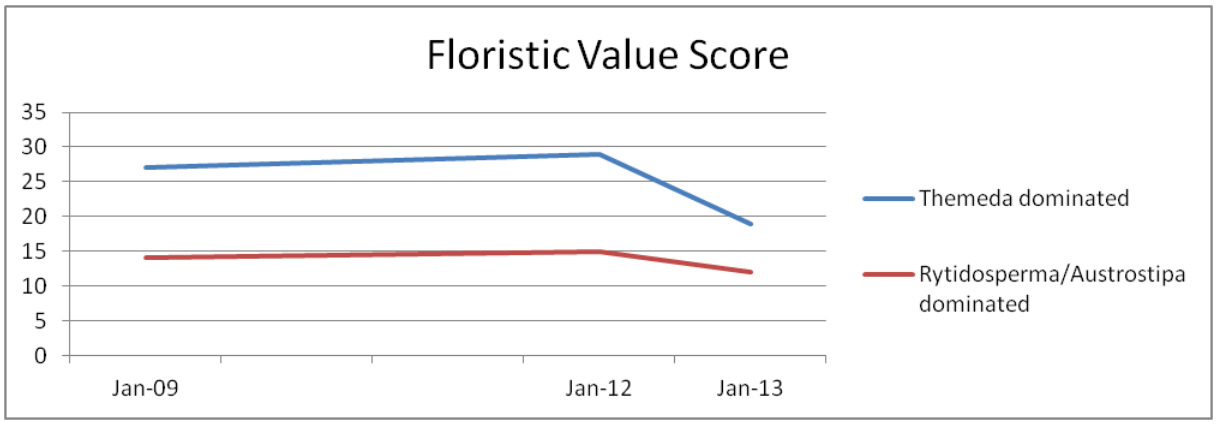
4.4 Interpretation of Results

The following shows a graphical representation of the results shown in **Table 4.2**. The graphs show a minor, gradual decrease in the number of native species, and increase in the number of exotic species. While overall quality has slightly decreased in 2013, the FVS are still considered moderate to high, and the decline is not considered substantial.

Graph 4.1 – Representation of Diversity within Natural Temperate Grassland Quadrats







5.0 Discussion

5.1 Perunga Grasshopper

No perunga grasshoppers were recorded during the survey undertaken by Umwelt. In addition, no grasshoppers had previously been observed during grassland surveys of the project area. It is considered, based on the results of this survey, and the lack of previous opportunistic sighting of the species, that perunga grasshopper is unlikely to be present on the site. If it does occur, it is likely to be at very low densities that were undetectable during surveys.

5.2 Golden Sun Moth

Golden sun moth is present in a number of locations throughout the project area, as previously mapped by Rowell (2012). The far south-western patch of habitat mapped by Rowell (2012) had been removed by recent road works, however all other patches were resurveyed.

No moths were observed in the southern-most patch, or the small, western patch of natural temperate grassland as shown in **Figure 3.1**; however all other areas of mapped habitat were observed to contain the species. Due to the variation in observations between survey days, it cannot be definitively concluded that the southern-most, or small, western patches no longer contain habitat, however if present, golden sun moth numbers during the course of surveys by Umwelt were considered too low for detection within these areas.

In general, numbers of flying moths were low across the site. Across four days of survey, an average of 12.5 moths per hour was recorded. However, this is higher than observations in Rowell (2012) where less than 3 moths per hour of survey were recorded. Additionally, the comparatively higher result from the current survey by comparison to that of Rowell (2012) may have been influenced by the disturbance and removal of cover as a result of slashing that occurred mid-survey.

As noted previously, slashing of golden sun moth habitat during the flying season may have influenced the results of the survey. In addition to this, regular slashing during the flying season has the potential to be negatively impacting the resilience of the populations. The ACT Government's 2012-13 Ecological Guidelines for Fuel and Fire Management Operations'[10] state that for golden sun moth:

> (PLAN 25.1) Where possible, slashing in GSM habitat should be minimised between Nov and Jan, to avoid the adult flying season.
>
> (OPS 25.2) Slashing in GSM habitat should not be undertaken below 10 cm.

The current management regime would not appear to be consistent with biodiversity conservation objectives for golden sun moth. When the LDA take ownership of this site, the management regime should be reviewed with consideration to this, as well as general maintenance and bushfire hazard management.

[10] ACT Government (2012). *2012-13 Ecological Guidelines for Fuel and Fire Management Operations*, Conservation Planning and Research, Canberra.

5.3 Natural Temperate Grassland

Both the *Themeda* and *Rytidosperma*/*Austrostipa* dominated areas meet the definition of the natural temperate grassland endangered ecological community under the EPBC Act.

FVS calculations suggest that the project area may have slightly declined in floristic values in the past two years, however the decline is not significant and may be an artefact of slightly different plot locations (the plots were not permanently marked) as some significant flora taxa recorded in low abundance by Rowell (2012) such as *Triptilodiscus pygmaeus* and *Gonocarpus tetragynus* were observed just outside plots surveyed as part of this study.

A decline in native and exotic species within the *Themeda* dominated area over time suggests that the dominance of kangaroo grass is likely to vary temporally, with higher species richness in times when inter-tussock spaces are prevalent (i.e. that the highest levels of biotic diversity are to be found at intermediate levels of disturbance and at intermediate time spans following the disturbance). However, data suggests that there may be an increase in the abundance of exotic species, with Chilean needlegrass (*Nassella neesiana*) and wild oats (*Avena* spp.) spreading further across the project area.

No EBPC Act threatened plant species were found to occur within the natural temperate grassland.

The areas of natural temperate grassland on the road verges of Dudley and Denman streets were less diverse and were reported by Rowell (2012) as having a higher proportion of weeds. This was verified as part of this study. Other areas were either dominated by exotic grasses such as Chilean needlegrass and wild oats, often with disturbance tolerant red-leg grass (*Bothriochloa macra*).

6.0 Conclusion

The following section summarises the key conclusions from this ecological assessment.

Perunga Grasshopper

It is concluded that it is unlikely that perunga grasshopper is present in the project area. No further survey is considered necessary for this species.

Golden Sun Moth

As previously recorded, a total of 2.5 hectares of golden sun moth habitat is present over a number of locations throughout the project area. In these areas, moths occur in varying densities, with the road reserves of Cotter Road, Denman Street, and the small Uniting Church patch maintaining the highest populations.

Species presence and density is understood, and despite some uncertainties associated with slashing conducted during surveys (discussed in **Section 5.2**), further surveys to describe or assess the conservation significance of the project area for this species are not necessary at this point in time; however an ongoing monitoring program should be considered.

Natural Temperate Grassland

The previously mapped 1.3 hectares of natural temperate grassland is still present within the site, and meets the definition of the endangered ecological community under the EPBC Act.

Community extent and quality are well understood, and further surveys are not considered necessary at this point in time.

Approvals Required

Any impact to golden sun moth habitat within the project area is considered significant under the EPBC Act due as a result of it being listed as a Critically Endangered species.

Any impact to natural temperate grassland would require assessment under the EPBC Act.

A referral under the EPBC Act is therefore required for any development of the project area.

Management Recommendations

The current management regime of the site has resulted in some ongoing degradation of habitat in particular the slashing regime during golden sun moth flying periods, and the management of weeds.

Management of identified areas of habitat to be retained as open space within the future urban area is recommended to be reviewed in light of the findings of this report, to promote the long term viability of golden sun moth.

Detrimental effects from shading, landscaping, weed invasion, foot traffic, changes to mowing frequency and alteration to site drainage could all result in loss of biodiversity within adjacent areas of habitat. Effects such as these could be partly mitigated by a buffer zone between habitat and the development edge, and the development and implementation of a conservation management plan.

7.0 References

ACT Government (1999). *Perunga Grasshopper (Perunga ochracea): A vulnerable species. Action Plan No. 21.* Environment ACT, Canberra.

ACT Government (2006). *National Recovery Plan for Natural Temperate Grassland of the Southern Tablelands (NSW and ACT): An Endangered Ecological Community,* Environment ACT, Canberra.

ACT Government (2012). *2012-13 Ecological Guidelines for Fuel and Fire Management Operations*, Conservation Planning and Research, Canberra.

DEWHA (2009). *Significant Impact Guidelines for the Critically Endangered Golden Sun Moth (Synemon plana). EPBC Act Policy Statement 3.12.* Department of Environment, Water, Heritage and the Arts, Canberra.

Rehwinkel, R. (2007). *A Method to Assess Grassy Ecosystem Sites: Using floristic Information to Assess a Sites Quality*. NSW Department of Environment and Climate Change.

Rowell, A. (2012). *Environmental Assessment of Blocks for Proposed Diplomatic Subdivision (Stirling Ridge, Near Old Canberra Brickworks, and Land adjacent to Federal Golf Club)*. Prepared for the National Capital Authority, Canberra.

APPENDIX 1

Floristic Survey Data

Plot 1 – Floristic Survey Data

Date		28/11/2013	
Description		*Rytidosperma* / *Austrostipa* dominated	
Location		GDA94 Zone 55 690377 E, 6090301 N	
Site Parameters			
Landform	Gentle midslope	**Bare Ground**	5%
Soil Type	Clay	**Litter**	2%
Rock	0%	**Cryptograms**	<1%

Native taxa	Sig 1/2	C/A	Exotic taxa	Sig 1/2	C/A
Bothriochloa macra	-	2	*Hypochaeris radicata*	-	1
Chrysocephalum apiculatum	1	1	*Vulpia myuros*	-	1
Rytidosperma laevis	-	2	*Tolpis barbata*	-	r
Cheilanthes sieberi subsp. sieberi	2	+	*Aira spp.*	-	1
Acaena ovina	-	r	*Hypochaeris glabra*	-	+
Austrostipa bigeniculata	-	4	*Nassella neesiana*	-	+
Rytidosperma carphoides	-	+	*Avena spp.*	-	+
Plantago lanceolata	-	1	*Poa sieberiana*	-	+
Wurmbea dioica	2	r	*Trifolium campestre*	-	+
Hypericum gramineum	2	1	*Tragopogon dubius*	-	r
Euchiton sphaericus	-	+	*Anagallis arvensis*	-	r
Wahlenbergia communis	-	+	*Bromus molliformis*	-	+
Themeda triandra (syn. T. australis)	-	1	*Centaurium erythraea*	-	+
Swainsona sericea	2	r	*Briza minor*	-	+
Elymus scaber	-	+	*Conyza spp.*	-	+
Lomandra bracteata	1	r	*Petrorhagia nanteuilii*	-	r
Cymbonotus lawsonianus	-	r	*Gamochaeta purpurea*	-	+
Goodenia pinnatifida	2	+	*Paspalum dilatatum*	-	+
Wahlenbergia luteola	-	r			
Schoenus apogon	-	+			
Rumex dumosus	-	r			
Epilobium billardierianum	-	r			

Floristic Value Score: 12

Plot 2 – Floristic Survey Data

Date		28/11/2013	
Description		*Themeda* dominated	
Location		GDA94 Zone 55 690202 E, 6090280 N	
Site Parameters			
Landform	Footslope	**Bare Ground**	<1%
Soil Type	Clay loam	**Litter**	<1%
Rock	0%	**Cryptograms**	<0% (none observed)

Native Taxa	Sig 1/2	C/A
Themeda triandra (syn. T. australis)	2	5
Plantago varia	2	1
Goodenia pinnatifida	2	1
Hypericum gramineum	2	1
Poa sieberiana	-	+
Chrysocephalum apiculatum	1	1
Elymus scaber	-	+
Asperula conferta	2	r
Schoenus apogon	-	1
Eryngium rostratum (syn. E. ovinum)	2	+
Rytidosperma laevis	-	+
Lomandra bracteata	-	r
Dianella longifolia	-	r
Acaena ovina	-	r
Rumex brownii	-	r
Austrostipa bigeniculata	-	r
Wahlenbergia communis	-	r
Lomandra filiformis subsp. coriacea	1	r
Leptorhynchos squamatus	2	r
Carex inversa	-	+

Exotic Taxa	Sig 1/2	C/A
Plantago lanceolata	-	1
Centaurium erythraea	-	1
Hypochaeris radicata	-	1
Nassella neesiana	-	r
Hypericum perforatum	-	r

Floristic Value Score: 19

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Briefing Note

To: Irena Sharp (Land Development Agency)
From: Umwelt (Australia) Pty Limited
Author: Karina Carwardine
Date: 09 November 2015
Subject: Ecological Assessment at Revised Brickworks Project Area

Purpose

To communicate the outcomes of the additional ecological survey completed for the Canberra Brickworks and Environs Project in November 2015.

Findings

Up to 1.2 hectares of exotic pasture dominated by Chilean needlegrass (*Nassella neesiana*) was identified, which may provide suitable habitat for the critically endangered golden sun moth (GSM; *Synemon plana*). No other matters of ecological significance were neither identified, nor were any substantial areas of native vegetation.

Recommendations

It is recommended that surveys are completed in the coming weeks to identify whether any GSM occurs within these areas of potential habitat.

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This briefing note and any files transmitted with it are confidential and are intended to provide information for use in discussions between Umwelt and the named recipient(s) only.

1.0 Introduction

Umwelt was engaged to undertake a basic ecological assessment of Blocks 1, 7 and 20 Section 102, Yarralumla (the Project Area) (**Figure 1**). This area forms part of the Canberra Brickworks and Environs site.

These areas were not surveyed in detail in the initial ecological assessment completed by Umwelt in 2014, as the aim of these surveys was the validation of previously mapped threatened species habitat restricted to the native grassland areas to the south of Denman Street.

The objective of the current assessment was to identify whether any ecological triggers for Impact Track Assessment under Schedule 4 of the *Planning and Development Act 2007* (PD Act) were applicable, or whether any matters of national environmental significance (MNES) protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were likely to be impacted. These triggers include the clearing of native vegetation, and impact to listed threatened species.

2.0 Methodology

A Senior Ecologist from Umwelt undertook a meandering survey of the Project Area on 6 November 2015. To address the project objectives, the survey focussed on delineating vegetation types, and identifying potential threatened species habitat.

Descriptions of each vegetation type were made, and the following map (**Figure 2**) developed based on observations. No quantitative surveys were undertaken as a component of the assessment.

3.0 Results

The survey identified a range of vegetation types which were in general, highly modified and dominated by exotic species.

The areas of the quarry and historic landfill were highly modified from cut and fill, and did not contain any natural features, support native vegetation or threatened species habitat.

The areas containing landscape tree plantings contained an exotic understorey. While the trees may provide potential opportunistic shelter for wide ranging species such as birds, they do not represent habitat for threatened species. The exotic composition of the plantings provides limited opportunities for most native species and is unlikely to represent and area of any importance to any listed species.

The areas of exotic pasture surrounding the entrance road to the site are dominated by Chilean needlegrass, a noxious weed. Recent studies have shown that GSM, which was previously understood to be a native grassland specialist, also occurs within Chilean needlegrass, due to a lifecycle dependence on C3 grasses (cool season or yearlong growing grasses) (Richter *et al*., 2010[1]).

[1] Richter A, Osbourne W & Tragoutt M (2010) *Dietary specialisation in the Golden Sun Moth Synemon plana – the key to understanding habitat requirements and site rehabilitation for this critically endangered species,* final report to Biodiversity and Programs Branch, Department of Sustainability and Environment (Victoria).

Figure 1 – Project Area

Table 1 provides a description of each vegetation type observed on site. This table should be read in conjunction with **Figure 2** which illustrates the distribution of vegetation, identified by the 'Code' field below.

Table 1 – Results of Vegetation Survey

Code	Definition	Potential GSM Habitat?	Description	Approximate Area (ha)
A	Exotic pasture	✓	Dominated by Chilean needlegrass (*Nassella neesiana*) with patches of African lovegrass (*Eragrostis curvula*). Dense regrowth has reduced inter-tussock spaces, rendering this area low quality potential GSM habitat.	0.2
As	Exotic pasture, slashed	✓	Dominated by Chilean needlegrass (*Nassella neesiana*) with patches of African lovegrass (*Eragrostis curvula*). This area is frequently slashed, with inter-tussock spaces suitable for GSM larval hatchings. Potential to be low-moderate quality GSM habitat.	1.0
B	Planted deciduous exotic trees, exotic understorey	×	Primarily Algerian Oak (*Quercus canariensis*), with an exotic understorey. Some Chilean needlegrass beneath, but summer shading renders this area not suitable for GSM.	0.15
C	Planted *Pinus radiata*, exotic understorey	×	Planted Pinus radiata, with numerous deciduous exotic trees, blackberry (*Rubus fruticosus* agg.), Cotoneaster (*Cotoneaster* spp.) and an exotic understorey dominated by phalaris (*Phalaris aquatica*), prairie grass (*Bromus catharticus*), and wild oats (*Avena* spp.). Infrequent occurrences of Chilean needlegrass and serrated tussock (*Nassella trichotoma*).	5.0
CLR	Cleared	×	Cleared.	0.1
D	Exotic pasture, former asphalt area	×	Former asphalt area. Fractured surface is dominated by numerous exotic forbs including small burnet (*Sanguisorba minor*) and narrow-leaf clover (*Trifolium angustifolium*), with exotic grasses including African lovegrass and wild oats. Minor native component of red-leg grass (*Bothriochloa macra*).	1.0
Ex	Exotic pasture	×	Exotic pasture dominated by perennial ryegrass (*Lolium perenne*), ribwort plantain (*Plantago lanceolata*), prairie grass, African lovegrass, red-flowered mallow (*Modiola caroliniana*), clustered clover (*Trifolium glomeratum*), haresfoot clover (*Trifolium arvense*), barley grass (*Hordeum leporinum*), fescue (*Festuca* spp.), rats-tail fescue (*Vulpia myuros*), buchan weed (*Hirschfeldia incana*), wild sage (*salvia verbenaca*), paspalum (*Paspalum dilatatum*) and wild oats. Occasional native elements including red-leg grass.	1.0
F	Landfill	×	Filled area. Not accessible through locked gate, visual assessment considers area to be dominated by annual exotic grasses. Not GSM habitat due to lack of structured soil profile.	0.2
I	Infrastructure	×	Brickworks site and associated infrastructure including roads and buildings.	3.0
Q	Quarry site	×	Dominated by planted radiata pine, and quarry pits regenerated with exotic pastures in line with area 'D'.	4.5
R	*Rytidosperma* spp. native grassland	✓	Small patch dominated by wallaby grass (*Rytidosperma* spp.), low likelihood of GSM occurrence.	0.01

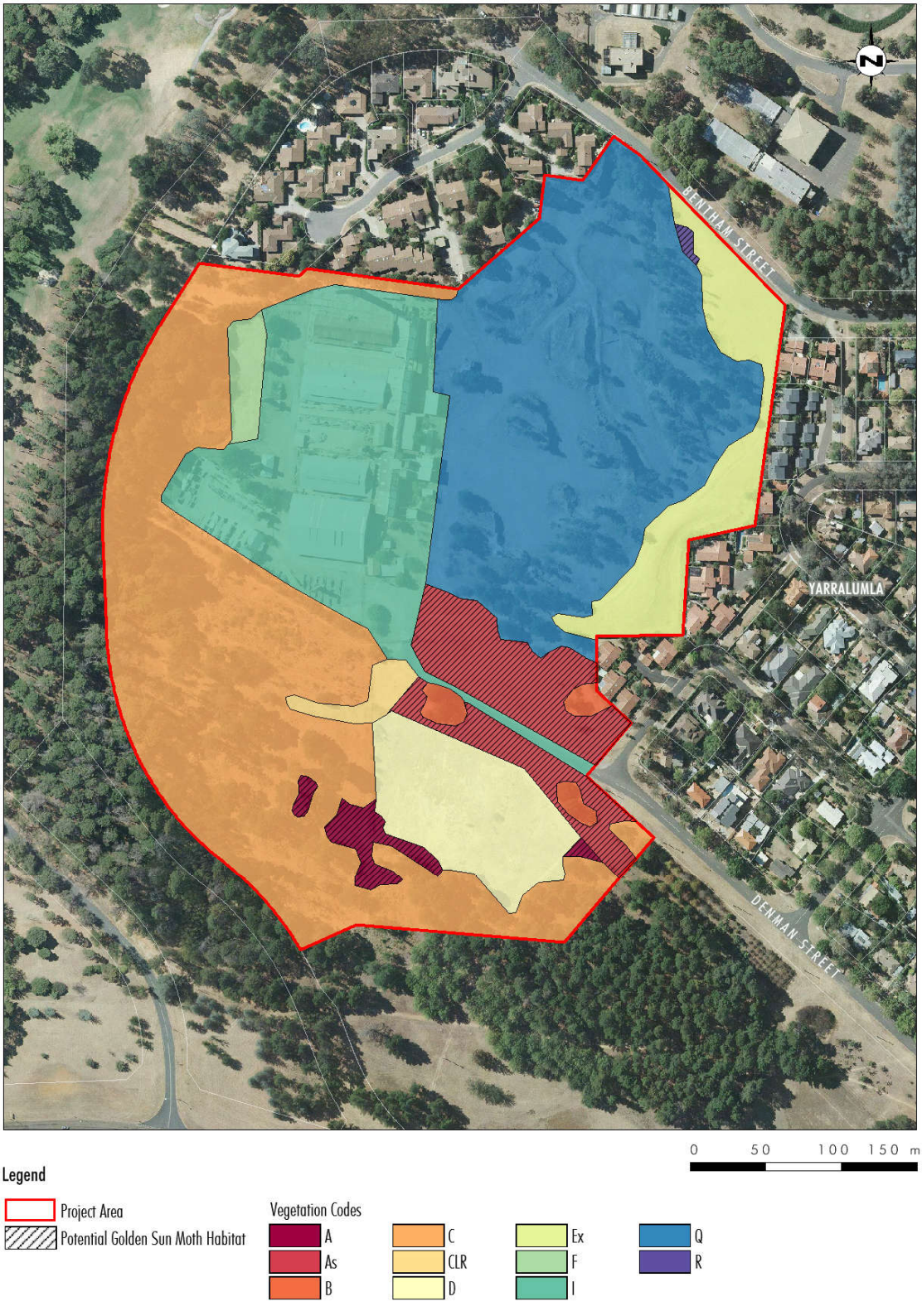

Figure 2 – Vegetation Map

4.0 Discussion

The aim of the project was to identify whether any ecological triggers under the PD Act or EPBC Act would apply to development of the Project Area. The following **Table 2** provides a summary of the applicable legislation.

Table 2 – Legislative Triggers

Legislation	Trigger	Applicable?	Discussion
EPBC Act	Impact to a matter of national environmental significance	Potential habitat for golden sun moth, a critically endangered invertebrate.	The identified potential habitat is a disturbed grassland, dominated by the noxious weed Chilean needlegrass. If the area is found to support golden sun moth, it would be considered an isolated small patch. Quality is likely to be moderate at best, however this would need to be assessed as a function of GSM abundance and noxious weed abundance. The presence or absence of the species should be verified in order to determine applicability of the Acts.
PD Act	Impact on threatened species or ecological communities.	Potential habitat for golden sun moth, a critically endangered invertebrate.	
PD Act	The clearing of more than 0.5ha of native vegetation in a native vegetation area	No.	There is not >0.5 hectares of native vegetation on the site.

5.0 Recommendations

It is recommended that a targeted golden sun moth survey is completed in the late 2015 GSM flying season (any time from late spring to early summer depending on seasonal conditions) to establish whether the species is present within the site. This would be a relatively simple exercise, as the area of habitat is small.

The methodology for golden sun moth surveys is as follows:

As per the EPBC Act Golden Sun Moth survey guidelines (DEWHA 2009[2]), survey is required to be undertaken over a period of four (4) non-consecutive days, with survey days targeted based on suitable climatic conditions (as follows):

- a warm to hot day (above 20°C by 10:00 am);
- the warmest part the day (i.e. between 10:00 am and 2:00 pm);
- clear or mostly cloudless sky;
- still or relatively still wind conditions during the survey period;
- ≥ 2 days since rain; and
- staggered to increase the likelihood of detection given the short adult life span (1-4 days between surveys).

The results of this survey will confirm species presence or absence, which will inform the requirement for further assessment or approvals.

References

DEWHA (2009) *Significant impact guidelines for the critically endangered golden sun moth (Synemon plana)*, Department of Environment, Water, Heritage and the Arts (Canberra).

Richter A, Osbourne W & Tragoutt M (2010) *Dietary specialisation in the Golden Sun Moth Synemon plana – the key to understanding habitat requirements and site rehabilitation for this critically endangered species,* final report to Biodiversity and

[2] DEWHA (2009) *Significant impact guidelines for the critically endangered golden sun moth (Synemon plana)*, Department of Environment, Water, Heritage and the Arts (Canberra).

Briefing Note

To: Irena Sharp (Land Development Agency)
From: Umwelt (Australia) Pty Limited
Author: Karina Carwardine, Rainer Rehwinkel
Date: 10 February 2016
Subject: Canberra Brickworks and Environs Project: Golden Sun Moth Survey and Ecological Assessment of the Dudley Street Road Reserve

Purpose

To communicate the outcomes of the golden sun moth (*Synemon plana*) survey and brief vegetation assessment completed for the Canberra Brickworks and Environs Project in December 2015 and January 2016.

Outcomes/Key messages

Golden sun moth, listed as critically endangered under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was confirmed to occur throughout the Dudley Street Road Reserve, in areas of both native and exotic grassland.

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1.0 Introduction

Umwelt was engaged in late December 2015 to undertake a targeted survey for golden sun moth within the Dudley Street road reserve in Yarralumla (from Cotter Road to Kent Street, as shown in **Figure 1**) as part of the ongoing Canberra Brickworks and Environs Project.

Despite the relatively late commencement of the work into the golden sun moth flying season, surveys were undertaken generally in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) survey guidelines for this species. However, the short time available to complete the scope of work resulted in some limitations to the application of the methodology and these are discussed further in subsequent sections.

To support the golden sun moth surveys, a brief vegetation survey was also undertaken. This survey focused on the delineation of native and exotic areas in order to confirm the extent of potential golden sun moth habitat. The vegetation component was conducted using a meandering survey methodology, and did not include any quantitative assessment.

Figure 1 – Project Area

2.0 Methodology

2.1 Vegetation Assessment

A Senior Ecologist from Umwelt undertook a meandering survey of the Project Area on 4 January 2016. To address the project objectives, the survey focussed on delineating vegetation types present at a high level, and identifying any potential threatened species' habitat.

Descriptions of each vegetation type were made, and a map (**Figure 2**) was developed based on observations. No quantitative surveys (such as quadrats) were undertaken as a component of the assessment.

2.1.1 Limitations

As no quantitative surveys were completed, and the objective of the vegetation assessment was to identify native and exotic areas, the delineation shown in **Figure 2** is high level, and should only be considered at the scale presented in the provided maps.

2.2 Golden Sun Moth Survey

The EPBC Act Golden Sun Moth survey guidelines (DEWHA 2009a[1]) specify conditions for surveys. They are to be undertaken over a period of four (4) non-consecutive days, with survey days targeted based on suitable climatic conditions (as follows):

- A warm to hot day (above 20°C by 10:00 am);
- The warmest part the day (i.e. between 10:00 am and 2:00 pm);
- Clear or mostly cloudless sky;
- Still or relatively still wind conditions during the survey period;
- ≥ 2 days since rain; and
- Staggered to increase the likelihood of detection given the short adult life span (1-4 days between surveys).

The methodology used involved a meandering survey and point observations. During the meander, whenever a moth was identified, the observer would record the GPS location, and count the number of moths visible in the immediate vicinity.

The entire Project Area was surveyed on each occasion.

All golden sun moth surveys were undertaken by appropriately qualified and experienced Environmental Scientists.

2.2.1 Survey Limitations

Due to Umwelt's engagement after the flying season had already commenced, not all survey efforts were able to be compliant with the survey guidelines. Two survey efforts were completed on consecutive days (18/12 and 19/12) to take advantage of suitable weather conditions. Also, due to cool weather leading up to Christmas, the last survey effort (24/12) was undertaken towards the end of the flying season, which is apparent in the lower number of observations made, and correlation from other reference sites (pers. comm.) across Canberra which noted a decline in observations from Mid-December.

[1] DEWHA (2009a) *Significant impact guidelines for the critically endangered golden sun moth (Synemon plana)*, Department of Environment, Water, Heritage and the Arts (Canberra).

3.0 Results

3.1 Vegetation Assessment

The vegetation assessment identified a range of vegetation types, including areas of natural grassland in various condition classes and areas of highly disturbed exotic grassland. Most of the trees and shrubs present were exotic species.

Native grassland covered 0.8 hectares (17%) of the Project Area. Some areas of grassland were identified as the endangered ecological community *Natural Temperate Grassland of the Southern Tablelands (NSW and ACT)* (natural temperate grassland). These areas were dominated by kangaroo grass (*Themeda triandra)* or mixtures of *T. triandra,* corkscrew grass (*Austrostipa scabra*) and red grass (*Bothriochloa macra*). Other native grasses and a variety of forbs were also present. Forb diversity varied between areas that were highly diverse and intact, to those low in diversity and highly disturbed.

The areas containing exotic landscape tree plantings were mostly typified by ground layer vegetation dominated by exotic grasses, with a minor component of native grasses and some disturbance-tolerant native forbs.

Exotic grassland covered 2.9 hectares (64%) of the Project Area. The areas of exotic grassland covering much of the Project Area were dominated by Chilean needlegrass (*Nassella neesiana*), a noxious weed. Other exotic grasses occur, with African lovegrass (*Eragrostis curvula*), paspalum (*Paspalum dilatatum*) and tall fescue (*Festuca arundinacea*) being the most common. Another noxious weed species, St John's wort (*Hypericum perforatum*) occurred throughout the site in varying densities. Occasional native grasses and disturbance-tolerant native forbs were scattered within the exotic grasslands and under the exotic trees.

Table 1 provides a description of each vegetation type observed within Project Area. This table should be read in conjunction with **Figure 2**, which illustrates the distribution of vegetation, identified by the 'Unit' field below.

Table 1 – Results of Vegetation Survey

Unit	Definition	Description	Approximate Area (ha)	Potential GSM Habitat?
1	Tree plantation, exotic ground layer (not slashed)	Dominated by oaks (*Quercus* spp.) and pines (*Pinus* spp.), with a ground layer dominated by Chilean needlegrass (*Nassella neesiana*). Some minor occurrences of native grasses and forbs, including River Tussock (*Poa labillardierei*), Common Snowgrass (*Poa sieberiana*), Tall Speargrass (*Austrostipa bigeniculata*) and Common Everlastings (*Chrysocephalum apiculatum*), and with scattered St John's Wort (*Hypericum perforatum*), Serrated Tussock (*Nassella trichotoma*), Blackberry (*Rubus fruticosus*) and other exotic grasses and forbs. Trees may provide shelter and feeding habitat for birds, including the NSW Listed Gang-Gang Cockatoo (*Calocephalon fimbriatum*).	0.9	No
2	Exotic grassland (slashed)	Dominated by *N. neesiana*, with other exotic grasses and forbs, including paspalum (*Paspalum dilatatum*), African lovegrass (*Eragrostis curvula*), with scattered *A. bigeniculata* and Monterey pine (*Pinus radiata*).	0.9	Yes
3	Exotic grassland (slashed)	Co-dominated by *N. neesiana, P. dilatatum* and *E. curvula*, with other exotic grasses and forbs, including St John's wort (*Hypericum perforatum*). A cluster of *P. radiata* in the west and a dense planting of Mexican pine (*P. patula*) in the east, and a lone elm (*Ulmus* sp.). Minor occurrences of native grasses and forbs, including *A. bigeniculata, C. apiculatum,* kangaroo grass (*Themeda triandra*), native bindweed (*Convolvulus angustissimus*), red	0.5	Yes

Unit	Definition	Description	Approximate Area (ha)	Potential GSM Habitat?
		grass (*Bothriochloa macra*) and scrambled eggs (*Goodenia pinnatifida*).		
4	Natural Temperate Grassland EEC (slashed)	An area of natural temperate grassland endangered ecological community (NTG EEC), with a co-dominance of native grasses including *T. triandra*, *B. macra,* corkscrew grass (*Austrostipa scabra*) and minor occurrences of *C. apiculatum* and a wallaby grass (*Rytidosperma* sp.). A high cover of *N. neesiana, P. dilatatum*, *E. curvula*, tall fescue (*Festuca arundinacea*) and other exotic grasses and forbs, including *H. perforatum*. The NTG in this unit extends south beyond the Project Area, however the total area is less than 0.1ha, below the minimum patch size for consideration as the EPBC listed ecological community[2].	0.02	Yes
5	Natural Temperate Grassland EEC (slashed)	An area of NTG EEC, with a co-dominance of native grasses including *T. triandra*, *B. macra* and *A. scabra,* and with a moderate diversity of other grasses and forbs, including occurrences of *C. apiculatum, G. pinnatifida,* a wiregrass (*Aristida* sp.), Nodding Saltbush (*Einadia nutans*), Many-flowered Mat-rush (*Lomandra multiflora*), Grassland Wood-sorrel (*Oxalis perennans*) and a native bluebell (*Wahlenbergia* sp.). A moderate cover of *N. neesiana* and *E. curvula*, and some *P. dilatatum,* a lone *R. fruticosus* and several other exotic grasses. Areas of bare ground (c. 5 %) and patches of cryptogams.	0.2	Yes
6	Exotic grassland (slashed)	A large part of this unit is bare ground (an unformed track surface). Grassland co-dominated by *N. neesiana, E. curvula*, and with other exotic grasses and forbs. Scattered native grasses include couch (*Cynodon dactylon*), windmill grass (*Chloris truncata*) and *B. macra*.	0.03	Yes
7	Exotic grassland (slashed)	Co-dominated by *N. neesiana, P. dilatatum*, *E. curvula* and *F. arundinacea*, and with other exotic grasses and forbs. A cluster of densely planted *P. radiata*. Occurrences of disturbance-tolerant native grasses and forbs, including *A. bigeniculata, B. macra, C. dactylon,* weeping grass (*Microlaena stipoides*) *O. perennans* and swamp dock (*Rumex brownii*).	0.2	Unlikely
8	Natural Temperate Grassland EEC (slashed)	An small area of NTG EEC, with a co-dominance of native grasses including *B. macra* and *A. scabra,* with *C. apiculatum* and a moderate cover of *N. neesiana, P. dilatatum*, and other exotic grasses and forbs. The NTG in this unit is less than 0.1 hectares, below the minimum patch size for consideration as the EPBC listed ecological community.	0.02	Yes
9	Exotic grassland (slashed)	Co-dominated by *N. neesiana, P. dilatatum* and *E. curvula*, and with other exotic grasses and forbs. Bordered by ash trees (*Fraxinus* sp.) and Cootamundra wattle (*Acacia baileyana*). Minor occurrences of *T. triandra* and *R. brownii.*	0.05	Yes
10	Natural Temperate Grassland EEC (slashed)	An area of NTG EEC, with a co-dominance of native grasses and forbs, including *T. triandra*, *A. scabra* and with *C. apiculatum, B. macra,* wallaby grasses (*Rytidosperma* spp.), *A. bigeniculata,* New Holland daisy (*Vittadinia muelleri*) and with minor occurrences of *Wahlenbergia* sp., caustic-weed (*Chamaesyce drummondii*), sheep's burr (*Acaena ovina*) and	0.1	Yes

[2] https://www.environment.gov.au/system/files/pages/6a948bae-0207-43a2-a5fe-1b2c8af4861b/files/draft-conservation-advice-temp-grasslands-se-highlands-ne-tablelands.pdf

Unit	Definition	Description	Approximate Area (ha)	Potential GSM Habitat?
		Convolvulus angustissimus. A moderate cover of *N. neesiana, E. curvula*, *P. dilatatum* and with other exotic grasses and forbs. Bare ground between 5 and 30%, apparently caused by slashing too close to the ground. Area partially bounded to the north by *P. radiata*, *A. baileyana* and cotoneaster (*Cotoneaster* sp.). The NTG in this unit extends to the north, beyond the Project Area. It was noted that the current management of NTG to the north of this unit should be reviewed for effectiveness, given the high incidence of *H. perforatum*, some *R. fruticosus* and seedlings of *A. baileyana*.		
11	Exotic grassland (slashed)	Co-dominated by *N. neesiana, P. dilatatum*, *E. curvula* and *F. arundinacea*, and with other exotic grasses and forbs, including *H. perforatum*. Occurrences of disturbance-tolerant native grasses, including *A. scabra, Rytidsoperma* spp.*, B. macra,* and minor occurrences of Native Woodruff (*Asperula conferta*) and *T. triandra,* especially adjacent to the area of NTG.	0.4	Yes
12	Natural Temperate Grassland EEC (not slashed)	A large area of high-quality NTG EEC, with a dominance of *T. triandra* and a diversity of other native grasses and forbs, including, *A. scabra, A. bigeniculata, P. labillardierei*, *P. sieberiana*, wallaby-grasses (*Rytidosperma* spp.), Blue Devil (*Eryngium ovinum*) Variable Plantain (*Plantago varia*), *G. pinnatifida,* and with minor occurrences of *C. apiculatum, R. brownii,* a plume-grass (*Dichelachne* sp.), yellow rush-lily (*Tricoryne elatior*), *Aceana ovina, Asperula conferta,* wattle mat-rush (*Lomandra filiformis*) and *C. angustissimus*. Patchy cover of exotic grasses and forbs, including Wild Oats (*Avena* sp.) and occasional scattered *H. Perforatum*, and a lone Blakely's red gum (*Eucalyptus blakelyi*). The area of NTG extends to the north of the Project Area. This area of NTG is in need of biomass control and weed management.	0.3	Unlikely, due to dominance of *T. triandra*.
13	Natural Temperate Grassland EEC (not slashed)	An area of NTG, dominated by *P. labillardierei* and some *T. triandra,* and with a high cover of exotic annual grasses (mostly *Avena* sp.) and perennial grasses and forbs, including *N. neesiana, P. dilatatum* and *H. perforatum.* This area of NTG is in need of biomass control and weed management.	0.05	Potential
14	Mixed grassland (slashed)	An area of marginal native grassland, co-dominated by *T. triandra, B. macra* and *A. scabra* and with *A. bigeniculata, C. apiculatum* and minor occurrences of small St John's wort (*Hypericum gramineum*), swamp raspwort (*Haloragis heterophylla*), a *Wahlenbergia* sp.*,* and a cudweed (*Euchiton* sp.) and with a high cover of exotic perennial grasses and forbs, including *N. neesiana, P. dilatatum* and *E. curvula.* Includes a cluster of *P. radiata.*	0.2	Potential, however substantial shading by pines limits likelihood of observing flying moths.

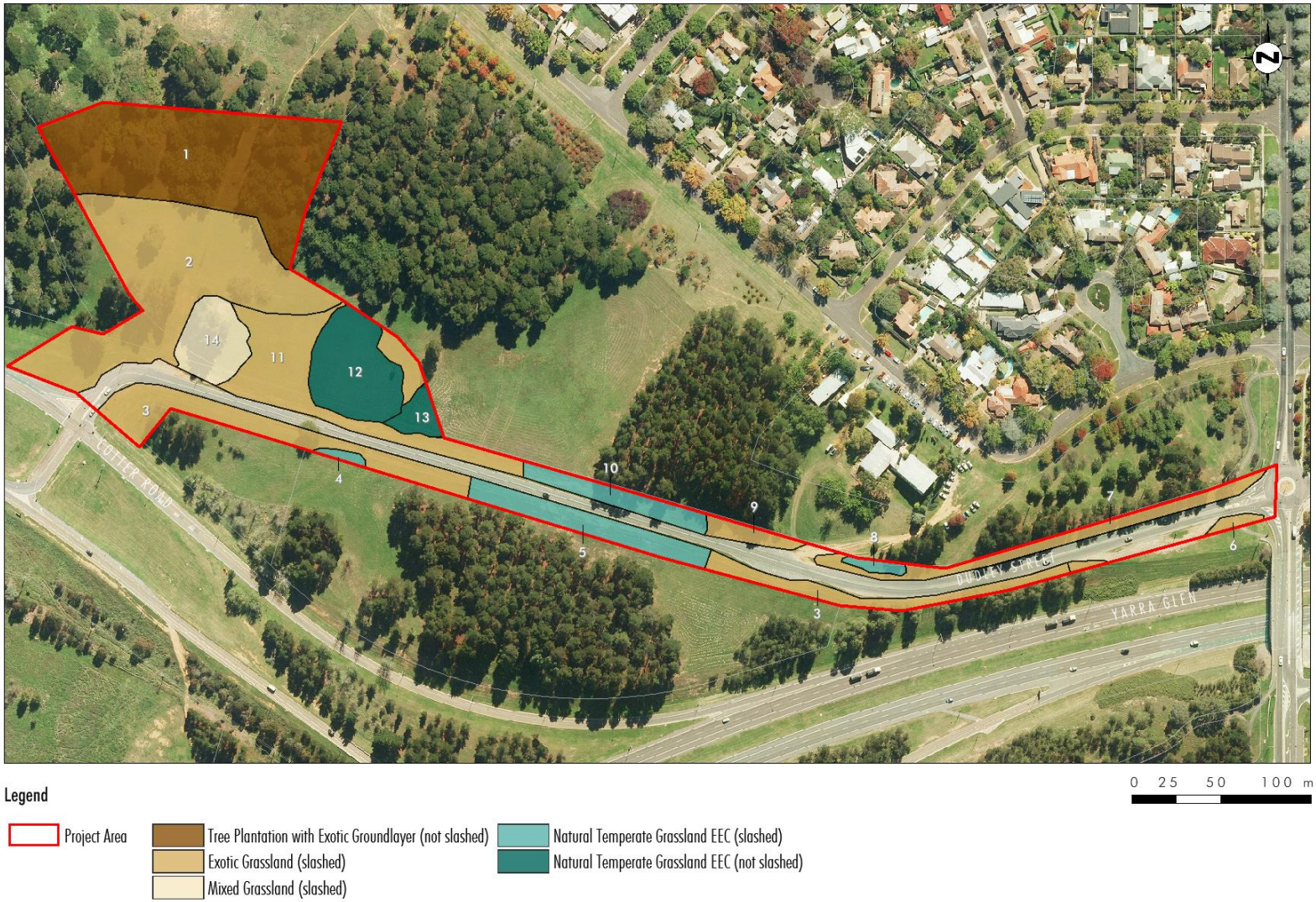

Figure 2 – Vegetation Assessment Results

3.2 Golden Sun Moth Survey

Survey results are shown in **Table 2** and **Figures 3**. The entire Project Area was surveyed on each survey effort.

Table 2 – Survey Details and Results

Date and Time	Weather	Sightings	Notes (Units refer to Figure 2)
16/12/2015 10:30 – 11:10	Slightly cloudy and breezy. Temp: 24°C Wind: 20km/hr ESE Rain: 0mm	37	- 2 moths in Vegetation Unit 6 - 8 moths in Vegetation Unit 6, south of Dudley Street - 8 moths in Vegetation Unit 2, north of Dudley Street - 19 moths in Vegetation Unit 11
18/12/2015 10:30 – 11:05	Clear and sunny. Temp: 28°C Wind: 11km/hr N Rain: 0mm	33	- 6 moths in Vegetation Unit 6, south of Dudley Street - 6 moths in Vegetation Unit 2, north of Dudley Street - 12 moths in Vegetation Unit 11 - 9 moths in Vegetation Unit 9
19/12/2015 11:00 – 11:25	Clear and sunny, breezy. Temp: 31°C Wind: 15km/hr WNW Rain: 0mm	19	- 3 moths in Vegetation Unit 3, south of the Uniting Church - 8 moths in Vegetation Unit 2, north of Dudley Street - 7 moths in Vegetation Unit 11 - 1 moth in Vegetation Unit 9
24/12/2015 10:17 – 10:47	Mostly sunny. Temp: 20.5°C Wind: 15km/hr ESE Rain: 0mm	5	Note: This survey was undertaken towards the end of the flying season, and lower numbers of flying moths was apparent. - 2 moths in Vegetation Unit 6 - 1 moth in Vegetation Unit 6, south of Dudley Street - 2 moths in Vegetation Unit 2, north of Unit 14.

Figure 4 presents the relative quality of golden sun moth habitat, based on the vegetation assessment and moth observations, as summarised in **Table 3**.

Table 3 – Summary of Relative Habitat Quality

Vegetation Type	Comprises Vegetation Units	Relative Number of Moths	Area (ha)
Exotic Grassland	2 and 6	Low	0.9
Exotic Grassland (Chilean Needlegrass Dominated)	3, 9 and 11	Moderate	0.9
Mixed Grassland	14	Absent. Potential Habitat.	0.2
Native Grassland	4, 5, 8 and 10	Moderate	0.3
Natural Temperate Grassland	13	Absent. Potential Habitat.	0.05

Figure 3 – Golden Sun Moth Survey Results

Figure 4 – Relative Quality of Golden Sun Moth Habitat

4.0 Discussion

Based on the wide distribution of golden sun moths throughout the Project Area, the majority of the site has been determined to constitute habitat, albeit of varying quality. Quality has been determined based on vegetation composition and moth observations, as shown in **Table 3** and **Figure 4**.

Sections of the Project Area previously surveyed for golden sun moth (Umwelt, 2014) had been assigned an overall 'moderate' quality based on vegetation quality and historical moth observations. This has been retained as the highest relative quality for the site.

The extent of habitat identified in this survey differs slightly from surveys completed in 2013. This is potentially due to a number of factors, including:

- The high biomass in Vegetation Unit 12 (Natural Temperate Grassland) makes the patch less suitable for golden sun moth. The current dominance of *T. triandra* also makes the patch less suitable for golden sun moth;

- The prevalence of Chilean needlegrass is likely to have increased without appropriate management, increasing the area of suitable habitat[3] for the species; and

- Annual distribution and observations may differ depending on emergence locations, moth flying patterns, weather conditions (e.g. wind blown moths), and other factors as discussed below.

There are inherent limitations associated with this survey method (observing flying male moths) that may also explain some annual variations in habitat mapping. Given females do not fly or fly very short distances, the presence of a male in any given location is not necessarily an indication of the presence of breeding habitat, but that the location is within the flying male dispersal distance from breeding habitat. As males are understood to be able to disperse to within 200 metres of their point of emergence, a margin of error needs to be allowed for in the interpretation of what constitutes golden sun moth habitat. This should also recognise that some locations that are not apparently occupied but otherwise support suitable features for golden sun moth could be regarded as potential habitat if they are functionally connected (adjoining) to areas where females are known to be present. Therefore areas of observed male golden sun moth flight are only considered habitat where suitable foraging habitat is also present.

Based on the surveys conducted in December 2015, there is approximately 2.1 hectares of golden sun moth habitat in the Project Area, and up to 0.25 hectares of potential habitat.

The area is considered to represent moderate quality habitat for the species, in addition to containing other ecological values, including areas of the natural temperate grassland endangered ecological community.

References

DEWHA (2009) *Significant impact guidelines for the critically endangered golden sun moth (Synemon plana)*, Department of Environment, Water, Heritage and the Arts (Canberra).

Richter A, Osbourne W & Tragoutt M (2010) *Dietary specialisation in the Golden Sun Moth Synemon plana – the key to understanding habitat requirements and site rehabilitation for this critically endangered species,* final report to Biodiversity and Programs Branch, Department of Sustainability and Environment (Victoria).

Umwelt (2014) *Canberra Brickworks and Environs Ecological Assessment*, report to the Land Development Agency, Canberra.

[3] Recent studies have shown that golden sun moth, which was previously understood to be a native grassland specialist, also occurs within stands of *N. neesiana*, due to a lifecycle dependence on C3 grasses (cool season or year-long-growing grasses) (Richter *et al*., 2010).

31 May 2017

David Carey
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Barton ACT 2600

Dear David

Re: Ecological Assessment Gap Analysis for the Canberra Brickworks (Blocks 1, 7 and 20, Section 102, Yarralumla)
Project no. 24105

Biosis Pty Ltd was commissioned by Doma Group to complete a gap analysis of past ecological assessments relating to the Canberra Brickworks Precinct (the subject site) ((Blocks 1, 7 and 20, Section 102, Yarralumla) following the selection of Doma Group as the preferred tenderer for the Canberra Brickworks development.

The objective of this gap analysis is to provide Doma Group with an understanding of ecological assessment requirements necessary to support approval of the proposed development of the subject site under the ACT *Planning and Development Act 2007* (PD Act) and Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Background

The subject site covers an area of approximately 16 hectares in south-east Yarralumla and includes the former brickworks, a quarry and railway remnants with open grassland in the south. The subject site and adjoining areas previously included in the Canberra Brickworks and Environs (CB&E) site, have been the subject of several ecological assessments dating back to 2010. Most recently, the subject site was the subject of an ecological assessment completed by Umwelt (2015) with subsequent targeted surveys for Golden Sun Moth *Synemon plana*, completed by Umwelt (2016). A Stage 1 site investigation report for subject site has been produced by AECOM (2016) for the ACT Land Development Authority and summarises the planning famework and key site investigations completed for the subject site, including the Umwelt (2015 and 2016) ecological assessments.

Method

Database and literature review

Information provided by Doma Group as well as other key publically accessible information was reviewed in order to inform the gap analysis. Field-based assessment or verification of information contained in information sources outlined below was beyond the scope of this report. Information reviewed included:

- Previous ecological assessment reports pertaining to the subject site and adjacent areas previously included in the CB&E development area, including:

- Canberra Brickworks and Environs Ecological Assessment (Umwelt 2014a).
- Addendum to the Canberra Brickworks and Environs Ecological Assessment (Umwelt 2014c).
- Stage 1 Site Investigation Report for Canberra Brickworks Precinct (AECOM 2016).
- Stage 1 Site Investigation Report for Canberra Brickworks Precinct - Appendix F – Golden Sun Moth Assessment at Revised Brickworks Project Area (Umwelt 2015).

- Draft ACT Native Grassland Conservation Strategy and Action Plans (ACT Government 2017).
- Publically accessible threatened species databases:
  - Commonwealth Department of the Environment and Energy (DEE) Protected Matters Search Tool for matters protected by the EPBC Act.
  - The ACT Government ACTMapi interactive mapping service.
  - The Atlas of Living Australia.
  - Canberra Nature Map.
  - NSW Office of Environment and Heritage (OEH) BioNet Atlas of NSW Wildlife, for items listed under the *Threatened Species Conservation Act 1995* (TSC Act).
- The future ecological assessment requirements for the proposed development of the subject site were assessed in relation to key biodiversity legislation and policy including:
  - EPBC Act
  - PD Act
  - Nature Conservation Act 2014 (NC Act)
  - EPBC Act Environmental Offsets Policy and Offsets Assessment Guide (Commonwealth of Australia 2012)
  - ACT Weed Strategy 2009 – 2019 (DECCEW 2009)
  - Draft ACT Native Grassland Conservation Strategy and Action Plans (ACT Government 2017)
  - Significant impact guidelines for the critically endangered golden sun moth (*Synemon plana*) (Commonwealth of Australia 2009).

Results

Literature review

The subject site and adjoining areas previously included in the Canberra Brickworks and Environs (CB&E) site, have been the subject of eight ecological studies dating back to 2010. These studies and their key findings are summarised in Table 1. Summaries of assessments undertaken by Rowell (2010, 2011 and 2012) have been obtained from Umwelt (2014), and were not available for review as part of the current report.

Table 1 Summary of previous ecological assessments

Ecological assessment	Summary	Key ecological values identified	Assessment considerations relevant to current gap analysis
Rowell (2010)	Preliminary assessment of the CB&E area for threatened species and communities listed under the EPBC and NC Acts. The scope of works were to map vegetation communities, habitat for Golden Sun Moth, survey for presence of Golden Sun Moth, and make recommendations for future surveys.	Confirmed presence of Golden Sun Moth and patches of diverse Natural Temperate Grassland within the CB&E study area but outside current subject site. Confirmed presence of Golden Sun Moth in the North Curtin Horse Paddocks south of the subject site. Natural Temperate Grassland identified between Denman Street and Dudley Street beyond the subject site. Floristic Value Score (FVS) of Natural Temperate Grassland calculated as 27 indicating the grassland patches were high conservation value.	Study area included the subject site however no targeted surveys undertaken within the subject site. Ecological values identified beyond the subject site. Spatial extent of Natural Temperate Grassland and Golden Sun Moth shown in Figure 2.2, 3.2 and 4.3 of Umwelt (2014). Grassland survey results analysed using the previous method to calculate Floristic Value Score (Rehwinkel 2007). This method has since been superseded by Rehwinkel (2015). Grassland survey results assessed against the previously listed *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* endangered ecological community (Endangered Species Scientific Subcommittee 2000). This community has since been superseded by *Natural Temperate Grassland of the South Eastern Highlands* critically endangered ecological community (TSSC 2016). Insufficient information to determine whether survey effort meets current survey guidelines for Golden Sun Moth (i.e. DEWHA 2009).
Rowell (2011)	Investigation of the CB&E site, to determine extent of occupancy of Golden Sun Moth, its relative abundance, breeding sites and habitat quality. CB&E site also assessed for the extent of Natural Temperate Grassland Threatened Ecological Community, and its potential as habitat for other threatened species.	Confirmed presence of 1.5 hectares of Natural Temperate Grassland, and approx. 5 ha of Golden Sun Moth habitat in both native and exotic dominated vegetation. Both located beyond current subject site. Natural Temperate Grassland and Golden Sun Moth population considered likely to be viable in the medium term. Average Golden Sun Moth observations from 2011 surveys reported in Umwelt (2014) as approx. 10 moths per hour.	Ecological values identified beyond the subject site. Grassland survey results analysed using the previous method to calculate Floristic Value Score (Rehwinkel 2007). This method has since been superseded by Rehwinkel (2015). Grassland survey results assessed against the previously listed *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* endangered ecological community (Endangered Species Scientific Subcommittee 2000). This community has since been superseded by *Natural Temperate Grassland of the South Eastern Highlands* critically endangered ecological community (TSSC 2016). Insufficient information to determine whether survey effort meets current survey guidelines for Golden Sun Moth (i.e. DEWHA 2009). Spatial extent of Natural Temperate Grassland and Golden Sun Moth habitat shown in Figure 2.2, 3.2 and 4.3 of Umwelt (2014).
Rowell (2012)	Assessment of three sites, including subject site to map vegetation community extent and quality, and survey / map habitat for threatened fauna including Golden Sun Moth, Perunga Grasshopper *Perunga ochracea* and threatened woodland birds.	No threatened bird species records or habitat were identified. Potential habitat for Perunga Grasshopper was identified, however the species was not identified during targeted surveys. Floristic Value Score of Natural Temperate Grassland – 29 indicating the grassland patches assessed by Rowell (2010) continued to have high conservation value.	Study area included the subject site however no targeted surveys undertaken within the subject site. Ecological values identified beyond the subject site. Grassland survey results analysed using the previous method to calculate Floristic Value Score (Rehwinkel 2007). This method has since been superseded by Rehwinkel (2015). Grassland survey results assessed against the previously listed *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* endangered ecological community

Ecological assessment	Summary	Key ecological values identified	Assessment considerations relevant to current gap analysis
	Floristic value scores were calculated for areas of Natural Temperate Grassland previously assessed by Rowell (2010).	Golden Sun Moth were found in very low numbers (Average number of observations – 3 per hour); however, it was noted that it was a poor season for observations across Canberra and this may have also affected results of surveys for the Brickworks site. Two locally uncommon flora species were identified: Swainson's Purple-pea *Swainsona sericea* and Native Storksbill *Pelargonium australe*.	(Endangered Species Scientific Subcommittee 2000). This community has since been superseded by *Natural Temperate Grassland of the South Eastern Highlands* critically endangered ecological community (TSSC 2016). Insufficient information to determine whether survey effort meets current survey guidelines for Golden Sun Moth (i.e. DEWHA 2009). Spatial extent of Natural Temperate Grassland and Golden Sun Moth shown in Figure 2.2, 3.2 and 4.3 of Umwelt (2014).
Umwelt (2014a)	Targeted surveys of Golden Sun Moth and Perunga Grasshopper using habitat polygons mapped by Rowell (2012) within the CB&E site. Survey to validate the extent of Natural Temperate Grassland within the CB&E site and calculate Botanical Significance Rating (BSR). Re-survey of floristic plots previously surveyed by Rowell (2012) to calculate Floristic Value Score (FVS) as per Rehwinkel (2007).	No Perunga Grasshoppper recorded. Golden Sun Moths observed within previously mapped habitat. Average number of observations -approx. 12.5 per hour. No Natural Temperate Grassland mapped within current subject site. Natural Temperate Grassland located outside subject site between Dudley and Denman Streets. Floristic Value Score of Natural Temperate Grassland – 19. Both FVS and number of native species was identified as lower than in previous years (i.e. Rowell 2009, 2012).	Study area included the subject site however no targeted surveys undertaken within the subject site. Ecological values identified beyond the subject site. Golden Sun Moth survey timing, effort and method meets guidelines. No quantitative assessment of Golden Sun Moth habitat quality. Grassland survey results analysed using the previous method to calculate Floristic Value Score (Rehwinkel 2007). This method has since been superseded by Rehwinkel (2015). Grassland survey results assessed against the previously listed *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* endangered ecological community (Endangered Species Scientific Subcommittee 2000). This community has since been superseded by *Natural Temperate Grassland of the South Eastern Highlands* critically endangered ecological community (TSSC 2016). No targeted surveys for threatened flora or fauna species other than Perunga Grasshopper and Golden Sun Moth reported.
Umwelt (2014b)	Site reconnaissance survey to identify Natural Temperate Grassland and potential Golden Sun Moth and Perunga Grasshopper habitat in expanded CB&E footprint – entry and exit ramps to Yarra Glen via Cotter Road – outside current subject site. Golden Sun Moth targeted surveys as per EPBC Act guidelines.	Mix of very low and low quality habitat along the road reserve on western side of Cotter Road, and north and south side of Yarra Glen. Low numbers of Golden Sun Moth detected – average approx. 10 moths per hour. Low quality habitat supported the greatest number of moths. Very low quality habitat links Golden Sun Moth population within CB&E to the Curtin Horse Paddocks population.	Study area outside the subject site. Golden Sun Moth survey timing, effort and method meet guidelines. However, conditions sub-optimal for past two survey days. No quantitative assessment of Golden Sun Moth habitat quality. Unclear whether native grassland areas meet Natural Temperate Grassland NC Act and/or EPBC Act listing. Umwelt (2015) determined additional survey for GSM not required in areas targeted.
Umwelt (2015)	Targeted Golden Sun Moth surveys within subject site in line with EPBC Act guidelines in order to confirm presence.	Golden Sun Moth recorded in low abundance north of Denman Street in south east of subject site. A total of 0.5 hectares of 'confirmed habitat' and further 0.4 hectares of 'potential habitat' comprising exotic pasture dominated by Chilean Needle-grass and African Lovegrass *Eragrostis curvula*. Habitat considered low quality.	Golden Sun Moth survey timing, effort and method meet guidelines. No quantitative assessment of Golden Sun Moth habitat quality. Golden Sun Moth population within the subject site considered unlikely to contribute to overall ecological health of the species as extremely small, isolated and degraded habitat.
AECOM (2016)	Provides a summary of the planning framework and key site investigation for the subject site	Golden Sun Moth identified as the key ecological constraint.	Information contained within report is based on findings of previous studies outlined above.

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Ecological assessment	Summary	Key ecological values identified	Assessment considerations relevant to current gap analysis
	including a summary of ecological assessment completed by Umwelt (2015).	Areas of landscape tree plantings occupy parts of the site and contain exotic tree species providing sheltering habitat for common wide-ranging species only. Planting do not provide habitat for threatened species. Exotic pasture in the south east around Denman Street is dominated by Chilean Needle-grass and provides habitat for Golden Sun Moth. Native vegetation within the subject site is less than 0.5 hectares.	
Biosis (2017)	Targeted Golden Sun Moth surveys within current subject site (as per areas surveyed by Umwelt 2015) in line with EPBC Act guidelines, in order to confirm presence.	Golden Sun Moth recorded north and south of Denman Street within habitat previously mapped by Umwelt (2015). Average Golden Sun Moth observations – 17 per hour.	Golden Sun Moth observations within the subject site substantially higher than Umwelt (2015). No quantitative assessment of Golden Sun Moth habitat quality undertaken.

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Database review

Background searches of publically accessible databases (refer Method section above) identified 11 threatened flora species and 25 threatened fauna species recorded or predicted to occur (DEE 2017) within 5 kilometres of the study area. Based on the desktop review of previous surveys conducted within the subject site it is considered unlikely that the subject site provides habitat for any threatened flora species, as native vegetation within the subject site is substantially degraded and isolated from patches of better quality native vegetation.

The Golden Sun Moth is known to inhabit the south eastern corner of the subject site. Potential habitat for an additional five threatened fauna species was also identified, including:

- Perunga Grasshopper
- Little Eagle *Hieraaetus morphnoides*
- Swift Parrot *Lathamus discolor*
- Superb Parrot *Polytelis swainsonii*
- Scarlet Robin *Petroica boodang*

Based on the degraded nature of available habitats within the subject site and the habitat preferences of the threatened bird species described above, the threatened bird species are considered to have a moderate likelihood of occurrence within the subject site, using the site as occasional foraging and dispersal habitat only. Grassland habitat within the subject site is degraded and dominated by exotic grasses, including Chilean Needle-grass. As such, the Perunga Grasshopper is considered to have a low likelihood of occurrence.

Vegetation communities

The subject site contains a range of predominately exotic vegetation types, including areas of landscape plantings and exotic pasture; all of which are considered highly modified and dominated by exotic species. No areas of native vegetation have been reported to occur within the subject site (AECOM 2016).

Noxious weeds

A comprehensive list of weed species occurring within the subject site was not available from the previous studies reviewed. However, AECOM (2016) reports Chilean Needle-grass as a dominant species within exotic pasture in the south east of the site. Chilean Needle Grass is also a weed of national significance (WONS) and a declared Class 3 pest plant in the ACT pursuant to the Pest Pants and Animals (Pest Plants) Declaration 2005 (No 1). Under the ACT declaration, Chilean Needle Grass must be managed and contained (DECEW 2009).

Conclusions

Parts of the subject site have been the subject of ecological assessments dating back to 2010 which, taken together, provide a relatively detailed assessment of the known and potential ecological values of the site. More recently, targeted surveys for threatened species considered likely to occur have been undertaken (Umwelt 2015; Biosis 2017) and have shown the subject site to support relatively small numbers of Golden Sun Moth, listed as endangered under the NC Act and as critically endangered under the EPBC Act.

Ecological values known or likely to occur within the subject site are relatively few and, based on previous studies include:

- Golden Sun Moth individuals and potential habitat.
- Foraging and dispersal habitat for four highly mobile threatened bird species (Little Eagle, Superb Parrot, Swift Parrot, Scarlet Robin).
- Foraging, dispersal and breeding habitat for common and widespread native fauna.
- Provision of landscape connectivity (e.g. between Lake Burley Griffin and areas of intact native vegetation to the south associated with Red Hill Nature Reserve).

While a number of studies have been completed, several of these have been undertaken across the broader CB&E and as such the locations and scope (i.e. effort) of ecological assessment undertaken specifically within the subject site is difficult to ascertain. The assessment of Natural Temperate Grassland patches located beyond the subject site have been undertaken in accordance with the now outdated methodology of Rehwinkel (2009) (recently superseded by Rehwinkel (2015)) and previous authors (Rowell 2010, 2011, 2012 and Umwelt 2014) have assessed native grassland against a now superseded listing of the Natural Temperate Grassland endangered ecological community.

Surveys completed for the Golden Sun Moth within the subject site and broader CB&E study area appear consistent with the current survey guidelines (DEWHA (2009). However, previous studies have not attempted to quantify the quality of Golden Sun Moth habitat. An understanding of Golden Sun Moth habitat quality will be required to support ongoing impact assessment and design of appropriate mitigation measures and offsets.

Based on database and literature review detailed above, it is recommended that additional ecological assessment is undertaken in order to:

- Validate and ground-truth information contained within earlier ecological studies.
- Obtain quantitative data regarding the quality of Golden Sun Moth habitat across the subject site.
- Obtain quantitative data regarding structure and composition of grassland in order to confirm the absence of native vegetation and, specifically, Natural Temperate Grassland ecological community listed as endangered under the NC Act and as critically endangered under the EPBC Act.
- Confirm the absence of habitat for other threatened flora and fauna, particularly those with the potential to utilise degraded habitats within the locality.

Recommendations for future ecological assessment

The following actions are recommended in order to ensure a sufficient understanding of the ecological values and to support future assessment of ecological impacts of the proposed subject site development under provisions of the PD Act and EPBC Act. Actions have been identified as 'Priority' where the action is considered critical to inform ongoing environmental impact assessment and as 'Preferred' where the action

is not essential but considered likely to better inform the assessment and future development of mitigation and offsetting measures.

- Obtain outstanding relevant ecological information pertaining to the subject site:
  - The full report of Umwelt (2015a) and any supporting ecological information relied upon by Umwelt (2015) (i.e. Rowell 2010, 2011 & 2012) should be obtained and reviewed for adequacy in terms of any general and targeted surveys completed. **Priority.**
  - Request all spatial data relevant to the site including, where available, spatial extent and type of native and exotic plant communities, weed locations, native and exotic flora and fauna records (particularly Golden Sun Moth records). **Priority**
- Undertake additional ecological field investigation of the subject site, including:
  - A general field survey of the subject site to validate, and where necessary map, existing ecological information including:
    - Location and extent of exotic vegetation and confirmation that not more than 0.5 hectares of native vegetation (as defined in the PD Act) occurs within the subject site. **Priority**
    - Map extent of environmental weeds, noxious weeds and WONS across the subject site in order to inform future weed management during construction and operation of the subject site development. **Preferred**
    - Map type and extent of disturbance across the subject site in order to allow accurate characterisation of the environmental condition of the subject site during environmental impact assessment. **Preferred**
  - Vegetation survey of areas of exotic pasture / grassland within the subject site using the methodology of Rehwinkel (2015) in order to confirm the absence of Natural Temperate Grassland as listed under the NC Act and *Natural Temperate Grasslands of the South Eastern Highlands* critically endangered ecological community as listed under the EPBC Act. The vegetation survey will simultaneously enable quantitative assessment of Golden Sun Moth habitat within the subject site and will therefore inform future offset calculations under the EPBC Act Environmental Offsets Assessment Guide, should they be required. **Priority**
  - Targeted survey for Golden Sun Moth and Perunga Grasshopper within the subject site. Additional surveys will provide further information on species stocking rates (for use in future EPBC Act offset calculations, if required) and will allow the subject site records to be placed in the context of the local unimpacted population beyond the subject site. **Preferred.**
- Undertake additional ecological field investigations of potential road approaches to the subject site.

  AECOM (2016) notes the possibility of access to the subject site via an upgrade at the intersection of Dudley Street / Cotter Street and current access to the subject site is via Denman Street.

  Previous studies have identified Natural Temperate Grassland and Golden Sun Moth habitat south east of the subject site between Dudley and Denman Streets, south of Cotter Street and north and south of Yarra Glen. We recommend completing additional surveys for Natural Temperate Grassland and Golden Sun Moth in these areas in order to provide flexibility to future designs for access to the subject site. Additional surveys of these areas are not required if there is little likelihood of these areas being directly or indirectly impacted by the proposed development.

  If undertaken, additional surveys should include:

- Vegetation survey of areas of exotic pasture / grassland using Rehwinkel (2015) to determine presence of NC Act and EPBC Act listed Natural Temperate Grassland.
- Targeted surveys of Golden Sun Moth and Perunga Grasshopper including quantitative assessment of grassland habitat quality for Golden Sun Moth.

Timing of additional ecological investigations

All actions identified as 'Priority' above can be completed in winter (additional report and spatial data review, weed species survey and mapping) and spring (vegetation survey). Therefore, a field survey undertaken in spring 2017 would be suitable to complete the majority of recommended actions.

Targeted surveys for Golden Sun Moth would be undertaken in November and December subject to seasonal conditions in accordance with relevant guidelines.

I trust that this advice is of assistance to you however please contact me if you would like to discuss any elements of this ecological advice further.

Yours sincerely

Samuel Luccitti

Senior Botanist

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31 May 2017

David Carey
Senior Development Manager
Doma Group
Unit 4 / 3
Sydney Avenue
Barton ACT 2600

Dear David

Targeted Survey for the Golden Sun Moth at the Yarralumla Brickworks (Blocks 1, 7 and 20, Section 102, Yarralumla).

Project no. 23847

Biosis Pty Ltd was commissioned by Doma Group to undertake targeted surveys for the Golden Sun Moth *Synemon plana* at the Canberra Brickworks Precinct at Blocks 1, 7 and 20 Section 102 Yarralumla, ACT (herein referred to the subject site). The subject site is located in south-west Yarralumla and is bounded by residential development to the north and east, open landscape to the south and a landscape buffer to the Royal Canberra Golf Club to the west. The subject site includes the western end of Denman Street and is bordered by Bentham Street in the north.

The Golden Sun Moth is listed as endangered under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Habitat for the Golden Sun Moth was identified within the Canberra Brickworks and Environs (CB&E) area by Rowell (2010) and subsequently identified within the subject site following targeted surveys by Umwelt (2015).

Umwelt (2015) recorded a total of eight Golden Sun Moth within a patch of exotic pasture in the south east of the subject site. The exotic pasture was dominated by Chilean Needle-grass *Nassella trichotoma* (a weed of national significance (WONS) and a declared Class 3 pest plant in the ACT, pursuant to the *Pest Pants and Animals (Pest Plants) Declaration 2005 (No 1*). Umwelt (2015) described the available Golden Sun Moth habitat within the subject site as low quality. Approximately 0.5 hectares of exotic pasture immediately north of Denman Street was mapped by Umwelt (2015) as 'confirmed habitat' with a further 0.4 hectares north of 'confirmed habitat' and south of Denman Street mapped as 'potential habitat'.

Based on the findings of the 2015 targeted survey, Umwelt (0215) concluded that Golden Sun Moth habitat within the subject site represents an extremely small, isolated and degraded patch; however the habitat on site is connected to better quality habitat to the south east between Denman Street and Dudley Street.

The objective of this letter report is to describe the findings of Golden Sun Moth targeted surveys completed during the 2016 flying season within areas mapped as 'confirmed habitat' and 'potential habitat' by Umwelt (2015). The results of targeted survey will inform an environment impact assessment for the proposed future development of the subject site.

Method

Targeted surveys for Golden Sun Moth were undertaken in accordance with the survey guidelines provided in the *Background Paper to EPBC Act Policy Statement 3.12 - Significant Impact Guidelines for the Critically Endangered Golden Sun Moth* (*Synemon plana*) (DEWHA 2009). Surveys were undertaken in open areas of exotic pasture dominated by Chilean Needle-grass, which had previously been mapped as either 'confirmed habitat' or 'potential habitat' for the Golden Sun Moth (Umwelt, 2015). These areas focused on two areas immediately north and south of Denham Street as well as smaller isolated areas in the south and north of the subject site (Figure 1).

Targeted surveys were undertaken between 27 November 2016 and 21 December 2016. All surveys were conducted during the hottest period of the day, on days when moths were known to be flying at other locations in the ACT. This was determined through survey of a nearby reference site located at Campbell Park, and through communication with other ecologists surveying for the species in the ACT region. Survey replicates were spaced with a minimum of four days between replicates and surveys were not conducted within two days of rainfall.

Targeted surveys for Golden Sun Moth should involve fixed point counts or transects, as most suitable to the size and topography of the potential habitat (DEWHA 2009). Parallel transects were selected as the primary survey method for the subject site, with meandering transects used in some areas. Parallel transects, spaced 5 - 10 metres apart were walked across all open grassland areas within the subject site. The surveying ecologist continuously scanned for flying males while walking each transect; recording GPS location of all Golden Sun Moth detected. Attempts to locate females where made in areas where males were observed circling or landing in the grass. It is likely that the same flying males were recorded more than once on adjacent transects. Therefore, all records of Golden Sun Moth are reported as flight detections rather than absolute abundance.

Survey conditions and number of Golden Sun Moth flights detected are detailed in Table 1.

Table 1 Golden Sun Moth survey conditions and results

	Survey 1	Survey 2	Survey 3	Survey 4
Date	27/11/2016	2/12/2016	13/12/2016	21/12/2016
Time Period	2:15pm-3:00pm	12:24pm – 1:15pm	11:30am – 12:45pm	2:00pm – 3:00pm
No. Flights	0	21	18	9
Temperature	34	32	32	29
Humidity	32	22	22	26
Cloud Cover	Clear	Clear	Clear	Clear
Wind Speed	8 – 10 km/hr	3.5 -18 km/hr	7 -18 km/hr	3.5 – 14.5 km/hr
Ground Conditions	Dry	Dry	Dry	Dry

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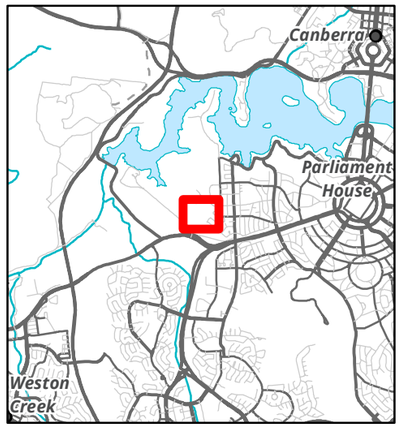

Legend

- Study area
- Golden Sun Moth habitat

Golden Sun Moth records

- Rep 2 - 02/12/2016
- Rep 3 - 13/12/2016
- Rep 4 - 21/12/2016

Figure 1: Golden Sun Moth records and habitat

0 20 40 60 80 100

Metres

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 23847
Date: 31 January 2017,
Checked by: CD, Drawn by: LH, Last edited by: lharley
Location:P:\23800s\23847\Mapping
23847_F2_GSM

Acknowledgements: Basemap © Land and Property Information 2016; Imagery © Nearmap 2016

Results

Golden Sun Moth was recorded a total of 48 times during targeted surveys. The first replicate of survey failed to detect the species flying within the subject site despite the species being recorded elsewhere in the ACT prior to survey. However, three of the four replicates confirmed the species flying within the subject site (Table 2)

Table 2 Golden Sun Moth targeted survey results

	Survey 1	Survey 2	Survey 3	Survey 4
Date	27/11/2016	2/12/2016	13/12/2016	21/12/2016
No. Flights	0	21	18	9

The locations of Golden Sun Moths detected within the subject site are shown in Figure 1. Golden Sun Moth were detected in three discrete areas within the subject site. The majority of these (80%) were recorded in an area of exotic pasture dominated by Chilean Needle-grass, north of Denham Street, within the area identified by Umwelt (2015) as 'confirmed habitat'. The grassy groundcover in this area appeared to be maintained through slashing while exotic pasture further to the north appeared to be less frequently maintained and consequently displayed a more closed grassland structure.

Golden Sun Moths were also recorded within exotic pasture to the south of Denham Street within an area mapped as 'potential habitat' by Umwelt (2015). A total of seven records were recorded in habitat immediately south of Denman Street (Figure 1). The groundcover in this area was not slashed during the survey period but was subsequently mown in a similar manner to the adjacent habitat in subsequent prior to the second round of survey.

Finally, Golden Sun Moth were recorded from a small, somewhat isolated patch of exotic pasture which lay approximately equidistant between Denman Street and Dunrossil Drive. Three Golden Sun Moth were observed from this area which was not previously identified as 'potential habitat' by Umwelt (2015). These three records were returned from areas of tall closed grassland below an open pine tree canopy. This area did not appear to be maintained with any slashing or other type of biomass control. Furthermore, significant patches of blackberry were observed and appeared to be encroaching on the available exotic grassland.

Conclusions

The recent targeted survey reported here confirms the continued presence of Golden Sun Moth within exotic pasture habitat of the subject site and extends the area of known habitat previously described by Umwelt (2015). The following conclusions have been drawn from this assessment:

- Golden Sun Moth records were more widely distributed north of Denman Street than reported in Umwelt (2015).
- Records of Golden Sun Moth in a small isolated patch to the south of Denman Street (not recorded by Umwelt 2015) suggest the subject site population is likely connected with the population of Golden Sun Moth described by Umwelt (2014) between Denman and Dudley Streets south east of the subject site.

- Substantially more Golden Sun Moth observations were recorded in 2016 relative to Umwelt (2015). Umwelt (2015) recorded only eight male moths over four days in 2015, while an average of approximately 12 moths per hour were observed over four days in 2016.
- To date, surveys have failed to record the presence of any female Golden Sun Moth within the subject site (though it is unclear to what extent, if any, searching for female moths was undertaken by Umwelt (2015)) and as such, breeding of Golden Sun Moth within the subject site is yet to be confirmed.
- Given the life history traits of the Golden Sun Moth and the cryptic nature of females of this species, a lack of female records to date may not reflect a true absence. Chilean Needle-grass dominated exotic pasture, particularly the regularly slashed areas immediately north of Denman Street may provide suitable breeding habitat.
- The absence of native grassland within the subject site indicates Golden Sun Moth, if breeding, is likely wholly dependent on Chilean Needle-grass. Records of moths were noticeably fewer in areas of exotic pasture not subject to regular slashing. Regular road-side slashing of Chilean Needle-grass dominated exotic pasture is likely promoting the spread of this weed and maintaining grass biomass at levels suitable for the Golden Sun Moth.
- Counts of flying adult male moths are not a precise or reliable indicator of Golden Sun Moth population size at a locality and can vary greatly depending on prevailing daily and seasonal weather conditions (ACT Government 2017) and surveys over multiple years may be required to gain an understanding of population trends.
- Given the disparity between the extent and density of Golden Sun Moth records reported by Umwelt (2015) and those reported here, it is recommended that the completion of a third targeted survey is undertaken in 2017. Targeted survey should encompass areas of Golden Sun Moth habitat beyond the subject site between Denman and Dudley Streets in order to gain a better understanding of Golden Sun Moth extent in the locality. This information will provide important context to future environmental impact assessment associated with the proposed subject site development.

I trust that this advice is of assistance to you however please contact me if you would like to discuss any elements of this ecological advice further.

Samuel Luccitti

Senior Botanist

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ACT Government
Chief Minister, Treasury and Economic Development

OFFSET STRATEGY

Dudley Street Upgrade and Canberra Brickworks Precinct Access Road Construction

FINAL

July 2018

ACT Government
Chief Minister, Treasury and Economic Development

OFFSET STRATEGY

Dudley Street Upgrade and Canberra Brickworks Precinct Access Road Construction

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Chief Minister, Treasury and Economic Development Directorate

Project Director:	Karina Carwardine
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Report No.	8146_R01_V5
Date:	June 2018

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3	Karina Carwardine	26/4/18	Karina Carwardine	26/4/18
4	Karina Carwardine	15/6/18	Karina Carwardine	15/6/18
5	Karina Carwardine	11/7/18	Karina Carwardine	11/1/18

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1.0 Introduction

Umwelt (Australia) Pty Limited (Umwelt) were engaged by the Chief Minister, Treasury and Economic Development Directorate of the Australian Capital Territory (ACT) Government to prepare this Offset Strategy report to support a Referral made under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The objectives of this report are to refine the offset requirements of the proposed Dudley Street Upgrade and Canberra Brickworks Access Road Construction Project (the Project, described in detail in **Section 1.1**), and determine the suitability of the North Mitchell Grasslands as a potential offset for the Project. . The suitability will be assessed against the current Commonwealth and ACT Offset Policies (described in **Section 1.2**).

1.1 Introduction

The Project is the proposed upgrade of Dudley Street in Yarralumla from a minor collector road to a major collector road, and the construction of a new access road to service the proposed future urban area of the Canberra Brickworks Precinct (CBP) as shown in **Figure 1.1**.

Despite substantial redesign to avoid impacts to matters of national environmental significance (MNES) protected under the EPBC Act within the Impact Area, the Project has been determined to have residual significant impacts on golden sun moth (*Synemon plana*), a critically endangered species; and natural temperate grassland of the South Eastern Highlands (natural temperate grassland), a critically endangered ecological community.

As such, an EPBC Referral (ref. 2017/0872) was made to the Minister for the Environment. On 1 December 2017, the Project was determined to be a controlled action due to these likely significant impacts on threatened species and communities (i.e. MNES) to be assessed on preliminary documentation. This report has been prepared to meet the information requirements of the preliminary documentation, specifically, the identification of an offset and preparation of an offset strategy.

A potential Offset Area has been identified at the North Mitchell Grasslands, Block 4, Section 47, Franklin, ACT (**Figure 1.2**). The block is currently zoned as 'NUZ: Hills Ridges and Buffer Areas' and 'PRZ1: Urban Open Space'.

This Strategy aims to refine the definition of the Project's impact, and identify whether this site is appropriate to offset the proposed impact.

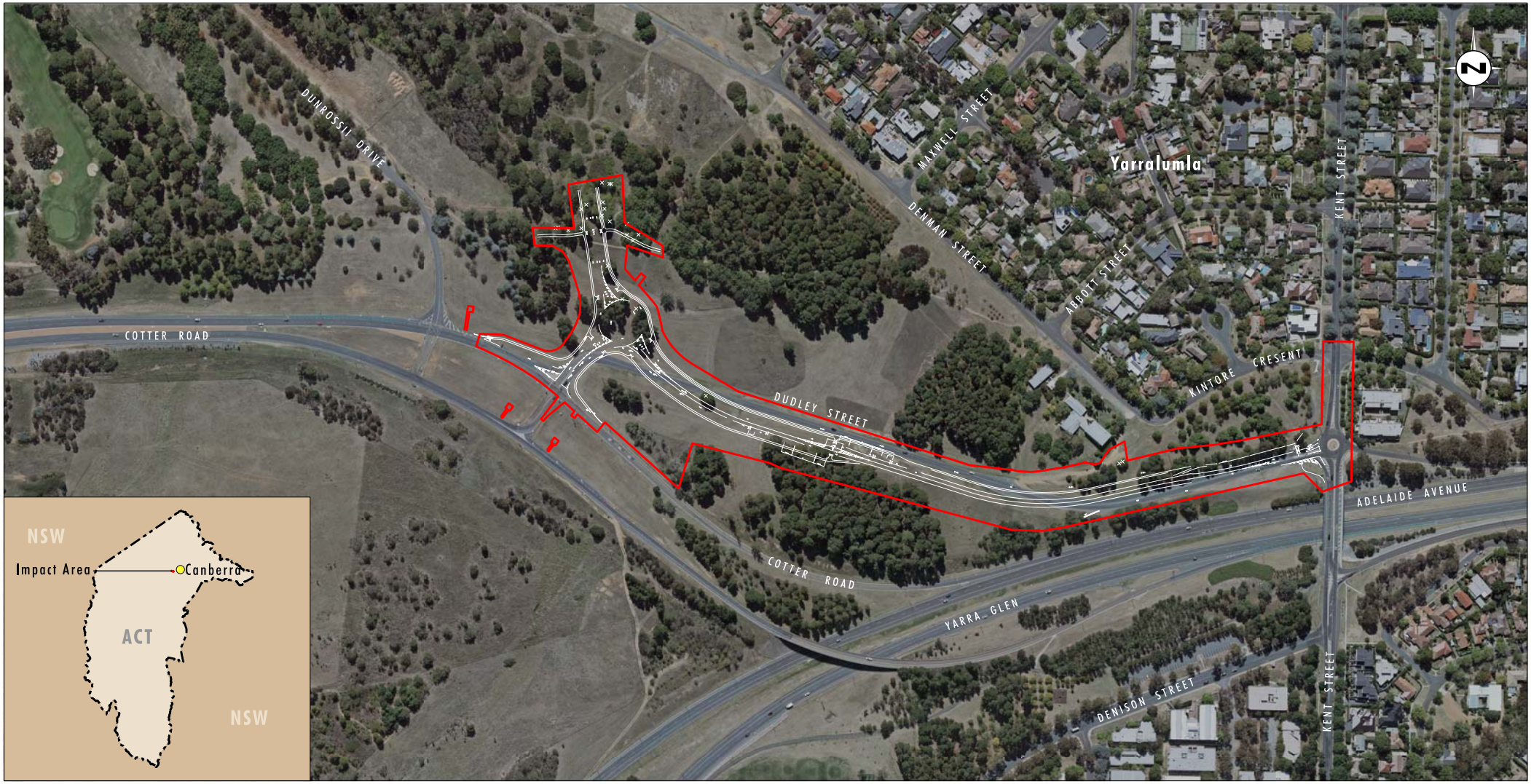


Image Source: Environment and Planning Directorate, ACT Government (2016)
Data Source: AECOM (2017)

0 100 200 250m
1:5000

Legend

- Impact Area
- Preliminary Sketch Plan (AECOM 2017)

FIGURE 1.1

Impact Area

Image Source: Environment and Planning Directorate, ACT Government (2016)

0 100 200 400m
1:7 500

Legend

Offset Area

FIGURE 1.2

Offset Area

1.2 Relevant Offset Policies

1.2.1 Commonwealth Offsets Policy

The Commonwealth Offsets Policy states that if a proposed action is considered likely to cause a significant impact to MNES, an environmental offset may be proposed. An environmental offset is a measure that compensates for a significant residual impact that cannot be avoided or mitigated. It must be in effect for the full duration of the significant impact (i.e. if the removal of habitat is permanent, then the offset must be established in perpetuity). In this instance, this entails providing for the perpetual protection and management of a location that supports like-for-like habitat for the relevant MNES.

A proposed offset strategy will only be considered under the Commonwealth Offsets Policy if avoidance and mitigation measures have demonstrably been implemented prior to the consideration of offsets. That is, the proposed offset is a last resort, which compensates for residual impacts that cannot be effectively managed through planning, design, or management measures.

The Commonwealth Offsets Policy outlines the principles upon which any proposed offset strategy should be based. This document describes and assesses the effectiveness of the offset strategy proposed as part of the Project.

This assessment has been prepared in consideration of the Commonwealth Offsets Policy, and the supporting guide and documents (SEWPaC, 2012b; DoEE, 2017).

1.2.2 ACT Offset Policy

The ACT has developed an Environmental Offsets Policy, which is consistent with the Commonwealth Offsets Policy with regard to MNES (EPD, 2015). As such, if an Environmental Offset has been established for an MNES under the EPBC Act, a separate offset is not required under the ACT Offset Policy, even if the MNES is also protected under relevant ACT legislation.

The Project will not be impacting upon any matters that are protected in the ACT and are not MNES. As such, the ACT Offset Policy will not apply and is not discussed in detail in this report.

2.0 Impact Area

2.1 Known Environmental Values

The environment of the Impact Area is generally highly disturbed and fragmented by the existing road network. Much of the Impact Area is covered with stands of exotic trees, namely *Pinus canariensis*, *P. radiata*, *P. patula*, *Ulmus procera*, and *Quercus palustris*. The majority of grassland areas are also exotic, dominated by Chilean needlegrass (*Nassella neesiana*), with some areas of mixed and native grassland (Umwelt, 2017a).

The Impact Area has been surveyed numerous times as part of the planning for the CBP development and surrounding areas (Rowell, 2012; Umwelt, 2014; Umwelt 2016; Umwelt 2017a). Two MNES are known to occur within the Impact Area:

- natural temperate grassland of the South Eastern Highlands (natural temperate grassland), a critically endangered ecological community; and
- golden sun moth (*Synemon plana*), a critically endangered invertebrate species.

2.1.1 Natural Temperate Grassland

The extent of this ecological community was most recently confirmed by Umwelt (2017a), when five (5) patches of natural temperate grassland were identified (**Table 2.1** and **Figure 2.1**), totalling 0.45 hectares (ha). The vegetation associations described relate to the Commonwealth Conservation Advice for the ecological community (TSSC, 2016) and are provided to give further context to the floristic values present at the site.

Table 2.1 Natural Temperate Grassland Patches (Umwelt, 2017a)

Patch ID	Natural Temperate Grassland Vegetation Association	Floristic Value Score	Total Area (hectares)
5	7: kangaroo grass – wallaby-grass – snow-grass moist tussock grassland of the south eastern highlands bioregion	10.01	0.11
10	5: wallaby-grass – tall speargrass – common everlasting tussock grassland of the south eastern highlands bioregion	12.56	0.12
12 + 13	7: kangaroo grass – wallaby-grass – snow-grass moist tussock grassland of the south eastern highlands bioregion	24.61	0.32 (0.27+0.05)
15	5: wallaby-grass – tall speargrass – common everlasting tussock grassland of the south eastern highlands bioregion	19.20	0.20

2.1.1.1 Avoidance and Mitigation Measures

Substantial work has been undertaken to minimise the Project's footprint on natural temperate grassland. Due to the proximity of the grassland patches to the edge of Dudley Street, complete avoidance has been impossible. As such, **Table 2.2** identifies the areas that will be unavoidably impacted by the Project.

The landscape plan developed by AECOM specifies the planting of native 'C3' grasses along the northern verge of Dudley Street, which should help to ameliorate edge effects into the retained areas of natural temperate grassland. Construction management and activities such as weed control would be specified in the project's Environmental Impact Statement, and should also work to minimise edge effects.

2.1.1.2 Indirect Impacts

Indirect impacts have also been considered in this assessment. Despite the action only removing small slivers of the community along the southern edges of the community, disturbance from this activity may result in additional edge effects which are difficult to predict. An additional buffer of 10 metres (m) from the edge of the impact has been included in the consideration of impacts, to ensure a conservative estimate of the likely impact of the action.

These areas would not be lost as a result of construction, however may experience some degradation. As the extent of this degradation is difficult to accurately predict, the entire buffer area has been assumed to be lost for the purposes of offset calculations.

2.1.1.3 Impact Assessment

Once the additional avoidance and mitigation measures have been applied, the Project is expected to result in the following impacts to natural temperate grassland:

- Direct loss of 0.12 ha as a result of the change in road alignment and construction footprint of the new access road; and
- Indirect impacts to approximately 0.16 ha affected by edge impacts and general disturbance from construction.

Table 2.2 summarises the quality of natural temperate grassland impacted by the Proposed Action.

Table 2.2 Impacted Natural Temperate Grassland

Patch ID	Habitat Quality	Area (ha)
Direct Impacts		
5	High	0.11
10	High	0.003
12	Very high	0.01
Indirect Impacts		
10	High	0.1
12	Very high	0.04
13	Very high	0.02
	Total	**0.28**

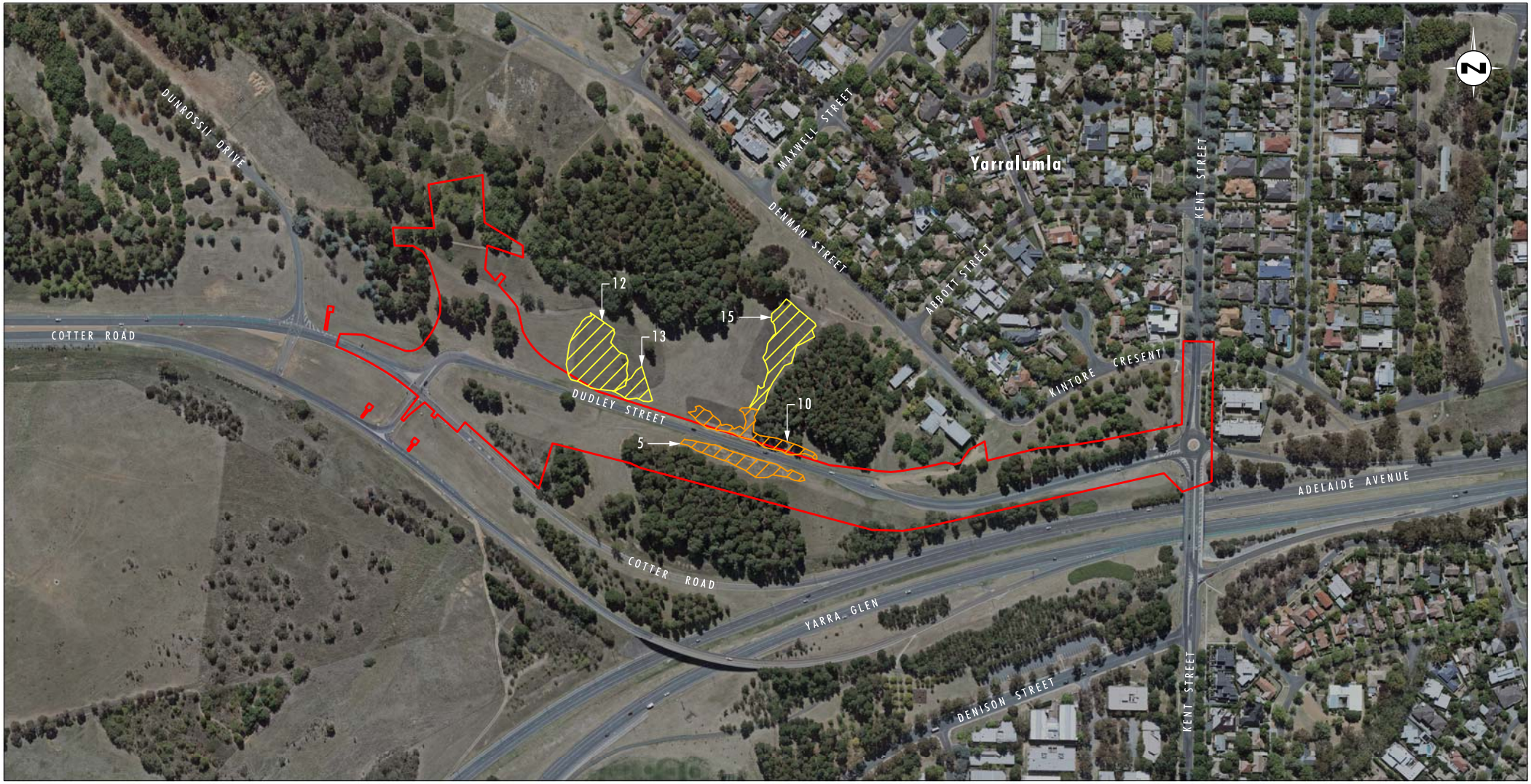


Image Source: Environment and Planning Directorate, ACT Government (2016)

0 100 200 250m
1:5000

Legend

- Impact Area
- Current Natural Temperate Grassland - Very High
- Current Natural Temperate Grassland - High

FIGURE 2.1

Natural Temperate Grassland Extent

2.1.2 Golden Sun Moth

Umwelt (2017a) also confirmed the presence of golden sun moth at the Impact Area; and identified 7.39 ha of golden sun moth habitat in the area surrounding Dudley Street (**Figure 2.2**). This includes nearly all grassland areas (native and exotic); except the dense *Themeda* dominated patches of natural temperate grassland (patches 12 and 13); the heavily disturbed former asphalt plant in the north (north of patch 24 on **Figure 2.2**) and a boggy drainage area on the corner of Kintore Crescent and Novar Street (north of patch 7 on **Figure 2.2**). Habitat quality varies throughout the locations where the species was recorded.

Table 2.3 summarises the habitat types and quality present within the golden sun moth 2016 survey area (Umwelt, 2017a).

Table 2.3 Golden Sun Moth Habitat at the Impact Area

Vegetation Type	Quality	Area (ha)
Exotic Grassland (Chilean needle grass dominated)	Moderate (Disturbed)	1.41
Exotic Grassland (mixed golden sun moth feed species)	Low	0.84
	Moderate (Disturbed)	2.91
Mixed Grassland	Low	0.77
	Low-Moderate	0.78
Native Grassland (*Rytidosperma* spp.)	Low	0.21
Native Grassland (*Rytidosperma*, *Austrostipa* spp.)	Low	0.05
	Moderate	0.42
	Total	**7.39**

The highest density of moths was recorded in Exotic Grassland (Chilean needle grass dominated) and in Exotic Grassland (mixed golden sun moth feed species) in the north west of the Survey Area (patch 2 on **Figure 2.2**). Moderate numbers of golden sun moths were recorded throughout much of the remaining area. Low golden sun moth numbers were recorded on the southern verge of Cotter Road (patch 19 on **Figure 2.2**) and in moderately disturbed grassland bordering the former asphalt plant in the north (patches 24 and 26 on **Figure 2.2**.

The original Referral stated that the Project would impact upon 3.17 ha of golden sun moth habitat (Umwelt, 2017a). Since this time, work has continued to be undertaken to minimise the Project's footprint on golden sun moth habitat. This has included re-design of the road alignment, detailed consideration of construction access and land use options (i.e. placement of the site compound), and preparation of the post construction rehabilitation plans for the site.

As these changes affect the nature of the potential impacts of the Project, the impact assessment has been updated where relevant in the following sections of this report.

Image Source: Environment and Planning Directorate, ACT Government (2016)

0 100 200 250m
1:5000

Legend

- Impact Area
- Low Quality Habitat
- Low-Moderate Quality Habitat
- Moderate Quality Habitat
- Moderate (Disturbed) Quality Habitat

FIGURE 2.2

Golden Sun Moth Extent

File Name (A4): R01/8146_005.dgn
20180420 15.58

2.1.2.1 Avoidance and Mitigation Measures

Further consideration of construction access and storage requirements has identified that only one site compound will be required for the duration of the Project. As such, the secondary location north of Dudley Street, near to the Yarralumla Uniting Church, has been removed from the impact footprint. The site compound to be located south of Dudley Street, at the western end of the alignment remains. In addition, minor changes to the road alignment and design have been made. These actions have allowed for further avoidance of golden sun moth habitat, additional to that reported in the Referral, by reducing the extent of the impact area.

2.1.2.2 Indirect Impacts

Following construction, there are likely to be some changes to surface water flows as a result of the road design, particularly to the south of Dudley Street. Any small, isolated fragments downslope of the action have been considered likely to experience indirect impacts. While these areas of habitat may not be lost, they are likely to experience some degradation as a result of the action. Given the difficulty in accurately predicting the extent of degradation, all of these areas have been assumed to be lost for the purposes of the offset calculations.

2.1.2.3 Impact Assessment

Once the additional avoidance and mitigation measures (described in **Section 2.1.2.1**) have been applied, the Project is expected to result in the following impacts to golden sun moth habitat:

- Direct loss of 2.64 ha as a result of the change in road alignment and construction footprint of the new access road; and
- Indirect impacts to approximately 0.44 ha south of Dudley Street through surface water changes and fragmentation.

Table 2.4 summarises the quality of golden sun moth habitat impacted by the Proposed Action.

Table 2.4 Quality of Impacted Golden Sun Moth Habitat

Habitat Quality	Area (ha)
Direct Impacts	
Low (native grassland with a moderate component of native C3 grasses, on shallow, eroded soils; or moderately mixed grassland)	0.35
Low – Moderate (understorey includes moderate cover of native C3 grasses but is affected by shading of planted trees)	0.25
Moderate (Disturbed) (exotic grassland dominated by Chilean needlegrass)	2.0
Moderate (native grassland with a moderate component of native C3 grasses)	0.04
Indirect Impacts	
Low (exotic grassland with mixed feed species)	0.13
Moderate (Disturbed) (exotic grassland dominated by Chilean needlegrass)	0.31

2.2 Offset Requirements

As assessed by Umwelt (2017b) and in the above sections, the Project will have a significant impact on up to 0.28 ha of natural temperate grassland (**Figure 2.3**) and 3.08 ha of golden sun moth habitat (**Figure 2.4**). As these impacts are considered significant under the EPBC Act, they need to be compensated through the Commonwealth Offsets Policy.

In order to calculate the area of habitat required to compensate for the impact, the Commonwealth Offset Tool relies on an assessment of habitat quality. As described in detail in Umwelt (2017b) the habitat quality score requires consideration of patch size, connectivity, floristics, and species stocking rate (as relevant). **Table 2.5** summarises the quality of impacted habitat for natural temperate grassland and golden sun moth at the Impact Area. The methods of determining the habitat quality score for the impacted habitat in Umwelt (2017) were generally consistent with those described in **Section 4**; however a slightly modified version has been used in this report to simplify the method.

Table 2.5 Habitat Quality Scores – Impact Area

MNES	Impact Area (ha)	Quality Score
Natural temperate grassland	0.28	5 out of 10
Golden sun moth	3.08	7 out of 10

It is proposed to use the North Mitchell Grasslands as the environmental offset area. The values present at the Offset Area are described in the following **Section 3**, and **Section 4** assesses the suitability of the proposed Offset Area against the Commonwealth Offsets Policy.

Image Source: Environment and Planning Directorate, ACT Government (2016)

0 100 200 250m
1:5000

Legend

- Impact Area
- Natural Temperate Grassland - Direct Impact Area
- Natural Temperate Grassland - Indirect Impact Area
- Natural Temperate Grassland - No Impact

FIGURE 2.3

Natural Temperate Grassland Impact Area

Image Source: Environment and Planning Directorate, ACT Government (2016)

0 100 200 250m
1:5000

Legend

- Impact Area
- Golden Sun Moth Impact Area - Direct
- Golden Sun Moth Impact Area - Indirect
- Golden Sun Moth Impact Area - No Impact

FIGURE 2.4

Golden Sun Moth Impact Area

3.0 Offset Area

3.1 Understanding of the Site

The North Mitchell Grassland is located within the urban area of Franklin, ACT. It is approximately 20 ha in size, and ranges in elevation between approximately 600 and 610 m above sea level. There is a small drainage line running south-west across the south-eastern corner of the Block, which includes a dam. The broader landscape is heavily urbanised, with little remaining native vegetation (ACT Government, 2018). The site is known to have a contaminated site located along the southern edge, where uncontrolled fill has been historically dumped (refer **Section 4.2.4**).

A review of existing information was undertaken prior to site survey to develop an appreciation of the site. The following vegetation types were identified as being present:

- Tablelands Dry Tussock Grassland (meeting the definition of EPBC listed natural temperate grassland);
- *Eucalyptus melliodora – Eucalyptus blakelyi* Tableland Grassy Woodland; and
- exotic pasture.

The vegetation at the site is generally reflective of the site topography, with higher areas generally being more native dominated, and lower areas being wetter and weed dominated.

The 2005 ACT Lowland Native Grassland Conservation Strategy (AHE, 2005) identified 14.8 ha of natural temperate grassland within the Offset Area. In 2014, Umwelt (2015) re-surveyed the site and recorded a significant reduction in the extent of natural temperate grassland present (3.81 ha).

Golden sun moth had been recorded at moderate density at the Offset Area in 2008 (Richter *et al*, 2009). Habitat for the species was mapped as coinciding with the Tablelands Dry Tussock Grassland community (ACT Government, 2018); which had also declined from 14.8 to 3.81 ha between 2005 and 2014 (Umwelt, 2015).

The Offset Area is identified as a Category 1 Conservation Site in the ACT Native Grassland Conservation Strategy (EPSDD, 2017) as it provides habitat for one of two known populations of Ginninderra peppercress (*Lepidium ginninderrense*), a plant that is endemic to the ACT and listed as vulnerable under the EPBC Act. In December 2017, the population count of Ginninderra peppercress was approximately 150 plants (pers. comms. Michael Mulvaney, 4 January 2018).

Other environmental values are understood to include the following:

- a patch of Yellow Box – Red Gum Grassy Woodland in the north-east, which is an endangered ecological community under the ACT's *Nature Conservation Act 2014* (NC Act) (Umwelt, 2015);
- foraging habitat for superb parrot (*Polytelis swainsonii*), an EPBC listed vulnerable bird species. Habitat coincides with the Yellow Box – Red Gum Grassy Woodland patch (Umwelt, 2015);
- striped legless lizard (*Delma impar*), an EPBC listed vulnerable reptile species. Habitat occurs within approximately 17 ha of native and exotic grassland (Umwelt, 2015) and population estimates are between 200 and 400 (pers. comms. Michael Mulvaney, 4 January 2018); and

- perunga grasshopper (*Perunga ochracea*), a NC Act listed vulnerable invertebrate. This is a cryptic species which is difficult to survey. One grasshopper was recorded at the site in December 2017 (Canberra Nature Map, 2018).

3.2 Ecological Survey

In order to complete the assessment of the suitability of the North Mitchell Grasslands as an Offset Area under the Commonwealth Offsets Policy, a targeted ecological survey was undertaken on 10 January 2018.

The aims of the ecological survey were to:

- confirm the presence of natural temperate grassland within the Offset Area, based on the updated listing advice for the critically endangered ecological community (TSSC, 2016);
- map the extent of natural temperate grassland and golden sun moth habitat within the Offset Area; and
- assess the quality of natural temperate grassland and golden sun moth habitat.

The population of golden sun moth was not targeted as part of this survey. The flying season was finished across much of Canberra, with only a limited number of males still flying at some sites. This is not considered a major limitation as golden sun moth are known to occur at the site, and the offset calculations use habitat area as the primary metric for this species, due to the species' inherent seasonal fluctuations in population size being poorly understood.

An additional site visit with the aim of identifying further potential golden sun moth habitat was undertaken on 2 March 2018. This visit was targeted at identifying areas of native and mixed grassland that may provide additional habitat to that identified in the initial survey.

3.2.1 Methodology

3.2.1.1 Natural Temperate Grassland

The survey for natural temperate grassland was undertaken in accordance with the floristic value score (FVS) approach outlined in the EPBC Conservation Advice for the ecological community (TSSC, 2016).

Four 400 m^2 (generally 20 by 20 m) floristic plots were sampled throughout the Project Area to assess the vegetation type and condition present. These plots were located within areas previously identified as natural temperate grassland, and any new locations identified as being dominated by native grasses (**Figure 3.1**). Where possible, the floristic plots were located near to the locations sampled by Umwelt (2015), noting however that the plots must be located where the highest flora diversity occurs under the FVS approach.

Floristic plots were supported by a meandering search to delineate the extent of the natural temperate grassland. This was conducted at a fine scale, appropriate to the scale of the Project and as required to support the assessment. The meandering search also included four rapid vegetation assessments to assist the identification of natural temperate grassland (locations shown on **Figure 3.1**).

The quality of natural temperate grassland was assessed using the methodology and thresholds outlined in the EPBC Conservation Advice (TSSC, 2016). These thresholds are determined by the FVS, the presence of 'indicator'[1] species, or native non-grass species.

3.2.1.2 Golden Sun Moth

Habitat for golden sun moth was mapped according to dominant vegetation type and presence of feed species (i.e. 'C3' grasses, namely wallaby grass (*Rytidosperma* spp.), spear grass (*Austrostipa* spp.), and Chilean needle grass (*Nassella neesiana*)).

Three 50 m step-point transects were undertaken within the areas previously identified as natural temperate grassland and golden sun moth habitat (**Figure 3.1**). Two additional 50 m step-point transects were undertaken within areas of native or mixed grassland. These step-point transects were used to identify the presence and cover of golden sun moth feed species and percent cover of bare ground.

The transect surveys were supported by a meandering search to delineate the extent of the golden sun moth habitat throughout the Offset Area.

[1] Typically disturbance sensitive, native species that are useful surrogates for conservation value. Full list of indicator species is maintained here: http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=152&status=Critically+Endangered

Image Source: Environment and Planning Directorate, ACT Government (2016)

Legend

- Offset Area
- GSM Habitat Transects
- FVS Plot Locations
- Rapid Assessment Locations

FIGURE 3.1

Offset Area Survey Locations

File Name (A4): R01/8146_007.dgn
20180413 14.06

3.2.2 Results

3.2.2.1 Natural Temperate Grassland

The vegetation mapping confirmed the presence of the three vegetation communities previously mapped.

Four patches of natural temperate grassland were identified, two of which were previously unmapped (Umwelt, 2015). One previously recorded patch is no longer discernible as native grassland and is dominated by Phalaris (*Phalaris aquatica*).

The remaining grassland is exotic, generally dominated by Phalaris, panic grass (*Panicum* spp.), Yorkshire Fog (*Holcus lanatus*), and wild oats (*Avena* spp.). This is consistent with previous vegetation mapping (Umwelt, 2015).

In total, 3.8 ha of natural temperate grassland was recorded (**Figure 3.2**). **Table 3.1** summarises the extent, FVS, and floristic quality of the natural temperate grassland identified using floristic plots. One new patch (0.43 ha) of natural temperate grassland was also identified through the rapid survey. The rapid results put the floristic quality of this patch as being similar to Plot 6.

Table 3.1 Natural Temperate Grassland Floristic Plot Results

Plot Number	Area (ha)	Indicator Species (No.)	Native Non-grass Species (No.)	FVS	Floristic Quality[1]
1	2.1	7	12	22.59	Very High
2		3	11	13.63	Very High
5	1	8	13	25.41	Very High
6	0.27	7	10	12.60	High

[1] Based on the Conservation Advice for natural temperate grassland (TSSC, 2016).

3.2.2.2 Golden Sun Moth

As with previous mapping (Umwelt, 2015), the 2018 surveys confirmed that golden sun moth habitat coincides with natural temperate grassland at the Offset Area. An additional 1.1 ha of native dominated grassland was identified along the eastern edge of the site which was also considered to represent golden sun moth habitat. As such, 4.9 ha of golden sun moth habitat was recorded (**Figure 3.2**).

The matrix between these patches of habitat was defined as exotic dominated or mixed grassland. At the time of survey, this area was dominated by Phalaris, and while it contained remnant native species, it did not contain an adequate cover of golden sun moth feed species to warrant being surveyed in detail.

3.2.2.3 Other MNES

In addition to the targeted surveys for natural temperate grassland and golden sun moth, the following MNES were recorded opportunistically:

- 21 Ginninderra peppercress plants, near floristic plot 1; and
- 6 Latham's snipe (*Gallinago hardwickii*) flushed from the dam in the south-east. Latham's snipe is listed as a marine and migratory species under the EPBC Act.

Image Source: Environment and Planning Directorate, ACT Government (2016)

0 100 200 400m
1:7 500

Legend

- Offset Area
- Natural Temperate Grassland - Very High
- Natural Temperate Grassland - High
- Golden Sun Moth Habitat - Direct
- Remediate and Rehabilitate

FIGURE 3.2

Proposed Offset Strategy for Natural Temperate Grassland and Golden Sun Moth

File Name (A4): R01/8146_008.dgn
20180413 14.08

4.0 Proposed Offset

4.1 Offset Strategy Elements

The proposed strategy for the use of this site as an offset would have the following basic elements:

- Secure site as a direct offset, and protect under a conservation land use zoning (apply the Pc: Nature Reserve Overlay – **Section 5.2**).
- Management of site for habitat improvement and long term resilience of MNES (**Section 4.5**):
    - weed and pest control;
    - review of grazing regimes; and
    - management of biomass.
- Investment in site infrastructure (fencing, access tracks etc.) (**Section 5.3**).
- Remediation and reseeding of spoil site on southern edge of site (**Section 4.4.4**).

4.2 Offset Analysis

This section assesses the suitability of the proposed offset strategy against the Commonwealth Offsets Policy and Guide. This has been developed with reference to the EPBC Act Offset Policy and Guide and the ecology and habitat requirements of each threatened species considered.

This assessment includes consideration of the type, importance, and size of the habitat being impacted and the scale of improvement and averted loss as a result of the offset.

The benefit of an offset should last for the duration of the impact; in this case, as the loss of MNES habitat would be permanent, the offset would require protection in perpetuity. The offset should deliver an overall conservation outcome that improves the viability of the protected matter. The offset should also be delivered in an efficient, timely, transparent, scientifically robust, and reasonable manner and have transparent governance arrangements.

This offset strategy identifies the risk of the offset not succeeding. An associated offset management plan would provide measures to monitor and recover conditions should values be found to be decreasing.

The EPBC Act Offset Guide outlines the key considerations for determining the habitat quality for threatened species. This is summarised in **Figure 4.1** below.

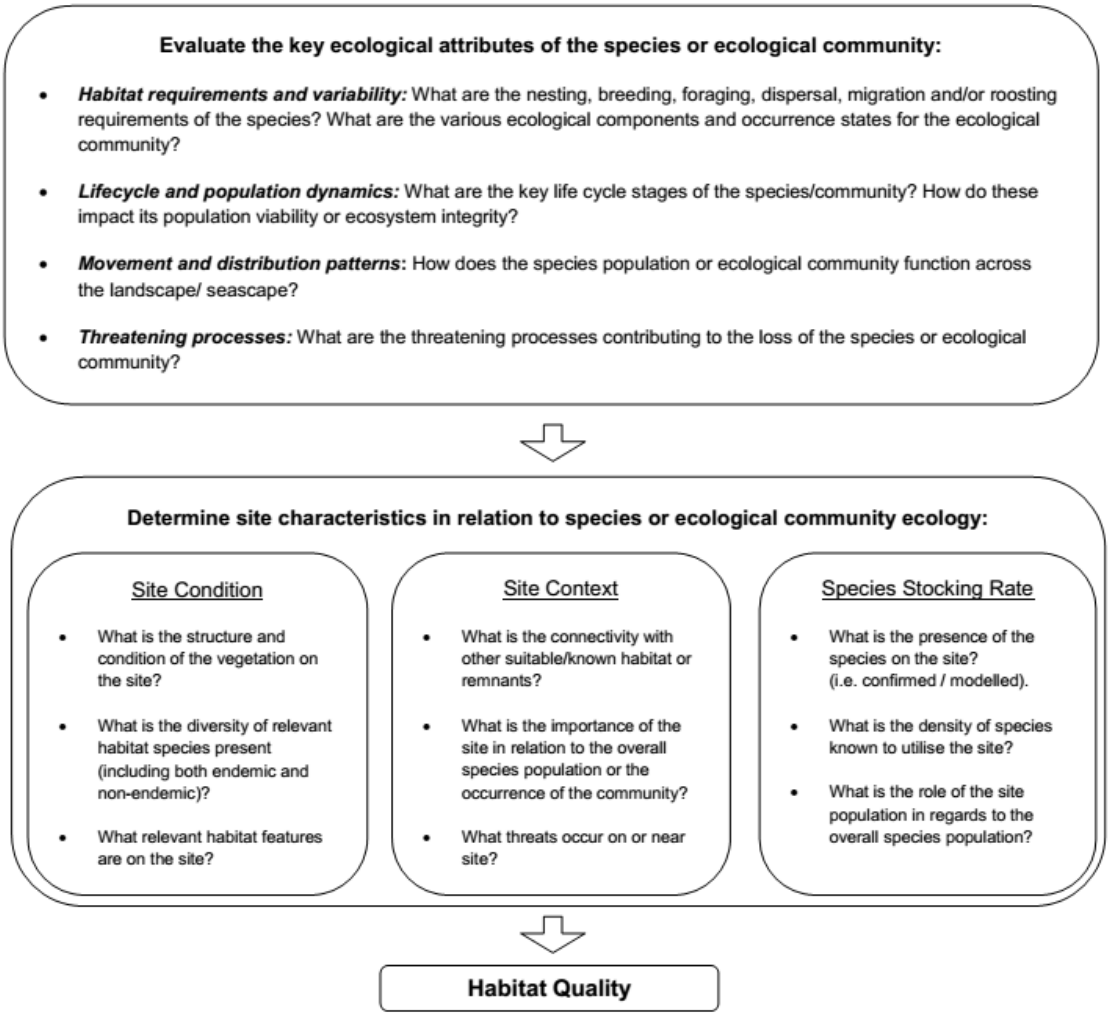


Figure 4.1 Determining Habitat Quality for an Offset (SEWPaC, 2012)

4.3 Natural Temperate Grassland

4.3.1 Metrics

The parameters used to determine the habitat quality score for natural temperate grassland are based on two site characteristics as defined in the figure above: site condition and site context. Species stocking rate is not relevant for natural temperate grassland.

Parameters selected are discussed in detail below.

Site Condition

Site condition scores (**Table 4.1**) for natural temperate grassland were based on listing criteria for the ecological community and represent a combination of:

- species diversity (including native grasses and forbs);
- presence of disturbance tolerant/sensitive species (reflecting disturbance history); and
- presence and cover of weeds.

Table 4.1 Site Condition Values for Natural Temperate Grassland

Score	Rationale
1	Low diversity of native species (mostly disturbance tolerant native grasses), very low native forb diversity, and low cover of introduced perennial species.
2	Moderate diversity and cover of native species, including disturbance tolerant species (but excluding disturbance sensitive or moderately sensitive species).
3	Moderate diversity and cover of native species, including disturbance sensitive species.
4	High diversity and cover of native species, including disturbance sensitive species and/or moderately sensitive species. Includes high diversity of forbs.
5	Native cover only, reflecting biological diversity prior to European settlement. Community dominated by perennial tussock grasses with wide variety of other herbs.

Site Context

Site context is comprised of a number of factors which create an understanding of the relative importance of the subject site and threats which might act against future potential quality.

Site context, in this assessment, has included consideration of:

- patch size;
- patch shape;
- isolation and/or connectivity; and
- threats.

The approach for patch size relates specifically to natural temperate grassland, where the minimum size for assessing the presence of the community is 0.1 hectares. The size classes have been developed to be reflective of the average size of patches present in the ACT (**Table 4.2**).

Shape complexity has been used to help determine the extent that external effects will influence a patch. A simple circular or square reserve will have a lower shape complexity and be less influenced by external effects (lower edge:core ratio), than an irregular or convoluted shaped reserve. This has been calculated using the following formula:

$$Shape\ Index = \frac{Perimeter(m)}{2\sqrt{\pi \times Area(sqm)}}$$

The approach for connectivity has been developed on the principle that less distance between patches is preferable, and the majority of fauna species utilising a grassland environment would generally have lower capacity to travel across unsuitable habitat and barriers than, for instance, more mobile woodland species. This metric also considers the matrix around the patch, with native pasture or grassland being more permeable than exotic grassland, trees, or development (such as buildings and roads).

Consideration of threats has been based on the presence and intensity of key threats, as identified in EPBC Act Listing Advice for natural temperate grassland. The extensive list of threats provided by the guidance material covers a wide range of land use activities and processes that are the consequence of three main categories of threat as follows:

- Land use and management change:
    - Grazing, pasture improvement and cropping;
    - Urban development and infrastructure;
- Conflicting management practices:
    - Fire regimes;
    - Soil disturbance, altered salinity and acidity; and
    - Altered hydrology.
- Degrading processes:
    - Exotic species (including pasture species).

In summary, the site context scores for natural temperate grassland as developed by this assessment are presented in **Table 4.2**.

Table 4.2 Site Context Scores for Natural Temperate Grassland

Score	Rationale
Patch Size	
1	Patch is between 0.1 and 1 ha. The minimum size for assessing the presence of natural temperate grassland under the EPBC Act is 0.1 ha.
2	Patch is less than 10 ha.
3	Patch is greater than 10 ha. It is assumed a large patch of 10 hectares or more would maintain its viability over the long term.
Patch Shape	
1	Highly irregular shape.
2	A moderately irregular shape.
3	A simple shape approaching a square or circle in configuration.
Isolation / Connectivity	
1	More than 200 m to the closest patch of natural temperate grassland. This is primarily based on the potential for movement of grassland species, and transfer of genetic material. Separated by exotic grassland, trees, or development.
2	Less than 200 m but more than 20 m between patches would indicate some potential for movement between sites. Separated by native pasture or grassland, no impermeable barriers.
3	20 m or less separation would indicate a high level of connectivity between patches.
Surrounding Threats	
0	Threat absent.
1	Low intensity threat (2 or less threats).
2	High intensity threat (3 or more threats).

4.3.2 Calculations

The following table demonstrates the performance of the proposed natural temperate grassland offset against the Commonwealth's offset calculator. A copy of the Commonwealth offset calculator is provided in **Appendix A**.

Table 4.3 Performance of the Proposed Natural Temperate Grassland Offset

<table>
<tr><th>Variable</th><th>Value</th><th colspan="6">Rationale</th></tr>
<tr><td colspan="8">Summary of Quality</td></tr>
<tr><td rowspan="5">Area of Habitat (Impact)</td><td rowspan="5">0.28 ha</td><td colspan="6">Direct impact to 0.13 ha and indirect impact to up to 0.16 ha of natural temperate grassland of varying qualities. The condition and areas are from Umwelt (2017) as summarised in Table 2. 2.</td></tr>
<tr><td rowspan="2">ID</td><td rowspan="2">Area (ha)</td><td rowspan="2">Site Condition</td><td colspan="4">Site Context</td></tr>
<tr><td>Isolation</td><td>Shape</td><td>Threats</td><td>Size</td></tr>
<tr><td>5</td><td>0.11</td><td>2/5
Moderate diversity and cover of native species, including disturbance tolerant species (but excluding disturbance sensitive or moderately sensitive species).</td><td>3/3
<20m from other patches</td><td>1/3
Very irregular</td><td>2/2
High threats</td><td>1/3
<1 ha</td></tr>
<tr><td>10</td><td>0.012</td><td>2/5
Moderate diversity and cover of native species, including disturbance tolerant species (but excluding disturbance sensitive or moderately sensitive species).</td><td>3/3
<20m from other patches</td><td>1/3
Very irregular</td><td>2/2
High threats</td><td>1/3
<1 ha</td></tr>
<tr><td>12</td><td>0.01</td><td>3/5
Moderate diversity and cover of native species, including disturbance sensitive species.</td><td>2/3
<200m from other patches</td><td>2/3
Moderate irregularities</td><td>2/2
High threats</td><td>1/3
<1 ha</td></tr>
<tr><td>10 (Indirect)</td><td>0.1</td><td>2/5
Moderate diversity and cover of</td><td>3/3
<20m from</td><td>1/3
Very irregular</td><td>2/2
High threats</td><td>1/3
<1 ha</td></tr>
</table>

<table>
<tr><th>Variable</th><th>Value</th><th colspan="7">Rationale</th></tr>
<tr><td></td><td></td><td></td><td></td><td>native species, including disturbance tolerant species (but excluding disturbance sensitive or moderately sensitive species).</td><td>other patches</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>12 (indirect)</td><td>0.04</td><td>3/5
Moderate diversity and cover of native species, including disturbance sensitive species.</td><td>2/3
<200m from other patches</td><td>2/3
Moderate irregularities</td><td>2/2
High threats</td><td>1/3
<1 ha</td></tr>
<tr><td></td><td></td><td>13 (indirect)</td><td>0.02</td><td>3/5
Moderate diversity and cover of native species, including disturbance sensitive species.</td><td>2/3
<200m from other patches</td><td>2/3
Moderate irregularities</td><td>2/2
High threats</td><td>1/3
<1 ha</td></tr>
<tr><td rowspan="5">Area of Habitat (Offset)</td><td rowspan="5">3.8 ha</td><td colspan="7">Proposed direct offset of 3.8 hectares of natural temperate grassland at the North Mitchell Grassland.</td></tr>
<tr><td rowspan="2">ID</td><td rowspan="2">Area (ha)</td><td rowspan="2">Site Condition</td><td colspan="4">Site Context</td></tr>
<tr><td>Isolation</td><td>Shape</td><td>Threats</td><td>Size</td></tr>
<tr><td>1</td><td>0.27</td><td>3/5
Moderate diversity and cover of native species, including disturbance sensitive species.</td><td>2/3
<200m from other patches</td><td>2/3
Moderate irregularities</td><td>2/2
High threats</td><td>1/3
<1 ha</td></tr>
<tr><td>2</td><td>2.1</td><td>4/5
High diversity and cover of native species, including disturbance sensitive species and/or moderately sensitive species. Includes high diversity of forbs.</td><td>2/3
<200m from other patches</td><td>1/3
Very irregular</td><td>2/2
High threats</td><td>2/3
<10 ha</td></tr>
<tr><td>3</td><td>1</td><td>4/5
Moderate diversity and cover of native species, including disturbance sensitive species.</td><td>2/3
<200m from other patches</td><td>2/3
Moderate irregularities</td><td>2/2
High threats</td><td>2/3
<10 ha</td></tr>
</table>

Variable	Value	Rationale						
		4	0.43	3/5 Moderate diversity and cover of native species, including disturbance sensitive species.	2/3 <200m from other patches	2/3 Moderate irregularities	2/2 High threats	1/3 <1ha
Quality (Impact)	5	A weighted quality score of 5 has been determined by considering the site condition and context of the individual impact areas, weighted by the size of the patches. This data has been transparently shown in the above section.						
Quality (Offset)	7	A weighted quality score of 7 has been determined for the offset areas by considering the site condition and context of the individual impact areas, weighted by the size of the patches.						

	Raw (weighted scores by area)	
	Impact	**Offset**
Site Condition	2	4
Site Context	6	6
Isolation	*3*	*2*
Shape	*1*	*1*
Threats	*2*	*2*
Size	*1*	*2*

	Transformed (scores out of 10)	
	Impact	**Offset**
Site Condition	4	8
Site Context	5	6
Quality	**5**	**7**

Offset Calculator		
Time over which loss is averted	20	This is the maximum time period over which the guide is designed to function, it is appropriate for permanent impacts.
Risk of loss without offset	5%	There are a number of factors that could influence the risk of loss of a site, including: • presence and strength of formal protection mechanisms currently in place on the proposed site (e.g. zoning, restrictive covenants or state vegetation clearing laws); • presence of pending development applications, mining leases or other activities on the proposed offset site that indicate development intent and likelihood; and • average risk of loss for similar sites. The risk of loss without offset is considered to be low for this site, as the site has been proposed to be used as an offset for a number of

Variable	Value	Rationale
		years due to its ecological values, therefore risk of development is low, however it has not yet been placed under any formal protection nor is being actively managed. The extent of grassland has been shown to have decreased substantially since its initial mapping (refer to **Section 3.1**).
Risk of loss with offset	1%	Management actions implemented as a result of the transfer to offset would include a management framework designed to strategically address natural temperate grassland. Only unforeseeable factors would result in the loss from the habitat offset site.
Time until ecological benefit	10	No direct commitments to improvement have been made for natural temperate grassland, other than the mitigation of surrounding threats. Improvements would be expected as a flow on from activities such as weed control and biomass management in the habitat improvement area (refer to **Section 4.4.3**). Within 5 years, natural temperate grassland would experience reduced threats due to the actions targeting golden sun moth (**Section 4.4.2**), however this intensive management is targeted to the boundaries of the patches. Mitigation of larger, site-wide threats to the community such as African lovegrass may take longer than this initial period.
Future quality without offset	5	*Future quality without offset* is the estimate of the habitat quality based on a business as usual scenario – that is, considering current management practices, use of the site and historic trends for the quality of habitat on the site. Without the proposed offset, the calculations predict a decline in the quality of natural temperate grassland. Without the offset, and the management of the sites as nature reserve, the site is expected to experience a loss of native species diversity, loss of habitat structure and increase in weed abundance. This is based on demonstrable trends. The drop in quality from 7 to 5 is based on the following (detailed in the table below): • Site condition from 4 to 2: o Original condition score of 4 is defined by: High diversity and cover of native species, including disturbance sensitive species and/or moderately sensitive species. Including high diversity of forbs. o Future condition score of 2 is predicted by: Moderate diversity and cover of native species, including disturbance tolerant species (but excluding disturbance sensitive or moderately sensitive species). o Based on the threat of African lovegrass creating a dense monoculture within areas of natural grassland, and the continued threat of Phalaris, this is considered a reasonable prediction. • Shape complexity from 2 to 1: this predicts a further increase in the shape index (edge: core) of the habitat patches from weed encroachment.
Future quality with offset	7	*Future quality with offset* is the estimated habitat quality at the same future time incorporating the proposed offset activities. The management of land as nature reserve will result in a higher level of duty of care, in addition to increased funding for management activities. As the patches are currently of high quality, no improvement of condition has been proposed. The value of the offset will be in the retention of existing patches at their current state, and removal of threats.

Variable	Value	Rationale

Quality increase
Quality decrease

	Raw (weighted scores by area)	
	Offset (without)	**Offset (with)**
Site Condition	2	4
Site Context	6	8
Isolation	*2*	*2*
Shape	*1*	*1*
Threats	*2*	*0*
Size	*2*	*2*

	Transformed (scores out of 10)	
	Offset (without)	**Offset (with)**
Site Condition	4	8
Site Context	5	7
Quality	**5**	**7**

Confidence in result	80%	Confidence in the result is high. The ACT Government has already committed to $1.5 million of funding in the 2018/19 Budget for the establishment of the proposed offset. This will include site establishment, initial management including weed and biomass control, and rehabilitation of the spoil site. Ongoing funding will be secured through the ACT Budget Process, with Treasury understanding the importance and requirements of Environmental Offsets. The offset will be managed by the ACT Government's Offset Team. This team is dedicated to managing, monitoring and reporting on offsets established under the EPBC Act. They have an excellent track record. This offset strategy has been developed in consultation with both the Offsets Team and the ACT Government Conservation Branch, and it is considered that the commitments are achievable and realistic.
Overall Performance	229%	This offset represents a surplus to what is required to offset the impact. It is considered to represent a strategically significant offset for natural temperate grassland.

4.4 Golden Sun Moth

4.4.1 Metrics

The parameters used to determine the habitat quality score for golden sun moth are based on three site characteristics as defined in **Figure 4.1**: site condition, site context, and stocking rate.

Parameters selected are discussed in detail below.

Site Condition

Site condition scores for golden sun moth were based on listing criteria for the ecological community, and represent a combination of:

- structure and condition of vegetation on site (native grassland or pasture);
- presence of forage species; and
- presence and cover of weeds.

The following site condition criteria have been developed specifically for golden sun moth.

Vegetation Structure

Vegetation structure is a reflection of the habitat type (i.e. grassland or open woodland) and the amount of inter-tussock space available (i.e. rank or open grassland). Golden sun moth typically occupies grassland; therefore, grassland structures score higher than woodland.

The species also requires inter-tussock space in which the females bask to attract males during breeding (i.e. flying) season, therefore, open grassland scores higher than rank grassland (DEWHA, 2009a). The range of vegetation structure scores is shown in **Table 4.4**. Any vegetation type that does not fit into one of these categories is not considered to be golden sun moth habitat from a structural perspective and is highly unlikely to support the species.

Table 4.4 Vegetation Structure Sub-Scores for Golden Sun Moth

Score	Rationale
1	Grassy open woodland or shrubland. It is the least suitable of habitats that are occupied by golden sun moth.
2	Rank (i.e. overgrown) grassland.
3	Open grassland. Provides optimal habitat structure.

Vegetation Condition

The vegetation condition sub-score considers the proportion of exotic to native species and the availability of golden sun moth forage species at the site. Scores are determined based on dominance to give an overall impression of the types of grass species that occur. Exotic species dominance is ranked lowest as it is considered to be a sign of poor ecosystem health and a detriment to biodiversity as a whole.

Sites with mixed dominance, or dominance of native non-forage species (e.g. kangaroo grass) are given an equal score. This is considered appropriate as it is believed that the presence (not dominance) of forage

species is enough to provide habitat for golden sun moth in some circumstances. Despite this, sites with a dominance of forage species are ranked the highest as they provide the most habitat resources for golden sun moth and are considered to be of a higher quality. The range of habitat vegetation scores that may be assigned is shown in **Table 4.5**.

Table 4.5 Vegetation Condition Sub-Scores for Golden Sun Moth

Score	Rationale
1	Dominated by exotic species.
2	Mixed exotic and native forage species dominance.
3	Dominated by native forage species (e.g. short wallaby grass and spear grasses).

Forage Species Diversity

The forage species diversity sub-score demonstrates the species richness (i.e. the number of species present at a site) and the evenness of the percentage cover for each species. It is important to note the difference between species richness (total number of species present) and species diversity (a function of species richness and abundance). The range of scores presented here is outlined in **Table 4.6**.

Table 4.6 Forage Species Diversity Sub-Scores for Golden Sun Moth

Score	Rationale
1	Low species diversity.
2	Medium species diversity.
3	High species diversity.

Site Context

As above, site context (**Table 4.7**) has included consideration of:

- patch size;
- patch shape;
- isolation and/or connectivity; and
- threats.

Specifically for golden sun moth, the following site context values have been developed.

Patch size is based on the Significant Impact Guidelines for the species:

- Patch is less than 1 hectare. There is not considered to be a minimum patch size for golden sun moth habitat, however areas less than 1 hectare are considered very small, and at high risk from external influences and catastrophic events;
- Patch is between 1 and 10 hectares. The Significant Impact Guidelines refer to small or fragmented habitat area as <10 hectares; and

- Patch is greater than 10 hectares. The Significant Impact Guidelines refer large or contiguous habitat as >10 hectares.

The approach for connectivity has been developed on the understanding of golden sun moth's limited ability to disperse. Females are not able to traverse over any non-habitat substrate due to their inability or poor flying ability (ACT Government 2005), and as such any break in habitat connectivity is considered an absolute barrier that females cannot cross. The distance that males will traverse depends upon the substrate they are travelling over. A substrate that consists of non-habitat grassland will be permeable for male golden sun moths up to a distance of 200 metres (ACT Government 2005); whilst a substrate of concrete, water, bare ground or the like is taken on the basis of observation to be permeable up to a distance of 15 metres. Beyond this distance they are considered absolute barriers and male moths will not cross. In addition, features such as trees, shrubs, or buildings are an absolute barrier for male golden sun moth (DEWHA 2009b).

Based on this, any separation in habitat greater than 200 metres is considered likely to represent separate populations. The matrix surrounding each patch has also been considered, with native pasture or grassland matrix being considered of higher value than exotic grassland or development.

- 20 metres or less separation would indicate a high level of connectivity between patches;
- Less than 200 metres but more than 20 metres between patches would indicate some potential for movement between habitat;
- More than 200 metres to the closest patch of habitat. This distance is considered a barrier to movement.

Consideration of threats has been based on the presence and intensity of key threats, as identified in Significant Impact Guidelines for golden sun moth and the species' Conservation Advice. The extensive list of threats provided by the guidance material covers a wide range of land use activities and processes that are the consequence of four main categories of threat as follows:

- Land use and management change:
    - Grazing, pasture improvement, cropping, ploughing;
    - Overstocking;
    - Urban development and infrastructure;
- Conflicting management practices:
    - Fire regimes;
- Degrading processes:
    - Exotic species (including pasture species);
    - Loss of inter-tussock spaces;
    - Soil compaction;
    - Drought and climate change.

Table 4.7 Site Context Scores for Golden Sun Moth

Score	Rationale
Patch Size	
1	Patch is less than 1 ha
2	Patch is less than 10 ha
3	Patch is greater than 10 ha
Patch Shape	
1	Highly irregular shape.
2	A moderately irregular shape.
3	A simple shape approaching a square or circle in configuration.
Isolation / Connectivity	
1	More than 200 m to the nearest golden sun moth population would indicate the population is isolated and has no capacity for natural recolonisation. It should be noted however that given females are very poor fliers, recolonisation even between very closely associated sites is potentially unlikely. Regardless, this factor is considered important as the ability for males to move between occupied patches is an indication of connectivity and the potential for genetic interchange.
2	Less than 200 m but more than 20 m between patches would indicate some potential for movement between sites however this may also be limited by other factors that golden sun moth find insurmountable
3	20 m or less separation across suitable ground would indicate ready potential for movement of males between patches.
Surrounding Threats	
0	Threat absent.
1	Low intensity threat (2 or less threats).
2	High intensity threat (3 or more threats).

Species Stocking Rate

Stocking rates are based on observations of flying moths during targeted surveys. Although there is presently insufficient information to fully explain the relationship between flying moth numbers and population size, it is considered the most appropriate method for representing stocking rates.

Targeted surveys have not recently been completed during the appropriate flying season at this site, so a conservative assumption based on historical results has been made.

Table 4.8 Species Stocking Rates for Golden Sun Moth

Quality	Rationale
0	No records in potential habitat.
1	Very low numbers of golden sun moth observed during surveys (1 or less per minute)
2	Low number of moths observed (5 or less per minute)
3	Low to Moderate number of moths observed (5 - 10 per minute)
4	Moderate to high number of moths observed (10 - 20 per minute)
5	High numbers of moths observed (20 or more per minute)

4.4.2 Calculations – Existing Habitat

The following table demonstrates the performance of the proposed golden sun moth offset against the Commonwealth's offset calculator. A copy of the Commonwealth offset calculator is provided in **Appendix A**.

Table 4.9 Performance of the Proposed Golden Sun Moth Offset

<table>
<tr><th>Variable</th><th>Value</th><th colspan="7">Rationale</th></tr>
<tr><td colspan="9">Summary of Quality</td></tr>
<tr><td rowspan="7">Area of Habitat (Impact)</td><td rowspan="7">3.08 ha</td><td colspan="7">Direct impact to 2.64 hectares and indirect impacts to up to 0.44 hectares of golden sun moth habitat of varying qualities, as described in Umwelt (2017) and Table 2.4.</td></tr>
<tr><td rowspan="2">ID</td><td rowspan="2">Area (ha)</td><td rowspan="2">Site Condition</td><td colspan="4">Site Context</td><td rowspan="2">Stocking Rate</td></tr>
<tr><td>Isolation</td><td>Shape</td><td>Threats</td><td>Size</td></tr>
<tr><td>1</td><td>0.35</td><td>3/5
Open grassland, mixed condition, low diversity.</td><td>3/3
<20m between patches</td><td>1/3
Very irregular</td><td>2/2
High threats</td><td>2/3
<10 ha</td><td>4/5
Moderate</td></tr>
<tr><td>2</td><td>0.25</td><td>3/5
Open grassland, mixed condition, low diversity.</td><td>3/3
<20m between patches</td><td>1/3
Very irregular</td><td>2/2
High threats</td><td>2/3
<10 ha</td><td>4/5
Moderate</td></tr>
<tr><td>3</td><td>0.04</td><td>3/5
Open grassland, mixed condition, low diversity.</td><td>3/3
<20m between patches</td><td>1/3
Very irregular</td><td>2/2
High threats</td><td>2/3
<10 ha</td><td>4/5
Moderate</td></tr>
<tr><td>4</td><td>2</td><td>3/5
Open grassland, mixed condition, low diversity.</td><td>3/3
<20m between patches</td><td>1/3
Very irregular</td><td>2/2
High threats</td><td>2/3
<10 ha</td><td>4/5
Moderate</td></tr>
<tr><td>5
(Indirect)</td><td>0.13</td><td>2/5
Open grassland, exotic dominated, low diversity.</td><td>3/3
<20m between patches</td><td>1/3
Very irregular</td><td>2/2
High threats</td><td>2/3
<10 ha</td><td>2/5
Low</td></tr>
</table>

<table>
<tr><th>Variable</th><th>Value</th><th colspan="8">Rationale</th></tr>
<tr><td></td><td></td><td>6
(Indirect)</td><td>0.31</td><td>3/5
Open grassland, mixed condition, low diversity.</td><td>3/3
<20m between patches</td><td>1/3
Very irregular</td><td>2/2
High threats</td><td>2/3
<10 ha</td><td>4/5
Moderate</td></tr>
<tr><td rowspan="8">Area of Habitat (Offset)</td><td rowspan="8">4.9 ha</td><td colspan="8">Proposed direct offset of 4.9 ha of natural temperate grassland and native pasture at the North Mitchell Grassland.</td></tr>
<tr><td rowspan="2">ID</td><td rowspan="2">Area (ha)</td><td rowspan="2">Site Condition</td><td colspan="4">Site Context</td><td rowspan="2">Stocking Rate</td></tr>
<tr><td>Isolation</td><td>Shape</td><td>Threats</td><td>Size</td></tr>
<tr><td>1</td><td>0.27</td><td>5/5
Open grassland, native dominated, high diversity</td><td>2/3
<200m from other patches</td><td>2/3
Moderate irregularities</td><td>2/2
High threats</td><td>1/3
<1 ha</td><td>2/5
Low</td></tr>
<tr><td>2</td><td>2.1</td><td>5/5
Open grassland, native dominated, high diversity</td><td>2/3
<200m from other patches</td><td>2/3
Moderate irregularities</td><td>2/2
High threats</td><td>2/3
<10 ha</td><td>2/5
Low</td></tr>
<tr><td>3</td><td>1</td><td>5/5
Open grassland, native dominated, high diversity</td><td>2/3
<200m from other patches</td><td>1/3
Very irregular</td><td>2/2
High threats</td><td>2/3
<10 ha</td><td>2/5
Low</td></tr>
<tr><td>4</td><td>0.43</td><td>5/5
Open grassland, native dominated, high diversity</td><td>2/3
<200m from other patches</td><td>2/3
Moderate irregularities</td><td>2/2
High threats</td><td>1/3
<1ha</td><td>2/5
Low</td></tr>
<tr><td>5</td><td>1.1</td><td>4/5
Open grassland, native dominated, low diversity</td><td>2/3
<200m from other patches</td><td>2/3
Moderate irregularities</td><td>2/2
High threats</td><td>2/3
<10ha</td><td>2/5
Low</td></tr>
<tr><td>Quality (Impact)</td><td>7</td><td colspan="8">A weighted quality score of 7 has been determined by considering the site condition, context, and stocking rates of the impact areas, weighted by the size of the patches. This data has been transparently shown in the above section.</td></tr>
<tr><td>Quality (Offset)</td><td>6</td><td colspan="8">A weighted quality score of 6 has been determined for the offset area by considering the site condition, context, and stocking rates of the individual impact areas, weighted by the size of the patches. A conservative species stocking rate of ‘low’ has been applied.</td></tr>
</table>

<table>
<tr><th>Variable</th><th>Value</th><th>Rationale</th></tr>
<tr><td colspan="3">
<table>
<tr><th></th><th colspan="2">Raw
(weighted scores by area)</th></tr>
<tr><th></th><th>Impact</th><th>Offset</th></tr>
<tr><td>Site Condition</td><td>3</td><td>5</td></tr>
<tr><td>Stocking Rate</td><td>4</td><td>2</td></tr>
<tr><td>Site Context</td><td>7</td><td>6</td></tr>
<tr><td>Isolation</td><td>3</td><td>2</td></tr>
<tr><td>Shape</td><td>1</td><td>1</td></tr>
<tr><td>Threats</td><td>2</td><td>2</td></tr>
<tr><td>Size</td><td>2</td><td>1</td></tr>
</table>
<table>
<tr><th></th><th colspan="2">Transformed
(scores out of 10)</th></tr>
<tr><th></th><th>Impact</th><th>Offset</th></tr>
<tr><td>Site Condition</td><td>6</td><td>10</td></tr>
<tr><td>Stocking Rate</td><td>8</td><td>4</td></tr>
<tr><td>Site Context</td><td>6</td><td>5</td></tr>
<tr><td>Quality</td><td>7</td><td>6</td></tr>
</table>
</td></tr>
<tr><td colspan="3">Offset Calculator</td></tr>
<tr><td>Time over which loss is averted</td><td>20</td><td>This is the maximum time period over which the guide is designed to function, it is appropriate for permanent impacts.</td></tr>
<tr><td>Risk of loss without offset</td><td>5%</td><td>There are a number of factors that could influence the risk of loss of a site, including:
• presence and strength of formal protection mechanisms currently in place on the proposed site (e.g. zoning, restrictive covenants or state vegetation clearing laws);
• presence of pending development applications, mining leases or other activities on the proposed offset site that indicate development intent and likelihood; and
• average risk of loss for similar sites.
The risk of loss (distinct to the future quality without offset) is considered to be low for this site, as the site has been proposed to be used as an offset for a number of years due to its ecological values, therefore risk of development is low, however it has not yet been placed under any formal protection nor is being actively managed.</td></tr>
<tr><td>Risk of loss with offset</td><td>1%</td><td>Management actions implemented as a result of the transfer to offset would include a management framework designed to strategically address golden sun moth. Only unforeseeable factors would result in the loss from the habitat offset site.</td></tr>
<tr><td>Time until ecological benefit</td><td>5</td><td>This assessment is considerate of the time that it would take to see a measurable improvement in quality of the existing golden sun moth habitat patches with active management. As improvement targets for this portion of the offset are based on the removal of threats, particularly weeds and biomass control, initial improvements with site establishment funding could be achieved quickly. As discussed below, this does not include the increase of condition (i.e. golden sun moth feed species), rather the increase of patch size through improved connectivity and permeability.</td></tr>
</table>

Variable	Value	Rationale
Future quality without offset	3	*Future quality without offset* is the estimate of the habitat quality based on a business as usual scenario – that is, considering current management practices, use of the site and historic trends for the quality of habitat on the site. The extent of habitat has been shown to have decreased substantially since its initial mapping – a decline of 75% over 9 years (refer to **Section 3.1**), due to just the absence of active management. Without the proposed offset, the calculations predict a decline in the extent of golden sun moth habitat. Without the offset, and the management of the sites as nature reserve, the site is expected to experience a loss of habitat structure and increase in weed abundance, particularly due to the presence of *Phalaris* in between habitat patches. This vegetation is not conducive to golden sun moth, and as such, any increases in its extent reduces the permeability and suitability of the environment for golden sun moth. The presence of a threatening weed (African lovegrass (*Eragrostis curvula*)) has also been identified at the boundary of the site. African lovegrass is considered to represent a serious threat to natural grassland ecosystems. The species is aggressive; drought and frost tolerate; and is capable of invading natural temperate grassland and suppressing native groundcover (ACT Government 2005), while forming a dense monoculture. As a C4 grass, it does not provide foraging opportunities for golden sun moth (as Chilean needlegrass does). The threat of African lovegrass is highlighted in many current management plans and conservation listings, including but not limited to: • Golden sun moth SPRAT profile: "In the ACT, the following perennial and highly invasive weed species are of particular concern and are all the subject of weed control activities by land management agencies: African Lovegrass (*Eragrostis curvula*), etc." • ACT Environmental Weeds Operations Plan for 2017-18: "African lovegrass and other invasive grasses are recognised as a critical threat to biodiversity and agriculture". In the WOP, African lovegrass is listed as a 'High Priority Project' for the North Mitchell Grasslands. This is considered to be a very high risk factor for the site. The drop in quality from 6 to 3 is based on the following (detailed in the table below): • Site condition from 5 to 2: o Original condition score of 5 is determined by: open grassland / native dominated / high habitat species diversity. o Future condition score of 2 is predicted by: rank grassland / exotic dominated / low habitat species diversity. o Based on the threat of African lovegrass creating a dense monoculture within areas of natural grassland, and the continued threat of Phalaris, this is considered a reasonable prediction. • Shape complexity from 2 to 1: this predicts a further increase in the shape index (edge:core) of the habitat patches from weed encroachment; • Stocking rate from 2 to 1: this predicts a potential drop from low to very low numbers as a result of reduction in C3 grasses which provide habitat for the species.
Future	8	*Future quality with offset* is the estimated habitat quality at the same future time incorporating the proposed offset activities.

<table>
<tr><th>Variable</th><th>Value</th><th>Rationale</th></tr>
<tr><td>quality with offset</td><td></td><td>The management of land as nature reserve will result in a higher level of duty of care, in addition to increased funding for management activities. The improvement of quality will include targeted actions to manage weeds, overgrazing (by stock, native and pest animals), and biomass control. Some rehabilitation works are also proposed which are expected to increase the extent of habitat on site. The site context metrics are also expected to improve with the management of the surrounding exotic vegetation to increase size and decrease shape complexity. The details of these actions are described in Section 3.3.4.
The increase in quality from 6 to 8 is based on the following (detailed in the table below):
• Stocking rate from 2 to 3: this predicts a potential increase from low to moderate numbers as a result of improved connectivity and increased area of habitat patches. While stocking rate is a difficult metric to measure, and it is unknown how long exactly it will take for on-ground actions to result in changes to moth numbers, it is expected in this instance to reflect an improved environment for the moths to fly and breed.
• Threats from 2 to 0: The proposed management actions will eliminate the immediate threats acting on the known patches of habitat. Site wide suppression of threats on the site relate to the long-term habitat improvement targets in Section 4.4.3.
• Size from 1 to 2: The improvement of habitat directly surrounding the known patches of habitat (i.e. the Management Buffer Zone) will effectively increase the size of each patch. This does not include the entire Habitat Improvement Zone, (which has a longer timeframe of 15 years). The management of biomass levels between patches will improve connectivity and allow the separate smaller patches to function as a whole larger area of habitat.</td></tr>
<tr><td colspan="3">
Quality increase
Quality decrease

<table>
<tr><th></th><th colspan="2">Raw
(weighted scores by area)</th></tr>
<tr><th></th><th>Offset (without)</th><th>Offset (with)</th></tr>
<tr><td>Site Condition</td><td>2</td><td>5</td></tr>
<tr><td>Stocking Rate</td><td>1</td><td>3</td></tr>
<tr><td>Site Context</td><td>5</td><td>9</td></tr>
<tr><td>Isolation</td><td>2</td><td>2</td></tr>
<tr><td>Shape</td><td>1</td><td>2</td></tr>
<tr><td>Threats</td><td>2</td><td>0</td></tr>
<tr><td>Size</td><td>1</td><td>2</td></tr>
</table>

<table>
<tr><th></th><th colspan="2">Transformed
(scores out of 10)</th></tr>
<tr><th></th><th>Offset (without)</th><th>Offset (with)</th></tr>
<tr><td>Site Condition</td><td>4</td><td>10</td></tr>
<tr><td>Stocking Rate</td><td>2</td><td>5</td></tr>
<tr><td>Site Context</td><td>5</td><td>8</td></tr>
<tr><td>Quality</td><td>3</td><td>8</td></tr>
</table>
</td></tr>
<tr><td>Confidence in result</td><td>80%</td><td>Confidence in the result is high.
The ACT Government has already committed to $1.5 million of funding in the 2018/19 Budget for the establishment of the proposed offset. This will include site establishment, and initial management including weed and biomass control, and rehabilitation of the spoil site. Ongoing funding will be secured through the ACT Budget Process, with Treasury understanding the importance and requirements of</td></tr>
</table>

Variable	Value	Rationale
		Environmental Offsets. The offset will be managed by the ACT Government's Offset Team. This team is dedicated to managing, monitoring and reporting on offsets established under the EPBC Act. They have an excellent track record. This offset strategy has been developed in consultation with both the Offsets Team and the ACT Government Conservation Branch.
Overall Performance	64%	This offset does not represent the required 90% direct offset for the proposed impact.

4.4.3 Calculations – Habitat Improvement

This site does not immediately offer the required direct offset for the impacted golden sun moth, however, a program of habitat improvement is proposed for the currently exotic dominated matrix between the known golden sun moth habitat patches. The method of valuing the currently unoccupied habitat in **Table 4.10** was developed in consultation with DoEE (pers. comms. Zac Neulinger, 2 March 2018). A copy of the Commonwealth offset calculator is provided in **Appendix A**.

Table 4.10 Performance of the Proposed Golden Sun Moth Offset – Habitat Improvement Areas

<table>
<tr><th>Variable</th><th>Value</th><th colspan="7">Rationale</th></tr>
<tr><td colspan="9">Summary of Quality</td></tr>
<tr><td>Area of Habitat (Impact)</td><td>3.08 ha</td><td colspan="7">As defined in Table 4.9.</td></tr>
<tr><td rowspan="3">Area of Habitat (Offset)</td><td rowspan="3">6 ha</td><td colspan="7">Proposed direct offset of up to 6 ha of grassland at the North Mitchell Grassland for habitat improvement.</td></tr>
<tr><td rowspan="2">ID</td><td rowspan="2">Area (ha)</td><td rowspan="2">Site Condition</td><td colspan="4">Site Context</td><td rowspan="2">Stocking Rate</td></tr>
<tr><td>Isolation</td><td>Shape</td><td>Threats</td><td>Size</td></tr>
<tr><td>1</td><td>6</td><td>2/5
Rank grassland, exotic dominated, absent diversity</td><td>3/3
<20m from other patches</td><td>2/3
Moderate irregularities</td><td>2/2
High threats</td><td>3/3
>10 ha (total patch size)</td><td>0/5
Absent</td></tr>
<tr><td>Quality (Impact)</td><td>7</td><td colspan="7">A weighted quality score of 7 has been determined by considering the site condition, context and stocking rates of the impact areas, weighted by the size of the patches. This data has been transparently shown in the above section (Table 4.9).</td></tr>
</table>

Variable	Value	Rationale
Quality (Offset)	0	The metrics developed for this project recognise the value of this area as currently a '4' however based on discussions with DoEE, a value of '0' has been applied. Despite this, it is considered important to highlight that the grassland between patches of 'occupied habitat' (natural temperate grassland and native grassland) can represent marginal habitat for golden sun moth. While not providing breeding or foraging opportunities, it allows the movement of the species between patches. The permeability of the site (i.e. the absence of any absolute barriers to movement to the species) can be considered in the offset calculations, as defined in **Table 4.7**.

	Raw (weighted scores by area)	
	Impact	**Offset**
Site Condition	3	2
Stocking Rate	4	0
Site Context	7	9
Isolation	*3*	*3*
Shape	*1*	*2*
Threats	*2*	*2*
Size	*2*	*3*

	Transformed (scores out of 10)	
	Impact	**Offset**
Site Condition	6	4
Stocking Rate	8	0
Site Context	6	8
Quality	**7**	**4**
Adjusted Quality	**7**	**0**

Offset Calculator		
Time over which loss is averted	20	This is the maximum time period over which the guide is designed to function, it is appropriate for permanent impacts.
Risk of loss without offset	0%	As this area does not currently represent habitat, there is no risk of loss.
Risk of loss with offset	0%	As this area does not currently represent habitat, there is no risk of loss.
Time until ecological benefit	15	A long time period to meet habitat improvement targets has been applied to ensure this is an achievable target.
Future quality without offset	0	Without the proposed offset, this area will remain as exotic grassland, not representing habitat for the species.
Future quality with offset	5	*Future quality with offset* is the estimated habitat quality at the same future time incorporating the proposed offset activities. The management of land as nature reserve will result in a higher level of duty of care, in addition to increased funding for management

<table>
<tr><th>Variable</th><th>Value</th><th>Rationale</th></tr>
<tr><td></td><td></td><td>activities.
The improvement of quality will primarily include management of grazing regimes to reduce biomass and targeted weed control for Phalaris and other weeds of concern.
The future quality commitment is considered achievable, as it includes the improvement of exotic dominated, rank grassland, to mixed native and exotic, open grassland. The improvements in context relate to the overall benefit to the site of managing the matrix between known patches.</td></tr>
<tr><td colspan="3">
<table>
<tr><th></th><th>Raw
(weighted scores by area)</th></tr>
<tr><th></th><th>Offset (with)</th></tr>
<tr><td>Site Condition</td><td>3</td></tr>
<tr><td>Stocking Rate</td><td>1</td></tr>
<tr><td>Site Context</td><td>10</td></tr>
<tr><td>Isolation</td><td>3</td></tr>
<tr><td>Shape</td><td>2</td></tr>
<tr><td>Threats</td><td>1</td></tr>
<tr><td>Size</td><td>3</td></tr>
</table>
<table>
<tr><th></th><th>Transformed
(scores out of 10)</th></tr>
<tr><th></th><th>Offset (with)</th></tr>
<tr><td>Site Condition</td><td>3</td></tr>
<tr><td>Stocking Rate</td><td>2</td></tr>
<tr><td>Site Context</td><td>9</td></tr>
<tr><td>Quality</td><td>5</td></tr>
</table>
</td></tr>
<tr><td>Confidence in result</td><td>50%</td><td>Confidence in the result is moderate due to the inherent risks associated with restoration type activities. However, as the area was up until recently native dominated, and the commitments generally relate to the improvement of structure and prevention of further weed infestation, this is expected to be a conservative and achievable target.
Furthermore, this offset strategy has been developed in consultation with both the Offsets Team and the ACT Government Conservation Branch, it is considered that the proposed approach to habitat restoration activities is achievable.</td></tr>
<tr><td>Overall Performance</td><td>26%</td><td>In combination with the 64% direct offset in Section 4.4.2, this meets 90% of the required direct offset for golden sun moth.
In addition, an indirect offset is being proposed.</td></tr>
</table>

4.4.4 Indirect Offsets for Golden Sun Moth

In addition to the direct offset for golden sun moth at North Mitchell Grasslands, other compensatory measures are being proposed. These are described below.

4.4.4.1 Rehabilitation at Impact Site

A detailed Landscape Planting Plan has been developed for the Impact Site, which will see disturbed areas that are not hardstand, levelled and revegetated with native 'C3' grasses. As native 'C3' grasses provide fodder for golden sun moth, this will enable the moths to recolonise these areas, and result in the restoration of habitat consistent with, or in higher quality than that removed.

Near-annual surveys of golden sun moth at the impact site have been undertaken since 2012 (Rowell, 2012; Umwelt, 2014; Umwelt, 2016; Umwelt, 2017); and have consistently demonstrated an increased range of the species each year, into disturbed roadside environments. Based on these observations the species has the propensity for expanding into new habitat at this site, it is considered highly likely that with appropriate landscaping, the area disturbed by roadworks could be restored into appropriate habitat for the species.

Appendix B shows the proposed landscaping plan.

This indirect offset is expected to benefit golden sun moth in three ways:

- Firstly, by rehabilitating the roadside verges of Dudley Street with 'C3' grasses, up to 2.2 ha of golden sun moth habitat impacted by the works would be restored.

- Secondly, the activity, whether successful or unsuccessful, will help to contribute to the understanding of golden sun moth habitat rehabilitation, particularly in roadside environments. This will help to increase the ACT Government, and DoEE's confidence in proposing and approving rehabilitation actions for the species.

- Finally, by reseeding with native grasses, and including weed control in the post-construction maintenance program, there is potential that the infestation of Chilean needlegrass, which is currently threatening natural temperate grassland patches, can be contained. While Chilean needlegrass currently appears to provide habitat for golden sun moth, there are no long term studies to demonstrate the resilience and longevity of the species utilising this type of habitat.

The proposed approach to ensure the success of this measure is as follows:

1. flatten and seed disturbed areas using a mix of native 'C3' grasses (golden sun moth feed species);

2. include weed management in post-construction maintenance program for 12 months, or until grasses established;

3. undertake annual combined golden sun moth and weed surveys for up to 5 years to confirm golden sun moth are utilising the area during the flying season. Once moths are observed flying in rehabilitated areas, monitoring can cease; and

4. prepare report detailing the findings of the indirect offset, including any successes and failures for future learnings.

As the areas proposed for rehabilitation currently comprise low to moderate quality, primarily exotic grassland areas, which have only been recently been observed to be occupied (Umwelt, 2016), it is

assumed that these areas are not critical breeding habitat. As such, the restoration of flying habitat is considered to represent like-for-like habitat. This offset does not include any commitments for the long conservation of the area as a nature reserve.

This compensatory measure would be funded as a component of the Project budget.

4.4.4.2 Remediation of Spoil Site

In addition to the golden sun moth habitat improvement, it is proposed that the contaminated site to the south of the offset area be remediated. This will include re-profiling the stockpiles, and revegetation with native grasses to promote the suppression of weeds, and occupation of the area by golden sun moth.

This represents additional value as an experimental exercise which may result in overall conservation gains and improve the long term resilience and viability of the site.

This compensatory measure would be funded as a component of the offset site establishment by both the proponent and the proposed land manager (PCS).

4.5 Management for Improvement of MNES

The following section describes the range of strategies that would be included in the Offset Management Plan and implemented by the land manager, PCS, upon establishment of the Offset.

PCS has prepared an outline of the initial management actions for the North Mitchell Grasslands. These actions will be further reviewed during the preparation of the Offset Management Plan, but demonstrate an understanding of the initial works that will be required to achieve the outcomes of this offset strategy and their costs (see **Appendix C**).

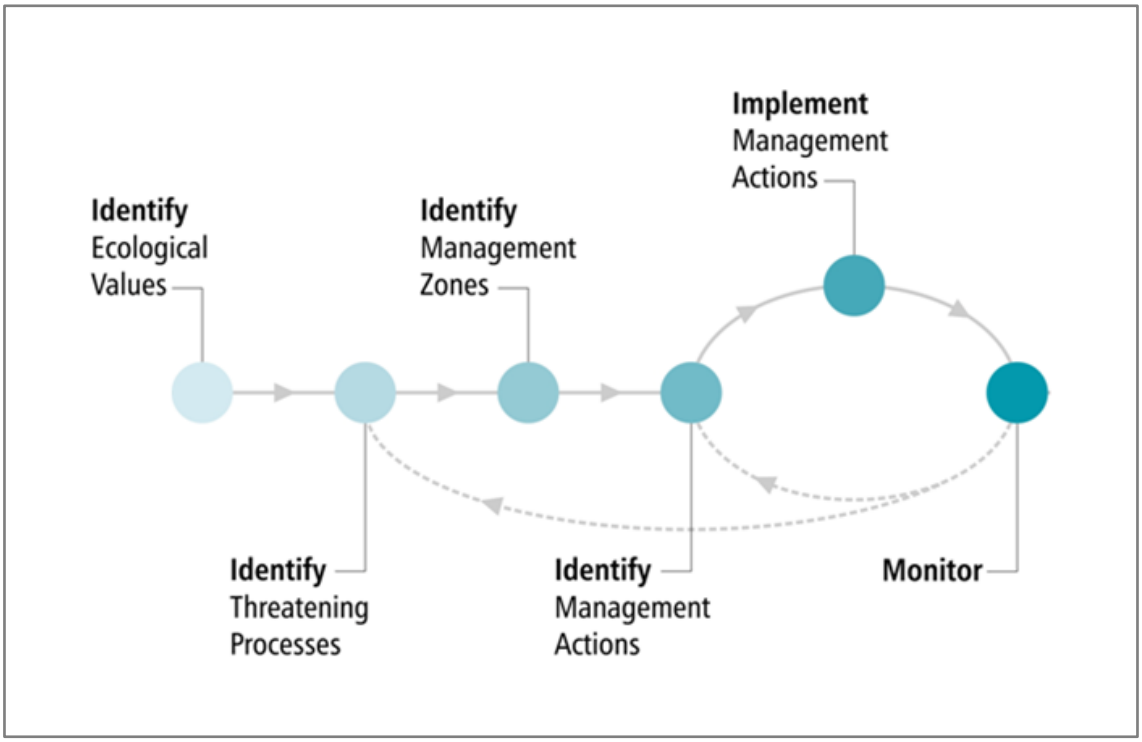
4.5.1 Outcomes Based Approach

The Offset Strategy as presented above has three major proposed outcomes:

- Maintain natural temperate grassland;
- Improve good quality golden sun moth habitat; and
- Increase area of golden sun moth habitat in currently exotic dominated areas.

These outcomes have been developed through an understanding of threatening processes (both currently and historically active), combined with an appreciation of ecological values. This enables the identification of management zones and correlating actions.

The following flowchart represents the process that has been undertaken to date, and will continue to be undertaken while managing the offset. Ongoing monitoring will be used to inform ongoing management actions and reporting requirements for the Offset.



4.5.1.1 Golden Sun Moth Habitat Improvement

A key aspect of the offset strategy is the improvement of the currently exotic dominated grassland areas forming the matrix between the known golden sun moth habitat patches. These areas were up until recently (<10 years) native grassland, and still contain a minor component of native grasses.

It is proposed that with appropriate regimes to manage biomass, and targeted weed management, this area can be improved to mixed, or native dominance. This would increase the permeability of the landscape to golden sun moth, to allow the utilisation of all habitat patches by the species, and reduce threats to both grassland MNES.

Based on advice from the ACT Government's Conservation Planning Branch (pers. comms. Michael Mulvaney, 28 February 2018), the site has high potential for improvement, with up to six additional hectares of the site capable of representing golden sun moth habitat within the medium term (refer **Section 4.4.3**).

4.5.1.2 Management Zones and Strategies

Although detailed management will be developed by PCS in the Offset Management Plan, the following objectives and strategies have been developed to demonstrate the range of management activities that may be undertaken to achieve the proposed offset outcomes.

A number of zones have been described in **Table 4.11** below. These zones have been defined by the ecological conditions identified by Umwelt (2018), and general site features, including topography and drainage. These zones (or their equivalent, as defined by PCS) will be used to target management activities.

Table 4.11 Proposed Management Zones and Objective

Zone	Description	Zone Objective	Time to Ecological Benefit
A	Native grassland patches	Maintain and enhance native grassland to achieve required improvement in existing golden sun moth habitat. Maintain the quality of natural temperate grassland values.	5 years
B	Management buffer around native grassland patches	Mitigate immediate surrounding threats on native grassland patches that contain golden sun moth and/or natural temperate grassland. Promote increased size, and reduced shape complexity of golden sun moth habitat patches through reduction of threats and improved permeability.	5 years
C	Higher slopes, mixed dominance	Increase native dominance to promote expansion of golden sun moth habitat.	15 years
D	Drainage lines, exotic dominated	Contain weeds (primarily Phalaris).	Ongoing
E	Box gum woodland	Maintain – *not part of this offset strategy*.	N/A
F	Spoil Site	Remediate and monitor - *see Section 4.2.4.*	10 years

These zones are shown in **Figure 4.2**. The key management activities will be focused around weed management, and biomass control. These are detailed further below.

Image Source: Environment and Planning Directorate, ACT Government (2016)

0 50 100 200m
1:4 000

Legend

- Offset Area
- Zone A: Native Grassland Patches
- Zone B: Management Buffer
- Zone C: Higher Slopes, Mixed Dominance
- Zone D: Drainage Lines, Exotic Dominated
- Zone E: Box Gum Woodland
- Zone F: Spoil Site

FIGURE 3.3

Proposed Management Zones

Weed Management

Weed management will be key to reducing threats to natural temperate grassland and golden sun moth. The intensity of weed management objectives are defined by the overall zone objective, as either: intensive management; suppression; or containment, as shown in **Table 4.12** and **Figure 4.3**.

Table 4.12 Weed Management Objectives

Zone	Weed Management Objectives		
	Intensive Management	Suppression	Containment
A	X	-	-
B	X	-	-
C	-	X	-
D	-	-	X
E	-	X	-
F	-	X	-

To achieve the outcomes described in **Table 4.11**, a number of management strategies may be implemented. **Table 4.13** outlines key management measures that may be incorporated into the Offset Management Plan.

Table 4.13 Management Actions – Weed Control

Management Method	Target Species			Scenario / Timing	Zone	MNES Outcome	Offset Calculation Outcome
	African lovegrass	Phalaris	Woody Weeds				
Grazing	X	X	-	A grazing plan with feed budget will be developed for the site. This will inform stock grazing requirements to maintain habitat structure for the MNES and to suppress the cover of weed species (particularly Phalaris). Target species: Phalaris and African lovegrass (and exotic annual grasses) May also be used in conjunction with herbicide application if greater suppression is required. Grazing can also be applied to knock down Phalaris prior to burning.	C	Reduce competition and suppression from invasive weed species. Allows native species, including existing GSM feed species, to compete and establish.	- Threat - Isolation
					D	Reduce seed set in Zone D, which is currently a source of seed for the remainder of the Offset Area.	
Spot-spraying	X	-	X	During active growth period of target weed species. May apply multiple times a season if required.	A, B	Intensive management of significant threat (i.e. African lovegrass) from within and adjacent to existing patches of NTG and GSM habitat.	- Threat
					C	Suppression of significant threat (i.e. weed invasion).	

Management Method	Target Species			Scenario / Timing	Zone	MNES Outcome	Offset Calculation Outcome
	African lovegrass	Phalaris	Woody Weeds				
Burning		X		Ecological burns also will be used to further assist control Phalaris. Burns can be applied in conjunction with grazing.	C	Reduce competition, suppression, and seed dispersal from invasive weed species. Allow native species, particularly GSM feed species, to compete and establish in areas where GSM habitat expansion is a primary management aim. Will improve permeability and habitat structure.	- Threat + Size - Isolation
Profile and reseed	-	-	-	Spring Change the profile of the existing waste stockpile in accordance with the Preliminary Site Investigation recommendations (Jacobs, 2018). A concept plan will be developed to determine how to best utilise this site, from both a community recreation/engagement and restoration perspective. Restoration works will include re-seeding the spoil site to increase the area of GSM habitat.	F	Removal of invasive species' seed bank in the soil; allowing seeded natives a greater chance of establishing and out-competing the weeds over time. Result in increased cover of GSM feed species throughout the Offset Area.	N/A

Biomass Control

Biomass control will be the other key management activity undertaken. Biomass control will assist in maintaining the open grassland structure, to promote golden sun moth habitat expansion, and allow competition by native grasses, currently being overshadowed by exotics.

Table 4.14 Management Actions – Biomass Control

Management Method	Scenario / Timing	Target Zone	MNES Outcome	Offset Calculation Outcome
Grazing	A grazing plan with appropriate feed budget will be developed by a qualified agronomist to inform stock levels required to meet the required habitat structure for the MNES. The grazing plan will be followed by PCS staff. Specific timing and intensity of grazing will be managed by vegetation cover thresholds (both minimum and maximum) (see **Section 3.3.3**).	A, C, E, F	Control of biomass accumulation, maintaining an open grassland structure for NTG and GSM. Open grasslands promote grassland diversity (both floral and faunal); and are important for GSM reproduction. Reduce overshading to promote GSM expansion.	- Threat + Condition + Size - Isolation
		B	Control of biomass in Zone B will promote the establishment of native species within these areas, resulting in better connectivity throughout the Offset Area.	

Image Source: Environment and Planning Directorate, ACT Government (2016)

0 50 100 200m
1:4 000

Legend

- Offset Area
- Zone A: Weed Mitigation; Protect from Overgrazing
- Zone B: Weed Mitigation; Biomass Control
- Zone C: Weed Suppression; Biomass Control
- Zone D: Weed Containment
- Zone E: Maintain
- Zone F: Remediate and Monitor

FIGURE 3.4

Proposed Management Objectives

4.6 Establishment of Baselines and Targets

This offset strategy commits to maintaining habitat quality within the natural temperate grassland patches; improving the existing golden sun moth habitat quality; and increasing the extent of golden sun moth habitat by six hectares.

The mapping included in this Offset Strategy will form the baseline for the purposes of demonstrating improvement over time. These baselines and targets are defined in the following sections.

4.6.1 Habitat Extent

The Offset Strategy commits to maintaining the overall extent of natural temperate grassland throughout the Offset Area. This will be measured in total hectares present within the site, which will allow for the natural movement of boundaries and fluctuations inherent to a natural system.

Similarly, the six hectare increase in golden sun moth habitat will be measured according to the total extent of habitat present after 15 years, compared with the current extent defined in this Offset Strategy.

Table 4.15 Habitat Extent Baseline and Targets

MNES	Outcome	Baseline (2018)	Target	Timeframe
Natural temperate grassland	Maintain quality and extent of natural temperate grassland	3.8 ha	3.8 ha	15 years
Golden sun moth	Increase extent of golden sun moth habitat	4.9 ha	10.9 ha	15 years

4.6.2 Habitat Quality

The Offset Strategy commits to maintaining the quality of natural temperate grassland; and improving the quality of golden sun moth habitat (**Table 4.16**).

This improvement is proposed through the removal of threats to the existing habitat; particularly targeting weed control and biomass management on the edges of the patches, which would result in improved condition, patch size and long term viability.

Table 4.16 Habitat Quality Baseline and Targets

MNES	Outcome	Baseline (2018)	Target	Timeframe
Natural temperate grassland	Maintain quality and extent of natural temperate grassland	7/10	7/10	15 years
Golden sun moth	Improve quality of golden sun moth habitat	6/10 (4.9 ha)	8/10 (4.9 ha)	5 years

MNES	Outcome	Baseline (2018)	Target	Timeframe
Golden sun moth	Increase extent of golden sun moth habitat	0/10 (6 ha)	5/10 (6 ha)	15 years

4.6.3 Definition of Thresholds

To allow monitoring and reporting on the success (or otherwise) of the Offset, baselines and targets will be established for factors such as biomass state (i.e. high, medium, or low), amount of inter-tussock space, and species richness. These thresholds, including the methodology for measurement, will be defined in the OMP.

The aims of these measures will be to provide a quantitative and repeatable method of assessing the change in quality of habitat over time, based on consideration of the existing and preferred thresholds for natural temperate grassland and golden sun moth habitat.

The thresholds will also be used to define management action triggers for adaptive management (e.g. adjust grazing management plan if biomass accumulation exceeds the allowable limit).

5.0 Offset Establishment and Management

5.1 Offset Responsibilities

The offset will be managed by the ACT Government's Offset Team, part of the Parks and Conservation Service in the Environment, Planning and Sustainable Development Directorate (EPSDD).

This team is dedicated to managing, monitoring and reporting on offsets established under the EPBC Act.

Any reporting for the impact area or against development conditions will be undertaken by the Project Proponent. The Offset Team will work closely with the Proponent to ensure that all reporting requirements are co-ordinated effectively.

To align with all other ACT offset reporting timeframes, annual reports would be submitted on 30 August, beginning at least 12 months after a decision from DoEE.

5.2 Site Security

Land use in the ACT is governed by the Territory Plan, which defines zoning and allowable uses. The legal mechanism to ensure the protection of the offset site in perpetuity will be a land use zoning variation through the Territory Plan.

A 'Nature Reserve Overlay' (Pc) will be applied over the currently non-urban NUZ3 zoned land. The overlay will apply additional objectives (as defined by Schedule 3 of the PD Act) to:

- Conserve the natural environment (primary objective); and
- Provide for public use of the area for recreation, education and research (secondary objective).

The change in zoning will result in a change in land management objectives and responsibilities, and subsequent increase duty of care. Land management will be the responsibility of Parks and Conservation Services (PCS), the ACT Government's land manager.

The variation under the Territory Plan will be completed following EPBC Approval.

5.3 Offset Funding

The Offset will be funded by the ACT Treasury through the Government's annual budget bid process.

Initial funding for offset establishment, including site infrastructure (fencing, gates, stock watering points, access tracks) and remediation of the contaminated site (**Section 4.4.4**) has already been secured in the 2018/19 budget through the funding for the Dudley Street Project.

Funding for ongoing management would be secured by the future land manager annually, and would include costs for weed management, biomass control, monitoring and reporting. This is a mature process, with offsets funded annually.

5.4 Offset Management Plan

An Offset Management Plan (OMP) would be prepared for the site by the Offset Team to guide management, monitoring, and ongoing improvement activities.

As the OMP needs to be a live, adaptive document, it is appropriate that it is prepared by the land manager. As such, this offset strategy does not aim to define all the requirements of the OMP, however has provided the range of activities to be undertaken to achieve the offset commitments. These activities would be further defined by the land manager to ensure consistency with their existing processes.

6.0 Assessment of Suitability

For natural temperate grassland, the proposed offset represents a surplus to what is required to directly offset the proposed impact. It is considered to represent a high quality offset, replacing like-for-like and also protecting other important MNES values.

For golden sun moth, the combined proposed offsets would provide 90% of the required direct offset. The habitat improvement component is considered to be a long term value add for the offset site, and would increase the long term resilience and viability of habitat within the North Mitchell Grasslands.

Acknowledging that habitat restoration activities may generally be difficult to achieve, this target has been developed in consultation with the ACT Government Conservation and Research Branch, in addition to the future land manager of the site, and is considered to have a moderate to high likelihood of being successful (as demonstrated in **Section 4.4.3**). Setting realistic targets for the area, to improve habitat to increase site permeability and resilience, rather that recreating natural grassland, will help to ensure this is a commitment that can be achieved.

In addition to the 90% direct offset supplied by the North Mitchell Grasslands; this offset strategy also includes other compensatory measures in the rehabilitation of Dudley Street road reserves, and the North Mitchell spoil site. These indirect offsets will contribute to the current understanding of the rehabilitation of golden sun moth habitat through reseeding with native C3 grasses. In conjunction with the direct offset, these other compensatory measures are considered adequate and appropriate to fully offset the direct loss to golden sun moth.

The North Mitchell Grassland site would provide a high value offset for the MNES values lost from the development of the Project. It is recommended that this site is used to offset the proposed impact.

7.0 References

AECOM (2017) *Canberra Brickworks Access Road and Dudley Street Upgrade Preliminary Sketch Plan*, prepared for the Chief Minister, Treasury and Economic Development Directorate, Canberra.

ACT Government (2005) *Action Plan No. 28 A Vision Splendid of the Grassy Plains Extended, ACT Lowland Grassland Conservation Strategy*, Environment ACT, Canberra

ACT Government (2018) *ACTmapi: Significant Species, Vegetation Communities and Registered Trees Map*, ACT Government, Canberra, accessed online (February 2018): http://app.actmapi.act.gov.au/actmapi/index.html?viewer=ssvcrt.

Department of Environment, Water, Heritage and the Arts (2009a) *Significant Impact Guidelines for the Critically Endangered Golden Sun Moth (Synemon plana),* Nationally Threatened Species and Ecological Communities EPBC Act Policy Statement 3.12, Department of Environment, Water, Heritage and the Arts, Canberra.

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Threatened Species Scientific Committee (TSSC) (2016) *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (s226B) Approved Conservation Advice (including Listing Advice) for the Natural Temperate Grassland of the South Eastern Highlands (EC 152)*, Australian Government, Canberra.

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Umwelt (2016) *Canberra Brickworks and Environs Project – Golden Sun Moth Survey and Ecological Assessment of the Dudley Street Road Reserve*, Briefing Note to Irena Sharp of the Land Development Agency, Canberra.

Umwelt (2017a) *Canberra Brickworks Access Road Ecological Surveys 2016*, briefing note prepared for Gerard Coffey, Chief Minister, Treasury and Economic Development Directorate, ACT Government, Canberra.

Umwelt (2017b) *Impact Assessment Report: Canberra Brickworks Access Road and Dudley Street Upgrade Area, Yarralumla, ACT*, unpublished report prepared for the Chief Minister, Treasury and Economic Development Directorate, ACT Government, Canberra.

APPENDIX A

Offset Calculator Spreadsheets

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Natural Temperate Grassland of the
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	**6.8%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	Yes	Dudley Street and surrounds.	**Area**	0.28	Hectares	Umwelt (2017a and 2017b)
			Quality	**5**	Scale 0-10	
			Total quantum of impact	0.14	Adjusted hectares	
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	Yes	0.14	Adjusted hectares	North Mitchell Grasslands	**Risk-related time horizon (max. 20 years)**	20	**Start area (hectares)**	3.8	**Risk of loss (%) without offset**	5%	**Risk of loss (%) with offset**	1%	0.15	75%	0.11	0.03	0.24	169.08%	Yes	
									Future area without offset (adjusted hectares)	3.6	**Future area with offset (adjusted hectares)**	3.8								
					Time until ecological benefit	15	**Start quality (scale of 0-10)**	**7**	**Future quality without offset (scale of 0-10)**	**5**	**Future quality with offset (scale of 0-10)**	**7**	2.00	80%	1.60	0.60				
Threatened species habitat																				
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	0.14	0.24	169.08%	**Yes**	$0.00	N/A	$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Golden Sun Moth (Synemon plana)
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	**6.8%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Dudley Street and surrounds.	**Area**	3.08	Hectares	Umwelt (2017a and 2017b)
			Quality	**7**	Scale 0-10	
			Total quantum of impact	2.16	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	2.16	Adjusted hectares	North Mitchell Grasslands	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	4.9	**Risk of loss (%) without offset**	5%	**Risk of loss (%) with offset**	1%								
									Future area without offset (adjusted hectares)	4.7	**Future area with offset (adjusted hectares)**	4.9	0.20	75%	0.15	0.04	1.37	63.62%	No	
					Time until ecological benefit	5	**Start quality (scale of 0-10)**	**6**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**8**	5.00	80%	4.00	2.88				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	2.156	1.37	63.62%	**No**	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Golden Sun Moth (Synemon plana)
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	**6.8%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Dudley Street and surrounds.	**Area**	3.08	Hectares	Umwelt (2017a and 2017b)
			Quality	**7**	Scale 0-10	
			Total quantum of impact	2.16	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	2.16	Adjusted hectares	North Mitchell Grasslands	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	6	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%								
									Future area without offset (adjusted hectares)	6.0	**Future area with offset (adjusted hectares)**	6.0	0.00	50%	0.00	0.00	0.56	25.93%	No	
					Time until ecological benefit	15	**Start quality (scale of 0-10)**	**0**	**Future quality without offset (scale of 0-10)**	**0**	**Future quality with offset (scale of 0-10)**	**5**	5.00	50%	2.50	0.93				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

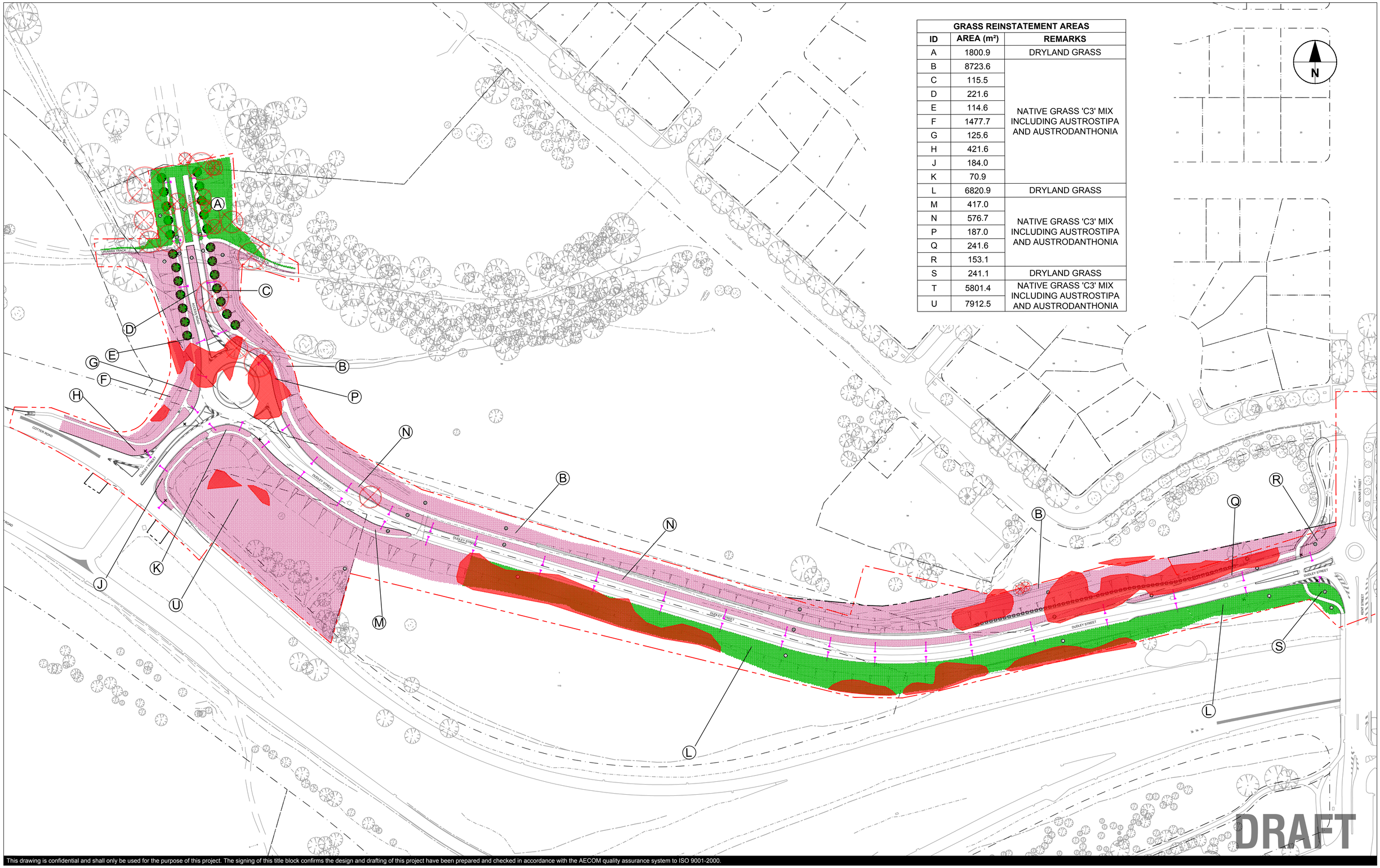
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	2.156	0.56	25.93%	**No**	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

APPENDIX B

Landscaping Plan

ISO A1 594mm x 841mm

GRASS REINSTATEMENT AREAS		
ID	AREA (m²)	REMARKS
A	1800.9	DRYLAND GRASS
B	8723.6	NATIVE GRASS 'C3' MIX INCLUDING AUSTROSTIPA AND AUSTRODANTHONIA
C	115.5	
D	221.6	
E	114.6	
F	1477.7	
G	125.6	
H	421.6	
J	184.0	
K	70.9	
L	6820.9	DRYLAND GRASS
M	417.0	NATIVE GRASS 'C3' MIX INCLUDING AUSTROSTIPA AND AUSTRODANTHONIA
N	576.7	
P	187.0	
Q	241.6	
R	153.1	
S	241.1	DRYLAND GRASS
T	5801.4	NATIVE GRASS 'C3' MIX INCLUDING AUSTROSTIPA AND AUSTRODANTHONIA
U	7912.5	



This drawing is confidential and shall only be used for the purpose of this project. The signing of this title block confirms the design and drafting of this project have been prepared and checked in accordance with the AECOM quality assurance system to ISO 9001-2000.

Last saved by: WILLIAMSR20(2018-03-16) Last Plotted: 2018-03-16
Filename: P:\CBR\60533438\5. CAD\25-SKETCHES\60533438-SKT-30-0000-LA-9200.DWG

AECOM

CONSULTANT

AECOM Australia Pty Ltd
A.B.N 20 093 846 925
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PROJECT

Canberra Brickworks Access and Dudley Street Upgrade

CLIENT

Procurement and Capital Works
Levels 2 & 3, Annex, Macarthur House,
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Prepared for:
Procurement and Capital Works
A.B.N 66 676 633 401

FOR INFORMATION

REGISTRATION

0 25 50 m
1:1000

PROJECT MANAGEMENT INITIALS

DESIGNER	CHECKED	APPROVED

PROJECT DATA

DATUM		SURVEY	

ISSUE/REVISION

A		INFORMATION ONLY
I/R	DATE	DESCRIPTION

PROJECT NUMBER

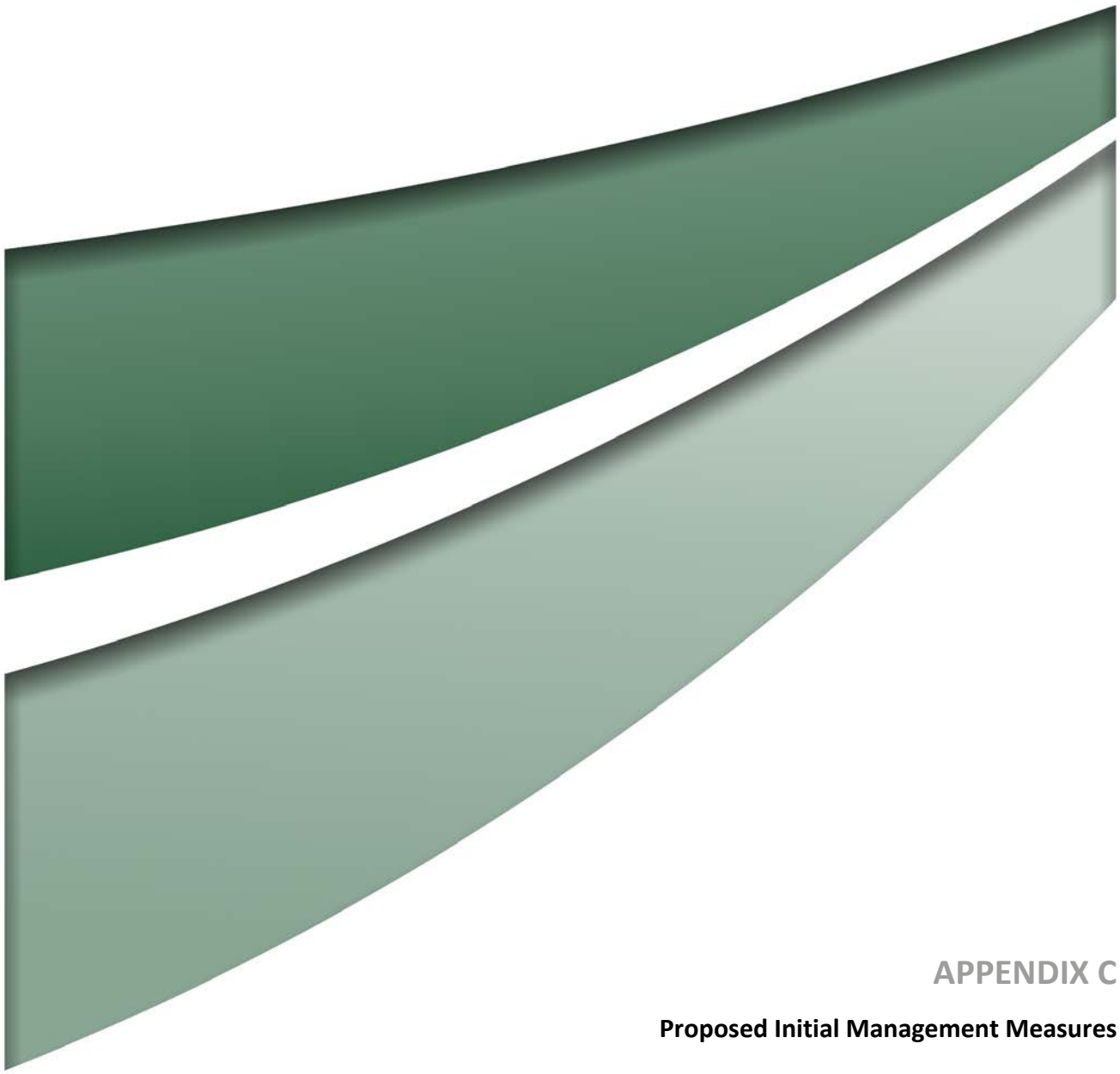
60533438

SHEET TITLE

DUDLEY STREET UPGRADE LANDSCAPING PLAN

SHEET NUMBER

60533438-SKT-30-0000-LA-9200



APPENDIX C

Proposed Initial Management Measures

Initial Proposed Management Actions for North Mitchell Grasslands

This amount is for plans and works undertaken over the first 2 years. It includes planning required for the long term management of the site and for actions required in preparation for delivering restoration works identified in the offsets strategy (noting the short timeframes for delivery) and staff costs.

Costs have been calculated over 2 years to factor in delays in approval timelines which may result in the process misaligning with the budget bid cycle for 2019/20 (i.e. it will provide a buffer in case we are unable to secure funding through the ACT budget until 2020/21).

The total funding PCS are seeking to undertake the works and cover associated costs: $482,000.

Planning

Activity	Description	Responsibility	Estimated Costs 2018-2020
Spatial analysis of site characteristics to inform biomass management (decision tree) and associated grazing plan (for ecological and fuel management purposes)	Develop a spatial plan with decision tree that will help inform habitat structure management requirements (biomass management) for sites. Decisions based on site characteristic (soil, species composition and values present and bushfire fuel management requirements). A Grazing Plan (with feed budget) will guide how the biomass management requirements will be monitored and delivered.	PCS to engage a suitably qualified consultant	$15,000 Includes soil testing and agronomy
Concept Plan	A concept plan will be developed to inform how to engage community within grassland ecosystems. The plan will include options for recreational and interpretation infrastructure. The plan will align with the PCS Landscape Classification System, which classifies reserves based on recreational and community engagement opportunity and related levels of service. PCS will seek funding through a business case to roll out infrastructure etc as guided by this planning process	PCS	$20,000
Cultural Heritage Assessment Reporting and Management requirements and Ngunnawal naming	To incorporate traditional ecological knowledge will also inform land management planning via the PCS Healthy Country team and RAOs. RAOs will also be engaged to develop a new reserve name from the Ngunnawal language.	PCS	Delivered on house. Covered under staff costs

Activity	Description	Responsibility	Estimated Costs 2018-2020
Offset management plan and restoration project plans	An offset management plan will be required for the area (required by DoEE). This will be developed after the above planning process are complete (with the exception of the concept plan, which can be done after, depending on DoEE's time lines for when they want the OMP to be completed). In addition given the short time for the restoration efforts to be realised, a detailed restoration project plan will also be required. Future iterations to be developed by PCS	PCS to engage a consultant	$20,000

Capital Improvement and Maintenance

Activity	Description	Responsibility	Estimated costs 2018 2018-20
Fences	All fencing and associated grazing infrastructure needs to be guided by the reserve values spatial analysis and grazing plan. Cost estimates have been calculated based on re-aligning boundary fences, one internal fence, 2 troughs and steps overs.	PCS	$50,000
Management tracks / recreational trails etc.	To be informed by the concept plan and Landscape Classification System. To be funded via budget bid.	PCS	-
General Information Signage	General park signs and prohibited activity signage (as is required under the under the Nature Conservation Act 2014) will be installed on the offset boundary. 1 large reserve sign and 1 smaller reserve sign sufficient	PCS	$5000

Environmental Enhancement and Operational Works

Activity	Description	Responsibility	Estimated# Budget 2018-2020
Protection of Natural Regeneration	Tree guards and temporary fencing to protect natural eucalypt regeneration from grazing cattle. Regeneration limited to BGW management area	PCS	$1000

Activity	Description	Responsibility	Estimated# Budget 2018-2020
Spoil site: levelling in prep for revegetation	Spoil site: It is recognised that the EPA determined that they stockpile does not have to be removed from site. It is also recognised that removing soil is costly to Government. The site however needs to be remediated and will be actively managed in-perpetuity. Site remediation needs to align with management requirements including for revegetation and ongoing management access. TCCS has agreed to fund an analysis of the final foot print of the site post levelling (with sides battered to 1:4 ratio – including any capping material and revegetation substrate). The footprint must not go into areas identified as NTG or native grasslands on the maps (excess soil to be removed). Any cement must be deeply buried or removed from site. Top layer of soil must be free of rock, which would make on-going management difficult. Capping material is TBC by TCCS, however for any revegetation to occur additional soil (or 'B' horizon quality – as advised by Greening Australia) is required. The soil currently on site is inadequate for this purpose.	TCCS	Covered by TCCS under separate contract (s)
Revegetation	To secure sufficient seed to undertake restoration works (and tight timeframes), PCS needs to engage seed collectors asap.	PCS	$40,000
Weed control	An intensive and highly targeted weed control program delivered in house is proposed for 3 years. After this time, the site can be incorporated into the offsets weed control program utilising highly trained weed control contractors or in house (risk dependant). Target weed: ○ CNG ○ Serrated Tussock ○ St Johns Wort ○ Blackberry and other woodies ○ Phalaris ○ African Lovegrass *PCS will also accept responsibility for weed incursions along road verge*	PCS	$80,000

Activity	Description	Responsibility	Estimated# Budget 2018-2020
Invasive Animals (Rabbits)	Rabbits can be monitored and controlled annually in Autumn and Spring, in conjunction with the North District Rabbit Control Program (VOP).	PCS	Delivered on house. Covered under staff costs
Bushfire fuel reduction	Bushfire fuel will be assessed in to ensure that it meets the standards applicable for Strategic Bushfire Abatement and appropriate action to reduce fuel load undertaken as required.	PCS	Delivered on house. Covered under staff costs

Monitoring Program and Review

Proposed Activity	Description of Proposed Works	Responsibility	Estimated[#] Budget 2018-2020
MNES monitoring	Engage a suitably qualified expert to deliver the mapping and monitoring program – part of developing long term baseline quality assessment	PCS to engage a suitably qualified expert	$16,000

Management Resources

Proposed Activity	Description of Proposed Works	Responsibility	Estimated[#] Budget 2018-2020
Staffing	• To deliver the actions outlined in this, plan resources to support a part-time a Senior Ranger (Ranger Grade 3) and Field Officer and vehicle. • Funding will also be required to support the on-going planning and ecological support. • Funding calculated on a pro rata amount based on site size and level of commitments. • The amount calculated for the field officer is without time for weed control, noting that funding has been allocated for that purpose above.	PCS	$235,000

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Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Golden Sun Moth (Synemon plana)
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	CBP	**Area**	1.58	Hectares	Umwelt (2017a and 2017b); Umwelt (2020)
			Quality	**5**	Scale 0-10	
			Total quantum of impact	0.79	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	0.79	Adjusted hectares	Googong Biobanking Site	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	6.6	**Risk of loss (%) without offset**	5%	**Risk of loss (%) with offset**	3%	0.13	75%	0.10	0.10	0.80	101.52%	Yes	
									Future area without offset (adjusted hectares)	6.3	**Future area with offset (adjusted hectares)**	6.4								
					Time until ecological benefit	5	**Start quality (scale of 0-10)**	**5**	**Future quality without offset (scale of 0-10)**	**4**	**Future quality with offset (scale of 0-10)**	**6**	2.00	60%	1.20	1.19				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0.79	0.80	101.52%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

GOLDEN SUN MOTH

Site Condition

STRUCTURE	
1	Grassy open woodland/shrubland
2	Rank grassland
3	Open grassland

CONDITION (FORAGE SPECIES)	
1	Exotic dominated
2	Mixed
3	Native dominated

HABITAT SPP DIVERSITY	
1	Low
2	Mod
3	High

SITE CONDITION

max *9*

CBP1	Structure	3	
	Condition	1	
	Spp diversity	1	
	raw	5	*sum of raw scores*
	adjusted	**3**	*sum of raw scores divided by max multiplied by 5*
CBP2	Structure	3	
	Condition	1	
	Spp diversity	1	
	raw	5	
	adjusted	**3**	
Biobanking Site	Structure	3	
	Condition	2	
	Spp diversity	2	
	raw	7	
	adjusted	**4**	

SPECIES STOCKING RATE	
0	Absent
1	V. Low
2	Low
3	Low-mod
4	Mod
5	High

SITE CONTEXT

Isolation from other patches	
1	>200m
2	<200m
3	<20m

Shape	
1	v. Irregular
2	moderate irregularities
3	square

Threats	
2	High Threats
1	Low Threats
0	Threats Absent

Patch size	
1	<1 Ha
2	<10Ha
3	>10 Ha

SUMMARY - IMPACT SITES

Site ID	Area	Weighting	Site Condition		Species Stocking Rate		Site Context							
			Unweighted	Weighted	Unweighted	Weighted	Isolation (U)	Isolation (W)	Shape (U)	Shape (W)	Threats	Proximity (W)	Size (U)	Size (W)
CBP1	1.3	0.82278481	3	2.46835443	1	0.8227848	2	1.64556962	1	0.82278481	2	1.64556962	2	1.64557
CBP2	0.28	0.17721519	3	0.53164557	1	0.1772152	2	0.35443038	1	0.17721519	2	0.35443038	1	0.177215
	1.58	1		**3**		**1**		2		1		2		1.822785

SUMMARY - OFFSET SITES

Site ID	Area	Weighting	Site Condition		Species Stocking Rate		Site Context							
			Unweighted	Weighted	Unweighted	Weighted	Isolation (U)	Isolation (W)	Shape (U)	Shape (W)	Threats	Proximity (W)	Size (U)	Size (W)
Biobanking Site	9.5	1	3	3	1	1	2	2	1	1	1	1	3	3
	9.5	1		**3**		**1**		**2**		**1**		**1**		**3**

The Offset

	Raw		Transformed	
	Impact	Offset	Impact	Offset
Site Condition	3	3	6	6
Stocking Rate	1	1	2	2
Site Context	6	8	5	7
Isolation	*2*	*2*		
Shape	*1*	*1*	**4**	**5**
Threats	*2*	*1*		
Size	*2*	*3*		

Future Qualities	Raw		Transformed	
(Offset)	Without	With	without	with
Site Condition	3	3	6	6
Stocking Rate	1	1	2	2
Site Context	6	8	5	7
Isolation	*1*	*1*		
Shape	*1*	*2*	**4**	**5**
Threats	*1*	*1*		
Size	*2*	*3*		

umwelt
Environmental & Social Consultants

Inspired People
Dedicated Team
Quality Outcomes

Briefing Note

To: Doma Group
cc: David Carey
From: Umwelt Environment and Social Consultants
Author: Natasha Crook, Caitlin Adcock
Date: 11 February 2020
Subject: Golden Sun Moth Surveys, Canberra Brickworks

1.0 Introduction

The purpose of this briefing note is to provide the results of the 2019 golden sun moth (*Synemon plana*) habitat evaluation and the targeted survey at the Canberra Brickworks Precinct (Study Area) undertaken by Umwelt Environmental and Social Consultants (Umwelt).

This investigation was undertaken to confirm the continued presence and determine the current extent of golden sun moth within the Study Area.

2.0 Methodology

On 31 October 2019, an Umwelt ecologist evaluated the golden sun moth habitat identified by Biosis (2017) at the Study Area. The Study Area was surveyed on foot to assess the extent and quality of the golden sun moth habitat.

A program of targeted golden sun moth surveys was then undertaken to confirm the extent of golden sun moth within identified habitat. As per the survey guidelines for the species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), surveys were undertaken in the following conditions:

- warm to hot day (i.e. above 20 degrees Celsius by 10.00 am) with a clear or mostly cloudless sky
- between 10.00am and 2.00pm
- still or relatively still wind conditions during the survey period
- at least two days since rain.

Surveys were undertaken in the previously identified golden sun moth habitat, which has been described as an exotic pasture dominated by Chilean needle grass (*Nassella neesiana)* (Biosis 2017), in addition to potential areas of habitat identified in the habitat assessment (**Section 3**).

The targeted survey involved placing seven 100m (approximate) transects in the golden sun moth habitat. The ecologist walked along the transect and recorded all golden sun moths. Incidental records and female golden sun moth were recorded independently to the transects.

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3.0 Habitat Assessment

The vegetation assessment confirmed that golden sun moth habitat occurs in the Study Area (**Figure 1**). There was a small reduction in the extent of the golden sun moth feed species, Chilean needle grass, previously mapped immediately north and south of Denham Street (i.e. Zone 1 and Zone 2) of the Study Area due to the expansion of the non-feed species, African love grass (*Eragrostis curvula*).

Golden sun moth habitat has however expanded in a small isolated patch of Chilean needle grass to the south of Denman Street (Zone 3). The mixed golden sun moth feed species (i.e. native speargrass *Austrostipa* sp. and Chilean needle grass) to the south of Denham Street has also expanded (i.e. Zone 4).

A total area of 1.58 hectares of low-quality golden sun moth habitat was identified within the Study Area (see Figure 1). This is an increase of approximately 0.34 hectares since the initial Biosis (2017) investigation was undertaken (see Figure 2).

Error! Reference source not found. details the golden sun moth habitat extent identified within the Study Area from 2017 and 2019. It is noted that the Umwelt (2018) investigation only covered part of the current Study Area, as its purpose was to assess impacts for the proposed Dudley Street access road project.

Figure 2 demonstrates the changes in the golden sun moth habitat from 2017 and 2019 within the Study Area.

Table 3-1 Golden sun moth habitat comparison

Zone	Description	Biosis (2017) (ha)	Umwelt (2018) (ha)	Umwelt (2019) (ha)
Zone 1	Exotic grassland – Chilean needle grass-dominated	0.70	-	0.69
Zone 2	Exotic grassland – Chilean needle grass-dominated	0.37	-	0.32
Zone 3	Exotic grassland – Chilean needle grass-dominated	0.17	-	0.24
Zone 4	Exotic grassland – mixed GSM feed species (additional areas not mapped by Biosis)	-	0.30	0.33
TOTAL		1.24	0.30	1.58

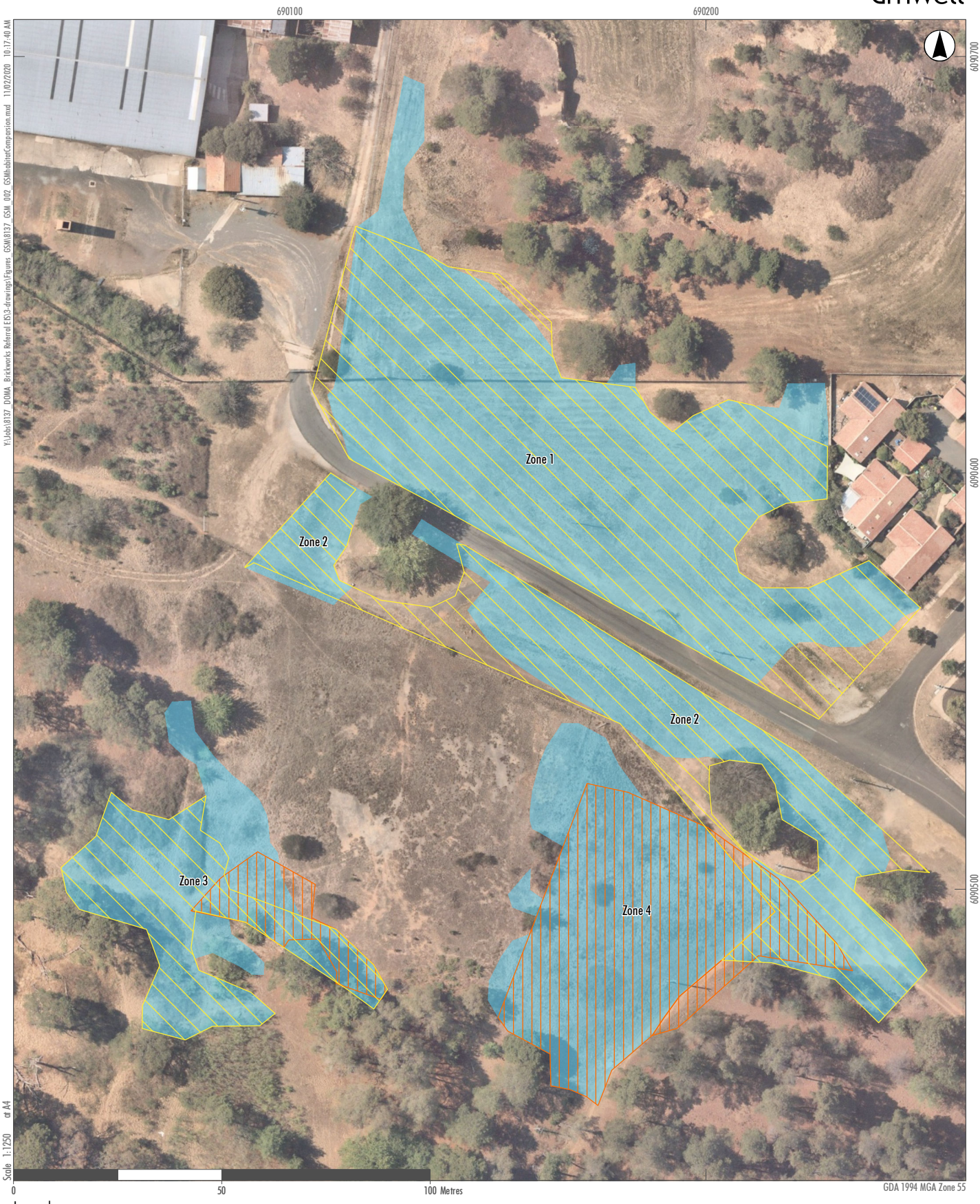
Legend

- GSM Habitat
- One Male GSM
- 2 Male GSM
- 5 Male GSM
- 7 Male GSM
- 10 Male GSM
- 14 Male GSM
- 16 Male GSM
- 30 Male GSM

FIGURE 1

Golden Sun Moth Habitat and Records

Image Source: Nearmap (Jan 2020) Data source: Biosis (2017); Umwelt (2019)



Legend

- GSM Habitat (Umwelt 2019)
- GSM Habitat (Umwelt 2018)
- GSM Habitat (Biosis 2017)

FIGURE 2

Comparsion between 2017 and 2019 Golden Sun Moth Habitat

Image Source: Nearmap (Jan 2020) Data source: Biosis (2017); Umwelt (2019)

4.0 Survey Results

Golden sun moth surveys were undertaken on three occasions throughout late October and November 2019. All surveys were undertaken under ideal conditions, and are compliant with the EPBC Survey Guidelines.

A total of 86 male golden sun moths were recorded during targeted surveys (**Figure 1**). One male golden sun moth was observed on the 31 October during the habitat assessment before the targeted survey. No female golden sun moths were observed.

A summary of the survey conditions and results is provided in **Table 4-1**.

Table 4-1 Golden sun moth results and weather conditions

Survey Timing	Conditions	Golden Sun Moth Observed
31 October 2019 **10.21 am – 11.32 am**	**Cloud cover:** fine **Wind:** Still (less than 11 kilometres per hour) **Temperature:** 23 – 27 degrees Celsius	4
14 November 2019 **1.41pm – 2.06pm**	**Cloud cover:** fine **Wind:** Gentle - moderate (between 11 – 28 kilometres per hour) **Temperature:** 25 – 25 degrees Celsius	39
15 November 2019* **1.01pm – 1.03pm**	**Cloud cover:** fine to partly cloudy **Wind:** Fresh (between 29 – 38 km per hour) **Temperature:** 24 degrees Celsius	2
29 November 2019 **11.30 am – 11.58 am**	**Cloud cover:** fine to partly cloudy **Wind:** light (less than 11 km per hour) **Temperature:** 29 degrees Celsius	41
	Total GSM	**86**

*Due to access, transect 1 could not be surveyed on 14 November and was instead completed on 15 November.

Golden sun moths were observed within all areas identified as potential golden sun moth habitat in **Section 3**.

5.0 Conclusion

The habitat assessment confirms the presence of golden sun moth habitat within the Chilean needle grass pasture previously described by Biosis (2017).

The extent of golden sun moth habitat has:

- Reduced in Zone 1 and 2 because of the encroachment of African love grass
- Increased in Zone 3 and Zone 4 because of increased extent of Chilean needle grass.

The targeted surveys confirm the presence of golden sun moth within the Chilean needle grass exotic grassland, as well as within mixed native and exotic grassland areas within the Study Area. A total of 1.58 hectares of habitat identified. All surveys were undertaken in ideal conditions and are considered as valid surveys.

6.0 References

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Umwelt (2018), Offset Strategy: Dudley Street Upgrade and Canberra Brickworks Precinct Access Road Construction. Prepared for Chief Minister, Treasury and Economic Development Directorate.

Canberra Brickworks
Denman Street, Yarralumla, Canberra

Conservation Management Plan

Date	Document status	Prepared by
April 2010	Final	Lovell Chen
March 2010	Final draft	Lovell Chen

Cover: View of the Canberra Brickworks looking west, 1929 (National Archives of Australia)

Canberra Brickworks
Denman Street, Yarralumla, Canberra

Conservation Management Plan

Prepared for
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April 2010

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Executive Summary

Background

This Conservation Management Plan (CMP) for the former Canberra Brickworks site and complex in Yarralumla has been commissioned by the Land Development Agency (LDA), Canberra. The subject site is currently included in the ACT Heritage Register pursuant to the *Heritage Act*, *2004* (Part 3).

The CMP has been developed in accordance with the *Australia ICOMOS Burra Charter*, 1999, (as adopted by Australia ICOMOS) and its guidelines.

The Commonwealth Government established the Canberra Brickworks in order to support the development of Canberra as the new Federal Capital. The project was announced in 1910 and work began on the development of the complex in 1913. The complex supplied the bricks for the construction of buildings in Canberra in the early period of the establishment of the capital, including Canberra's major public buildings of the 1920s. Bricks and other specialty lines were produced at the site from this time until the closure of the complex in 1976. Production capacity at the site varied in response to fluctuations in demand for bricks and the Brickworks was expanded in a number of key phases, notably in the 1920s and the 1950s.

Following closure of the plant in the mid-1970s, the site was adapted for a range of uses (of varying duration) but other than for the subdivision of land and associated residential development on the perimeter of the site, relatively little physical change has occurred since this time. The surviving complex includes brick manufacturing infrastructure including kilns, stacks and ancillary buildings, with a quarry (brickpit) to the east. Currently, part of the complex is occupied by a timber recycling company.

This Conservation Management Plan builds on work previously undertaken by Lester Firth & Associates in 1986 (*Old Canberra Brickworks Conservation Plan).* In particular, the CMP incorporates historical and other research from the earlier Lester Firth study, acknowledging this material as is appropriate. The CMP includes an updated and expanded history, including detailing the recent history of the site (1986-2010) and updates the physical and descriptive material based on a detailed site survey.

While referencing this early work and other assessments as appropriate, in all other respects, this CMP constitutes a 'first principles' review and assessment of the heritage values of the Brickworks and, based on this, establishes a conservation planning framework (comprising conservation policies and management strategies) for the place. The policies in this CMP recognise and accept the challenge of establishing compatible and feasible long-term use or uses for complex redundant industrial heritage sites such as this one, and allow for the consideration of different approaches within the overall conservation management framework. This conservation management framework should be a key consideration in the future management of the place and in assessing any proposal for adaptation and/or redevelopment works.

Assessment of Significance

The assessment of significance for the site as a whole and for its component parts (refer to Chapter 7) was undertaken with reference to the Burra Charter values, and was also underpinned by a comparative analysis of other surviving brickworks across Australia.

Reference has been made to applicable criteria including those for the National Heritage List (under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999) and the Australian Capital Territory Heritage Register (under the *Heritage Act* 2004).

The conclusion of this assessment is that the Canberra Brickworks is of a relatively high order of significance, with its heritage values variously assessed as either at a State/Territory level or a local level.

The place has been assessed as having historical, scientific (geological and technological), aesthetic and social values as summarised in the table below.

Burra Charter Value	**Level**
Historic	
• Role in the early history of Canberra • Commonwealth brickworks – first Territory based industrial facility	State/Territory
• Role in the history of the local Yarralumla area	Local
Scientific	
• Geological	State/Territory
• Technological	
Kiln design	State/Territory
Extensive surviving brickworks complex	State/Territory
Aesthetic	
• Industrial complex	State/Territory Local
Social	
• Focus of local interest and action and broader community sensitivity	Local
Spiritual	*N/A*

The ACT Heritage Places Register Statement of Significance has been reviewed and a new Statement of Significance prepared for the Brickworks based in part on the existing statement but expanded and recast based on the analysis and assessment in this CMP.

Conservation Policy and Management Plan

The conservation policies and management strategies contained in this CMP (refer to Chapter 8) are wide-ranging and address issues related to the conservation of significant fabric, those related to curtilage and setting, the care and conservation of significant fabric, maintenance and repairs, adaptive reuse and site development. The policies are focussed on the physical conservation and retention of key heritage values of the place but are also directed at

providing a framework within which possible future uses and development associated with the site can be considered and assessed.

The principal objectives of the conservation policy are:

- The conservation (preservation, restoration, reconstruction and adaptation) of fabric of core and supporting significance, within a policy framework that is robust, easily understood, and consistent in its approach;
- to ensure that future works to the site are compliant with Burra Charter principles and responsive to the statutory heritage constraints;
- to maintain an understanding of the original function of the site; and
- in support of a sensitive approach to potential future change and the implementation of an adaptive reuse and redevelopment strategy that is both feasible and will support the long-term conservation of the core heritage values of the place.

Given the multiple values associated with the site, it is recognised that in addressing the conservation policy objectives, there will be options for future management, including for restoration and reconstruction, demolition, adaptation and site development.

It is also recognised that various elements on the site can be identified on the basis of their role in the history, operation and development of the place and/or on the basis of their contribution to particular values associated with the place or with the individual elements themselves.

The elements have variously been identified as 'core' or 'supporting' elements, and 'incidental' elements. These designations recognise that:

- A group of elements is associated with the establishment and operation of the Canberra Brickworks in the period 1915-1940. These elements are central to an understanding and appreciation of the operation and history of the site in this early period including its relationship with the early history and development of Canberra. These are generally designated as core elements.
- A number of elements are of individual scientific (geological or technological) significance in their own right. These have also been designated as core elements.
- A group of elements relate to the further development of the brickworks complex as it was expanded and evolved from the 1940s through to the 1970s and are able to demonstrate aspects of this expansion and the operation of the site in this period. These elements are generally designated as supporting elements.
- A further group has been designated as incidental elements. This group comprises buildings of the post-WWII period which while related to the expansion of the complex, were originally minor in nature, reflect ancillary uses rather than core manufacturing processes and/or are altered. In addition this group includes a small number of buildings that were introduced to the site following its closure as a brickworks.

The policies reflect and make reference to these designations. Specific policies are provided for individual core and supporting elements. For each of these elements, both a conservation policy and a comment on adaptation are provided.

Another key recommendation of the CMP is the establishment of Heritage Management Zones. These zones reflect the analysis of the key heritage issues of curtilage and setting as

they apply on this site and on land immediately abutting, and identify areas of greater or lesser significance and sensitivity. Explicit reference is made to these zones in the CMP policies for site development and new works, and it is recommended these are considered in any assessment of development proposals within or directly abutting the site.

The CMP also includes policies that address matters relating to the management of the place including statutory frameworks and other matters of a more practical nature which have the potential to impact on heritage significance and values.

1.0 INTRODUCTION

1.1 Background and brief

This Conservation Management Plan for the Canberra Brickworks, Canberra has been commissioned by the Land Development Agency (LDA), Canberra. The Brickworks is designated Block 1, Section 102 in the Territory Plan. The document also has regard for land adjacent to the Brickworks: Blocks 7 and 20, Section 102 in the Territory Plan.

The Canberra Brickworks includes former brick manufacturing infrastructure, comprising kilns, stacks and ancillary buildings, with a quarry to the east. In general, the manufacturing infrastructure and quarry (also referred to as 'brickpits') are referred to collectively as Canberra Brickworks or 'the Brickworks' throughout this document.[1]

The Canberra Brickworks has been the subject of numerous development and adaptive re-use proposals since it was decommissioned in 1976. A scheme to develop the site as a tourism and retail facility with housing to the east and north was partially realized in the early 1980s. The site is presently occupied by a timber merchant and a number of artists. The quarry is a secure area.

This CMP constitutes an update of the *Old Canberra Brickworks Conservation Plan*, prepared by Lester Firth Associates Pty Ltd (1986). The 1986 *Conservation Plan* provides a history of the Brickworks; datasheets for the individual site components, with an emphasis on history rather than physical analysis; and an assessment of significance for the site. In addition it identifies potential future uses for the Brickworks, and constraints and opportunities related to development and adaptive re-use. It also includes a limited Conservation Policy (Section 4) and Conservation Plan (Section 5.).

The content of the 1986 *Conservation Plan* that relates to the history and operation of the Brickworks has been drawn upon for this CMP, with additional information and detail provided by Lovell Chen. In addition, the limited descriptive detail in the datasheets (Appendix 2) has been used as a guide for the updated datasheets in this CMP. The sections that reference research by Lester Firth Associates are identified throughout, including original sources where cited.[2]

The CMP also follows other reports on the site and the adjacent land, including:

- National Capital Development Commission, *Canberra Brickworks, South Canberra, Policy Plan*, October 1988;
- Connell Wagner Pty Ltd, *The Old Canberra Brickworks and Environs Development Control Plan*, February 2001; and
- Susan Conroy & Munns Sly Architects, *The Yarralumla Brickworks & Environs Planning Review*, March 2005.

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1 The Brickworks have also been referred to as Old Canberra Brickworks, Westridge Brickworks, the Commonwealth Brickworks, the Government Brickworks and Yarralumla Brickworks. Throughout this document the site is referred to as the 'Canberra Brickworks' or the Brickworks.

2 Lester Firth Associates Pty Ltd, *Old Canberra Brickworks Conservation Plan* (1986) is an unpaginated document. References are cited by Section.

An Adaptive Reuse and Development Strategy for the Canberra Brickworks is also to be prepared. The Strategy, prepared by Lovell Chen Architects & Heritage Consultants, will address the potential of the site for adaptive reuse and development, and will provide guidance on the practical issues which will be confronted in the future use of the site.

1.2 Overview of methodology

This CMP broadly follows the format of the Australia ICOMOS (International Council on Monuments and Sites) guidelines for the preparation of conservation plans[3] and the principles set out in the *Australia ICOMOS Burra Charter*, 1999, adopted by Australia ICOMOS to assist in the conservation of heritage places.

As noted, this CMP follows the 1986 Lester Firth Associates' *Conservation Plan* and much of the material contained in that report has been reviewed, updated, and re-presented, with appropriate attribution to the original authors of that report. Where required, additional historical research was undertaken. A detailed physical survey was undertaken of the site to update and expand the information contained in the earlier study. The physical survey included an inspection of the exteriors and interiors of all buildings (with some minor exceptions) and a detailed review of the broader site.

The assessment of significance for the site as a whole and for its component parts was undertaken with reference to the Burra Charter values and was underpinned by a comparative analysis of other surviving brickworks across Australia. Reference has been made to applicable criteria including those for the National Heritage List (under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999) and the Australian Capital Territory Heritage Register (under the *Heritage Act* 2004).

The conservation policies and management strategies contained in this CMP are wide-ranging and address issues related to the conservation of significant fabric, those related to curtilage and setting, adaptive reuse and development. The policies are focussed on the physical conservation and retention of key heritage values of the place but are also directed at providing a framework within which possible future uses for the site can be considered and assessed. In developing the conservation policies, consideration has been given to the existing Heritage Register documentation for the site prepared by the ACT Heritage Council.

1.3 Report structure

Introduction (Chapter 1)

The Process of Brickmaking (Chapter 2)

This chapter provides a brief overview of the main processes involved in brickmaking, including a description of these processes as they occurred at this site. Chapter 2 also provides an overview of different brick kiln designs and types including those found on this site.

History and Physical Analysis (Chapters 3-6)

To reflect the primary phases in the evolution of the Canberra Brickworks, the History & Physical Analysis is divided into four chapters:

3 J S Kerr. *The Conservation Plan*. passim.

- Chapter 3: Establishment Phase, 1911-1920
- Chapter 4: Expansion Phase, 1921-1940
- Chapter 5: Post-War World II Phase, 1944-1976
- Chapter 6: Post-Closure Phase, 1976-present

Chapters 3-6 each comprise an historical overview followed by datasheets for each extant building or element built during each of the four main phases. The location of these buildings and elements are shown on site plans included for each chapter. Demolished components from each phase are also described briefly at the end of each chapter.

Chapters 3-6 draw on the material in Section 2.1 ('Development of the Brickworks') of Lester Firth Associates' *Conservation Plan* (1986). In addition, detail in relation to specific site components draws on the datasheets that comprise the second appendix in the 1986 *Conservation Plan*. Additional information and detail is provided by Lovell Chen. References are included throughout.

Assessment of Significance (Chapter 7)

This chapter assesses the place for its historical, technical, aesthetic, social and scientific values. The ACT Heritage Places Register statement of significance has been reviewed and a new statement of significance prepared based in part on the existing statement but expanded and recast as considered appropriate.

The site is also assessed against the ACT heritage significance criteria (under the *Heritage Act 2004*) and the National Heritage List criteria (under the *Environment Protection and Biodiversity Conservation Act 1999* and its Regulations).

Conservation Policy and Management Plan (Chapter 8)

This chapter provides conservation policies and management recommendations for the site as a whole and for individual elements.

1.4 Limitations

1.4.1 *Historical Research*

As noted above, this CMP relies in large part on historical material from the 1986 Lester Firth Associates' *Conservation Plan.* Limited additional historical research was undertaken by Lovell Chen where this was considered to be required.

In many instances, the Lester Firth Associates material is not specifically referenced in a conventional manner to original documentary or other sources, however it was beyond the scope of this CMP to revisit all original primary source documents used in the 1986 study to confirm the findings of the 1986 study.

While there clearly is considerable scope to undertake further historical research in relation to this site, it is considered that sufficient research has been undertaken to inform the analysis, assessment and development of policies in this CMP.

1.4.2 *Technology*

As part of the preparation of this CMP, additional historical and other research has been undertaken into the processes and technologies associated with brickmaking, both in a

general sense and specifically as they occurred on this site. This research is sufficient as to allow for a broad understanding of brickmaking on the site, including the sequence of processes as they occurred across the site and in different areas and buildings within the complex. The research is, however, limited in its scope. No detailed research or assessment has been undertaken in relation to the machinery that was used on the site and has subsequently been removed, or in relation to the provenance of the limited remnants of plant and equipment that remain on site. Recommendations are made in the CMP for further investigation of the brickmaking technologies used on this site including the potential for undertaking an oral history with former employees.

1.4.3 *Comparative Analysis*

A comparative analysis has been undertaken in the course of preparing this CMP, with the objective of identifying other surviving urban brickworks complexes of comparable type, scale and age. This comparative analysis was predominantly desktop-based. While a small number of comparative sites were inspected, the majority were not.

1.4.4 *Physical survey*

There were some relatively minor limitations to access during the survey phase of the CMP. Access was not available to the interior of office complex (Building 7) and the upper level of the second Hardy patent kiln at the north of the site (Building 12) was not inspected due to OH & S concerns.

1.4.5 *Scope*

The scope of this CMP does not include a consideration of Aboriginal cultural heritage issues.

Consideration has been given to non-Aboriginal (post contact) archaeological issues in this CMP and a number of recommendations are made for further investigation of the archaeological potential of the site and abutting sites. The CMP does not in itself include a detailed predictive assessment of the archaeological potential of the sites.

Consideration has been given to the possibility of the place having social value to particular individuals or groups and this issue is discussed in Chapter 6 of the report. No detailed social value study has been undertaken in the course of the study.

1.5 Location

The Canberra Brickworks is located approximately 5km west of the Parliamentary Triangle in central Canberra. The site is bounded to the north and east by low density residential development (Woolls Street, Banks Street, Bentham Street and Lane-Poole Place). To the west, the site is bordered by the Royal Canberra Golf Course and Westbourne Woods, and to the south by open space. The Brickworks covers an area of approximately 9.6 hectares.

Figure 1 The location of the Canberra Brickworks site.
Source: Land Development Agency.

1.6 Heritage listings and controls

1.6.1 *ACT Heritage Register (ACT Heritage Act)*

Canberra Brickworks (Block 1, Section 102) is included in the ACT Heritage Register, maintained by the ACT Heritage Council, pursuant to the *Heritage Act*, *2004* (Part 3). The entry to the Heritage Register is attached (Appendix A).

1.6.2 *National Heritage List & Commonwealth Heritage List (Commonwealth Environment Protection and Biodiversity Conservation Act)*

Neither the Canberra Brickworks nor the quarry are included in the National Heritage List or the Commonwealth Heritage List.

1.6.3 *Register of the National Estate*

Canberra Brickworks (Place ID 13318) was included in the Register of the National Estate as a registered place in 1982. The 'Yarralumla Brickpits' was also registered at this time (ID 13319), see Appendix A. The 1982 citation for the brickworks was amended in 1999, to take account of the site's landscape setting and its relationship with the surrounding area. The brickworks was subsequently re-listed as Yarralumla Brickworks Extended Area (Place ID 101439). The revised Statement of Significance expanded on the site's historical and aesthetic values (see Appendix A). The registered area was increased from approximately 8ha to 9.6ha, the additional area comprising the land to the west of the western alignment of

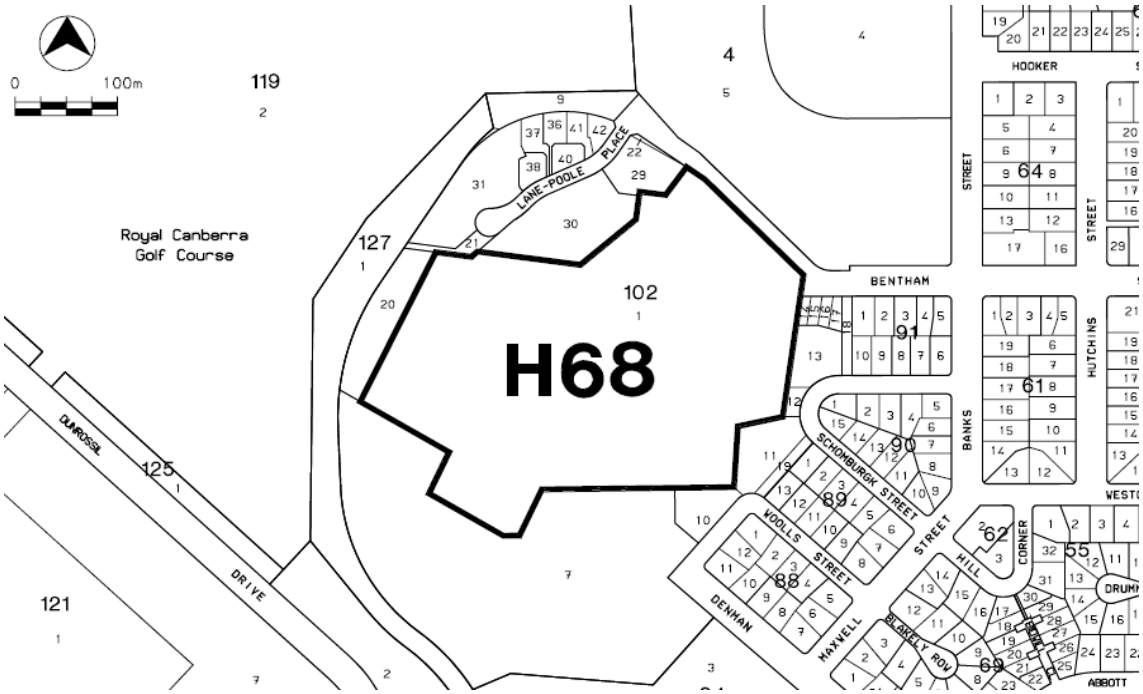


Figure 2 Extent of Heritage Register entry
Source: ACT Heritage Register

the fan house chimneys, and the land surrounding the former worker's hostel to the south-west of the site.

Following amendments to the *Australian Heritage Council Act 2003,* the RNE was frozen on 19 February 2007, meaning that no new places have been added or removed since that date. From February 2012, the RNE will cease to exist as a 'register' but will be retained by the Australian Heritage Council as a publicly accessible archive.

There are no statutory requirements relating to Canberra Brickworks as a consequence of these listings. Copies of the entries from the RNE are attached at Appendix A.

1.6.4 *National Trust of Australia (ACT)*

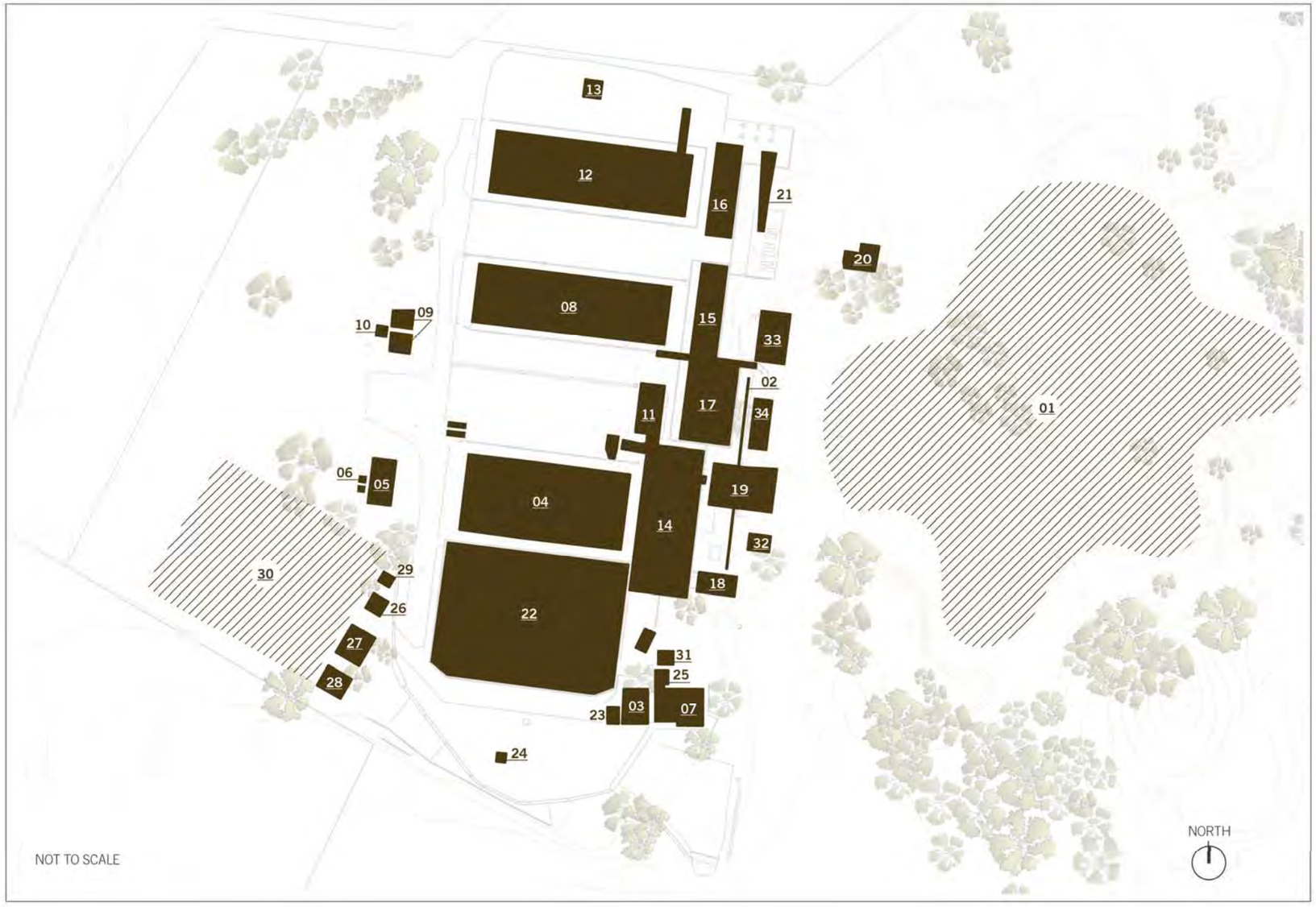
The 'Canberra Brick Works' was identified as a 'Classified' place by the National Trust of Australia (ACT) on 20 July 1981. The National Trust of Australia (ACT) does not maintain files or reports for classified places. There are no statutory requirements as a consequence of this classification.

1.7 Site documentation

1.7.1 *Numbering*

A new chronologically based numbering system has been used in this CMP. The following table includes the numbers of buildings/ elements in the CMP (left column), and the number (if applicable) of the corresponding building/ element in the ACT Heritage Places Register (H68).

The plan at Figure 3 shows the location of these site elements.



Number	Element
01	Quarry
02	Concrete retaining wall
03	Power House
04	Staffordshire Kiln (Kiln 1)
05	Fan house for Kiln 1
06	Chimney stack for Kiln1
07	Offices
08	Hardy patent Kiln (Kiln 2)
09	Fan house for Kiln 2
10	Chimney stack for Kiln 2
11	Amenities block
12	Hardy patent Kiln (Kiln 3)
13	Chimney stack for Kiln 3
14	Machine Bay I for Kiln 1
15	Machine Bay II for Kiln 2
16	Machine Bay III for Kiln 3
17	Workshop
18	Small Crusher House (Crusher House I)
19	Large Crusher House (White pan room / Crusher House II)
20	Primary Crusher House (Crusher House III)
21	Elevator / Conveyor
22	Downdraft Kilns (Kiln 4-6)
23	Downdraft kiln control room
24	Chimney stack for Kilns 4-6
25	Toilet block
26	Amenities block
27	Substation/control room
28	Boiler house
29	Ancillary storage building
30	Remnant of Extrusion plant (concrete pad)
31	Ancillary storage building
32	Storage shed
33	Model railway workshop
34	*Model railway storage shed*

Figure 3 Site plan showing location of elements

SITE ELEMENTS TABLE

No. in CMP (2010)	No. in ACT Heritage Places Register	Building/Element	Date/s of construction
01	11 (Geological features A-D, item 12)	Quarry	Extraction from c. 1913 until c. 1940
02	–	Concrete retaining wall	c.1915-16
03	14	Power House	1915-16
04	1	Staffordshire Kiln (Kiln 1)	1914-15
05	2	Fan house for Kiln 1	1914-15
06	7	Chimney stack for Kiln1	1914-15
07	13	Offices	c. 1925
08	3	Hardy patent Kiln (Kiln 2)	c. 1926, c. 1955
09	4	Fan house for Kiln 2	c. 1927, c.1955
10	8	Chimney stack for Kiln 2	c. 1927
11	–	Amenities block	c. 1950, c. 1977
12	5	Hardy patent Kiln (Kiln 3)	c. 1953
13	9	Chimney stack for Kiln 3	c. 1953, c. 2005
14	15	Machine Bay I for Kiln 1	c. 1955
15	16	Machine Bay II for Kiln 2	c. 1955
16	17	Machine Bay III for Kiln 3	c. 1955
17	18	Workshop	1955
18	21	Small Crusher House (Crusher House I)	c. 1958
19	19	Large Crusher House (White pan room/ Crusher House II)	c. 1955
20	20	Primary Crusher House (Crusher House III)	c. 1955
21	22	Elevator / Conveyor	c. 1955
22	6	Downdraft Kilns (Kilns 4-6)	c. 1960-3
23	–	Downdraft kiln control room	c. 1963

No. in CMP (2010)	No. in ACT Heritage Places Register	Building/Element	Date/s of construction
24	10	Chimney stack for Kilns 4-6	c. 1950s
25	–	Toilet block	c. 1960s
26	–	Amenities block	c. 1960s
27	–	Substation/control room	c. 1971
28	–	Boiler house	c. 1971
29	–	Ancillary storage building	c. 1971
30	–	Extrusion plant (remnants)	c. 1971
31	–	Ancillary storage building	c. 1960s
32	–	Storage shed	c. 1960s
33	–	Model railway workshop	c. 1979
34	–	Model railway storage shed	c. 1979
–	23	Remains of Brickworks Accommodation Village	1945

1.8 Terminology

The conservation terminology used in this report is of a specific nature, and is defined within The Australia ICOMOS Charter for the Conservation of Places of Cultural Significance (the *Burra Charter*) as endorsed by all statutory and national heritage bodies (See Appendix A). The terms most frequently referred to are: place, cultural significance, fabric, conservation, preservation, restoration, reconstruction, adaptation and interpretation. These terms are defined in the revised charter as follows:

Place means site, area, land, landscape, building or other work, group of buildings or other works, and may include components, contents, spaces and views.

Cultural significance means aesthetic, historic, scientific, social or spiritual value for past, present or future generations. Cultural significance is embodied in the place itself, its fabric, setting, use, associations, meanings, records, related places and related objects.

Fabric means all the physical material of the place including components, fixtures, contents and objects.

Conservation means all the processes of looking after a place so as to retain its cultural significance.

Maintenance means the continuous protective care of the fabric and setting of a place, and is to be distinguished from repair. Repair involves restoration or reconstruction.

Preservation means maintaining the fabric of a place in its existing state by removing accretions or by reassembling existing components without the introduction of new material.

Restoration means returning the existing fabric of a place to a known earlier state by removing accretions or by reassembling existing components without the introduction of new material.

Reconstruction means returning a place to a known earlier state and is distinguished from restoration by the introduction of new material into the fabric.

Adaptation means modifying a place to suit the existing use or a proposed use.

Use means the functions of a place, as well as the activities and practices that may occur at the place.

Compatible use means a use which respects the cultural significance of a place. Such a use involves no, or minimal, impact on cultural significance.

Setting means the area around a place, which may include the visual catchment.

Related place means a place that contributes to the cultural significance of another place.

Related object means an object that contributes to the cultural significance of a place but is not at the place.

Associations mean the special connections that exist between people and a place.

Meanings denote what a place signifies, indicates, evokes or expresses.

Interpretation means all the ways of presenting the cultural significance of a place

2.0 THE PROCESS OF BRICK PRODUCTION

2.1 Introduction

A number of processes and elements related to brick production are common to large twentieth century brickworks. These are summarised below:

2.1.1 *Quarrying*

Because of the cost of transporting raw materials in both nineteenth and early twentieth century brickworks, the raw materials for brickmaking (clay, shale) were typically quarried close to the brickworks themselves.

In the case of the Canberra works, until c. 1940 the shale was quarried on site (though clay is thought to have been brought onto the site for tilemaking from the early 1920s). From c.1940, all raw materials were quarried elsewhere and delivered to the site. [4]

2.1.2 *Crushing, Grinding and Pressing*

Raw materials, quarried in lumps, were crushed to a manageable size in a crusher. In some brickworks, crushers might be located at the point of quarrying, with the material then conveyed to another location (closer to the brick presses) where it would pass through grinding mills and pugmills (and further refined, worked and mixed). The material was then fed into the brick presses themselves.

A series of conveyors and hoppers moved the materials between and within buildings and through the different stages of the process. In the nineteenth century the presses and other machinery were powered by steam, but this changed to the use of electricity in the twentieth century (electricity was the only source of power used for machinery at the Canberra brickworks).

2.1.3 *Firing*

Once pressed, the bricks were transported to the kilns (the means of transport varied on different sites) where they were loaded into the kilns. The loading was done by hand until the mid- to late-twentieth century, when the use of forklifts began (often necessitating the widening of the wicket openings to the kiln chambers).

In terms of the firing process itself there were a number of different kiln types used in Australian brickworks of the late nineteenth and twentieth centuries. Refer to section 2.4 below.

2.1.4 *Transport off site*

Once fired, bricks were rarely stored for any length of time or in large quantities, but rather, were generally transported off site relatively quickly. At many brickworks the bricks were transported by rail. At the Canberra Brickworks the bricks were transported for a period by

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[4] Unlike their nineteenth century counterparts, the scale and investment required in twentieth century brickworks meant that they were able to survive the expiration of available raw materials on site. This occurred at Canberra, which imported raw materials from c. 1935 to 1976.

traction engine, and in the 1920s by a dedicated light rail line to the major construction sites in the centre of Canberra.

2.2 Operation of the Canberra brickworks, 1913-1940s

(The following section is from the *Conservation Plan* prepared by Lester Firth Associates, section 2.2 (Elements and Aspects), amended and with additional research by Lovell Chen.)

At the beginning of operations at Yarralumla, the raw material for brick making was obtained on site, primarily by levelling a knoll comprised a hard yellow shale to the north of the 'temporary' works. Minor quarrying also occurred on the western side of the site. Due to variety in the shale, material from various seams was mixed thoroughly to achieve a uniform colour in the bricks. Quarrying at the site was reported to be a complex process, and more costly than the average brickworks due to numerous seams of unusable material such as limestone and sandstone.

After spalling, the shale was conveyed to the works in tip trucks running on small gauge rails. It first passed through a jaw crusher that reduced the material to 75mm and then raised by bucket elevator to an overhead storage bunker. From the storage bunker, the crushed material was taken in one cubic yard truck leads to grinding mill hoppers. After grinding to pass through a fine mesh screen, the shale was elevated by bucket to a loft immediately above the brick presses and moved by gravity to the presses. Owing to the comparatively high lime content of the shale, a 'semi-plastic' pressing process was employed. The pressed bricks were then transported to the kilns for firing.

A description of the kilns, presses and output in the 1930s is given below:

> 1. 30 compartment 'Staffordshire,' with an output capacity of 125,000 per week [note this kiln had 20 not 30 chambers].
>
> 1. 'Hoffman' continuous kiln (Hardy Patent), with an output of 120,000 per week.
>
> 2. Single compartment down-draft kilns, with a capacity of 30,000 each per week.
>
> The downdraft kilns were used almost exclusively for the production of face and special bricks. The bricks presses were the 'New Era' semi-plastic type, made by Messrs Whittaker Bros, England.
>
> There were six brick making units, three for each of the two large kilns, and each unit consisting of a 10ft grinding mill, a 'New Era' brick press, and pug mixer, driven by a 150hp electric motor. The output of each unit is approximately 1,500 bricks per hour. Two units are required to serve each kiln, the third unit being a spare.
>
> In addition to ordinary bricks, wire-cuts and specials were made, and the attractive colour range which was produced was the subject of favourable comment from many quarters.[5]

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5 Cited as 'Ref.I.E. Aust. October 1938,' in Lester Firth Associates, 1986, Section 2.2.1.

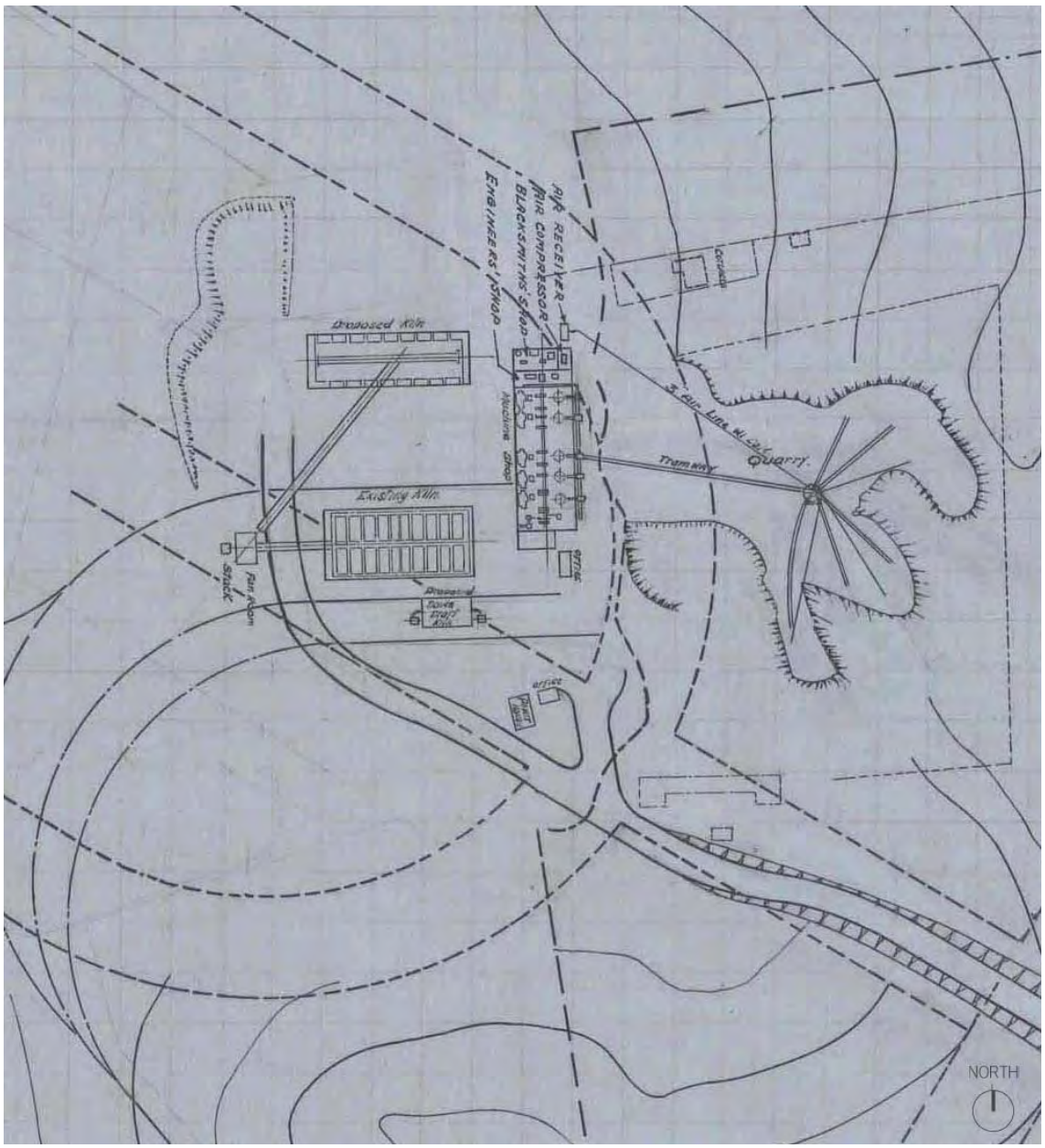

Figure 4 Site plan, 6 April 1926. On this plan, the processes occurred from east to west (right to left on this plan); the quarried material was transported via a tramway to machinery shop to be crushed, ground and pressed in the machinery shop in the centre and then to the kilns on the left. The plan shows both the existing Staffordshire Kiln and the proposed Hardy patent kiln to its north; it also shows the power house and office.
Source: National Archives of Australia.

Figure 5 View from the north-east towards the brick processing buildings, c. 1927
Source: National Library of Australia.

Figure 6 Another view, c. 1927. Note the excavated quarry on the left.
Source: National Library of Australia.

Aspects of the brickmaking process as it occurred in this phase of the site's history remain legible through the overall site layout and key buildings and site elements remaining from the establishment and expansion periods (1913-1940s), however the early crushing, grinding and pressing buildings have all been removed as has much of the associated plant.

2.3 Operation of the Canberra Brickworks, 1950s-1976

While the major brick kilns on the site were retained, the major expansion of the Brickworks that occurred in the 1950s saw the replacement of other early plant and buildings (see Figure 8). The early machine shop was replaced with a series of brick press buildings (machine bays) and a workshop, all of which remain today. The Brickworks was also equipped with a series of new crushers and 'pan rooms' connected to a conveyor system.

A Hazemag crusher (Crusher House 1, Building 18) was located closest to the office building and was connected by a conveyor to the 'White Pan Room' (Building 19) where 10'6" diameter grinding pans were used to further reduce the shale. The White Pan Room could also be fed directly from the quarry area and had two hoppers. Material was crushed, elevated, sorted, re-crushed and then conveyed across to the brick press at the top conveyer level where it could be subsequently directed southwards into hoppers above the individual brick presses which were gravity fed.

The primary crusher house (Building 20) was located further to the north. This building had two hoppers, a Ross feeder and a 'grissly feeder,' with rail bars across the opening to allow manual crushing. A Jacques swing jaw crusher was located under the Ross feeder. Material was then fed by conveyer to a 'Pan Building' for further processing. Only the foundations of this building remain today. From this Pan building material was elevated by conveyor (partially demolished, Building 21) and could be stored in massive bins or taken into the northern end of the brick press buildings for distribution throughout the plant. The material was conveyed along the length of the press buildings on conveyors and could be manually diverted into hoppers directly above the brick presses. The conveyor system, hoppers, control panels and chutes remain today. The southern brick press building was subsequently extended by two structural bays to service the 1970s extrusion plant.

Brick presses in use from the 1950s were Anderson double re-press semi plastic presses. Bricks were pressed twice for additional strength. No brick presses survive at the site. It is possible that they were removed to the new brickworks at Mitchell following the closure of the Canberra Brickworks in 1976.[6]

To the extent that the majority of process buildings on the site from the1950s through to the 1970s still remain, more substantial evidence remains of the brick making processes as they occurred on the site in this later period, when compared with the earlier phase of the site's history. Accepting this, the complex as it existed in this period is not complete (the Red Pan Room and the conveyor linking this with the Primary Crusher have been demolished). Critically, while sections of the conveying system and associated hoppers remain in the

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6 Lester Firth Associates Pty Ltd, at Section 2.1.4 (Post War Growth) of the *Old Canberra Brickworks, Conservation Plan*, June 1986, notes that following the closure of the Brickworks, 'All useable material was moved to the new site [Mitchell] and the remainder offered for sale'. It has not been established whether the 'useable material' included the brick presses.

Figure 7 Aerial view, c.1976, at the time of the closure of the Canberra works. At this date, the raw materials had form many years been brought onto the site but the process continued to occur moving from east to west across the site. The 'spine' of process buildings (grinding, crushing, pressing) was located east of the kilns (between the kilns and the quarry).
Source: ACT Heritage Library

Machine Bays, the ability of the complex to demonstrate the processes themselves is limited following the removal of the majority of manufacturing plant itself (crushing and pressing machinery).

2.4 Major brick kiln types in Australia

2.4.1 *Intermittent kilns*

Prior to the 1870s all kilns in Australia were intermittent, which is to say the fires went out after each burning.

Clamp kilns

The earliest kilns were clamps, an ancient technique used the world over in which stacks of unfired (green) bricks with fire holes below are sealed, perhaps with mud, and fired in the open air (see Figure 10). In clamps, heat distribution is extremely uneven, and brick wastage unavoidably high. Clamps typically leave little archaeological residue, apart from a shallow depression in the ground, although channels and flues have survived in the more

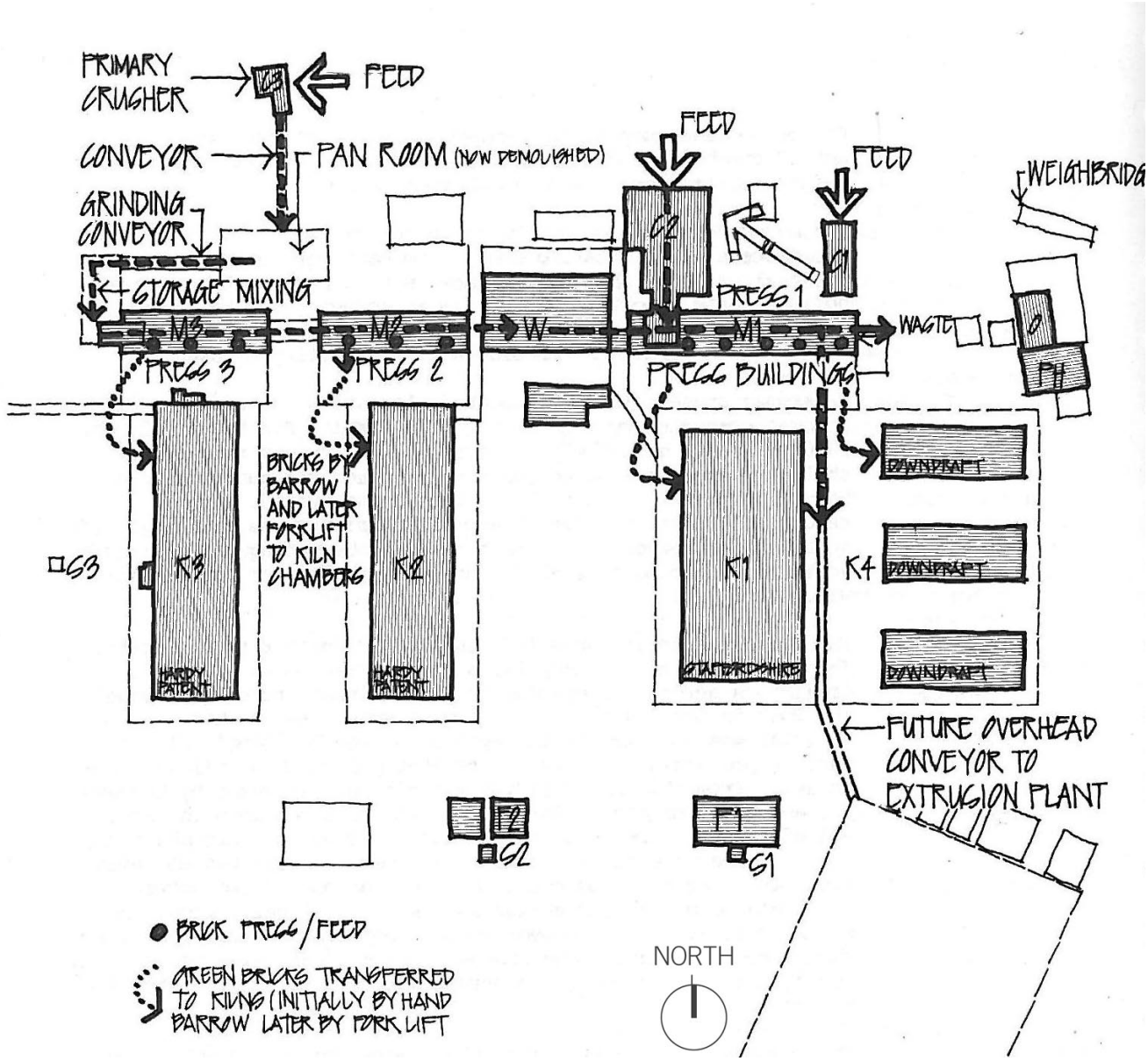

Figure 8 Sketch diagram of site operation c. 1960.
Source: Lester Firth Associates Pty Ltd, *Old Canberra Brickworks, Conservation Plan*, 1986, Section 2.2.1.

sophisticated examples.[7] Four clamp kilns were built at the Canberra Brickworks as part of the 'temporary' works, and these were operational by August 1913. The clamp kilns were located south-east of the present office building (see Figure 9).

7 Lester Firth Associates Pty Ltd, *Old Canberra Brickworks, Conservation Plan*, June 1986, Section 2.1.1 (Brick Firing Kilns).

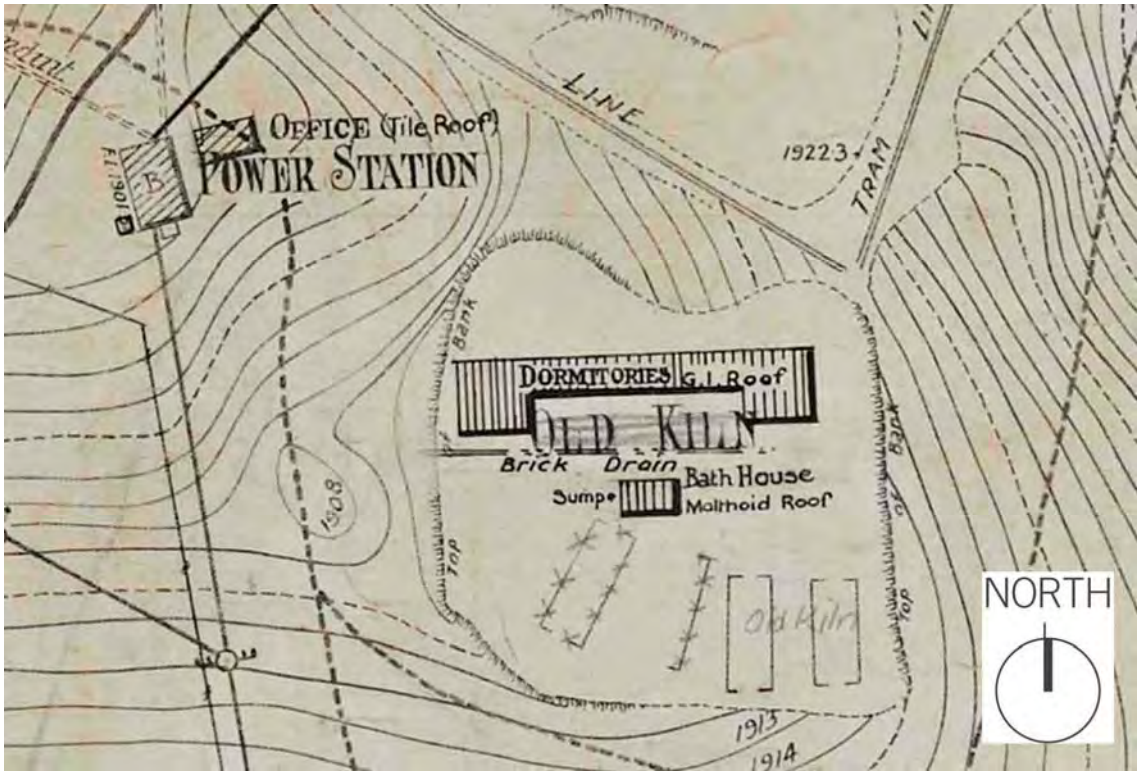

Figure 9 Detail of 'Detail of Contour and Detail Survey, Canberra Brick Yards, 20 December 1916'. Note the four clamp kilns ('Old Kiln') below the 'Dormitories' to the south-east of the Power Station.
Source: National Archives of Australia.

Scotch kilns

Among the first permanent kiln types to be constructed in Australia were 'Scotch' kilns, roofless constructions with three permanent walls and one temporary wall, which would be erected after the green bricks were placed in the kiln and demolished after firing (see Figure 11). The permanent walls directed the draught upwards. A Scotch kiln was in operation at Canberra during the mid-1920s (see Figure 12).

Downdraught kilns

The last of the broad typologies of intermittent kiln used in Australia was the Downdraught. Downdraught kilns are typically circular or rectangular in plan, with fire holes and wickets in the walls. Inside the single chamber the fire gases are funnelled to the roof through flues built against the side walls, and channelled out through underground flues to a detached chimney stack (see Figure 13). Two temporary Downdraught kilns were built at the Canberra Brickworks in 1925 (demolished 1958), close to the site of the present Downdraught kilns (Element 22), prior to the construction of the first of the Hardy-Patent kiln (Building 8). The present Downdraught kilns at the Canberra Brickworks (completed in 1963) are barrel vaulted, although circular kilns with domed roofs were also common. As occurred at Canberra, it was typical to build Downdraught kilns in groups, to enable consistent use through rotation.

Downdraught kilns were common prior to World War II, particularly in small country works. The three extant examples at Canberra are relatively late examples of the typology.

2.4.2 *Continuous kilns*

Continuous kilns are fired consistently, to enable full-time use and production. This is achieved through the principle of continuous burning around a fire passage, typically circular or rectangular. The passage accommodates a series of chambers, each with an opening (or wicket) through which the bricks were loaded and unloaded, and a branch flue leading to a main flue and chimney stack. The chambers can be set, burnt, cooled and emptied independently, with excess heat within the kiln used to dry green bricks prior to firing.

One of the earliest continuous kilns, and arguably the best-known, is the Hoffman kiln, designed by German Friedrich Hoffman in 1856, and patented in 1858 (Figure 15, Figure 16).[8] The Hoffman kilns in Australia are generally oval in form with straight sides and semi-circular ends, each kiln contains a continuous vaulted annular firing chamber which was filled with bricks for firing through wickets along the outer walls of the kiln. As for other continuous kiln types, Hoffman kilns are fired from above with the fire holes located in the roof of the vault and controlled from a first floor level above. Originally coal was dropped through the firing holes but later the kilns were adapted to use oil and subsequently gas, still from the firing holes.

The first Hoffman kiln in Australia was built in 1870 by the Hoffman Patent Brick and Tile Company at its works on Albert Street, Brunswick, Melbourne.[9] By the 1890s the Hoffman Company was claimed to be the largest enterprise of its kind in the Australian colonies.[10]

From the 1880s, multiple variations on the Hoffman concept were developed around the world. These are generally known as 'patent kilns', and involved subtle variations on the original Hoffman model. Modifications were related to achieving more even heat distribution, avoiding brick discolouration and more efficient regulation of heat to allow greater certainty about the quality of products.

Numerous patent kilns were developed in Australia in this period. In 1889, a patent for an 'improved kiln' was taken out by Isaac Button, Edward Peters and John Wesley Goodsell, all of Sydney. This was the 'Centennial Kiln,' which was built at the Croydon Brickworks in Sydney. Architectural historian Miles Lewis has described the form of the Centennial Kiln:

> Compared with the Hoffman kiln, [the Centennial kiln] was rectangular in plan, and consisted of two rows of chambers in parallel, none of them sweeping around at either end. The chambers were separately barrel vaulted, running in at right angles to the length of the kiln as opposed to the continuous vault of the Hoffman, and they were large enough for a dray or truck to be driven right into them for loading and unloading. Fuel was fed through holes in the top. The chambers at either end continued right across the kiln, with provision to divide them, but the rest were

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8 Martin Hammond, *Bricks and Brickmaking*, Shire Publications Ltd, Buckinghamshire, England, 1981, p. 23.

9 'Former Victorian Brickworks,' 72-106 Dawson Street, Brunswick, Victorian Heritage Database, vhd.heritage.vic.gov.au, accessed 18 January 2010; and G J R Line, *Industrial Awakening: A Geography of Australian Manufacturing 1788-1890*, ANU Press, Canberra, 1979, p. 265.

10 Nigel Lewis & Associates, *Brunswick Conservation Study*, Prepared for the City of Brunswick and the Australian Heritage Commission, Melbourne, 1982, p. 26.

> separated by a relatively long and narrow 'smoke chamber' along the spine, which connected with flues from either end of each chamber, and discharged to a stack. The kiln as built at Croydon had eighteen chambers, held 35,000 bricks, and was reckoned to turn out 200,000 bricks in a fortnight.[11]

Evidence indicates that the Centennial kiln was typically constructed with a long chimney or flue at one end of the main chamber.

Another variation on the Hoffman format was known as the 'Hardy patent' which was developed at around the same time as the Centennial kiln. From 1889 patent records in New South Wales and Victoria indicate that three Sydney men, Samuel Kirk, Thomas Kirk and John Richardson Hardy, had also developed an improved brick kiln design, specifically described as 'Improvements in the construction of kilns for burning bricks, tiles, pottery or other analogous materials,' for which they were seeking a patent.[12]

On 4 December 1891, the specifications of their application were accepted and the patent granted in Victoria.[13] The following year the men attempted to register the patent in New South Wales and Queensland.[14]

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11 Miles Lewis, Australian Building: A Cultural Investigation, see section 6.02.12, http://mileslewis.net/australian-building/.

12 Refer to correspondence with applicant Samuel Kirk, Thomas Kirk and John Richardson Hardy concerning invention entitled, 'Improvements in the construction of kilns for burning bricks, tiles, pottery or other analogous materials,' 1889, Series A4617/2, barcode 5150233, and 'New South Wales Letters Patent. Improvement in the construction of kilns for burning bricks, tiles, pottery or other analogous materials, Specification by Samuel Kirk and Thomas Kirk, item listing in series A4617/2, Barcode 4195049, National Archives of Australia. Samuel and Thomas Kirk, both of Croydon, in Sydney, were brick burners, while Hardy himself was listed as a contractor. See *Supplement to the Victorian Government Gazette*, 27 November 1891, p. 4658.

13 The patent was granted by Thomas Prout Webb, the Commissioner of Patents. See *Victorian Government Gazette*, 4 December 1891, p. 4683.

14 Application for Letters Patent by Samuel Kirk, Thomas Kirk and John Richardson Hardy titled - Improvements in the construction of kilns for burning bricks tiles pottery or other analogous materials, in Applications for Registration of Queensland Patents - Second system, Series A12572, barcode 7666027, National Archives of Australia.

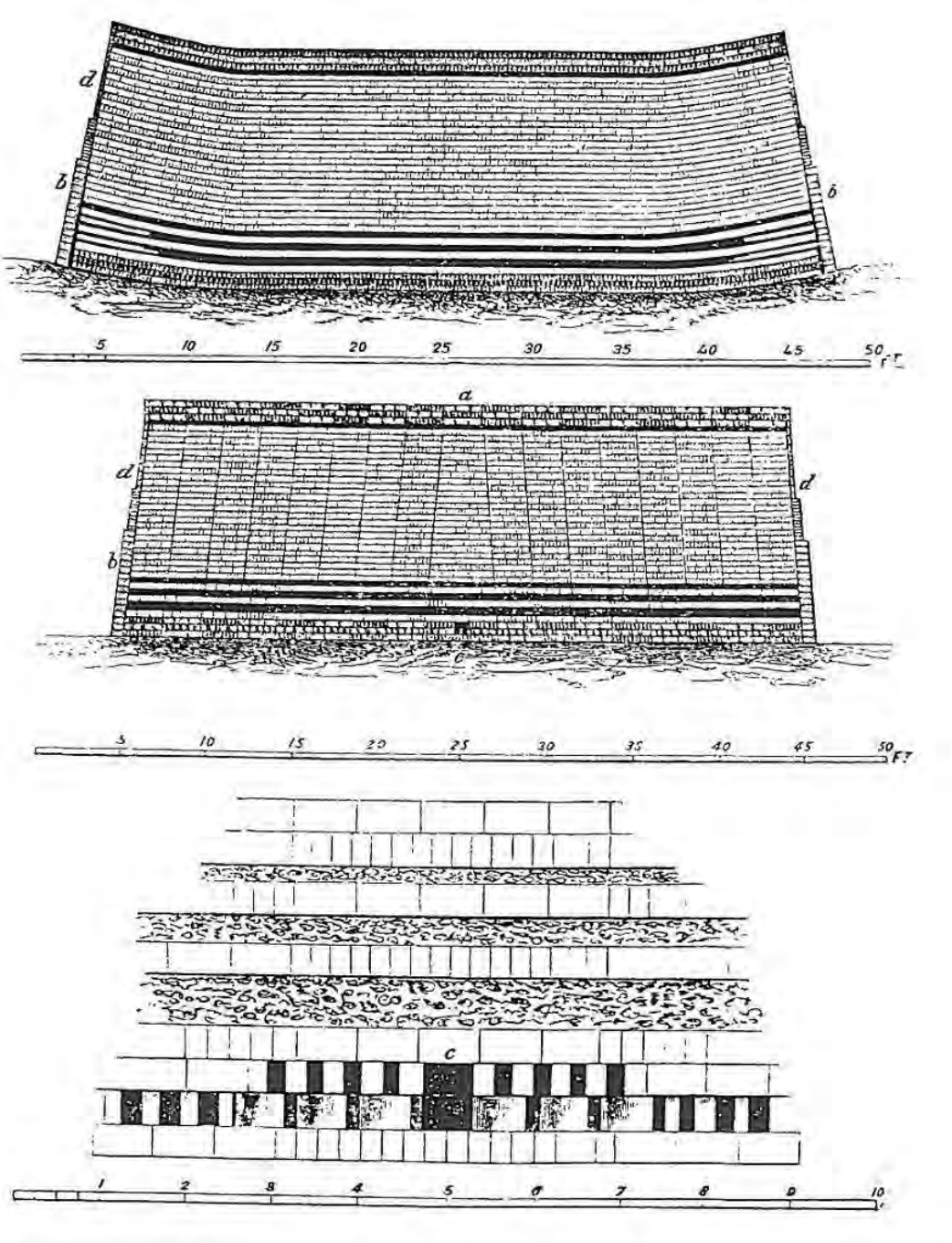

Figure 10 Sections through a clamp kiln, c. 1850, demonstrating the typical arrangement of bricks and fuel.
Source: Edward Dobson, *Rudimentary Treatise of the Manufacture of Bricks and Tiles*, 1850, copied from John Warren, *Conservation of Bricks*, 1999, p. 24.

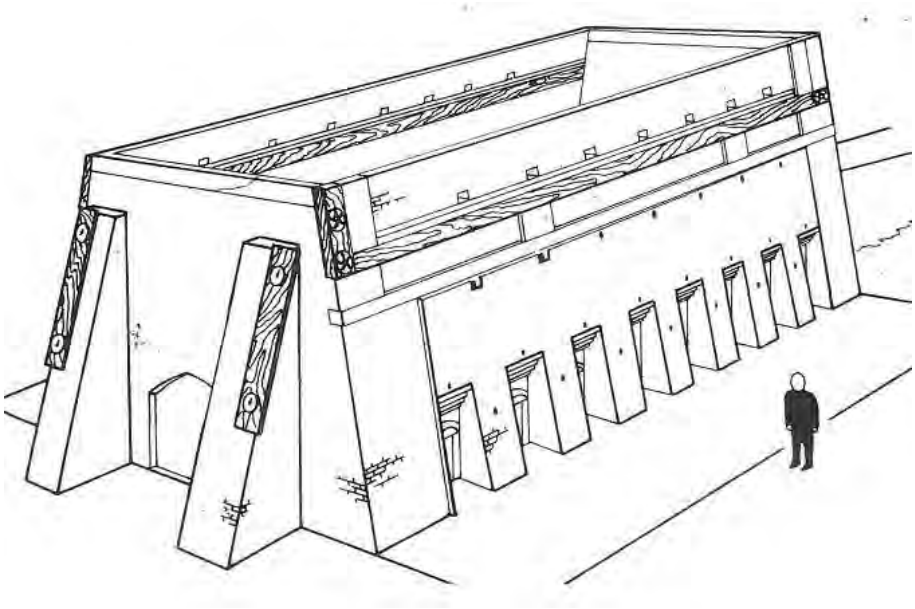

Figure 11 Sketch of Scotch kiln: roofless with three permanent walls to direct the draught upwards.
Source: Alan Cox, *Brickmaking: A History and Gazetteer*, 1979, p. 26.

Figure 12 Scotch kiln at Canberra (right), 1926. The first Hardy patent kiln is under construction at the rear of the picture.
Source: National Archives of Australia.

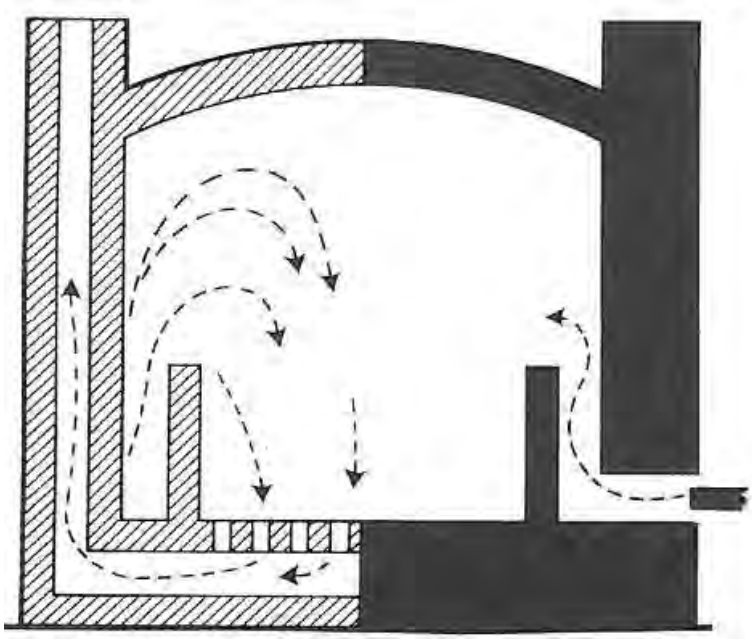

Figure 13 Section through a Downdraught kiln.
Source: Alan Cox, *Brickmaking: A History and Gazetteer*, 1979, p. 26.

Figure 14 Downdraught kilns numbers 3 and 4 at Canberra Brickworks (Building 22).

Hardy patent kilns are distinguished by freestanding stacks, as opposed to the integrated and centralised stack of the standard Hoffman kiln.

Two Hardy patent kilns were constructed at the Canberra Brickworks. Both are associated with major expansions of the Brickworks. The first (Building 8, and its stack and fan house, respectively Buildings 9 and 10) was built in 1926-27, as part of the drive to double the output of the plant ahead of the relocation of Parliament and public servants to Canberra.[15] The second (Building 11 and its associated stack, Building 13, see Figure 19) was constructed in 1953 as part of the post-World War II expansion of the site.

Another variation to the Hoffman model of continuous kiln was developed in the 1890s, when the capacity of the kilns was increased through the introduction of transverse arches. The maximum arch span of Hoffman kilns previously had been around 5.5m; orientating the arches so that they lay across the flow of fire allowed the length of arches to be increased without increasing the distance that the fire was required to travel in a circuit.[16]

In 1904, Dean and Hethrington of Lancashire, England, patented the 'Staffordshire kiln,' incorporating transverse arches, a detached chimney stack and a complex system of flues and dampers (see Figure 23). This enabled combinations of chambers to be used at any time, thereby allowing the simultaneous production of a range of products, bricks, tiles and pipes.

It was on this model that the first of the permanent continuous kilns at the Canberra Brickworks was built in 1915 (Building 4), along with its associated fan-house and stack (Buildings 5 and 6). The fan induced draught of the Canberra example enabled even greater temperature control, and obviated the requirement for a tall stack.

The construction of a Staffordshire kiln at Canberra was commissioned in 1913, less than a decade after the model was patented (1904) by Dean and Hethrington of Lancashire, England (the kiln was completed and brought into service in 1915). At the time, Staffordshire kilns were at the leading edge of brick burning technology, offering the potential for firing multiple types of products simultaneously. Given its isolation from the major urban centres and suppliers of construction materials, this flexibility was ideally suited to the requirements of the nascent Federal Capital.

15 As noted in Chapter 3, the Hardy patent kiln (Building 7) failed and was substantially re-built in 1955.

16 Martin Hammond, *Bricks and Brickmaking*, p. 24.

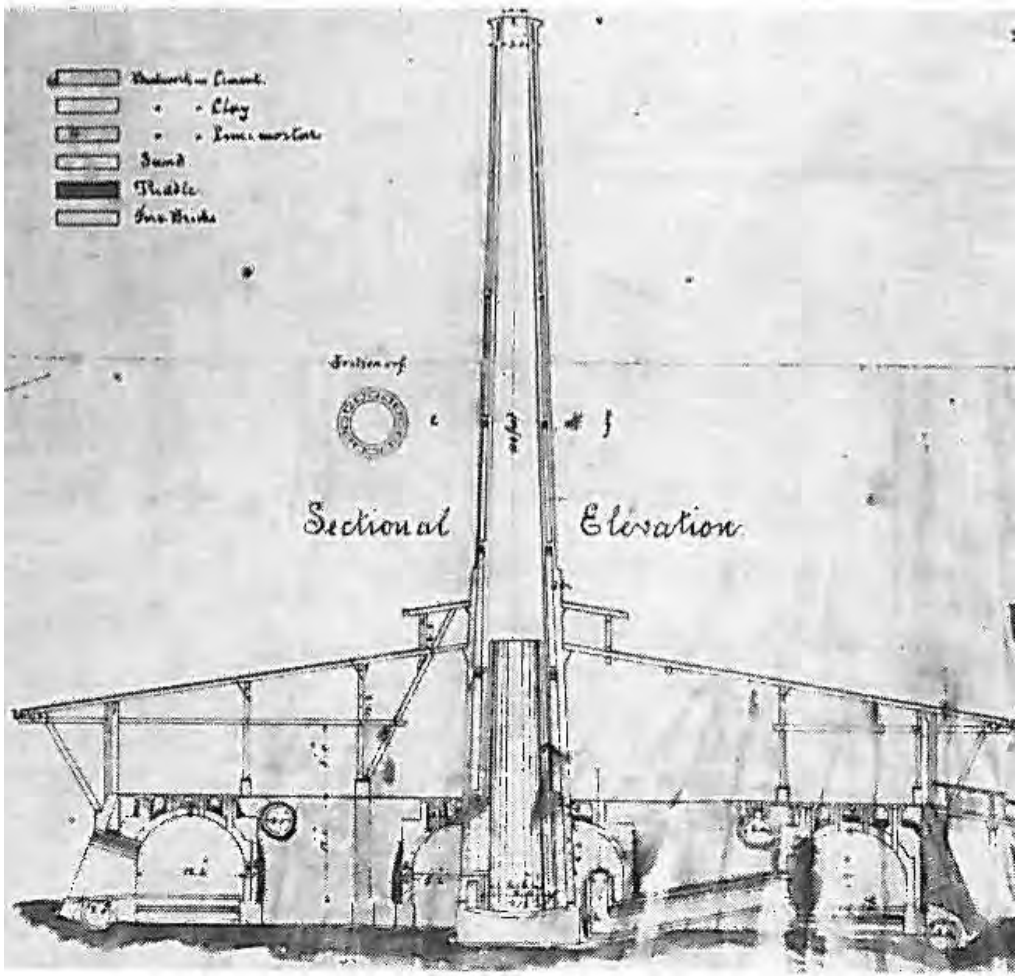

Figure 15 Section through a circular Hoffman kiln prepared by the office of Friedrich Hoffman, Berlin in 1875.
Source: Martin Hammond, *Bricks and Brickmaking*, p. 23.

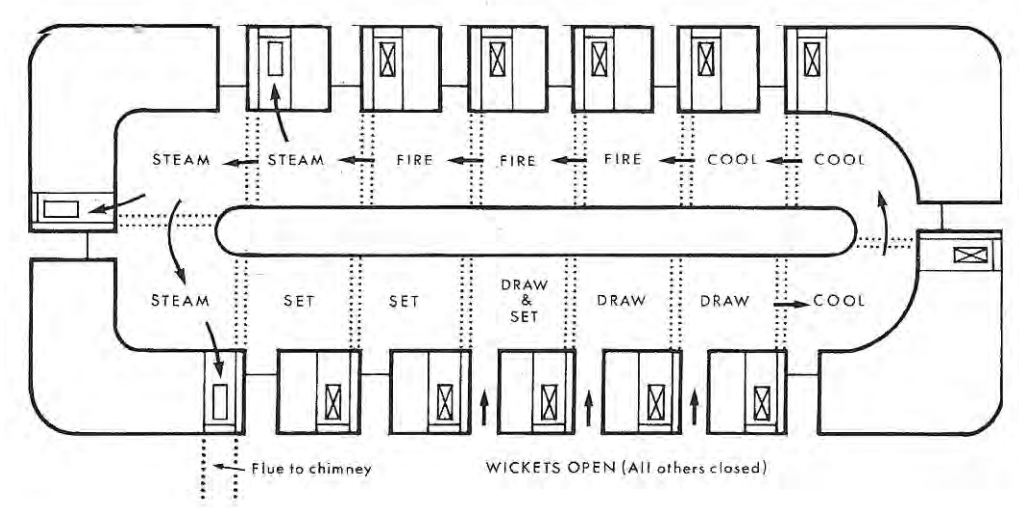

Figure 16 Plan of a rectangular 14-chamber Hoffman kiln.
Source: Alan Cox, *Brickmaking: A History and Gazetteer*, 1979, p. 43.

Figure 17 Hoffman kiln at the former Standard Brickworks, Box Hill (Victoria)
Source: Lovell Chen, January 2010

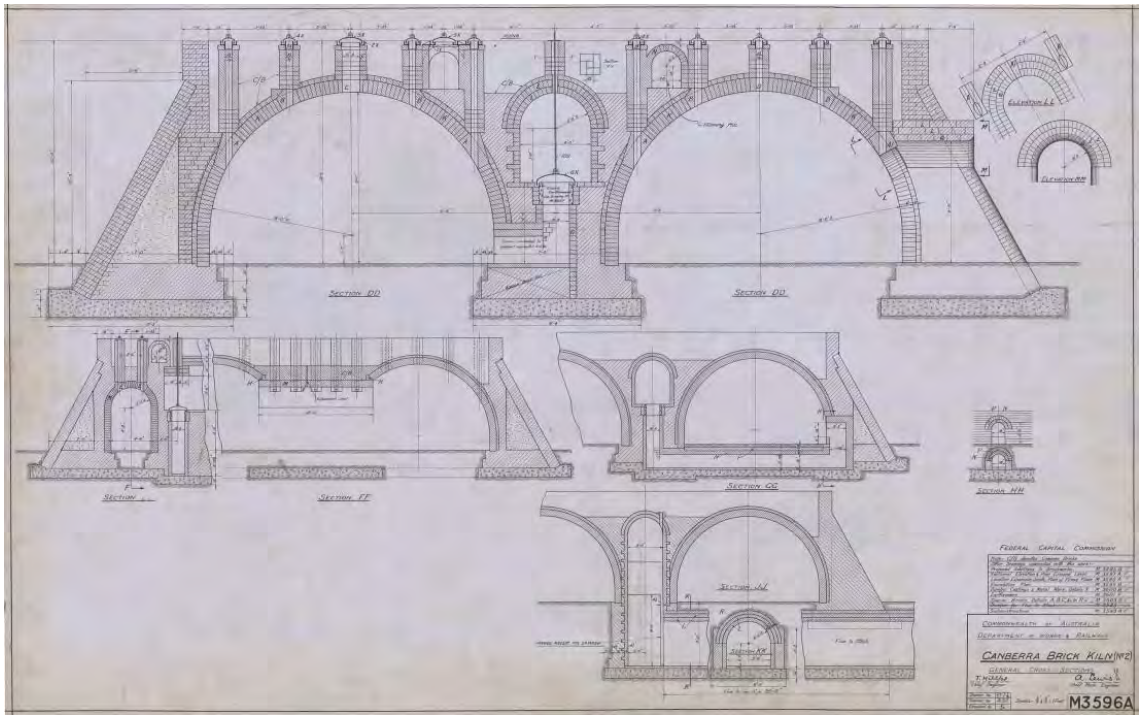

Figure 18 Cross section of the first Hardy patent kiln at Canberra Brickworks (Building 8), 1926.
Source: National Archives of Australia.

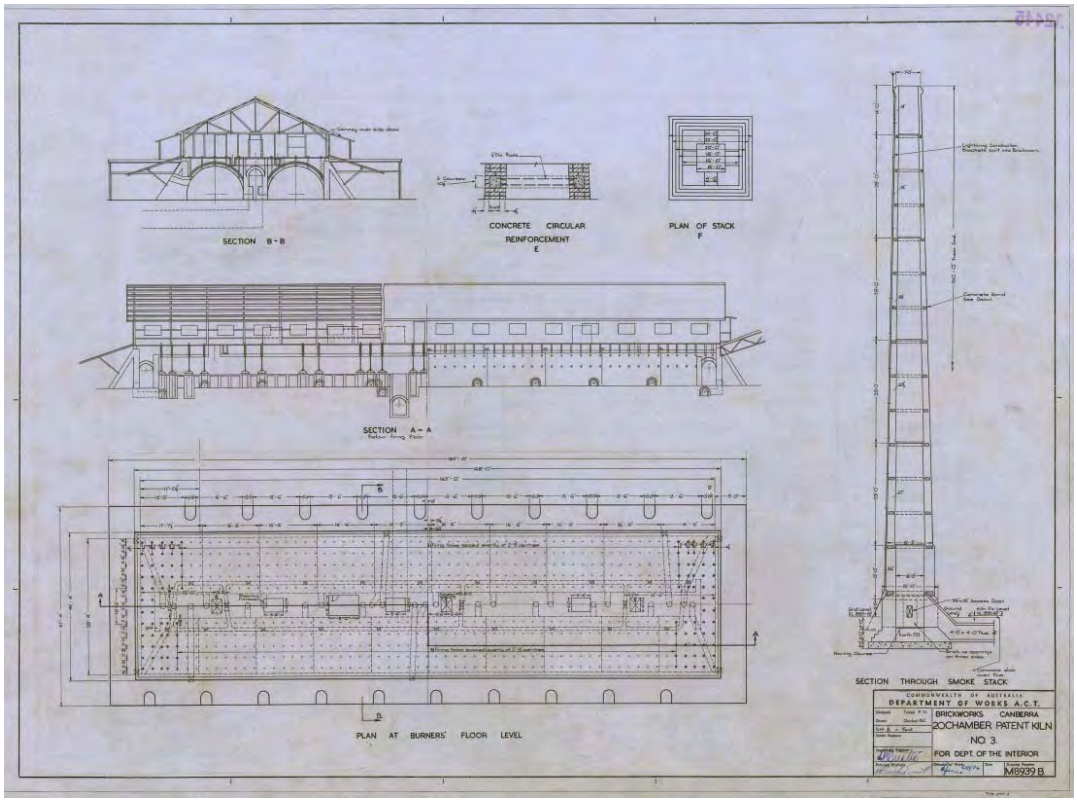

Figure 19 Drawing of 20-chamber Hardy patent kiln (Building 12), and stack (Building 13) at Canberra Brickworks, 1953.
Source: National Archives of Australia.

Figure 20 Hardy patent kiln, Canberra brickworks

Figure 21 View into the firing chamber of one of the Hardy patent kilns at the Canberra brickworks. Note the wickets (openings) on the right from which the bricks were loaded and unloaded, and the firing holes in the ceiling/walls.

Figure 22 Interior of the firing floor to one of the Hardy patent kilns at the Canberra Brickworks

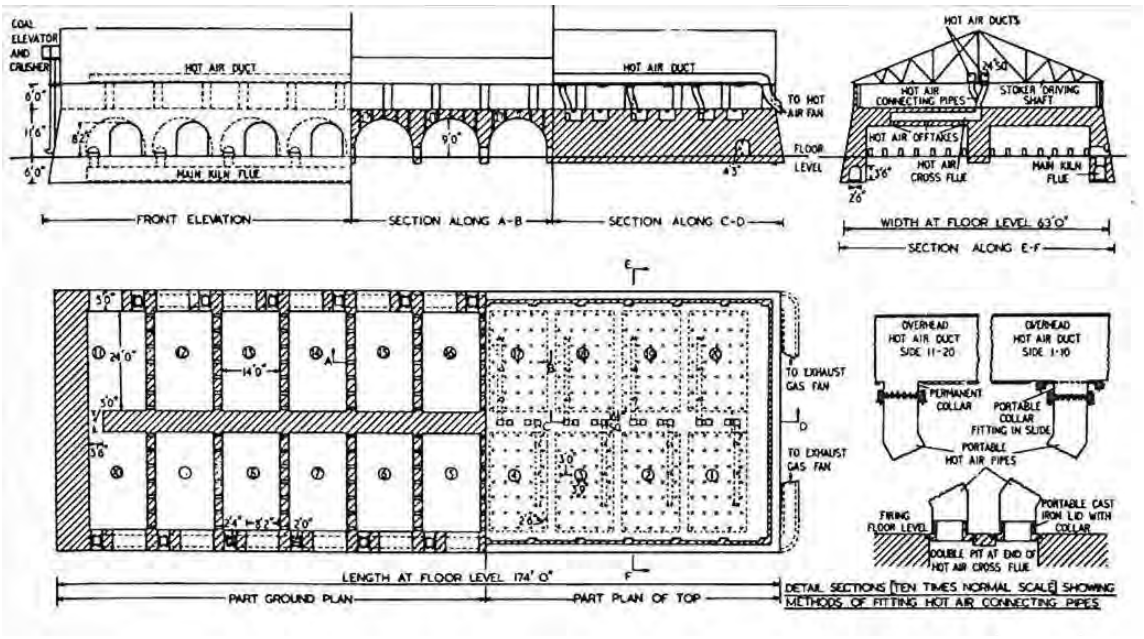

Figure 23 Plan, sections, front elevation and details of a Staffordshire kiln.
Source: Martin Hammond, *Bricks and Brickmaking*, p. 25.

Figure 24 Staffordshire kiln at the Canberra Brickworks

Figure 25 Interior of one of the chambers in the Staffordshire kiln.

Tunnel kilns (also referred to as car tunnel kilns) are a contemporary form of continuous kiln, albeit with eighteenth century origins. The model, used by the French Royal Porcelain Factory in 1751, comprises a pair of tunnels linked by flues.[17] Green bricks are set on cars and passed through the first tunnel, which is divided into zones for preheating, firing and cooling. Clean hot air from cooling zone of the kiln is channelled to the parallel drying tunnel. In England, until the 1970s, tunnel kilns were considered expensive to build and beset by technical problems, which outweighed the benefits of fuel saving and improved working conditions. Subsequent revisions have improved the model, which is now commonly used in industrial brick production, with kilns as large as 1.8m wide by 120m long.[18]

A tunnel kiln was planned and partially built at Canberra after World War II, before being abandoned in 1952. The foundations were incorporated into the second Hardy patent kiln completed in 1953 (Building 12).[19]

17 Martin Hammond, *Bricks and Brickmaking*, p. 25-6.

18 Martin Hammond, *Bricks and Brickmaking*, p. 25-6.

19 Department of Works, 'Canberra Brickworks No. Kiln, 20 Chamber Hardy Kiln Layout Plan,' drawing M8713c, National Archives of Australia.

3.0 HISTORY & PHYSICAL ANALYSIS: ESTABLISHMENT PHASE, 1911-1920

3.1 Historical background

3.1.1 *Establishing the National Capital*

The location of the capital of a federated Australia was debated for at least ten years before Federation was achieved (1901). The matter was raised at the Australian Federation Conferences (Melbourne, 1890 and Sydney 1891), and the National Australasian conventions of 1897-98.[20] The debates over the location of the capital were dominated by inter-colonial rivalries, although a broad consensus was reached on the requirement for an inland location (to obviate the perceived security risk presented by a coastal location). It was eventually decided that the decision on the location of the future capital would be taken by the new Parliament following Federation.[21]

The Australian Constitution of 1900 included direction to hold land for the National Capital:

> (125) The seat of Government of the Commonwealth shall be determined by the Parliament, and shall be within territory which shall have been granted to or acquired by the Commonwealth, and shall be vested in and belong to the Commonwealth, and shall be in the State of New South Wales, and be distant not less than one hundred miles from Sydney.
>
> Such territory shall contain an area of not less than one hundred square miles, and such portion thereof as shall consist of Crown lands shall be granted to the Commonwealth without any payment therefore. The Parliament shall sit at Melbourne until it meets at the seat of Government.[22]

At least 40 districts were proposed for the National Capital, of which 23 were inspected by parliamentarians, a Commission and a Royal Commission. In 1904 a *Seat of Government Act* was introduced, nominating Dalgety in New South Wales. However, the New South Wales State Government objected and refused to release the land to the Federal Government.[23] Finally, on 8 October 1908 – following the repeal of the 1904 *Act* – it was determined that the site would be in the Yass-Canberra district. The New South Wales District Surveyor, C R Scrivener, was dispatched to Yass-Canberra to determine the precise location of the future city. His brief was as follows:

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20 Lovell Chen, *Nomination of Canberra to the National Heritage List: An examination of the merits*, prepared for the National Capital Authority, April 2008, pp. 42-43.

21 The National Capital Development Commission, *Tomorrow's Canberra: Planning for Growth and Change*, Australian National University Press, Canberra, 1970, pp. 3-7; and Lovell Chen, *Nomination of Canberra to the National Heritage List: An examination of the merits*, prepared for the National Capital Authority, April 2008, pp. 42-43.

22 Commonwealth of Australia Constitution Act, Chapter VII.

23 The National Capital Development Commission, *Tomorrow's Canberra*, p. 3.

> The Federal Capital should be a beautiful city, occupying a commanding position with extensive views, and embracing distinctive features … consequently the potentialities of the site will demand careful consideration from a hygienic stand-point, with a view to securing picturesqueness, and also with the object of beautification and expansion.[24]

Scrivener's choice was an elevated site straddling the Molonglo River, with mountains and hills to the north-west, north-east, east and south. The 1909 *Seat of Government Surrender Act* (NSW) and 1909 *Seat of Government Acceptance Act* (Commonwealth) officially named Yass-Canberra as the site of the Federal capital. The site was formally handed over to the Commonwealth on 1 January 1911.

In April 1911, King O'Malley, Minister for Home Affairs for the standing Labor Government initiated an international competition for designs for the layout of the new city. The conditions of the competition stated that, 'The premiated [sic] Designs shall become the property of the Government for its unrestricted use … Any claim for further remuneration by … the authors … will not … be recognised …'[25] In May 1912, a proposal by architect Walter Burley Griffin (1876-1937) with drawings by his architect wife Marion Mahony Griffin (1871-1961), of Chicago, was awarded first prize (see Figure 26). Second prize was awarded to Eliel Saarinen of Helsinki (Helsingfors), Finland and third prize to Alf Agache of Paris, France.[26] The emphasis of the Griffin's proposal, largely determined by topography, combined a number of specialised centres (for administration, government, the capitol etc) in circular, octagonal and hexagonal street systems. The centres were linked by the primary axes, which were aligned to the surrounding hills and mountains.

In November 1912, O'Malley established a Departmental Board to review the three winning schemes. The Board prepared a new plan incorporating aspects of all of them. The composite 'Departmental Plan' was accepted by O'Malley in January 1913, and the foundation stone of the city was laid on 12 March 1913. The city was formally named Canberra at the ceremony.[27]

A change of government stalled progress, and led to Walter Burley Griffin being invited to Australia to advise on the development of the city. The new Minister for Home Affairs, W H Kelly, subsequently disbanded the Departmental Board and appointed Griffin as Federal Director of Design and Construction for the National Capital, a position that he held from 1913 to 1920.[28]

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24 Quoted in David Headon, *The Symbolic Role of the National Capital: From colonial argument to 21st century ideals*, Commonwealth of Australia (National Capital Authority), ACT, p. 36.

25 *Preparation of Competitive Designs for the Federal Capital City,* National Archives of Australia, A1818/12, quoted in Alasdair McGregor, *Grand Obsessions: The Life and work of Walter Burley Griffin and Marion Mahony Griffin*, Lantern (Penguin), Australia, 2009, p. 121.

26 The National Capital Development Commission, *Tomorrow's Canberra*, p. 6.

27 The National Capital Development Commission, *Tomorrow's Canberra*, p. 6.

28 The National Capital Development Commission, *Tomorrow's Canberra*, p. 6; and Alasdair McGregor, *Grand Obsessions,* pp. 197-204 and 321-41.

In October 1913 Griffin submitted a revised version of his plan ('Preliminary Plan', see Figure 27), with a report expanding on his ideas for the development of the city ('Report Explanatory'). Parliamentary factions and funding cutbacks caused by World War I contributed to the slow progress in the development of the National Capital in the following years.

3.1.2 *Commonwealth Brickworks*

In 1910, King O'Malley announced Government plans for the construction of a brickworks to serve the Federal Capital.[29] Other industries considered essential for the inland city included a power station, and a dam and pumping station (respectively the Kingston Power House and Cotter Dam).

Various experiments on shale in the region were carried out in early 1911. Two potential sites were investigated, one at the Duntroon Station and the other on Frederick Campbell's Yarralumla property. Samples from both sites were sent for testing.[30] Reports concluded that samples from Yarralumla produced bricks of excellent quality, equal to the best commercially produced bricks for hardness and porosity, while those produced from the Duntroon sample produced bricks of a better colour, but the material was 'little in weight, its absorption is greater and it has not burnt too well'.[31] The Yarralumla site was selected on this basis. Frederick Campbell agreed to the acquisition of approximately 38 acres of his land holding (see Figure 28). The area was gazetted on 27 July 1912, and development of the site began in 1913.[32]

As originally proposed the permanent Commonwealth Brickworks was to include three Staffordshire kilns, one rock breaker, five American Ring Pulverisers, five Whittaker mixing pans and ten Whittaker presses (see Figure 29). The kilns were to have induced draft fans in place of high chimneys. It was proposed to convey the bricks by aerial ropeway to a city depot.[33]

At this time (c. 1911–12) no other kilns of the Staffordshire type had been constructed in Australia, although the New South Wales State Brick Works at Homebush, west of Sydney, had announced plans for the imminent construction of several.[34]

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29 Lester Firth Associates Pty Ltd, *Old Canberra Brickworks, Conservation Plan*, June 1986, Section 2.1.1, citing the *Queanbeyan Age*, 23 February 1910.

30 Lester Firth Associates (Section 2.1.1) state that 1,000 test bricks were fired at the Hoffman Brick Co., Melbourne.

31 National Archives of Australia, Series A110/FC 1913/1055, in Ian Carnell, 'Canberra's Cornerstone,' *Canberra Historical Journal*, no. 5, March 1990, cited by Lester Firth Associates, 1986, section 2.2.1.

32 Ann Gugler, *The builders of Canberra, 1909-1929. Part one, Temporary camps & settlements*, Canberra, CPN Publications, 1994, p. 77.

33 National Archives of Australia, Series A110/FC 1913/1985, cited in Lester Firth and Associates, 1986, Section 2.1.1.

34 Lester Firth and Associates, 1986, Section 2.1.1, source uncited. It has not been confirmed if Staffordshire kilns were constructed at the State Brick Works at Homebush, which was developed from 1911 (see Chapter 6). However, the Royal Commission on Federal

Figure 26 Walter Burley Griffin's winning competition entry (1912), overlaid on the contour map prepared by C R Scrivener.
Source: National Archives of Australia (A710, 36-37).

A temporary plant was established and operational by 19 June 1913.[35] This comprised a grinding pan, brick making machine and elevator made by Geo. Foster and Sons, Sydney, and a portable steam engine. By contrast the permanent plant was to be electrically driven, with power from the 'Central Generating Station' (Kingston Power House), then under construction. By August 1913, four open kilns were in use at the temporary plant (see

Capital Administration (RC No. 378), which ran from June 1916 to 14 June 1917, found that the Staffordshire kiln at the Canberra brickworks was the first constructed in Australia.

35 National Archives of Australia, Series A119 Item 1914/723, cited in Lester Firth and Associates, 1986, Section 2.1.1. See also, Ann Gugler, *The builders of Canberra, 1909-1929. Part one, Temporary camps & settlements*, Canberra, CPN Publications, 1994, chapter 2. Copy viewed at ACT Heritage Library, Woden, ACT, Woden.

Figure 30), with plans for a fifth.[36] The temporary brickworks plant had an output of between 44,000 and 50,000 bricks per week.[37] Bricks were being produced for the construction of the kilns at the permanent brickworks,[38] and the Kingston Power House complex.[39]

The first stage of the construction of the permanent Brickworks, which comprised a single Staffordshire kiln, was approved on 1 December 1913 by P T Owen, the Director-General of Works.[40] It was proposed to use this kiln to produce bricks for the construction of a further two kilns.

The decision to build the Staffordshire kiln type at the site was based on the recommendations of Andrew Christie, a consulting engineer, who together with Owen had inspected 'the latest equipment' at the State Brickworks in Homebush. In correspondence dated 24 July 1911 Christie noted in relation to the Staffordshire that:

> …all drying, burning and cooling temperatures are under perfect control and high class goods of perfect colouring is the result. The kiln can also be for fancy and facing bricks, finials, pipes, etc., as well as ordinary bricks, the use of downdraught kilns is dispensed with and the cost of fuel materially reduced'.[41]

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36 Four open kilns are indicated on the survey plan of 1916, but newspapers reports refer to only three open kilns. *Queanbeyan Observer,* 18 February 1913, cited in Lester Firth and Associates, 1986, Section 2.1.1.

37 National Archives of Australia, Series A119 Item 1914/723, cited in Lester Firth and Associates, 1986, Section 2.1.1.

38 By September 1913, some 250,000 bricks had been produced for construction of the main kilns. *Queanbeyan Observer,* 9 September 1913, cited in Lester Firth and Associates, 1986, Section 2.1.1.

39 The Kingston Power House is a steel framed structure with roughcast concrete walls. It was designed by John Smith Murdoch, Chief Architect of the Department of Works and Railways, and completed in 1915. As originally envisaged, the building was to be portable. As such the steel frame was to be clad in galvanized steel. When a permanent site was found for the power house it was decided to change the cladding to brick. A total of 1.5 million bricks were manufactured at the Canberra Brickworks for the task. However, the bricks produced at the temporary works disintegrated before they could be used on the Power House. As a cost-effective solution, the steel frame was clad in unreinforced in situ concrete made with river gravel. The Power House was adapted to the Canberra Glassworks visitor centre in 2005-07 by Tanner Architects. Pers comm., Jocelyn Jackson, Project Director/Architect for the adaptive reuse of the Kingston Power House, Tanner Architects, and Adam Mornement, Lovell Chen, 3 February 2010. See also, Peter Freeman Pty Ltd, *Kingston Power House Precinct, Kingston, ACT*, Conservation Management Plan Review, 2001, Volume 1 of 2, pp. 18-20.

40 National Archives of Australia, Series A119 Item 1914/723, cited in Lester Firth and Associates, 1986, Section 2.1.1.

41 National Archives of Australia, Series A110 FC 1913/1055, 24 July 1911, cited in Lester Firth and Associates, 1986, Section 2.1.1.

Figure 27 Plan prepared by Griffin to accompany his 'Report Explanatory' of 1913. Source: National Archives of Australia (A1, 1917/7242).

The decision to build the Staffordshire kiln type at the site was based on the recommendations of Andrew Christie, a consulting engineer, who together with Owen had inspected 'the latest equipment' at the State Brickworks in Homebush. In correspondence dated 24 July 1911 Christie noted in relation to the Staffordshire that:

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42 National Archives of Australia, Series A110 FC 1913/1055, 24 July 1911, cited in Lester Firth and Associates, 1986, Section 2.1.1.

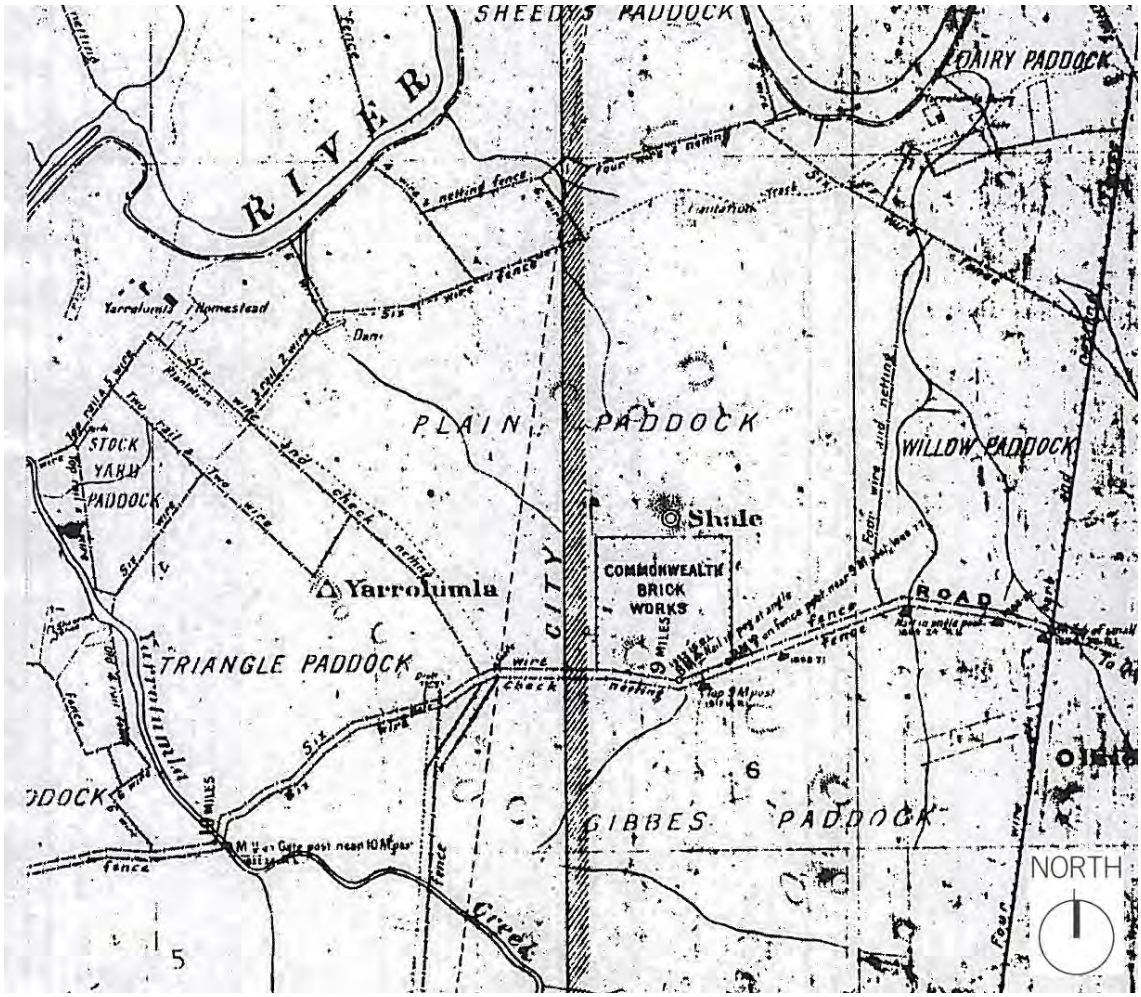

Figure 28 Site survey, c. 1911, showing the dimensions of the 38ha site acquired in 1912. Source: Lester Firth Associates, section 2.1.1. Original source not cited.

Plans for the Staffordshire kiln were purchased in early 1914 from the Australian agent of the patentees, R E Odd, and Christie prepared plans for machinery sheds to be constructed adjacent to the kiln. Tenders were accepted in March 1915 for major plant, equipment and materials for the permanent works. Messrs Jaques Bros of Richmond tendered for three rotary rockbreakers (cost £502); Messrs Timmings and Gardiner of Sydney for two grinding mills (£834); George Foster for ironwork for the Staffordshire kiln (£842); and George Weymouth of Melbourne for electric motors (£494).[43]

43 Lester Firth Associates 1986, section 2.1.1, sources uncited.

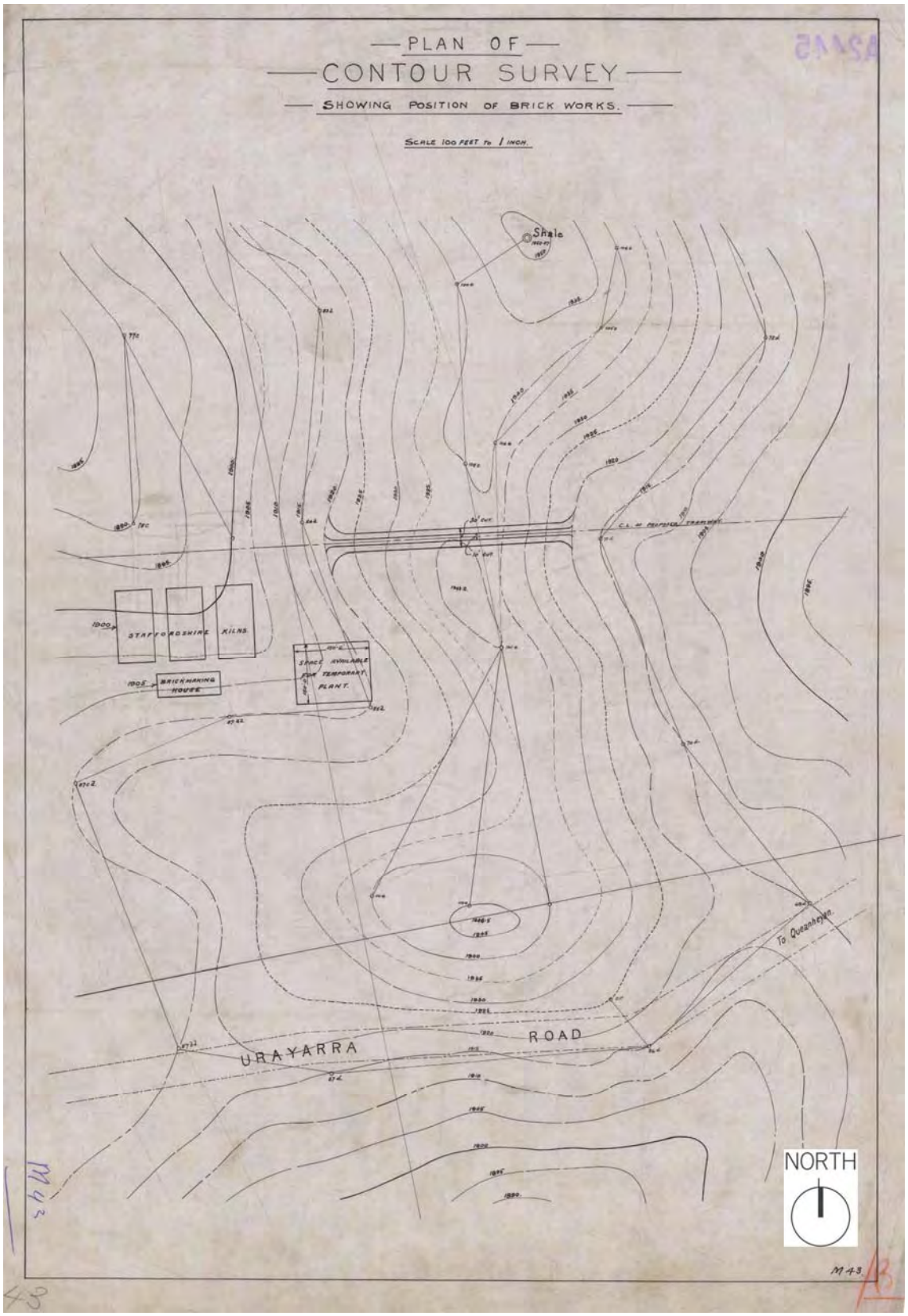

Figure 29 Contour plan with the layout of the brickworks as proposed in c. 1911, showing three Staffordshire kilns and the location of brick making plant.
Source: National Archives of Australia.

In September 1915 the brickwork for a 20 chamber Staffordshire kiln was nearing completion (see Figure 31, Figure 32 and Figure 33).[44] The internal chamber bricks, shaped to provide the arched form, were imported from England together with the steel work trusses in the kiln loft. Three burners are also believed to have been imported from England.[45]

A Survey Plan of the site, dated 20 December 1916 (see Figure 30), shows a small galvanised iron office building close to the 'Machine Shop', and a galvanised iron 'Cottage' with associated coal store and stable to the north-east of the site. Other features shown on the plan include the temporary 'Old Kiln' area with four kilns (shown in outline on the plan, with 'Dormitories' immediately to the north), a coal stage, a long concrete retaining wall separating the quarry zone and the working areas, water storage tanks on a high knoll, a remote powder depot, three detached WCs south of the kiln, an elevated gangway connecting the coal stage to the kiln and overhead electrical connections linking the 'Power Station' to the 'Fan Room,' and the 'Power Station' to the 'Machine Shop' and 'Cottage'. A tram line is indicated linking the quarry to the machine shop. The 2ft (610mm) gauge line was laid so that loaded trucks ran downhill to the works, and the empty trucks were pushed uphill by manpower. The tram lines could be relocated as the quarry face advanced.[46]

Elements shown on the 1916 plan and remaining on the site today are the 'Power Station,' the Staffordshire kiln (without verandahs to the north and south), the 'Fan Room' and 'Stack' and the long concrete retaining wall.

The Staffordshire kiln together with crushing, processing equipment and brick presses was ready for production in early 1916. However, the commitments of World War I, and consequent restrictions on the works program for Canberra, together with a coal strike, saw the brickworks close in December 1916.[47]

In 1917, the Royal Commission on Federal Capital Administration considered the Brickworks at Canberra.[48] Walter Burley Griffin had complained that the Brickworks were a 'nullification' of his plan and that they were 'established without any consultation with him'. It was found that this charge was not fairly made since the Brickworks were established while the Departmental Plan was in force, and before Griffin came to Australia.

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44 *Queanbeyan Age,* 14 September 1915, cited in Lester Firth and Associates, 1986, Section 2.1.1.

45 Lester Firth Associates 1986, section 2.1.1, sources uncited.

46 Walter M Shellshear, author of Chapter 2 (Railways) in W C Andrews, Alan Fitzgerald et al, *Canberra's Engineering Heritage*, Institution of Engineers, Australia, Canberra Division. 1983, viewed online (unpaginated) at, www.engineer.org.au, accessed 29 January 2010. The side-tipping trucks used at the brickworks were manufactured by Francis Theakston Ltd., Light Railway Engineers, Crewe Works, 66 Tufton Street, London.

47 Lester Firth Associates 1986, section 2.1.1, sources uncited.

48 The Royal Commission on Federal Capital Administration (RC No. 378) ran from 14 June 1916 until the Report was tabled on 14 June 1917. The Commissioner was W Blacket and matters examined included issues relating to Mr. Griffin; accounts and finance at Canberra; wasteful expenditure at Canberra; sewerage at Canberra; brickworks at Canberra and water supply, power. References to the Royal Commission are from the, *Report of the Royal Commission on Federal Capital Administration*, Victoria (1917), and Lester Firth Associates, 1986, section 2.1.1. The source is uncited.

The Royal Commission also established that the 250,000 bricks made at the temporary plant were of poor quality and not suitable for major building work. Instead they were used for filling and lining drains, and for the Staffordshire kiln. The Commission also found that construction of the Staffordshire kiln was begun in November 1914; that it was *the first Staffordshire kiln built in Australia* [emphasis added]; and that there was evidence of construction errors in estimating and design. (The findings of the Royal Commission are confusing when compared with the report in which Andrew Christie recommended the use of a Staffordshire kiln following an inspection of the works at Homebush, which suggests a Staffordshire in operation there. This anomaly in the historical record has not been resolved.)

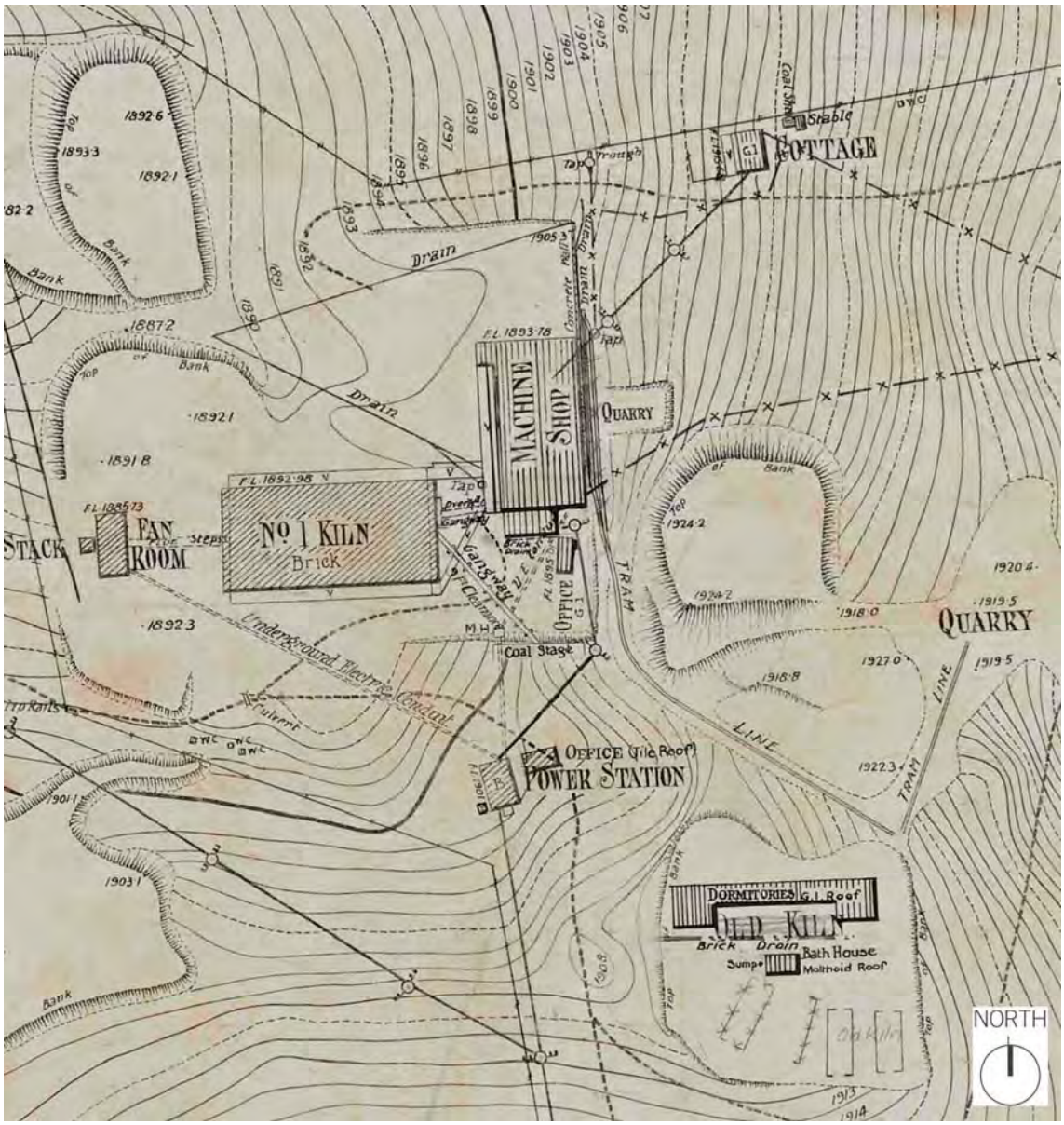

Figure 30 Detail of Contour and Detail Survey, Canberra Brick Yards, 20 December 1916. Note the locations of the clamp kilns below the 'Dormitories' to the south-east of the Power Station.
Source: National Archives of Australia.

Figure 31 Staffordshire kiln under construction, c. 1915
Source: National Library of Australia.

Figure 32 Constructing the transverse arches of the Staffordshire kiln, c. 1915.
Source: National Library of Australia.

Figure 33 The Staffordshire kiln pictured in c. 1917.
Source: National Library of Australia.

3.1.3 *The development of 'Westridge' (Yarralumla)*

Walter Burley Griffin envisaged the area to the west of the 'Capitol Centre' as a lake front suburb. The *Plan (of City and Environs)* of 1918, which was the last plan signed by Griffin during his tenure as Federal Capital Director of Design and Construction,[49] shows a broadly triangular area extending from the 'Capitol Centre' in the west, and defined by 'Adelaide Avenue' to the south, 'Westlake Esplanade' to the north and 'Mountain Way' to the west (see Figure 34).

Some elements of this plan were developed, including Adelaide Avenue and the southern section of 'Mountain Way,' which is on the approximate alignment of the present Novar Street. 'West Lake,' which is the western element of the waterway now known as Lake Burley Griffin, was formed in 1963, following the construction of the Scrivener Dam. Griffin named the suburb 'West Lake'. The area to the west of this proposed suburb, now Yarralumla, was popularly known as 'Westridge'.

Two enterprises underpinned the development and identity of the area between the city boundary and the west of Griffin's proposed layout for 'Westlake'. The first, operational from June 1913, was the Canberra Brickworks. The second, established in 1914, was Westbourne Woods Arboretum (also known as Westbourne Woods), which was a proving ground for the suitability of native and exotic plants to the Canberra climate. The Arboretum is associated with Charles Weston, the first Superintendent of Park and Gardens for the National Capital.

49 Paul Reid, *Canberra Following Griffin: A Design History of Australia's National Capital*, National Archives of Australia, Canberra, 2002, p. 16.

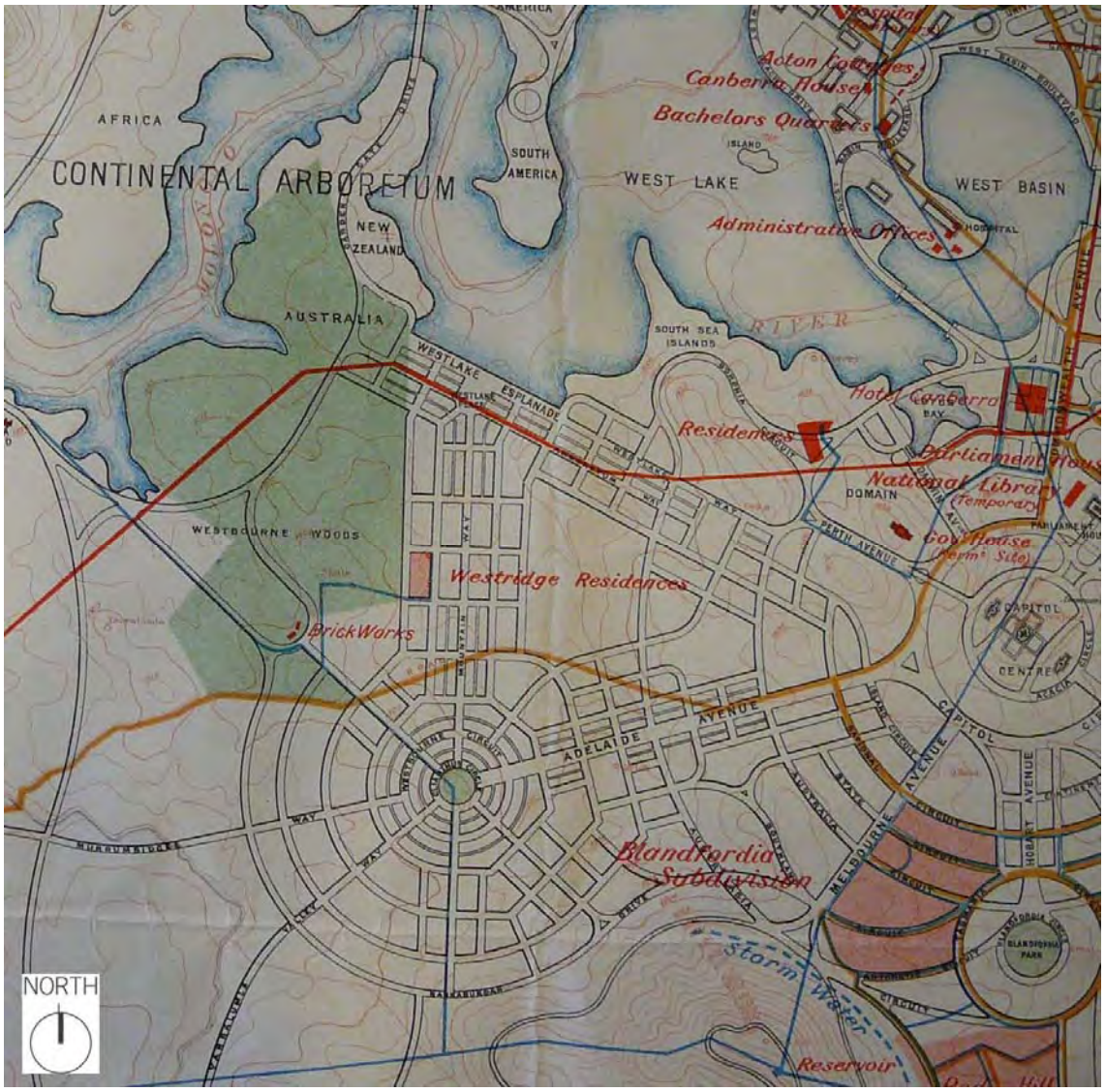

Figure 34 Detail of *Plan (of City and Environs)*, 1918. The 'Westridge Residences' may be the location of the Brickworks Camp.
Source: State Library of Victoria.

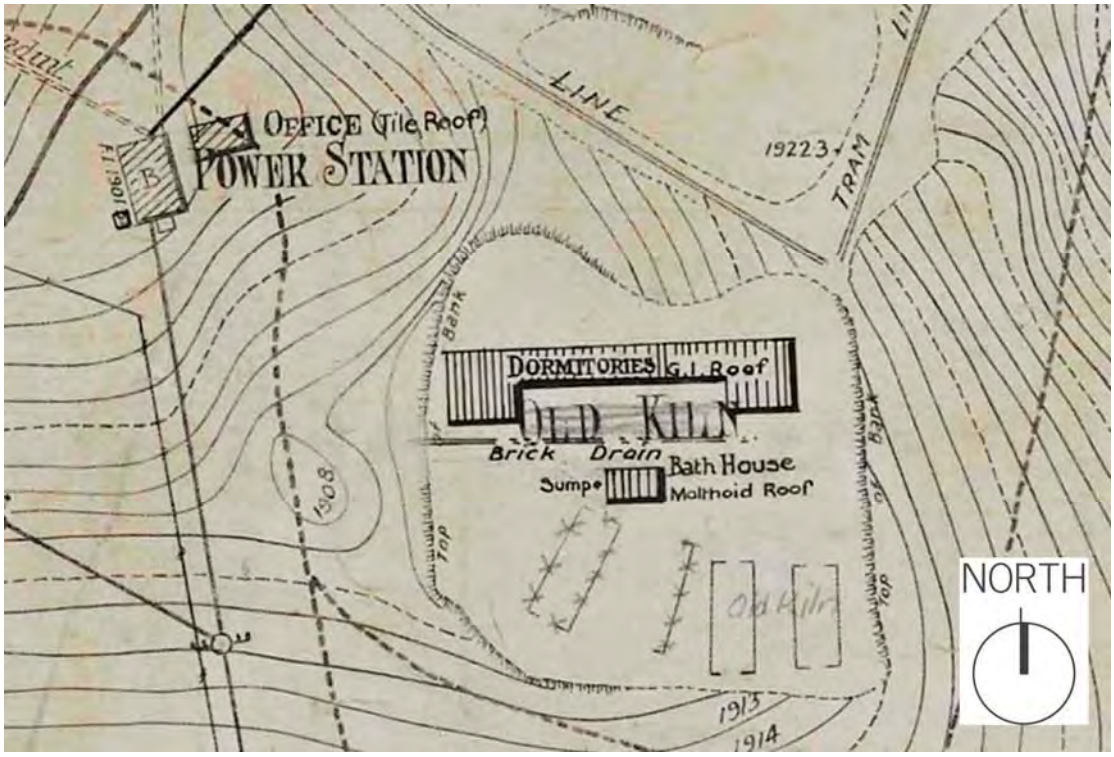

Figure 35 Excerpt from Detail Survey, 20 December 1916: it has not been established whether the 'Dormitories' on the site of the 'Old Kiln' was built.
Source: National Archives of Australia.

Since 1960, much of the site has been incorporated into the grounds of the Royal Canberra Golf Course.[50]

During the Establishment Phase of the Canberra Brickworks, prior to its closure from late-1916 until 1920, workers were accommodated in two camps of tents; one for married couples, the other for single men. The camps were located on Banks Street, near the present Forestry School (see Figure 34).[51] The census of 31 December 1913 recorded a total of 62 residents of Westridge (Yarralumla), comprising 37 men and 25 women, the majority of whom were employed at the Brickworks.[52]

A dormitory block is shown on the site of the 'Old Kilns' on later versions of the 1916 Survey Plan (see Figure 35). It has not been established whether this was built. The first recorded permanent dwellings for workers at the Yarralumla works were constructed in the 1920s, at the top of Denman Street (single men's camp), and to the south-west of the Brickworks (married quarters).[53] (See also Chapter 4.)

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50 Register of the National Estate, Westbourne Woods Area, Place ID 13337.

51 Ann Gugler, *The builders of Canberra, 1909-1929, Part one,* chapters 2 and 3.

52 Ann Gugler, *The builders of Canberra, 1909-1929. Part one,* p. 77.

53 The single men's camp had been abandoned by 1928. Ann Gugler, *The builders of Canberra, 1909-1929. Part one*, *Temporary camps & settlements*, Canberra, CPN Publications, 1994, chapter 2.

3.2 Datasheets for Establishment Phase elements

No	Name / Description	Date of construction
01	Quarry	Shale extraction from 1913 until c. 1940
02	Concrete retaining wall	c. 1913-16
03	Power House	1915-16
04	Staffordshire kiln	1914-15
05	Fan house for Staffordshire kiln	1914-15
06	Stack for Staffordshire kiln	1914-15

Figure 36 Location of elements surviving from the Establishment Phase. Refer to the larger scale site plan in Chapter 1 for more detail.

Name	Quarry	**Reference No**	01
Historical Phase	Establishment and Expansion phases (1911 – c. 1940)	**Survey Date**	3 December 2009
		Date	Shale extraction from 1913

Figure 37 View of the quarry showing the narrow gauge tramway used to transport shale to the crusher, 1921.
Source: National Archives of Australia.

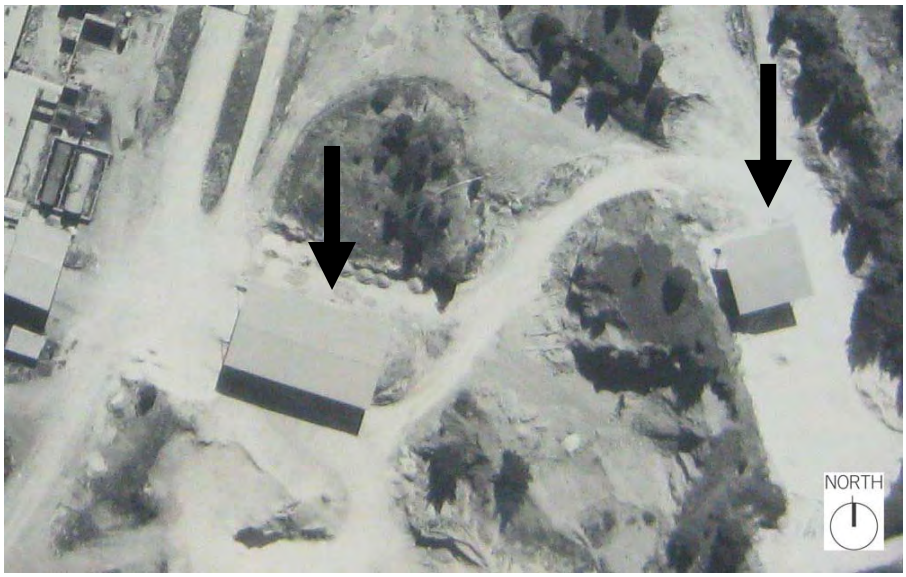

Figure 38 Detail of a 1976 aerial photograph showing the clay storage shed and an unknown smaller structure to the right (both demolished).

Figure 39 Detail of site landscaping plan prepared by A R Marr Pty Ltd showing the reflection pond and the location of the model railway, c. 1977.
Source: ACT Heritage Library, Woden, ACT.

Figure 40 View of the Quarry looking south-west from adjacent to the site boundary to Bentham Street.

Figure 41 Looking north across the quarry floor, the site of the reflection pool, developed as part of the A R Marr Pty Ltd proposal. The dividing wall in the centre of the image marks the location of a walkway which traversed the pool.

Figure 42 Quarry looking north towards Bentham Street.

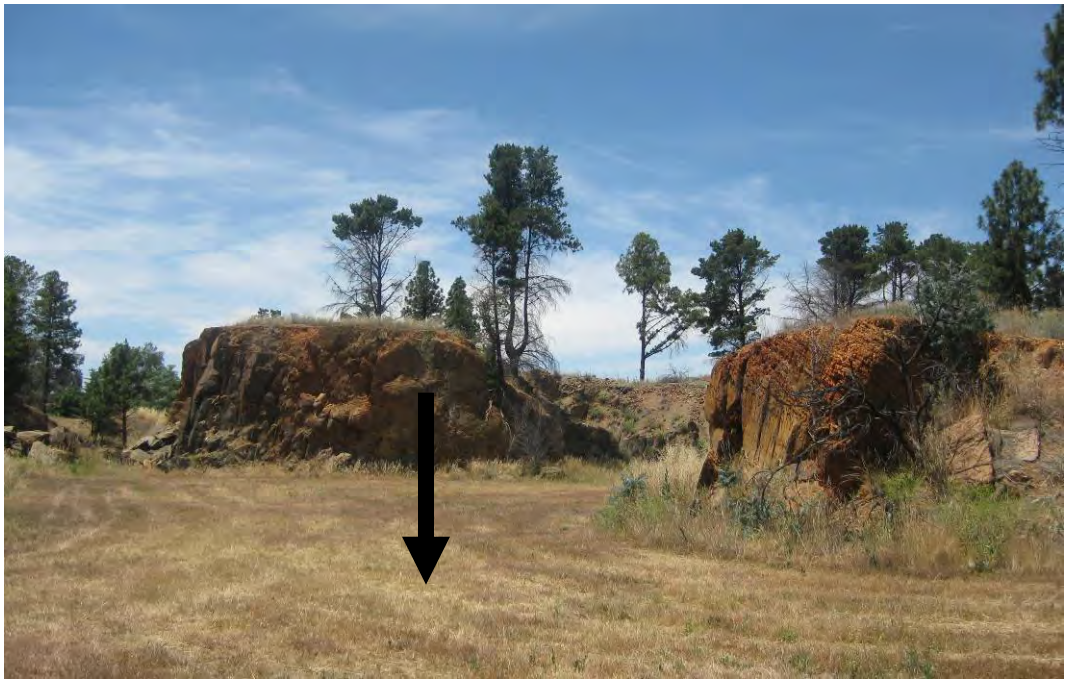

Figure 43 The approximate site of the clay storage shed, demolished after the closure of the works, is indicated by the arrow.

Historical background

The geology of Canberra consists of a range of both sedimentary and volcanic rock types which are relatively common in south-east New South Wales. The main rock types are:

- Deep water sediments of late Ordovician and early Silurian age
- Shallow water sediments of middle to late Silurian age
- Volcanic rocks of middle Silurian to early Devonian age

There are also minor outcrops of recent river gravels and stream deposits.

The deep water sediments (mudstone and siltstone) of the early Silurian age (424-423 million years ago) are present as what is known as the Yarralumla Formation. The Yarralumla Formation comprises shale - a very fine-grained sedimentary rock – which is fossiliferous in places.

The selection of the site for the 'Commonwealth Brickworks' on Frederick Campbell's Yarralumla property followed tests on shale samples which produced bricks of good hardness and porosity (though the quality proved not to hold over time).

The raw material quarried for the 'temporary' works from 1913 was a hard yellow shale which was obtained by levelling a knoll to the east of the works. The shale varied greatly in quality and material from the various seams had to be mixed thoroughly to secure uniform colour in the bricks, increasing production costs.[54] As noted at Section 3.1.2, the raw materials were transported to the brickworks by a narrow gauge tramway, which was constructed so that trucks ran downhill to the works and empty trucks were returned to the

54 Lester Firth Associates (Quarry datasheet, Appendix 2). The sources for the information in this paragraph are not cited.

quarry area using manpower. The tram lines could be relocated as the quarry face advanced (see Figure 37).

From the mid-1930s, raw materials were brought in from outside the works. Quarrying at the site was reported to be a complex process, and more costly than the average brickworks due to seams of unusable material such as limestone and sandstone.

Levelled areas of the quarry floor were subsequently used to house brickworks-related facilities, including an open-sided roofed enclosure for clay storage (since removed). It is shown in an aerial photograph of the site taken in 1976 (see Figure 38, see also Figure 43). Another smaller structure, located further east is also shown, although its purpose is not known.

After the closure of the Brickworks, the site development proposal prepared by A R Marr Pty Ltd proposed the construction of a narrow gauge railway and a 'reflection pool' in the former quarry (see Figure 39, and Figure 41). However, the pool failed to retain water and was frequently dry.

Description & Integrity

Other than for the works undertaken by Marr, the quarry appears to be little altered since the closure of the brickworks in the 1970s. It retains a series of rock outcrops which presumably contained unsuitable material, with quarrying continuing around them. It is not clear the extent to which sections of the quarry floor may have been modified and filled since the 1970s.

A concrete dividing wall, capped with stone paving at the quarry floor is a remnant of the A R Marr 'reflection pool', being a walkway across the pool. The railway has been dismantled.

There are areas of grass and the quarry and its edges are lightly treed, predominantly by self-seeded conifers.

The quarry is secured by a cyclone wire fence, due to safety concerns regarding the eroding quarry face, though access is available to residents whose properties back onto it.

Name	Concrete retaining wall	**Reference No**	02
Construction	Off-form concrete cast in situ	**Survey Date**	17 February 2010
Historical Phase	Establishment phase 1911-1920	**Date**	c.1913-16;

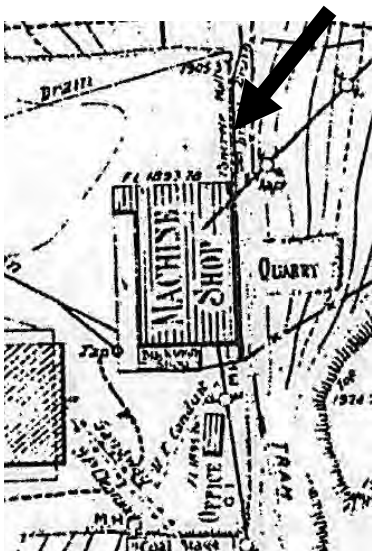

Figure 44 Detail from 1916 Survey Plan, with the concrete retaining wall highlighted.

Figure 45 Retaining wall to the rear of the Workshop (Building 17).

Figure 46 The north end of the concrete wall.

Historical background

A concrete retaining wall separating the quarry and the working area is shown on the 1916 Survey Plan. It is probable that it was constructed as part of the permanent works, during 1915-16. At its southern end, the wall returned to form the 'Coal Stage,' also shown on the 1916 Survey Plan. The wall extended to the north, approximately to the concrete base of the demolished Pan Room, where is returned to the east (see Figure 46). The rear of the original 'Machine Shop' abutted the retaining wall (see Figure 44).

Description & Integrity

The cast in-situ off-form concrete wall is approximately three metres high. Its depth has not been established. The original extent of the wall remains legible, although the former Coal Stage has been demolished. The crusher houses (Buildings 18 and 19) and the east and north brick walls of the model railway workshop (Building 33) are built on top of the wall. It also carries the pedestrian bridge that provides access to the firing floor of the first Hardy patent kiln (Building 8), see Figure 46.

Notwithstanding some deterioration at the top, and the impacts of buildings 18, 19 and 33, the wall is generally in sound condition.

Name	Power House	**Reference No**	03
Construction	Brick with terracotta tiled roof	**Survey Date**	3 December 2009
Historical Phase	Establishment phase 1911-1920	**Date**	c.1915-16;

Figure 47 The Power House is the tile roofed building in the centre of the image. The office building (Building 7) adjoins it to the right and the small cream brick structure is the Downdraught kiln control room (Building 23).

Figure 48 From left: South elevation and entry; interior showing retained plant.

Historical background

Prior to the commissioning of the Central Generating Station (Kingston Power House) in 1915, the Canberra Brickworks was powered by a steam driven donkey engine. When the Kingston Power House came on line in July 1915, the high voltage supply was broken down by transformers to lower voltages and distributed across the site. This was achieved by three overhead cables connected to the purpose-built Power House, described as the 'Power Station' on the Survey plan of December 1916 (see Figure 30). The locations of the original entry points for the cables are visible on the south elevation.

It is possible that the openings in the south elevation have undergone alteration.[55]

Description & Integrity

The Power House is built of face red brick, has a gable roof clad in terracotta tiles with timber vents within the gable to both the south and north end. Access is via paired ledged and braced timber doors to the south and north ends of the building. At present, the paired doors to the south elevation are in use and those to the north are secured internally by timber battens nailed across the doors. Highlight windows to the east wall and three access

55 A drawing dated 17 December 1953, (ref. Canberra Brickworks Proposed extension to Office Building Sketch-plans, National Archives of Australia) detailing additions to the adjoining office refers to the north elevation of the Power House as the 'front' and the south elevation as the 'rear'. The drawing details the doors to the north elevation but does not detail any openings to the south, possibly implying that the openings to the south are not original. No original drawings of the Power House have been located to confirm or refute this evidence, but a visual inspection of the fabric suggests that the door opening and the cable access points are original details or alterations of long standing, predating the 1953 drawing.

points for transmission cables in the south wall are bricked up and there are two non-original multi-paned metal-framed windows in the west wall.

Internally, the Power House has a concrete floor and the ceiling is lined with a narrow profile painted corrugated iron. Some early electrical equipment is still *in situ* within the building, including circuit breakers, ammeters, watt meters and distribution boards and some is in still in use, providing power for tenants. Other early high voltage switchgear and transformers are thought to have been removed. The original connection high up in the south wall has been discontinued and power is now relayed underground from a power pole in close proximity to the structure.

The building is in fair condition. Efforts to secure the building against illegal entry and vandalism have had a detrimental impact on its physical condition and presentation. The terracotta roof tiling and the soffit are both in poor condition. The entry doors are damaged with some of the boards removed and the highlight windows above are broken and sheeted over. Graffiti is also evident.

Openings to the east and south walls are bricked up.

The extension of the adjoining office block to the east and the siting of the small service building to the immediate west have had an adverse impact on the presentation of the building.

Name	Staffordshire Kiln	**Reference No**	04
Construction	Brick with corrugated steel roof	**Survey Date**	3 December 2009
Historical Phase	Establishment phase 1911-1920	**Date**	c. 1916

Figure 49 The Staffordshire kiln, fan house and stack, photographed in 1917 by Harry Connell. Note that in this view the kiln verandah does not extend to the west elevation.
Source: National Library of Australia.

Figure 50 The west elevation today.

Figure 51 The east elevation, photographed by Harry Connell in 1917.
Source: National Library of Australia.

Figure 52 The north elevation, photographed prior to the rebuilding of the verandah to support a first floor enclosed verandah structure.
Source: National Archives of Australia.

Figure 53 View of the west elevation from the 1920s showing the later two-level verandah structure.
Source: National Archives of Australia.

Figure 54 North elevation showing modified kiln entrances.

Figure 55 Kiln interior.

Figure 56 Interior of the upper floor of the kiln looking west across the firing floor.

Historical background

An overview of the history, planning and construction of the Staffordshire kiln is included in Chapter 2.

Plans for the Staffordshire kiln were purchased in early 1914 from Robert E Odd, the Australian holder of the patent for the 'Staffordshire' and 'Manchester' continuous brick kilns. The Staffordshire kiln, a variation on the Hoffman model, had been patented by Dean and Hetherington of Accrington, Lancashire (England) in 1904. The continuous tunnel of the Hoffman kiln was replaced by a series of separate side by side chambers, in this case 20 chambers. This allowed a single chamber to give special treatment to its contents; such as terracotta tiles or pipes which could therefore be produced alongside brick firing. Previously, separate kilns were required.

Fans accommodated in a separate fan house are used to draw the heat through the kiln tunnel to be dispersed through a short brick stack, rather than a high chimney. The Lester Firth Conservation Plan notes this aspect of the design of this particular Staffordshire kiln was pursued to avoid the visual impact of a higher stack in the Canberra area. No documentary evidence has been located to substantiate this claim, though there is some evidence that Staffordshire kilns constructed elsewhere may have had taller stacks. [56]

56 See, for example, the online views of a Staffordshire kiln at the Dunaskin Brickworks in the UK, http://www.scran.ac.uk/database/record.php?usi=000-000-481-395-C.

Construction of the kiln began in November 1914, and it was operational from early 1916. However, the brickworks closed within a year, a reflection of a reduced works program in Canberra during World War I, and the coal strike of November-December 1916.

The Staffordshire Kiln was the first permanent kiln structure to be constructed at Canberra and the only example of its type to survive in Australia today.[57]

Description & Integrity

As originally constructed, the Staffordshire kiln was a two-storey structure with a brick base, brick upper walls and a galvanised steel roof. It contained 20 chambers. The internal fire bricks were imported from England, and some were apparently numbered to show construction sequence. Truss work in the loft was also imported with steel beams stamped 'Frodingham England', indicating their manufacture by the Appleby-Frodingham Steel Co. A single level verandah, supported on timber posts enclosed the north and south elevations (see Figure 51 and Figure 52). By the mid 1920s, this structure had been removed and a more robust structure enclosed the north, south and west walls at first floor level with a timber enclosed verandah structure, thought to have been open to the firing floor internally (ie the brick walls having been demolished, see Figure 53). There is some evidence that this expanded upper level to the Staffordshire kiln may have been used for the drying of tiles, presumably those produced in the tile-making plant which is understood to have been added to the site in this period (at the south end of the Machine Shed)[58]. A 1925 plan showing proposed alterations at the site indicates two 'tile lifts' located adjacent to the Staffordshire kiln.[59] According to Lester Firth Associates, the first floor level to the verandah was demolished in the A E Marr period and the brick walls at first floor level were rebuilt in their original position at this time, but without the openings as in the original (refer to Figure 52).[60]

Today the Staffordshire kiln comprises the 20 kiln chambers to the ground floor with a firing floor above, enclosed by non-original brick side walls and original brick end walls, with a gable roof form, clad in corrugated steel. The gable to the west end is infilled with corrugated steel and timber louvres, which are thought to be the original treatment. A 1917 photograph shows that the same scheme was in place at the east end, now obscured by the skillion roof structure that later enclosed the yard area between the machine bays and the kiln (see Figure 51).

Significant rebuilding works took place in the mid 1950s, when the 1927 Hardy Patent kiln (Building 8) was also upgraded and extended, and a further Hardy patent kiln (Building 12) was constructed. At this time the kiln chamber entrances were enlarged to permit forklift access. The individual kiln numbers, originally painted above the centre of each of the arched entrances are today incised in a rendered 'pad' to the right side of each of the

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57 Up to three Staffordshire kilns were constructed at the State Brickworks, Homebush Bay Strathfield NSW in 1911-12, but since demolished.

58 Lester Firth Associates 1986, Section 2.1.2

59 Commonwealth of Australia, Department of Works and Railways: Proposed Additions to Brickworks, 18 November 1925, M3495B, National Archives of Australia, cited in Lester Firth Associates 1986, Section 2.1.2.

60 Lester Firth Associates, 1986, Datasheet appendix.

openings. To the south elevation, one of the kilns at the eastern end has been infilled with brickwork and a single door opening installed, enabling the space to be secured for storage. The first floor level of the verandah has been demolished and the supporting verandah is only extant in areas to the north, east and west ends, and is in an advanced state of deterioration.

Internally, between the kiln chambers, there are a number of 'trace-holes' which could be closed by dampers, which were raised and lowered from the firing floor above. Within the kiln arches the feedholes and hot air off-takes are still apparent. A number of the kilns have been paved internally with cement tiles, a modification which occurred after the closure of the plant, and for the accommodation of antiques stalls, part of the tourism concept for the site developed by A R Marr Pty Ltd in the late 1970s.

The upper floor and verandah of the Staffordshire Kiln has also been modified a number of times including the enclosing of the verandah with corrugated iron, bringing the line of the upper floor out to the edge of the original verandah. This modification was later reversed by A R Marr Pty Ltd when new brick walls were constructed on the line of the original building wall, with the intention of refitting the space as a commercial facility in line with a proposal to establish a tourist park. The roofing was also replaced at this time.

Several of the kiln linings are bulging and brickwork is loose in places. The first floor remnant verandah structure is in very poor condition and the former firing floor space is in poor condition.

Name	Fan house for Staffordshire kiln	**Reference No**	05
Construction	Brick with corrugated steel roof	**Survey Date**	3 December 2009
Historical Phase	Establishment phase 1911-1920	**Date**	c. 1916

Figure 57 Fan house with stack behind.

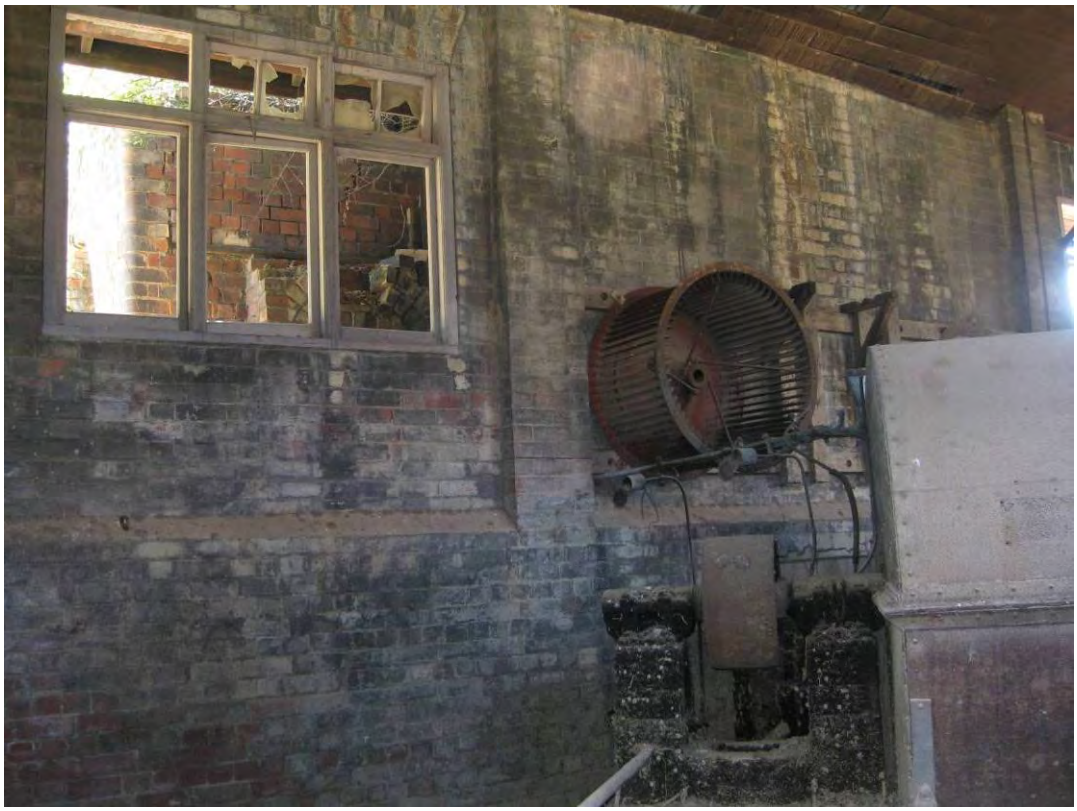

Figure 58 Interior of fan house. The tangential fan is mounted on the rear wall.

Figure 59 Another view showing the entry to the tunnel / flue connecting the fan house with the Staffordshire kiln.

Historical background

An unusual feature of the design of the Staffordshire kiln was the use of fans to help dissipate heat and burnt fuel. The use of fans compensated for the greater draw or suction a taller chimney would have provided, and allowing for the use of a lower brick stack.

The fan house, constructed of brick and roofed in corrugated steel, is located approximately 20 metres west of the Staffordshire kiln. It was constructed in conjunction with the kiln in c. 1915-16, and housed the machinery to induce the drafts required to disperse heat and burnt fuel through the stack.

Description & Integrity

The fan house is constructed of face red brick, laid in English bond with a Dutch gabled roof clad in of corrugated steel, recently renewed. The fan house presents as a single-storey building, but has a lower floor level internally. There is a central double door entrance in the east (front) elevation (door leaves removed), flanked by tripartite timber-framed casement windows with awning toplights, set on sloping sills of bullnose bricks. The windows are broken and some of the glazing bars to the toplights have been knocked out. Additional windows are centrally placed in the north and south end walls. The west wall has windows placed directly opposite the windows that flank the entrance. The rainwater goods, soffits and fascias to the roof have all been removed.

Internally the ceiling is lined in beaded painted timber boards, some of which are damaged. The walls are of brickwork, heavily stained by soot. Within the building there is a diamond-shaped concrete apron to the entry with metal ladder from stairs to a lower floor level to either side of the apron. There is a metal guardrail around the apron. The apron sits over the entry to the kiln draught tunnel and the tunnel to the stack. One of two fan motors remains (albeit in a dilapidated state) within the basement area and the concrete engine mounts are also intact. The fan housings are partly intact with the dampers in-situ and one of the tangential fans hanging on the rear wall. The ductwork which carries the exhaust to the stack is carried below ground.

The building is unsecured and in poor condition with evidence of the effects of vandalism including broken windows, missing entry doors and graffiti to the exterior brickwork. The replacement of the roof cladding is a positive action which is preventing further deterioration of the interior ceiling lining.

The bulk of the plant appears to have been removed, and what remains is in a dilapidated state. Remnants remain of the tangential fans, partially dismantled motor housing and components of one of the electric motors remain. The dampers to the kiln tunnel are also extant.

Name	Chimney stack for Staffordshire Kiln	**Reference No**	06
Construction	Brick	**Survey Date**	3 December 2009
Historical Phase	Establishment phase 1911-1920	**Date**	c. 1916

Figure 60 The full extent of the stack, with a smaller near-contemporary kiln adjoining to the right.

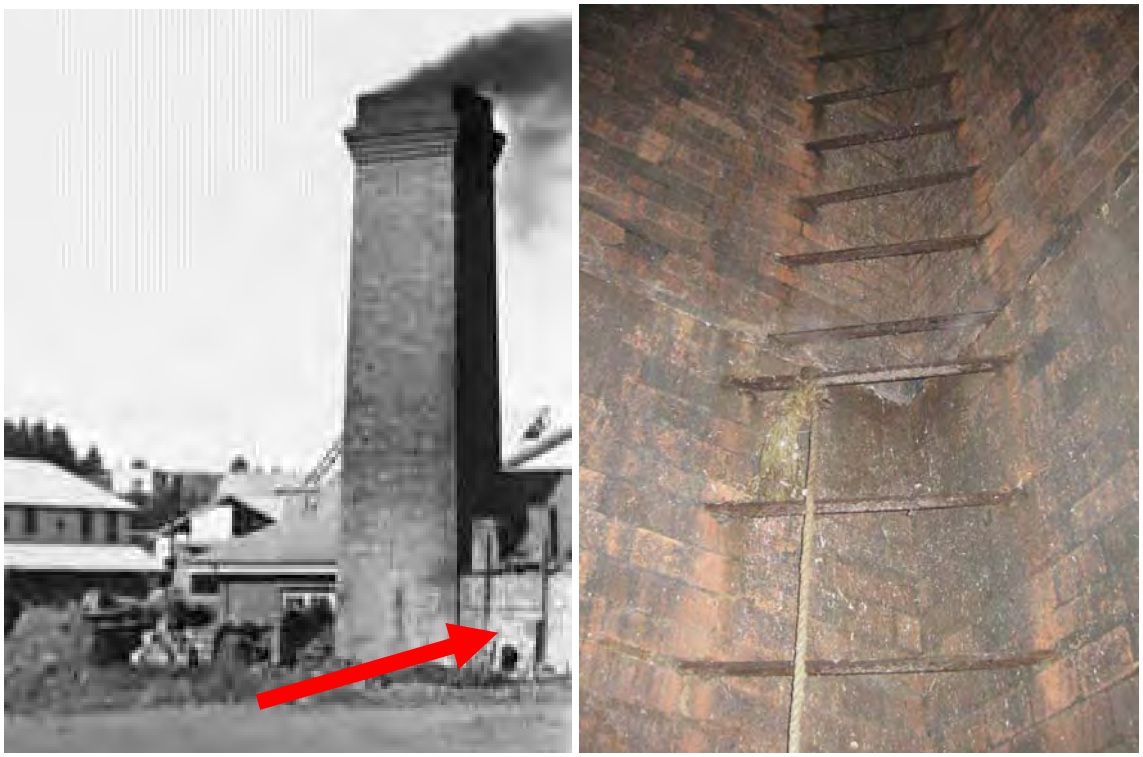

Figure 61 Left: Detail of a photograph of c.1926. The kiln abutting the stack is indicated by the arrow (Source: National Archives of Australia). Right: Interior of the chimney stack.

Historical background

In the case of the Staffordshire kiln, fans were used help dissipate heat, allowing for the use of a lower brick stack. The heat and burnt fuel was pushed by the fans through a subterranean duct to the stack, from which it was dissipated.

To its south, the stack abuts a small brick kiln, referred to in the 1986 *Conservation Plan* as an experimental kiln. While this element is not shown in a 1917 photograph of the works, it is clearly visible in a photograph taken in c. 1926 indicating it is an early site element (Figure 61).

Description & Integrity

The chimney stack, constructed of face red brick is adjacent to the Staffordshire kiln fan house and located approximately 30 metres west of the kiln building. A gravelled roadway separates the kiln from the stack and fan house. The stack is capped with several courses of corbelled brickwork and then surmounted by nine rows of brickwork. Metal bracing to the corners of the section above the stepped brickwork is partly intact. There is evidence of rebuilding of some of the upper courses and a lightning conductor has also been installed since the 1986 *Conservation Plan* was completed. An arched opening in the west face of the stack has been infilled with brickwork. Within the stack iron rungs have been installed on a diagonal to provide internal access.

To the right, a small brick kiln abuts the stack. It has an arched opening in both its west and south faces. The kiln is in a partially ruinous state and vegetation is impacting on the structure.

3.3 Demolished structures

The 1986 *Conservation Plan* provides background information, with varying degrees of detail, on a number of now demolished structures associated with the development of the Canberra Brickworks. Several of these relate to the establishment phase of the site and are addressed below. It is noted that there are structures relating to the post-war phase of development, including a clay storage shed, carpenter's workshop, oil and coal bunkers, weighbridge and a forklift shed, demolished since the 1986 *Conservation Plan*, are discussed in brief in Chapter 6.

3.3.1 *'Temporary' kilns*

The precise location of the temporary kilns (possibly clamps), delineated as four structures on the 1916 Survey Plan (see Figure 30), is unclear. While it is would appear that little discernible evidence of the structures were visible at the date of the compilation of the 1986 *Conservation Plan*, the site of the kilns and associated works would be of archaeological potential and this should be assessed prior to any proposed major disturbance to the site (refer to Chapter 8).

3.3.2 *Brickworks Hostel / Accommodation Village*

Initially workers were housed in tents along the ridge to the east of the works. Permanent dwellings for workers at the Yarralumla works were constructed in the 1920s, at the top of Denman Street (single men's camp), and to the south-west of the Brickworks (married quarters). The single men's camp was disused by 1928 (see also Chapter 4). The buildings that comprised the married quarters are shown in a detail of a 1929 photograph of the works, as well as in an image of the kiln 'road', running north-south between the kilns and fan houses, also of 1929 (see Figure 62, Figure 63). The married quarters were removed during World War II, and replaced by a new Brickworks Hostel (1945, demolished in the early 1970s). Little evidence of the former residential accommodation is visible, with revegetation resuming much of the area (Figure 64). Again, the site of the accommodation village, as well as its earlier temporary site would be of archaeological potential and this should be assessed prior to any proposed major disturbance of the site.

3.3.3 *Cottage complex*

This complex of buildings – refer to 1986 *Conservation Plan* datasheet NE4, Appendix 2 – apparently comprised a cottage with outbuildings located to the north of the second Hardy patent kiln and stack (Buildings 8 and 10). Set above the complex, the site today has been redeveloped as part of Lane Poole Place and is outside the study area. The archaeological potential of this site is considered to be very limited.

3.3.4 *Explosives store*

The explosives store was relocated from a site c. 180 metres south of the Power House to the opposite side of the brickworks, behind the brick extrusion plant – refer to 1986 *Conservation Plan* datasheet NE-3. Both locations should be examined to determine their archaeological potential prior to any proposed major disturbance of the site.

3.3.5 *Weatherboard cottage*

A cottage and stable building are delineated on the 1916 Survey Plan, sited to the north-east of the quarry – refer to 1986 *Conservation Pla*n datasheet NE6 – with its approximate site within the present day bounds of the quarry.

3.3.6 *Carpenters shed*

This structure was located approximately 50 metres south-east of the Power House –refer to 1986 *Conservation Plan* datasheet NE8. Its date of construction is not known and it was removed during the 1960s with the site later used as a car parking area – refer to detail of the 1976 aerial photograph at Figure 65. Prior to any redevelopment of the site of the former carpenters shed, the potential for archaeological significance should be assessed.

Figure 62 Detail of a 1929 photograph of the brickworks looking south-west showing the accommodation village buildings (indicated).
Source: National Archives of Australia.

Figure 63 Looking south along the kiln 'road', the Staffordshire kiln at left, 1929. The mess hall building and the roofs of several of the sleeping quarters are visible in the background.
Source: National Archives of Australia.

Figure 64 The remains of the accommodation village today, looking north-east.

Figure 65 Detail of a 1976 aerial photograph with the then car park, thought to be the site of the former carpenter's shed indicated.
Source: ACT Heritage Library, Woden, ACT.

4.0 HISTORY & PHYSICAL ANALYSIS: EXPANSION PHASE 1921-1940

4.1 Historical background

4.1.1 *Interwar Canberra*

At the end of 1920, following the end of World War I, the Hughes Government decided to proceed with the construction of Canberra. Major works completed in the 1920s included the Provisional Parliament House, Sydney and Melbourne Buildings, Albert Hall, Forestry School, Hotel Canberra, Hotel Ainslie and the Capital Theatre, as well as housing at Ainslie, Reid, Forest and elsewhere. Residential construction peaked in 1927, the year that Parliament first sat at Canberra, and just prior to the transfer of public servants to the National Capital in May 1928.

During the 1920s, the population of Canberra was approximately 3,000, the majority being construction workers (the influx of public servants effectively doubled the population of the city).[1] The construction workers were housed in 'barrack-like camps'[2] located around the edges of the evolving city. One of these camps was built on Stirling Ridge, elevated ground to the east of the Brickworks. 'Westridge' (as Yarralumla was then known) was also the location of Canberra's night soil depot, located on Adelaide Avenue, close to the present-day Kent Street-Novar Street overpass.[3]

When the Canberra Brickworks was reactivated (see Section 4.1.2), accommodation was required to attract workers to Canberra. In 1921/22, seven timber tenements and a number of brick cottages were constructed adjacent to the Brickworks Camp, near the present Forestry School on Banks Street. These were among the first permanent dwellings at Westridge. At around this time, a recreation ground and tennis courts were also constructed for the benefit of the workers at the Brickworks Camp. Further development in Westridge followed during the 1920s, including the construction of 62 timber cottages for workers on the Provisional Parliament House.

The next phase of residential development at the Brickworks began in February 1927, when a new single men's camp was constructed on the south side of Denman Street, close to the entrance to the site. New married quarters were located to the south of the Brickworks in the same year (see Figure 66).[4]

In 1925, Yarralumla was selected as the site of the Australian Forestry School (see Figure 67). A new building, designed in the Interwar Stripped Classical style by J H Kirkpatrick of the Federal Capital Commission (FCC), was completed in 1927. This was followed in 1928 by Westridge House, a house designed by Melbourne architect Harold Desbrowe Annear in collaboration with the noted interior designer, Ruth Lane Poole, as the premises of the

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1 Paul Reid, *Canberra Following Griffin: A Design History of Australia's National Capital*, National Archives of Australia, Canberra, 2002, p. 193.

2 Paul Reid, *Canberra Following Griffin*, p. 193.

3 Ann Gugler, *The builders of Canberra, 1909-1929. Part one, Temporary camps & settlements*, Canberra, CPN Publications, 1994, chapter 3.

4 Dates and details in this paragraph are from, Ann Gugler, *The builders of Canberra, 1909-1929. Part one*, chapters 2 and 3.

Figure 66 The married quarters camp (background), built to the south-west of the Brickworks in 1927.
Source: National Archives of Australia.

Figure 67 Forestry School, Banks Street, Yarralumla, built 1927.
Source: National Archives of Australia.

Figure 68 Westridge House, Yarralumla, built 1927/28.
Source: National Archives of Australia.

Figure 69 Plan of Canberra, 1933, showing the Brickworks to the west of the camp at 'Westridge' (Yarralumla).
Source: National Library of Australia, G8984 C3 G45 1933 NLA.

Figure 70 Plan of Yarralumla, 1927. The street layout (pictured right), derives from Griffin's scheme and was not fully realised.
Source: Ann Gugler, *The builders of Canberra, 1909-1929*, chapter 3.

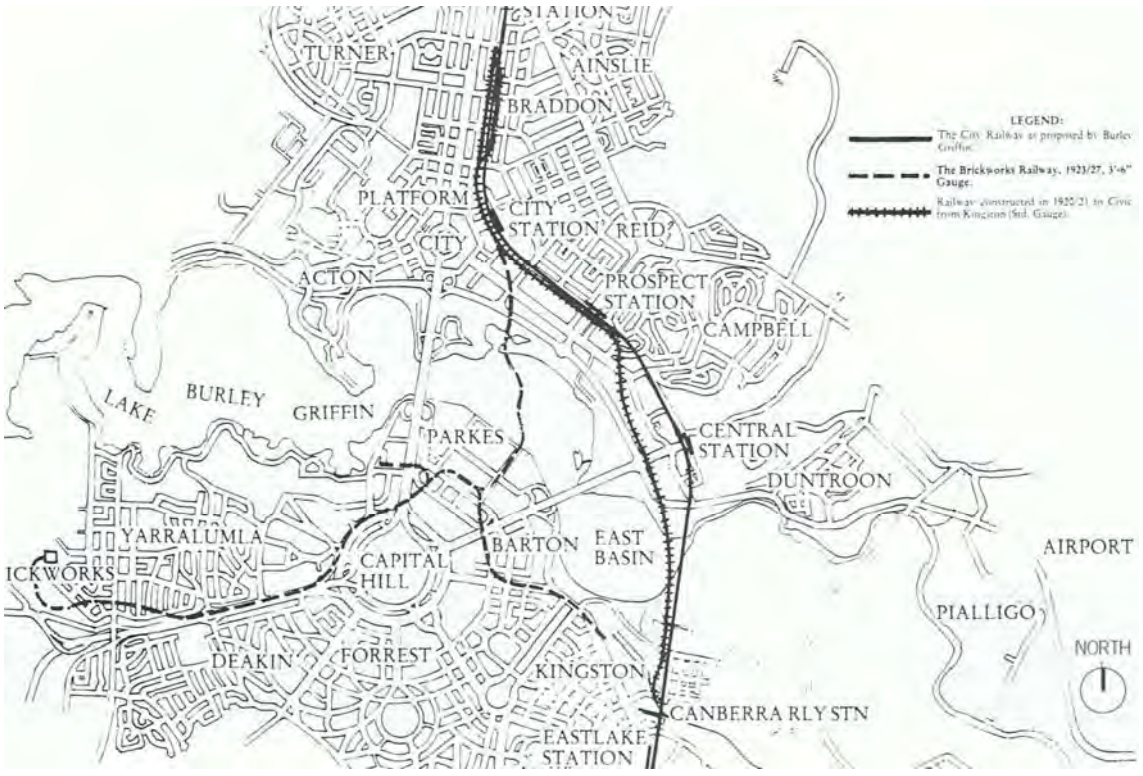

Figure 71 Plan of Canberra with the Brickworks Railway (broken lines) superimposed.
Source: Canberra's Engineering Heritage (www.engineer.org.au)

Figure 72 Aerial view of Canberra Brickworks, 1961. Note the railway cutting to the west of the site. The route of the railway east towards the city is also evident. Source: ACT Planning and Land Authority.

Principal of the Forestry School, Charles Lane Poole (see Figure 68).[5] The property survives, and the Lane Pooles are remembered in the name of the residential street to the north of the Brickworks.[6] Also in 1927/28, 27 'lined cubicles' and 'mess, recreation and ablution areas' for students were constructed in the grounds of the Forestry School.[7]

In the late 1920s, Westridge was an isolated outpost of the emerging National Capital. The area was not recognised as a suburb until October 1935, following complaints from local residents that they had been overlooked by the authorities (see Figure 69 and Figure 70).[8]

5 'Westridge House,' viewed at uncommonlives.naa.gov.au, accessed 31 January 2010.

6 Lane Poole Place was developed during the 1980s, following the decommissioning of the Brickworks (1976), and subsequent re-zoning of the site (1979). See Chapter 6.

7 Ann Gugler, *The builders of Canberra, 1909-1929. Part one*, chapter 3.

8 Ann Gugler, *The builders of Canberra, 1909-1929. Part one*, p. 77.

4.1.2 *Canberra Brickworks revived*

Repairs to machinery at the Canberra Brickworks were made in 1920, and the complex was re-opened early in 1921, with Mr W K Newbold as manager and a staff of only 35.[9]

A tile making plant was installed in 1922, located to the south of the 'Machine Shed'. In 1925, Dr Wunderlich of the Wunderlich Tile Company, Sydney reported to the Government that £5,000 had been expended on a small tile making plant, and that tiles were of poor quality. He recommended a £15,000 upgrade, however the Government decided to spend £2,000 on improving the product.[10]

By the end of 1923, five million bricks and 50,000 tiles had been produced at the plant by a workforce of 53.[11] The bricks produced at Yarralumla in this period were generally regarded as being of high quality. In 1925, Dr Wunderlich reported that, 'the Canberra Brickworks has been turning out a brick of remarkably fine quality; in fact a quality unnecessary for ordinary construction work'.[12]

Initially, bricks were transported from the Brickworks to the construction sites in the emerging city centre by traction engine. However, the machines were able to make only two daily round trips. To speed the process a light railway was constructed, leading from the south-west of the brickworks site, before aligning with the present Denman Street and heading east to the construction sites (see Figure 71). A bridge was constructed to carry the trains over the Molonglo River to the Civic Centre (now known as Civic). The 3' 6" (1,067mm) gauge steam powered railway was operational by the end of 1923.[13]

The 'branch lines' of the light railway were removed prior to the opening of the Provisional Parliament Building in May 1927 and the remaining sections of the railway were removed in 1929. From the late 1920s, bricks were transported by truck. The route of the railway is shown on a 1961 aerial view of the site (see Figure 72). It is believed that the only remaining evidence of the light rail network is the formation between Denman Street and the west side of the Brickworks.[14]

To cope with increased demand during the 1920s, two 'temporary' downdraught kilns and an associated stack were constructed in October 1925. These were oriented east-west and located close to the site of the three 1960s Downdraught kilns that remain today (see Figure

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9 Lester Firth and Associates, 1986, Section 2.1.2. Sources are not cited.

10 National Archives of Australia, File no. 25/15958, cited in Lester Firth and Associates, 1986, Section 2.1.2.

11 Dates and figures in this paragraph are taken from Lester Firth and Associates, 1986, Section 2.1.2. Sources are not cited.

12 *Queanbeyan Age,* 16 July 1925, cited in Lester Firth and Associates, 1986, Section 2.1.2.

13 Walter M Shellshear, author of Chapter 2 (Railways) in W C Andrews & Alan Fitzgerald, *Canberra's Engineering Heritage*, Institution of Engineers, Australia, Canberra Division, 1983, viewed online (unpaginated) at, www.engineer.org.au, accessed 29 January 2010.

14 Walter M Shellshear, author of Chapter 2 (Railways) in W C Andrews & Alan Fitzgerald, *Canberra's Engineering Heritage*, viewed online at, www.engineer.org.au, accessed 29 January 2010.

73). However, the additional output was insufficient to cope with the demands of the National Capital construction program; during this period at least five million bricks were purchased from outside the Australian Capital Territory. In 1926, the *Canberra Times* reported that by October of that year additional plant capable of doubling the output of the Brickworks, was to be operational.[15]

In 1926 the existing 'Machine Shed' (see Figure 74), was expanded by two bays for two new New Era 'Whittaker' brick machines and grinding pans. A Hardy patent kiln (a modified Hoffman-type kiln with a detached stack) was built and in use by early 1927, located to the north of and parallel to the Staffordshire kiln (see Figure 75 and Figure 76).[16] This kiln remains today, albeit in extensively modified form. Also during this period, a 'Scotch' kiln was in operation to the north of the Staffordshire kiln (see Figure 75), and the original section of the present office building was constructed (see Figure 78). In January 1927, the *Canberra Times* commented on the expanded capacity of the works, noting that in addition to the new Hardy patent kiln of 18 chambers (with a potential annual output of six million bricks), a new down draft tile kiln was operating with an annual output of 420,000 tiles and a new Roman tile machine had a daily output of 2,000 tiles. It also noted that three hand presses had been installed (presumably in the Machine Shed) 'for all classes of special work'.[17]

Ironically, considering the scale of the expansion works, with the end of major building operations in the ACT, the demands on the Brickworks were greatly reduced. The 1927/28 Federal Capital Commission *Annual Report* noted that the plant at Westridge, which comprised one 'Hoffman' (the Hardy patent kiln), one Staffordshire and two Downdraught kilns, was capable of producing 12,000,000 bricks and 500,000 tiles per annum. The report also noted that extra crushing plant and equipment was installed at the quarry, and large supplies of material for road construction and use in building works had been obtained. The Joinery Shop, Mechanical and Electrical Workshops had operated during the year although the Joiner's Shop was to be closed due to lack of demand.[18]

Due to instability, quarrying was reportedly more difficult and costly at Yarralumla as compared to other Brickworks. A comparison of prices in 1929 showed that 1,000 common Canberra Bricks cost £6.11s while the State Brickworks in Sydney could supply 1,000 commons for £2.18s 6d. But freighting 1,000 bricks to Canberra cost £5.1s, almost as much as it cost to manufacture them at Yarralumla. In addition the Brickworks was operating at a loss, because of Commission policies to sell bricks to private enterprise at little above cost price to make building as cheap as possible. Bricks for public servant homes were sold below cost price to give further incentive for them relocate to Canberra.[19]

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15 Cited in Lester Firth and Associates, 1986, Section 2.1.2. The date of the *Canberra Times* article is not included.

16 Lester Firth and Associates, 1986, Section 2.1.2, source uncited.

17 *Canberra Times*, 6 January 1927, p. 1.

18 Lester Firth and Associates, 1986, Section 2.1.2, citing the *Annual Report of the Federal Capital Commission*, 1927 and 1928.

19 Lester Firth and Associates, 1986, Section 2.1.2, citing the *Annual Report of the Federal Capital Commission*, 1929.

The 1929 Depression saw production severely curtailed. To minimise costs, timber was used for firing kilns instead of coal. Production eventually ceased altogether and the works closed in February 1931. Stockpiled bricks were used for essential construction purposes only. As the economy revived, Government funds were again available for office accommodation for public servant transfers to Canberra. Restricted production at the Canberra Brickworks began again in 1935. From this period problems with shale quality (limestone intrusion) meant that most material for brick production had to be brought to the site from elsewhere. Evidence of this limestone problem is evident in the rock outcrops in the quarry area.[20]

The late-1930s was a boom time for the construction of Canberra, and the Canberra Brickworks was unable to meet demand. On 19 October 1939 the *Canberra Times* reported that daily production at the brickworks was 45,800 bricks, and the average consumption in building operations was 50,280, a situation that required the purchase of 631,500 bricks from the Bowral works in New South Wales.[21] For the 12 months ending December 1940, the output of 7.25 million bricks was the highest since the boom days of the 1920s.[22]

World War II diverted peace time activity to works associated with the war effort, and saw the closure of the Brickworks once again. In April 1942 staff were laid off and a caretaker manager retained to issue bricks for essential works. At the time, three million bricks were in stock, some of which were used in the construction of the US Legation in Canberra.[23]

The range of products for building purposes produced at the Brickworks in the 1930s was enormous. A 1936 Stock Sheet of the Department of Interior lists all products and includes: 3" common bricks, 3" Face bricks (red), 3" Black bricks common, 2" Paving bricks, 2" Face bricks (red), 3" semi-glazed Face Bricks, 3" Chocolate Face bricks, 3" Pavers, 2" Common bricks, Squints, Ovolo Double return bricks, Special Mould bricks, Ovolo Type 8, Ovolo Type 17, Splay on End 3", 3" Splay on End Flat double, Angle Bricks, Scotia, Cornice, 3" Bull Nose Bricks, Plinth single Return, Double Return, Bull nose stops – single and double, Vents, Louvres, Air Bricks, kerbs, Tiles – Marseilles, Roman, with apex, ridge, starters and stops, paving tiles, chimney pots, fluted bricks and facing tiles.[24]

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20 Lester Firth and Associates, 1986, Section 2.1.2, source uncited.

21 'Canberra Bricks – Local Production Inadequate, Imports From Bowral,' *Canberra Times*, 19 October 1939, reproduced in Ann Gugler, *Canberra 1930-1943 & 1949, articles from the* Canberra Times *& other sources*, Mawson, ACT, 2002, p. 19

22 *Canberra Times,* 17 January 1941, cited in Lester Firth and Associates, 1986, Section 2.1.2.

23 Department of the Interior memo no. C480 16 April 1942, cited in Lester Firth and Associates, 1986, Section 2.1.2.

24 Department of Interior, Stock Sheet, 1936, referenced in Lester Firth and Associates, 1986, Section 2.1.2.

Figure 73 Detail of 1947 site plan, indicating the location of the two 'temporary' Downdraught kilns, to the south of the Staffordshire kiln ('No. 1 Kiln'). .
Source: National Archives of Australia.

Figure 74 The Machine Shop (left), pictured mid-1920s.
Source: National Library of Australia.

Figure 75 Hardy patent kiln under construction, 1926. Note Scotch kiln to right of picture.
Source: National Archives of Australia.

Figure 76 Hardy patent kiln under construction, c. 1926.
Source: National Archives of Australia.

4.2 Datasheets for Expansion Phase elements

No	Name / Description	Date of construction
07	Offices	c. 1925
08	Hardy patent kiln	c. 1926-27 (rebuilt 1955)
09	Fan house for Hardy patent kiln	c. 1927 (second phase c. 1955)
10	Chimney stack for Hardy patent kiln	c. 1926-27

Figure 77 Location of elements surviving from the Expansion Phase. Refer to the larger scale site plan in Chapter 1 for more detail.

Name	Offices	**Building No**	07
Construction	Brick with terracotta tiled roof, brick additions roofed with steel sheet	**Survey Date**	3 December 2009
Historical Phase	Expansion phase 1921-1942	**Date**	c. mid 1920s, extended c. 1953 and 1970s

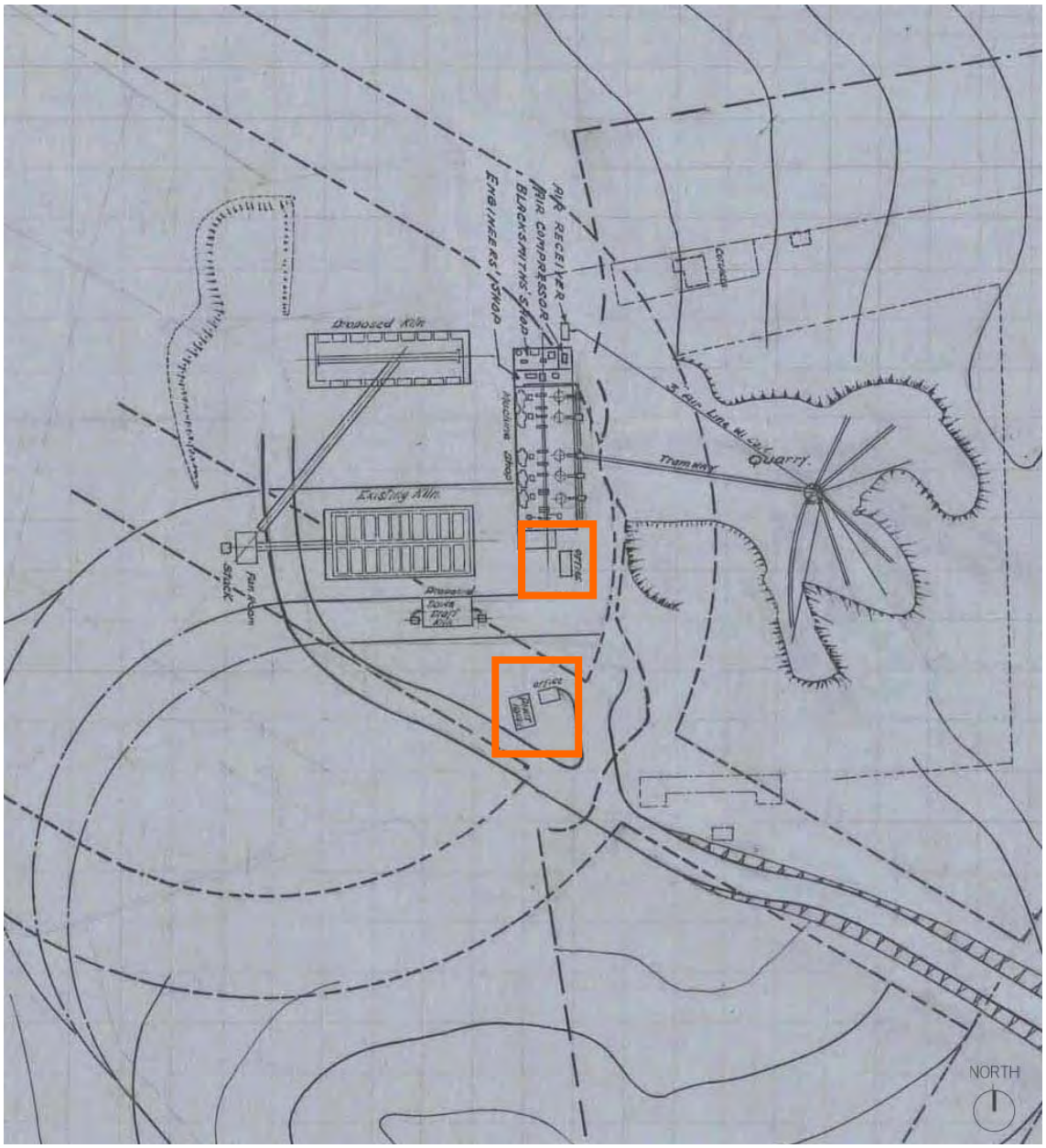

Figure 78 Detail from the Canberra Brickworks site plan, April 1926. The present office building (right), subsequently extended, and the original office (left), later demolished, are highlighted.
Source: National Archives of Australia.

Figure 79 Detail of a photograph of the Brickworks site in 1929 taken from the quarry area, showing the original form of the office building to the east of the Power House (foreground). Note that at this date, the main entrance to the Power House is from the north. The married quarters camp is in the background. Source: National Archives of Australia.

Figure 80 South elevation. Part of the Power House (Building 3) is visible at left.

Figure 81 East and north elevations, showing the extent of the additions. The only portion of the original two-roomed structure, not enclosed by additions is indicated by the arrow.

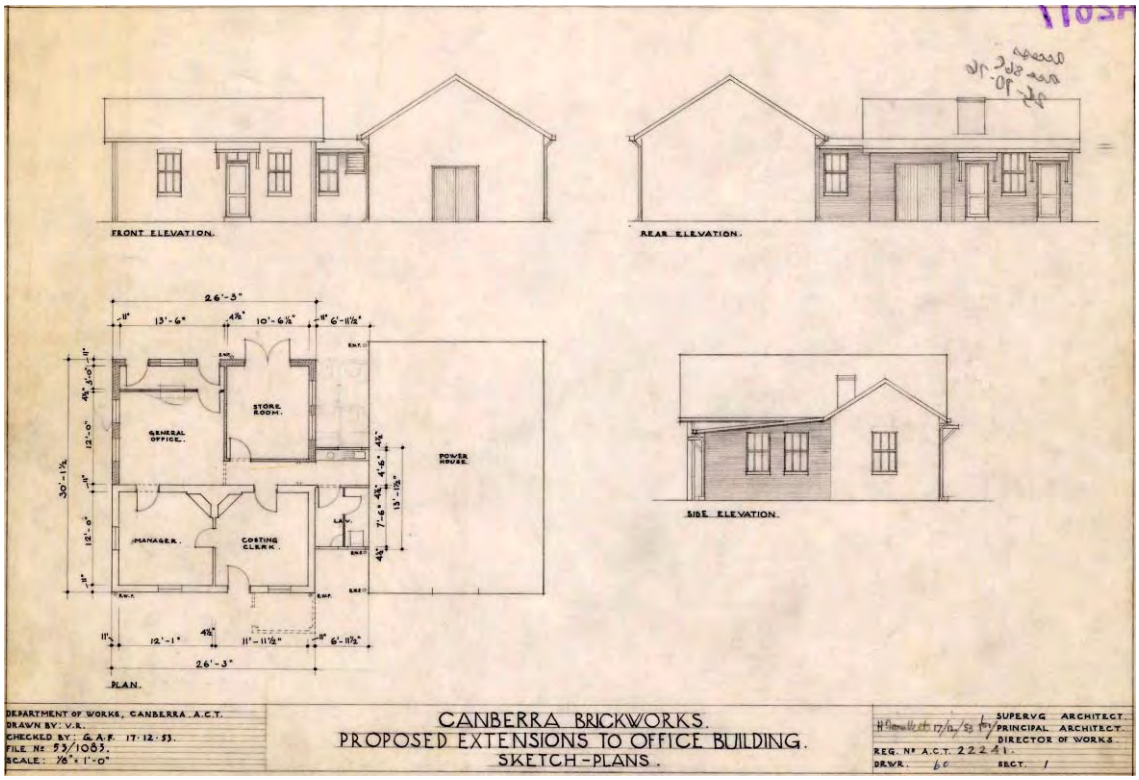

Figure 82 Office extension, consisting of a two roomed addition to the south and a lavatory/washroom infilling the space between the original structure and the Power House, 1953.
Source: National Archives of Australia.

Historical background

The Survey Plan of 1916 (see Figure 30) indicates a galvanised iron 'Office' located approximately 40 metres north of the present office building. This was subsequently removed and the site developed for the original Machine Shed. The date of construction for the original portion of the present offices – consisting of two rooms – has not been established. It is not indicated on a site plan dated September 1921, but is represented in outline on a site plan of April 1926 (see Figure 78).[25] It appears in a 1929 photograph, shown at Figure 79.

The offices have been extended in at least two phases, in 1953 and during the 1970s. The 1953 works doubled the size of the original building, extending the structure to the south to provide a General Office, office for the Manager and for a Costing Clerk, as well as a store room. A lavatory and washroom were located between the office and the Power House (Building 3) (Figure 82). The extension had a skillion roof of corrugated iron. A later extension, thought to have been built during the 1970s, extended the building to the east, and further altered the south elevation.

Description & Integrity

As constructed in the mid-1920s, the office building was a small brick and tiled roofed gable ended building, sited immediately to the east of the Power House. A number of extensions have been made to the original building, with extant drawings prepared in both 1953 and 1958 for alterations and extensions to the original two-roomed structure. The 1958 works appear not to have gone ahead.[26] During the 1970s a brick addition to the east and a new verandah partially enclosed the remainder of the south elevation, abutting the Power House. In addition, a small brick extension was added to the rear (north) of the building, and small skillion roofed outbuildings were constructed to the east and north.

The subsequent alterations have diminished the integrity and obscured the presentation of the building.

It was not possible to inspect the interior of the building during the site visit. The building - including the interior, it is understood - has been extensively vandalised.

25 Commonwealth of Australia. Dept. of Works and Railways. Canberra, Brickworks Layout. 14 September 1921, M1970C, National Archives of Australia; Federal Capital Commission. Commonwealth of Australia. Dept. of Works & Railways. Canberra Brickworks. Site Plan. 6 April 1926, National Archives of Australia respectively.

26 Lester Firth and Associates, 1986, 'O Office complex' data sheet, Appendix 2, source uncited.

Name	Hardy patent kiln I	**Building No**	08
Construction	Brick, upper floor and roof of corrugated galvanised steel	**Survey Date**	3 December 2009
Historical Phase	Expansion phase 1921-1942	**Date**	1926-27; substantially rebuilt in c. 1955

Figure 83 The first Hardy patent kiln (left) and the Staffordshire kiln in1928.
Source: National Archives of Australia.

Figure 84 The Hardy patent kiln showing the west and part of the north elevation.

Figure 85 Interior of the Hardy patent kiln. The kiln is divided in two by a non-original brick wall.

Figure 86 Kiln wickets – the opening at left has been altered to enable forklift access and the bricked-up the opening at right is as originally built.

Figure 87 Interior of the firing floor, showing remnants of a commercial fitout dating from the late 1970s.

Historical background

The Hardy patent kiln (Building 8) was built in 1926, and became operational in 1927. It was a critical component of the drive to double the output of the Brickworks in the build up to the relocation of the Parliament to Canberra (1927) and the transfer of public servants the following year.[27] Other components of the expansion of the Brickworks during the mid-1920s were two 'temporary' downdraught kilns (built in 1925, and demolished in the early 1960s), which were located close to the site of the present downdraught kilns, and a Scotch kiln (undated and demolished) located to the north of the Staffordshire kiln. The Hardy patent kiln fired continually in a clockwise cycle, and was able to produce up to 150,000 bricks per week (though in January 1927 the *Canberra Times* estimated annual output for the kiln as up to 6 million bricks). [28] A firing cycle lasted for 14 days.[29]

In the mid-1950s the partially collapsed kiln was extensively rebuilt. It was also extended at that time from 18 to 20 bays, though details of these works have not been located. Further works are understood to have been undertaken in the 1970s.[30]

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27 Cited in Lester Firth and Associates, 1986, Section 2.1.2. The date of the *Canberra Times* article is not included.

28 *Canberra Times*, 6 January 1927, p. 1.

29 Lester Firth and Associates, 1986, 'K2 Hardy patent' data sheet, Appendix 2, source uncited.

30 Lester Firth and Associates, 1986, 'K2 Hardy patent' data sheet, Appendix 2, source uncited.

Description & Integrity

The Hardy patent kiln is a two-storey structure of brick construction with a lighter-weight upper level clad in corrugated galvanised steel. The ground floor comprises 20 arched brick openings or 'wickets', which provide access to the two kiln chambers, which are oriented east-west. In the late 1960s each alternate wicket was widened to permit egress of forklifts. Other wickets have been infilled with brickwork. The outer walls of the kiln are battered at approximately 60 degrees. Wicket numbers are painted onto the brickwork next to each opening. A single-storey timber verandah roofed in corrugated galvanised steel extends around all sides of the building. The verandah is supported on timber props which extend at 45 degrees from the brickwork, as well as by a series of painted steel posts. To the east the verandah abuts the skillion roofed section of the corrugated steel machine bay to its east (Machine Bay 2, Building 15).

The first floor area (the firing floor), is of steel-framed construction, clad and roofed in corrugated sheet steel. As built, the walls to the north and south were interrupted at regular intervals by openings infilled with timber louvres, providing ventilation to the space.

Today the first floor retains part of a commercial fitout related to the development of the Brickworks by A R Marr from the late 1970s to the early 1980s, including the remains of insulation and lining boards to the ceiling and part-removed wall linings. There are a number of metal framed casement windows to the north and south walls. The position of these is unrelated to the original configuration of louvred openings and is thought to date from the rebuilding of much of the kiln structure in the 1950s. The floor retains a number of the firing holes and handles for opening and closing the flues. A portion of the floor area has been excavated and the form of the firing holes can be seen.

Originally, access to the west end of the firing floor was via a timber stair, which rose through the verandah to this elevation (see Figure 83). Today the re-cladding of the end wall and the present verandah form has removed any evidence of this access point. The east end has been modified with a walkway at first floor level extending from the south elevation and connecting the firing floor with the adjoining machine bay behind (the latter dating to the mid-1950s). Access to the firing floor is now through a single leaf ledged and braced timber door in the east wall.

The existing roof, first floor cladding and verandah roofing are thought to date from the early 1970s, when fire damaged the structure.[31]

The interiors of the kilns have been part floored in cement pavers, and divided by a non-original brick wall. These works were undertaken as part of the A R Marr post-closure development proposal.

31 Lester Firth and Associates, 1986, 'K2 Hardy patent' data sheet, Appendix 2, source uncited.

Name	Fan houses for Hardy patent kiln I	**Building No**	09
Construction	Timber frame, corrugated steel cladding	**Survey Date**	3 December 2009
Historical Phase	Expansion phase 1921-1942	**Date**	c. 1926, 1955

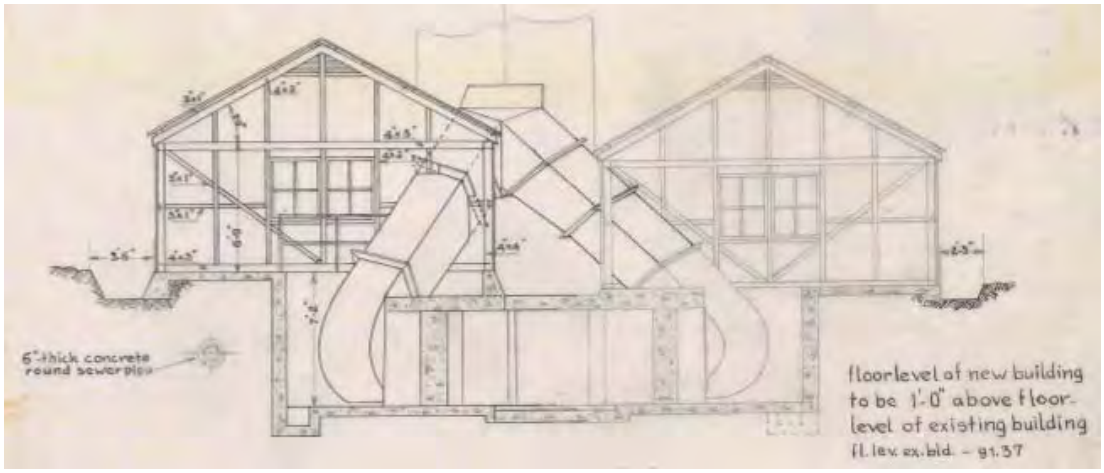

Figure 88 Section through the fan house for the Hardy patent kiln constructed in 1955. Source: National Archives of Australia.

Figure 89 The fan house at right is the earlier of the two (1927). The fan house on the left was added in 1955.

Figure 90 Interior of the 1927 fan house.

Figure 91 Ducts connect through to the chimney stack.

Historical background

The first stage of the Hardy patent kiln fan house was constructed in c. 1926 and was a considerably more modest structure than that constructed to support the Staffordshire kiln. It is located approximately 20 metres west of the Hardy patent kiln.

In 1955, plans were prepared to provide additional exhaust capacity and the fan house was augmented by a near identical structure was constructed immediately to its south. This structure was set approximately 30 centimetres above the floor level of the earlier building. The need for additional capacity may have related to the rebuilding and extension works to the Hardy patent kiln which was expanded from 18 to 20 chambers in c. 1955.

Description & Integrity

The fan house comprises two timber-framed sheds, with gabled roofs, clad and roofed in corrugated steel. There is an entry to the east elevation and windows in the rear and outer walls. Part of the wall cladding has been removed, and the glazing has also been broken and many of the glazing bars are missing. The entry doors have also been removed.

Internally, similar to the Staffordshire kiln fan house, the floor is below ground level and there is an, entry apron with metal handrail. Evidence remains of the now removed fan machinery, the location of which is discernible by the pedestal mount of the fan machinery. The ducts connecting the fan house with the stack are *in-situ*, and unlike the Staffordshire kiln fan house, these are visible rising out of the rear wall of the fan houses and connecting to the east elevation of the stack at a height of approximately two metres (Figure 91).

The fan house is in an advanced state of disrepair and the c. 1926 structure is severely impacted upon by unchecked growth of blackberries.

Name	Chimney Stack for Hardy patent kiln I	**Building No**	10
Construction	Brick	**Survey Date**	3 December 2009
Historical Phase	Expansion phase 1921-1942	**Date**	c. 1926-27

Figure 92 Left: North elevation. Right: South elevation with the 1955 fan house adjoining.

Historical background

The brick stack was built to service the 1927 Hardy patent kiln. While the stack is virtually identical to the Staffordshire kiln stack, in this case ductwork linking the fan house to the stack is not placed below ground and adjoins the stack through an opening in the east elevation approximately two metres above the ground.

Description & Integrity

The chimney stack, constructed of face red brick, is adjacent to the fan house and located approximately 30 metres west of the kiln building. A gravelled roadway separates the kiln from the stack and fan house. The stack is capped with several courses of corbelled brickwork and surmounted by nine rows of brickwork. There is a significant crack in the north elevation of the brickwork above the stepped courses. There is an arched opening in the south face of the stack, infilled with brickwork.

5.0 HISTORY & PHYSICAL ANALYSIS: POST-WW II PHASE 1944-1976

5.1 Historical background

5.1.1 *Post-war Growth (1944-1963)*

With the end of World War II in sight, the Canberra Brickworks reopened in September 1944, with production on a limited scale. From the late-1940s and into the 1950s output was stepped up to provide material to address the post-war housing shortage, resulting in a major expansion and redevelopment of the Brickworks (see Figure 93 and Figure 94).

Among the first post-war construction projects was the replacement of the Brickworks Camp (the married quarters, built during the 1920s), which had been removed by the Army during World War II. In the immediate post-War period a request for new quarters was made to attract more workers – recruitment of qualified and experienced workers was a problem during this period. The new 'Brickworks Hostel' was ready for occupation in 1945[92] and was located on the site of, or in close proximity, to the former married quarters (see Figure 95). Demolished in c. 1970, sections of the foundations of this structure survive. The Amenities Block (Building 11) also dates to the early post-War period of investment in staff facilities.

In 1952, plans for a new 'Tunnel' kiln were prepared, equipment was purchased and foundations were laid. However, the project was abandoned amid spiralling costs. The aborted Tunnel kiln project resulted in expenditure of £141,014. Department of Works records show that items of equipment purchased for the project were transferred to other sections of the Department (these items were valued at £39,193), and that redundant equipment to a value of £44,000 was still on site in 1956. A further £28,351 was lost on account of sales of redundant equipment, expenditure on site and compensation for equipment not received. Department records also note that a large prefabricated Marsden shed, which had been acquired to cover the kiln, was to be re-erected at Duntroon as a store for the Australian War Memorial.[93]

In July 1952, following the losses related to the Tunnel kiln project, responsibility for the Canberra Brickworks was transferred from the Department of Works to the Department of the Interior's Administration Branch.[94] Also in 1952, with demand for construction materials increasing, a C G D Butler of Melbourne advised the Department to build a 20-chamber 'Hoffman' kiln with a capacity of 20,000 bricks per chamber, to be located on the foundations of the Tunnel kiln (see Figure 96).[95] On 16 June 1954, the contract for the construction of a second Hardy patent kiln with loft, awning and tall stack was awarded to McDonald Bros & Co, of Lidcombe, Sydney.[96] This new kiln was to be lined with firebricks, equipped with the

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92 National Archives of Australia, Series A431, cited in Lester Firth and Associates, 1986, Section 2.1.4.

93 National Archives of Australia, Series A431, cited in Lester Firth and Associates, 1986, Section 2.1.4.

94 National Archives of Australia, File no. 171/8, cited in Lester Firth and Associates, 1986, Section 2.1.4.

95 National Archives of Australia, Series A431, cited in Lester Firth and Associates, 1986, Section 2.1.4.

96 National Archives of Australia, Series A431, cited in Lester Firth and Associates, 1986, Section 2.1.4.

latest system of hot air flues and wickets and large enough to permit free movement of fork lift trucks.[97] Its price was a relatively modest £43,455.

Unlike both of the existing continuous kilns at the Brickworks, the new Hardy patent type kiln was constructed utilising natural draught for firing, as opposed to being fan-induced. As a consequence a tall chimney stack was required (see Figure 96). Ironically, the natural draught process did not work efficiently and a fan was installed within about a year.

The expansion of the Brickworks in the 1950s saw a change in the process of brick making and in the machinery required for production at the Yarralumla works. The early machine shop, adjacent to the Staffordshire kiln, was replaced with a series of brick press buildings and a workshop. The Brickworks was also equipped with a series of new crushers and hoppers, an elevator and a 'Pan Building'; and a sequence of conveyor belts (see Figure 97 and Figure 98).[98] (The operation of the site during the 1950s is described in Chapter 2). In 1955 the existing Hardy patent kiln (Building 8) was also substantially rebuilt and enlarged by two bays.

By 1956, it was reported that progress had been made in re-organising the layout of the brickworks; that a large new kiln was in operation with other kilns being substantially reconstructed; and that all brick machines were of recent installation.[99]

In 1959, a report on the operations, management, equipment and economics of the Canberra Brickworks was prepared by an H H Macey (April1959), to address concerns about the low productivity of the plant.[100] Macey found that the works were generally well planned and maintained; that the grinding was 'a little on the coarse side' resulting in bricks of moderate quality; and that a reliable supply of high quality clay at reasonable costs was a notable problem. He also expressed concerns about heat 'leakage' to the Staffordshire kiln, which he suggested could be addressed with minimal difficulty.[101]

Macey's conclusion with regard to the low productivity of the plant was:

> The works is basically a good one and capable of a much greater output than at present. The essential cause of the low output is an ill-advised bonus payment [scheme] which not only provides no incentive towards greater output, but actually encourage a lack of production … Provided that the men can be made to work steadily and regularly at reasonable

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97 The recommendation for wide wickets was not carried through. As built, the wickets of the Hardy patent kiln were only a metre wide. See drawing, 'Canberra Brickworks layout of firing holes for No. 3 Kiln for Dept. of the Interior, n.d. M8759B,' National Archives of Australia.

98 Department of Works, Canberra Brickworks – Works Programme, 31 May 1955, drawing M8866D, National Archives of Australia.

99 Lester Firth and Associates, 1986, Section 2.1.4. Original sources for the content of this paragraph are not cited.

100 H H Macey, *Report on Canberra Brickworks*, April 1959. Copy supplied by the LDA.

101 H H Macey, *Report on Canberra Brickworks*, pp. 1-18.

> rate common elsewhere, the works is capable of making a considerable profit.[102]

The development of Canberra received renewed attention with the creation of the National Capital Development Commission (NCDC) in 1958, following the *National Capital Development Commission Act, 1957*. To meet construction needs the two 'temporary' downdraught kilns (built c. 1925) were demolished to make way for three new downdraught kilns, which were reputed to be the longest in Australia.[103] These were constructed on the site of the former 'temporary' kilns in 1960-63 (Building 22), although oriented north-south rather than east-west. Each held 120,000 bricks; the process of loading, firing and unloading took seven days. With the completion of the downdraught kilns the Brickworks had a capacity of 800,000 bricks per week.[104]

During the 1960s, oil replaced coal as the fuel for firing the kilns, and modifications were made to the entrances of the three continuous kilns (the Staffordshire and two Hardy-patents) for the use of forklift trucks to set and remove bricks.[105]

5.1.2 *Decline*

In 1967, the ACT Health Services Branch inspected the Brickworks Hostel and reported that the buildings were in a state of disrepair. Late in 1970 it was reported that the hostel was to be demolished.[106]

In 1971, a large building to the west of the 1960s downdraught kilns was constructed to house drying kilns and machinery for making extruded bricks was installed ($500,000.00 plant)[107] (Building 30). This operated until the closure of the works in 1976.

By 1973, the brickworks at Yarralumla were considered to be in need of extensive modernisation and proposals were prepared by Commonwealth Brickworks Pty Ltd for upgrading. These proposals were rejected by the NCDC on environmental grounds and a new site for a brickworks was released at Mitchell, north of Canberra. The *Canberra Times* cited the reasons for moving the brickworks as: the land being required for residential purposes; excessive use of neighbourhood roads by heavy traffic; and levels of air pollution incompatible with the amenity of residential development nearby.[108] The kilns at Yarralumla

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102 H H Macey, *Report on Canberra Brickworks*, p. 19.

103 Lester Firth and Associates, 1986, Section 2.1.4. Source uncited.

104 Lester Firth and Associates, 1986, Section 2.1.4. Source uncited.

105 Lester Firth and Associates, 1986, Section 2.1.4. Dates and precise details relating to these modifications are not included, and sources are not cited.

106 Lester Firth and Associates, 1986, Section 2.1.4. Original sources uncited.

107 Lester Firth and Associates, 1986, Section 2.1.4. Source uncited.

108 *Canberra Times*, 18 June 1974, cited in Lester Firth and Associates, 1986, Section 2.1.4.

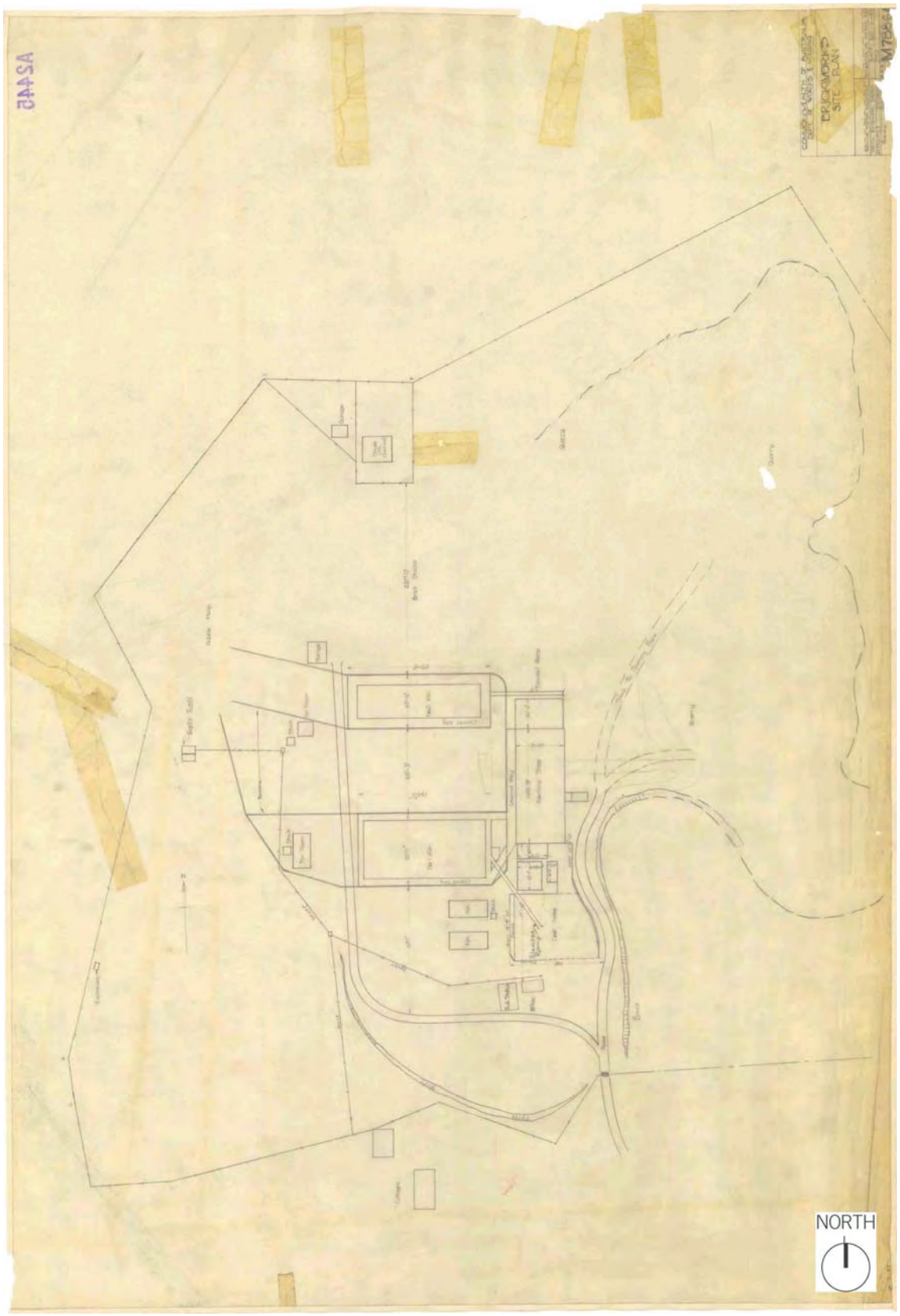

Figure 93 Site plan, 1947.
Source: National Archives of Australia.

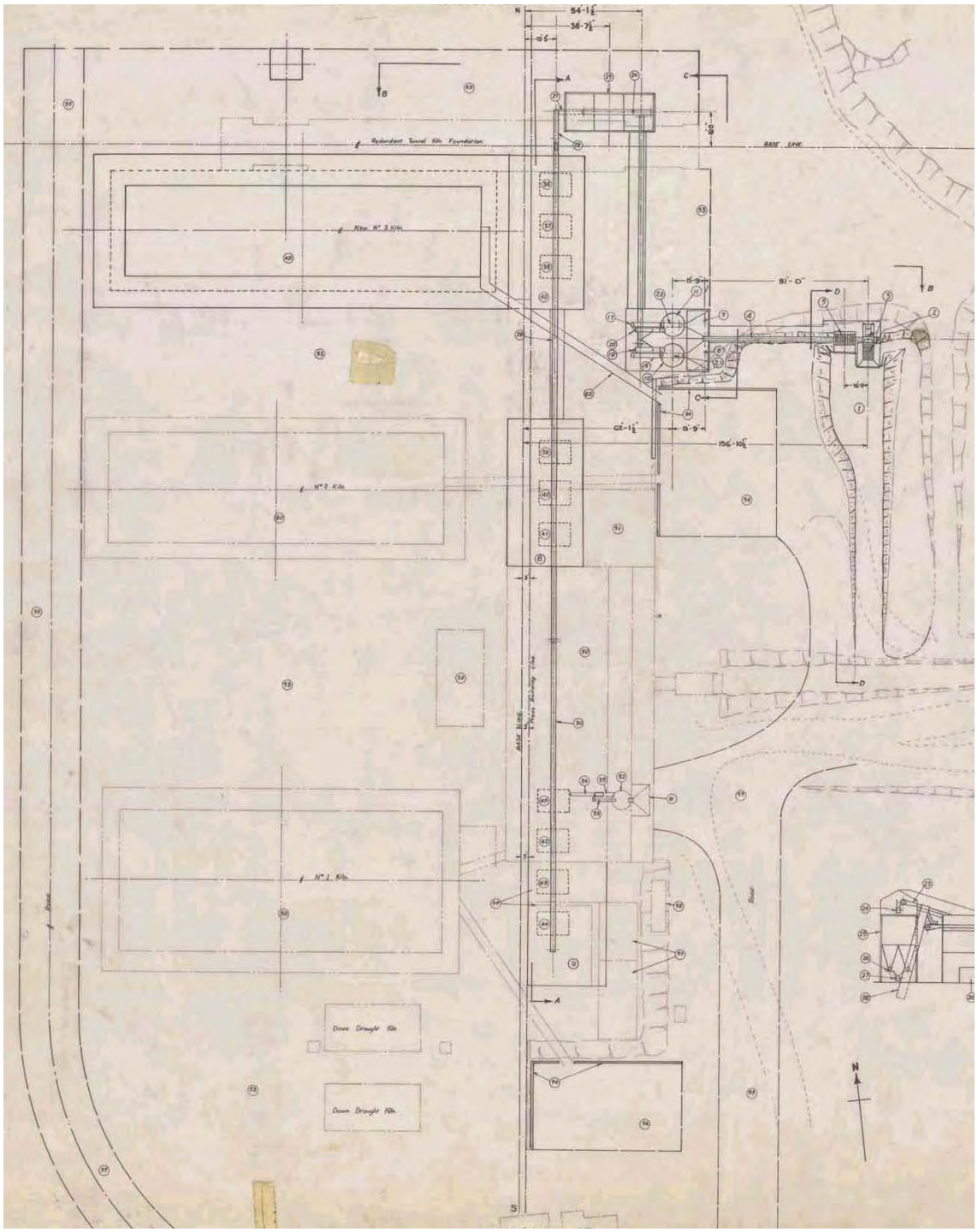

Figure 94 Layout of the site, 1954.
Source: National Archives of Australia.

Figure 95 Aerial view of the brickworks, 1950. Note the new 'Brickworks Hostel' to the south of the site.
Source: ACT Planning and Land Authority.

were unloaded for the last time in August 1976. All usable material was moved to the new site and the remainder offered for sale.

By the time of its closure it was estimated that some 600 million bricks had been produced at the Canberra Brickworks.[109]

109 Lester Firth and Associates, 1986, Section 2.1.4. Source uncited.

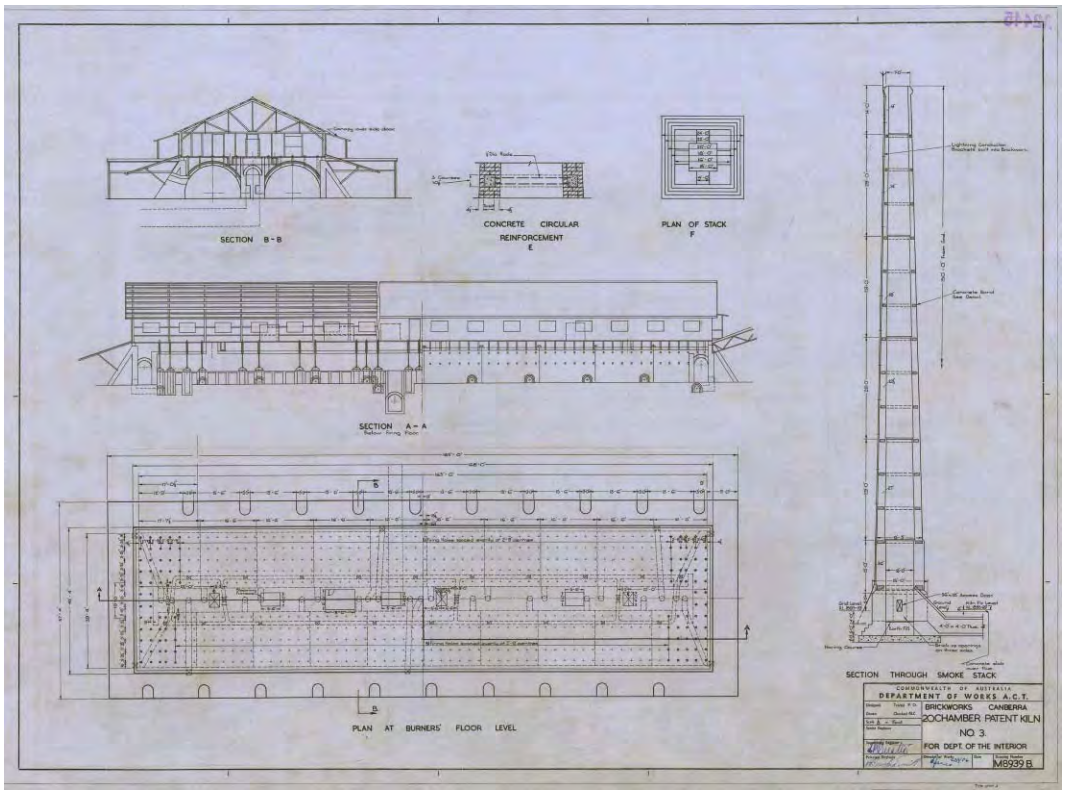

Figure 96 Plans for the Hardy patent kiln (Building 12) and stack (13), built 1954-55.
Source: National Archives of Australia.

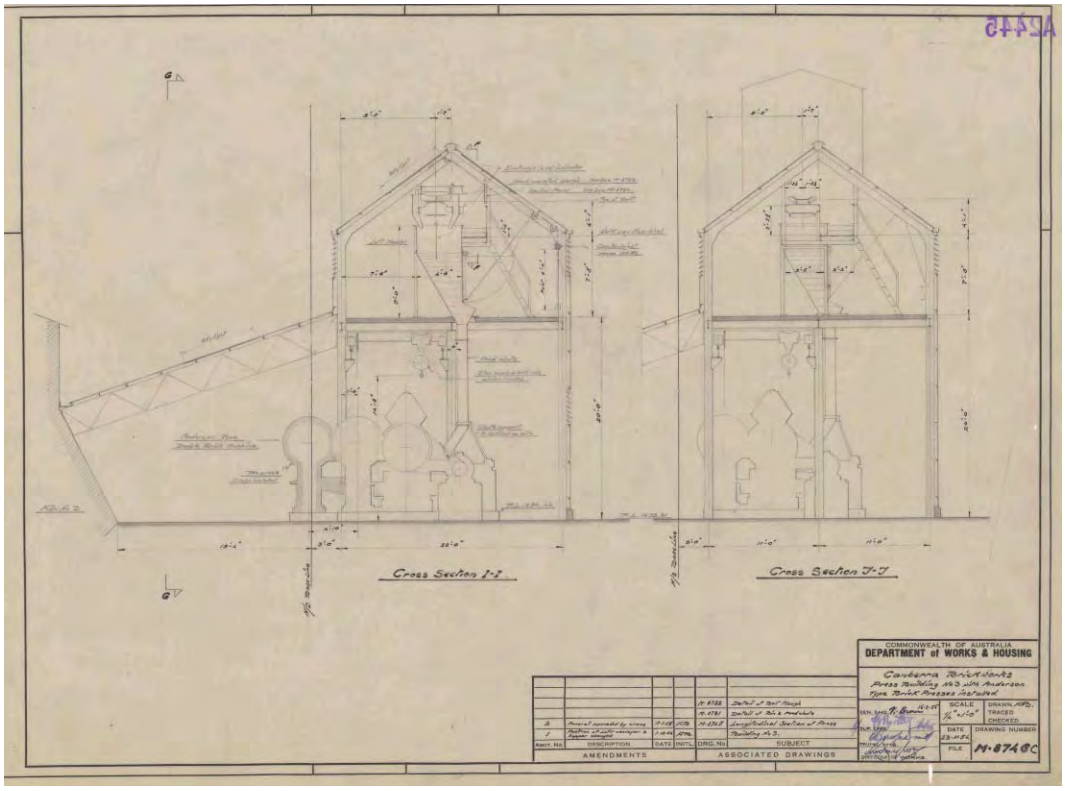

Figure 97 Cross section through machine bay for Hardy patent kiln (Building 12) showing brick press below, and conveyor in the gable.
Source: National Archives of Australia.

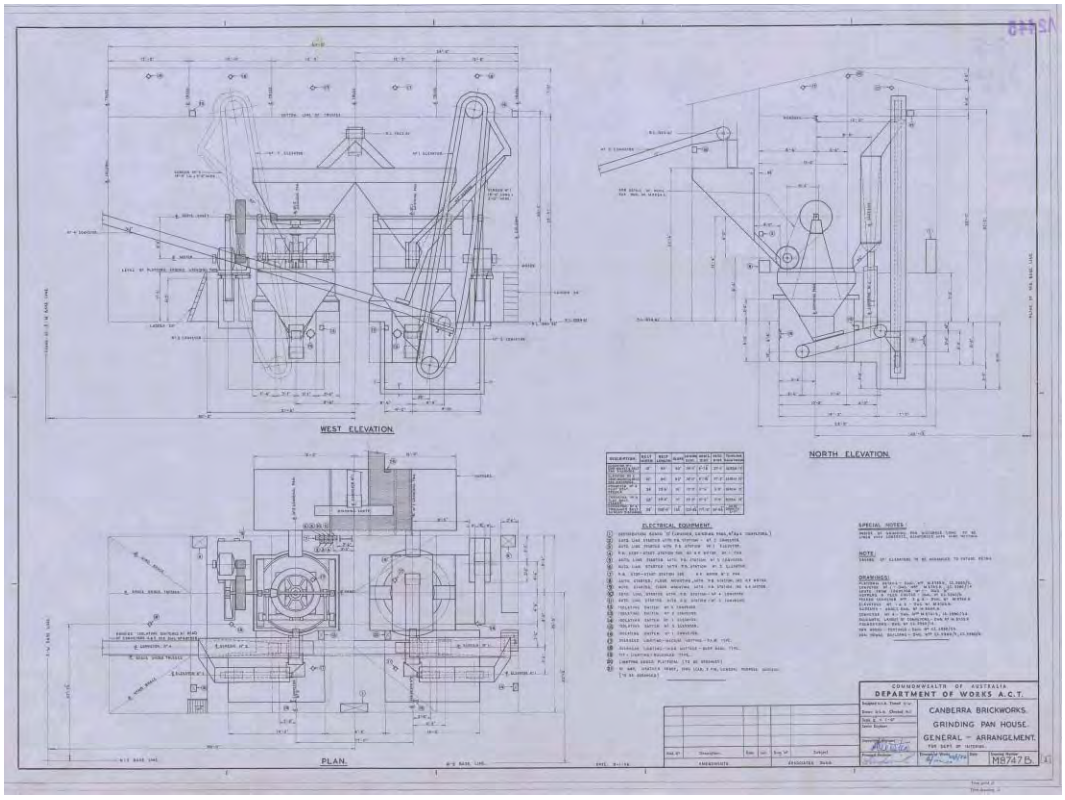

Figure 98 Grinding Pan House General Arrangement 1956 (Red Pan Room, demolished). Source: National Archives of Australia.

The Sixteenth *Annual Report* (1975-1976) of the Commonwealth Brickworks (Canberra) Limited recorded that the company received $2.25 million from the Department of the Capital Territory as compensation upon having to vacate the Yarralumla site. This report also indicates that between 1972 and the closure of the works in 1976 the workforce had halved, from 106 to 53, and total brick sales reduced from $22.25 million to $12.76 million. Substantial operational losses made during this period were attributed to the imminent relocation of the plant and the depressed state of the economy.[110]

Bricks were first produced in the Mitchell plant in October 1976.

110 The Sixteenth *Annual Report* (1975-1976) of the Commonwealth Brickworks. cited in Lester Firth and Associates, 1986, Section 2.1.4.

5.2 Datasheets for Post-WWII phase elements

No.	Name / Description	Date of construction
11	Amenities block	c. 1950, c. 1977
12	Hardy patent kiln	c. 1953
13	Chimney stack for Hardy patent kiln (Building 11)	c. 1953, c. 2005
14	Machine Bay I for Staffordshire kiln (Building 3)	c. 1955
15	Machine Bay II for Hardy patent kiln (Building 7)	c. 1955
16	Machine Bay III for Hardy patent kiln (Building 11)	c. 1955
17	Workshop	1955
18	Small Crusher House (Crusher House I)	c. 1958
19	Large Crusher House (White Pan Room/ Crusher House II)	c. 1955
20	Primary Crusher House (Crusher House III)	c. 1955
21	Elevator / Conveyor	c. 1955
22	Downdraught kilns (x3)	c. 1960-3
23	Downdraught kiln control room	c. 1963
24	Chimney stack for downdraught kilns	c. 1950s
25	Toilet block	c. 1960s
26	Amenities block	c. 1960s
27	Substation/control room	c. 1971
28	Boiler house	c. 1971
29	Ancillary storage building	c. 1971
30	Extrusion plant	c. 1971
31	Ancillary storage building	c. 1960s
32	Storage shed	c. 1960s

Figure 99 Location of elements surviving from the Post-WWII Phase. Refer to the larger scale site plan in Chapter 1 for more detail.

Name	Amenities Block	**Reference No**	11
Construction	Brick, reinforced concrete, galvanised steel	**Survey Date**	3 December 2009
Historical Phase	Post-war phase 1944-1976	**Date**	c. 1950, c. 1977

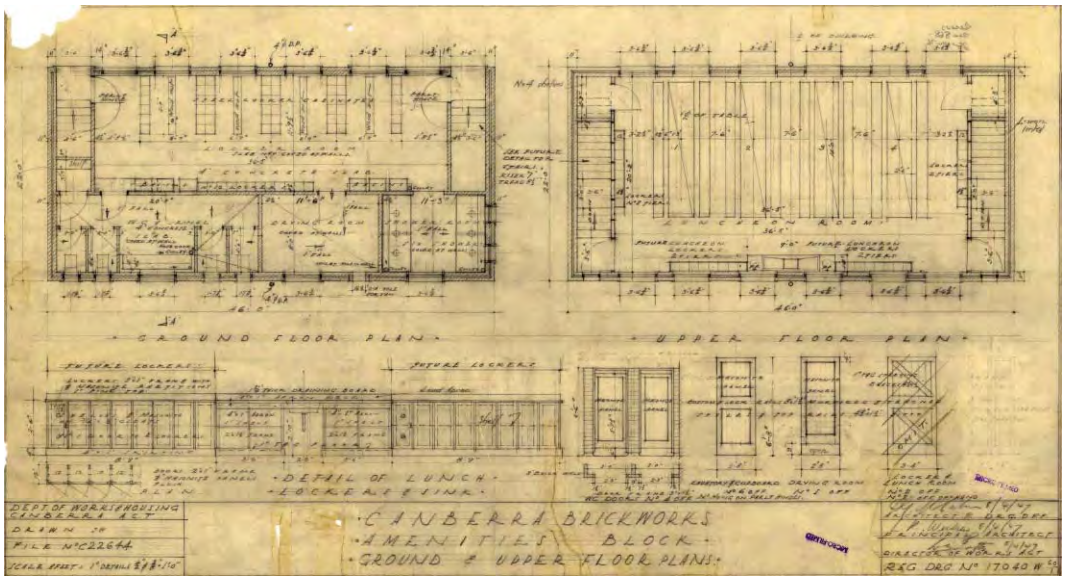

Figure 100 Amenities Block floor plans, 1947.
Source: National Archives of Australia.

Figure 101 The Amenities Block viewed from the west.

Historical background

The provision of a purpose-built amenities building, consolidating toilet, changing and lunch room facilities, was one of the first actions of the Brickworks administration in the years following World War II. It heralded an era of significant expansion and modernization and saw the provision of a modern up-to-date facility which centralized worker's amenities at the centre of the site.

Description & Integrity

The amenities block is a two-storey building of face red brick, with a gable roof clad in corrugated galvanised steel. The first floor originally accommodated a lunch room with access from a concrete staircase to both the north and south ends of the east (front) elevation with toilet and changing facilities including showers, a drying room and a locker room located on the ground floor. The present entrances to the ground floor toilets were originally windows. The ground floor spaces were originally accessed from the stairwells. The date of these works has not been established. The building previously had a covered breezeway protecting the entry and there is a ramp access to both toilets. The white painted area to the ground floor façade indicates the scale of the breezeway enclosure, since removed.

Internally the former locker room, showers and drying room have been reconfigured. A wall has been constructed, dividing the ground floor in half, on an east-west axis to provide male and female washrooms and toilet facilities. These alterations were undertaken by A R Marr Pty Ltd as part of the conversion of the site to a tourist precinct in the later 1970s. The finishes are typical of the period – ceramic tile, modular basins, laminate partitions and mosaic tiled floors.

A single-storey first aid room was appended to the south end of the building at a later date. Access to this room is from the east.

The building is in a badly vandalized state with only a few toilets and basins intact and operable. Most of the glazing has been broken and the exterior of the building spray-painted with graffiti. Access to the first floor space was not obtained with one of the stairs secured by a metal grille and the door off the stair landing to the south end nailed shut internally.

Name	Hardy Patent Kiln II	**Building No**	12
Construction	Brick, corrugated steel and corrugated fibro cement sheet	**Survey Date**	3 December 2009
Historical Phase	Post-war phase, 1944-1976	**Date**	c. 1953

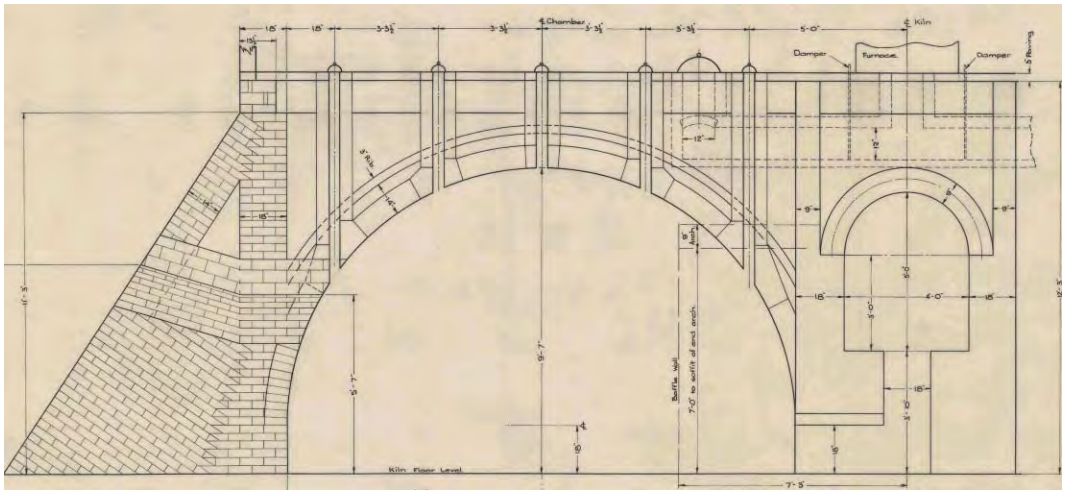

Figure 102 Section through wicket chamber and flue of the second Hardy patent kiln, 1953. Source: National Archives of Australia.

Figure 103 The Hardy patent kiln, showing the west end and part of the south elevation. Note the verandah cladding has been removed and the kiln wall part removed, presumably for improved access to the kiln interior.

Historical background

After the decision to abort construction of the Tunnel kiln was taken in 1952, plans were prepared and tenders called to authorize the construction of a new 20-chamber Hardy patent kiln, 50 metre stack, kiln loft and awning to meet Canberra's post World War II needs (see also Section 5.1.1). The new Hardy patent kiln was constructed on the foundations of the Tunnel kiln.

The decision to not adopt the fan-induced model of the Staffordshire kiln and the first Hardy patent kiln and instead build a taller chimney stack did not result in the expected superior drawing power, and fans had to be installed to augment the draw shortly after completion. A recommendation to provide wider wickets to enable access for forklifts, was not followed. Plans held in the National Archives of Australia indicate that the wicket openings were originally only a metre in width.[111] A number of these openings were widened for fork lift use during the 1960s, including the west kiln end.

Description & Integrity

The Hardy patent kiln is a two-storey structure. The ground floor comprises 20 arched brick openings or wickets, which provide the access points to the two east-west kiln chambers. Several of these – each alternate wicket – have been modified since construction, with the openings widened to permit access for forklifts. The outer walls are battered at approximately 60 degrees and the wicket numbers are painted directly onto the brickwork surrounding each opening.

A verandah roofed in corrugated steel extends around the all sides of the building, apart from the west where only the metal posts and support framing are intact. The removal of the verandah cladding may have occurred prior to the part removal of the brick end wall, where the two kilns are revealed in cross section –see Figure 103. To the east the verandah abuts the skillion roof that bridges the space between the corrugated steel machine bay to its east (Machine Bay 3, Building 16). The verandah structure here is of steel, extended at 45 degrees from the brickwork, supported on steel props as well as by a series of painted steel posts.

The first floor was not inspected internally due to OH&S concerns.[112] There are a number of metal-framed casement windows to the two long north and south walls and the west end wall.

The removal of the verandah flashing to the north elevation and the verandah to the west elevation have exposed the wall studs.

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111 *Canberra Brickworks layout of firing holes for No. 3 Kiln for Dept. of the Interior, n.d. M8759B*, National Archives of Australia.

112 Refer Robson Laboratories Pty Ltd, *Survey to determine the extent and condition of hazardous building materials at Yarralumla Brickworks,* March 2006 and *Specification for the removal of asbestos materials from Yarralumla Brickworks,* October 2006.

Name	Chimney Stack for Hardy Patent Kiln II	**Building No**	13
Construction	Brick, steel cladding	**Survey Date**	3 December 2009
Historical Phase	Post-war phase, 1944-1976	**Date**	c. 1953; c. 2005

Figure 104 Left: view from east. Right: West elevation, base of stack.

Figure 105 The Chimney stack viewed from across Yarramundi Reach, Lady Denman Drive.

Historical background

The tall stack for superior drawing power was specified as part of the new Hardy patent kiln (Building 12) in 1952. This represented a break with tradition at the Canberra Brickworks; the two existing continuous kilns at the site were fan induced, and required only low stacks. However, the tall stack was not a success, and fans were installed to augment the draw shortly after completion.

The suggestion has been made that the stack was designed by architect Eric Nicholls (1902-1966) however this has not been confirmed. Nicholls had designed the much earlier and architecturally distinctive Canberra Incinerator (for the Reverberatory Incinerator and Engineering Company) in 1938-9.[113]

Description & Integrity

The chimney stack comprises a brick plinth, a shaft and a 'crown' or capital of corbelled brickwork. It is constructed of face red brick laid in Colonial bond courses, and is approximately 150ft (45 metres) high. It is sited to the north of the second Hardy patent kiln (Building 12), and is surrounded by a large concrete slab. There is an arched brick entry hatch at ground level to all four elevations with the entry to the east elevation fitted with a secured wire mesh gate. To the west and north the openings are bricked up and to the south a concrete tunnel rises from underground indicating the location of the kiln tunnel. To the west elevation there is a large rectangular opening approximately 3.5 metres above the ground, secured by a metal grille. This may have been the location of ducts which linked the stack to a now demolished fan house facility, although this has not been confirmed. The chimney steps inwards, rising from a brick plinth, capped with brickwork laid on a 45 degree angle. A lightning conductor has been fixed to its south elevation. Sections of the upper courses of brickwork have been re-laid with new mortar visible. The opening has been part-capped with steel roofing as a part of a series of works undertaken c. 2005.

Internally the tunnel connection to the kiln is visible and there is a steel frame and timber work platforms installed within the stack. These were installed as part of the c. 2005 building works, which stabilized the structure, and repaired significant cracking and damage to the top of the structure.

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113 Ian Wood-Bradley, LDA, pers. com. Nicholls, Eric M, 1938, Exterior perspective view of incinerator, Canberra Incinerator, Westbourne Woods, Australian Capital Territory (picture), Eric Milton Nicholls, http://nla.gov.au/nla.pic-vn3603884-s428

Name	Machine Bay I for Staffordshire Kiln and Downdraught Kilns	**Building No**	14
Construction	Corrugated galvanised steel over steel frame	**Survey Date**	3 December 2009
Historical Phase	Post-war phase, 1944-1976	**Date**	c. 1955

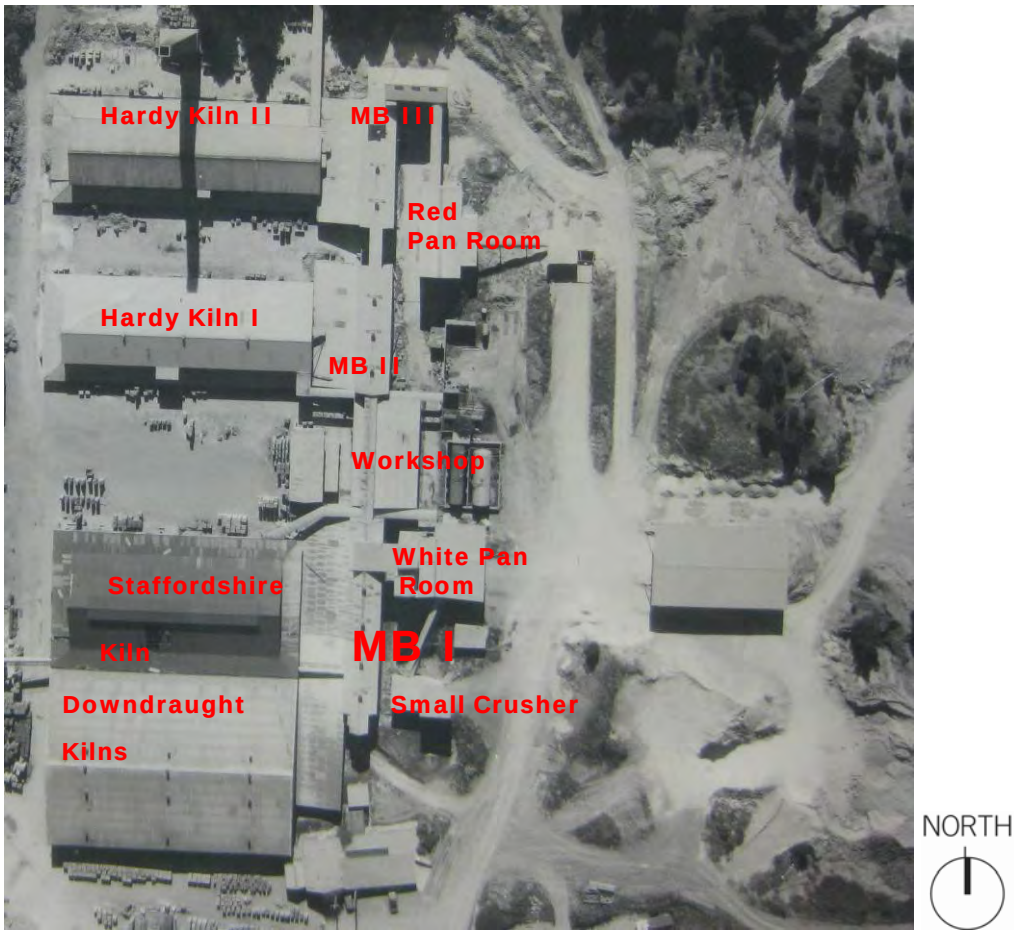

Figure 106 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. Machine Bay I is indicated by a larger font.
Source: ACT Heritage Library, Woden ACT.

Figure 107 From left: the truncated south end of Machine Bay 1, showing location of former headgear housing; interior of the loft space.

Figure 108 Interior of the Machine Bay shop floor, presently used by a timber recycling business.

Historical background

Known also as Brick Press No. 1, Machine Bay I is partly located on the site of the earlier by 1915 Machine Bay and tile making plant (demolished). The present machine bay was constructed in 1955 as part of the upgrading of the Brickworks to meet post World War II production requirements. After grinding and processing through the crusher houses and pan rooms, raw materials were fed along the top level conveyor system, housed within the upper (loft) areas of the three machine bays, and passed through the upper roof area of the Workshop (Building 17) to hoppers and gravity fed via chutes to the brick presses below. After pressing, the bricks were transported by forklift to the adjoining kiln for firing. Machine Bay 1, which serviced the Staffordshire Kiln (Building 4) also received white clay material refined in the adjoining White Pan Room (also known as the Large Crusher House, Building 19), immediately to the east. The machine bay was extended by two additional bays to service the early 1960s downdraught kilns (Building 22). This addition was subsequently demolished and the present tenant has an office on the site.

The former brickmaking floor is utilised by the present tenant as the main workshop space for the sanding and treatment of recycled timber.

Description & Integrity

Machine Bay I is a three level steel-framed and corrugated galvanised steel-clad structure. It comprises the loft gallery, containing the overhead conveyor, which extends through the loft space of all three machine bays and the workshop, and hoppers which fed the brick presses housed on the 'shop floor' below. The loft space has a concrete floor and the conveyor, housed within the roof space is accessed by steel ladder-form stairs from this level. The conveyor level walkway is of timber, some sections of which are in poor condition. There are a number of holes in the concrete floor where machinery and stairs have been removed. There is a row of windows, previously fitted with glass louvres to the east and west sides of the loft space, and a row of windows to the east (rear) wall of the shop floor below. The shop floor is raised on a concrete slab, and the space between the end (west) wall of the kiln and the machine bay is roofed by a skillion roof, clad in corrugated steel over a series of warren trusses. A number of skylights have been let into the roof. This roof form is thought to be original – refer to the section drawing for Machine Bay III (Building 16), at Figure 113.

The brick making machinery (brick presses and the like) has been removed, and the southern extension to service the downdraught kilns has been demolished.

Name	Machine Bay II for Hardy Patent Kiln I	**Building No**	15
Construction	Corrugated galvanised steel over steel frame	**Survey Date**	3 December 2009
Historical Phase	Post-war phase, 1944-1976	**Date**	c. 1955

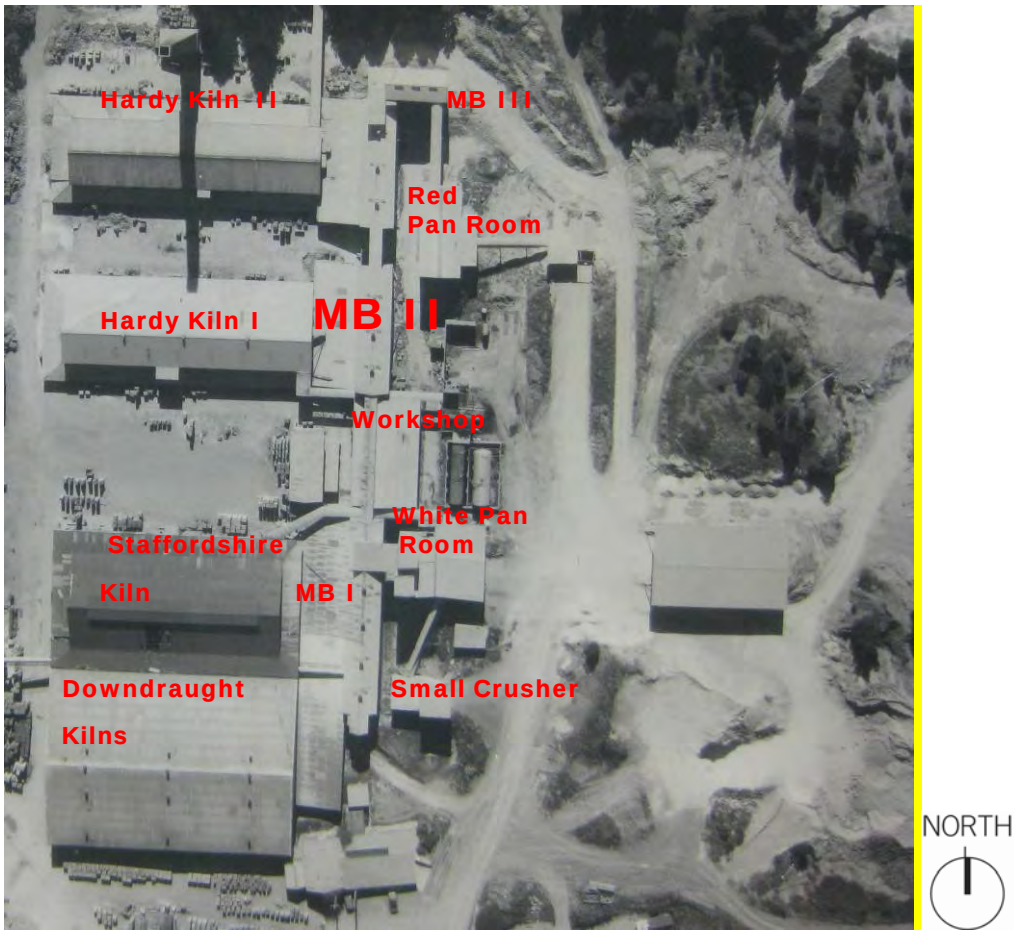

Figure 109 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. Machine Bay II is indicated by a larger font.
Source: ACT Heritage Library, Woden ACT.

Figure 110 The rear (east) wall of Machine Bay II. The adjoining building (to the north) is Machine Bay III.

Figure 111 Interior of the Machine Bay II shop floor, looking north.

Historical background

Machine Bay II was built in 1955 as part of the upgrade of the Brickworks to meet post World War II production increases. It is interlinked with Machine Bays I and III as well as the workshop (Building 17).

After grinding and processing through the crusher houses and pan rooms, raw materials were fed along the top level conveyor system, housed within the lofts of the three machine bays and passed through the upper roof area of the Workshop (Building 17) to hoppers and gravity fed via chutes to the brick presses below. After pressing, the bricks were transported by forklift to the adjoining kiln- in this case the Hardy patent kiln I - for firing. Machine Bay II received raw materials transported via conveyor from Machine Bay III, which was fed from the 400 ton hopper (now demolished) which adjoined the west end of Machine Bay III.

The former brick making floor is utilised by the present tenant as a storage area for recycled timber.

Description & Integrity

Machine Bay II is a three level steel-framed and corrugated galvanised steel-clad structure. The structure comprises the loft gallery containing the overhead conveyor which extends through the loft space of all three machine bays and the workshop, and hoppers which fed the brick presses housed on the 'shop floor' below. The loft space has a concrete floor and the conveyor, housed within the peak of the roof space is accessed by steel ladder-form stairs from this level. The conveyor level walkway is of timber, some sections of which are in poor condition. There is an open walkway at the height of the concrete floor level which interconnects this building with Machine Bay III, to the north. There is a row of windows, previously fitted with glass louvres to the east and west sides of the loft space, and a row of windows to the east (rear) wall of the shop floor below. The shop floor is raised on a concrete slab, and the space between the end (west) wall of the kiln and the machine bay is roofed by a skillion roof, clad in corrugated steel over a series of warren trusses. The shop floor is raised on a concrete slab, and the space between the end (west) wall of the kiln and the machine bay is roofed by a skillion roof, clad in corrugated steel over a series of warren trusses. A number of skylights have been let into the roof. This roof form is thought to be original – refer to the section drawing for Machine Bay III (Building 16), at Figure 113.

The brick making machinery itself has been removed.

Name	Machine Bay III for Hardy Patent Kiln II (Brick Press Building)	**Reference No**	16
Construction	Corrugated galvanised steel over steel frame	**Survey Date**	3 December 2009
Historical Phase	Post-war phase, 1944-1976	**Date**	c. 1955

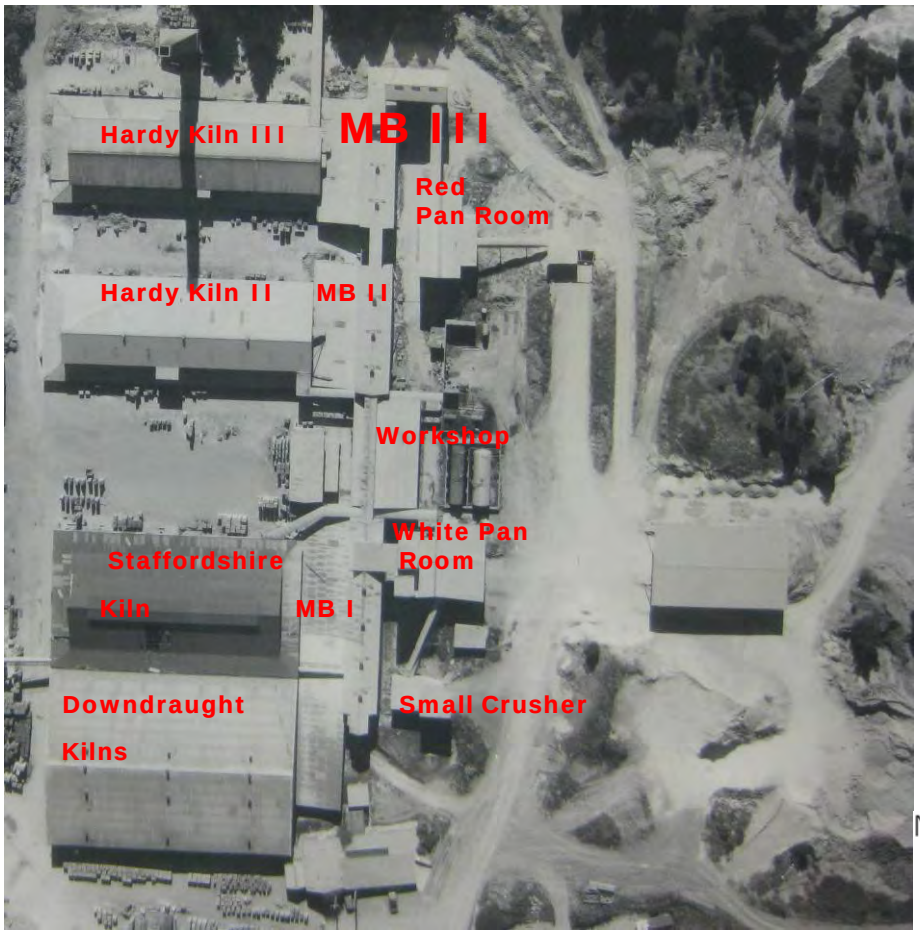

Figure 112 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. Machine Bay III is indicated by a larger font.
Source: ACT Heritage Library, Woden ACT.

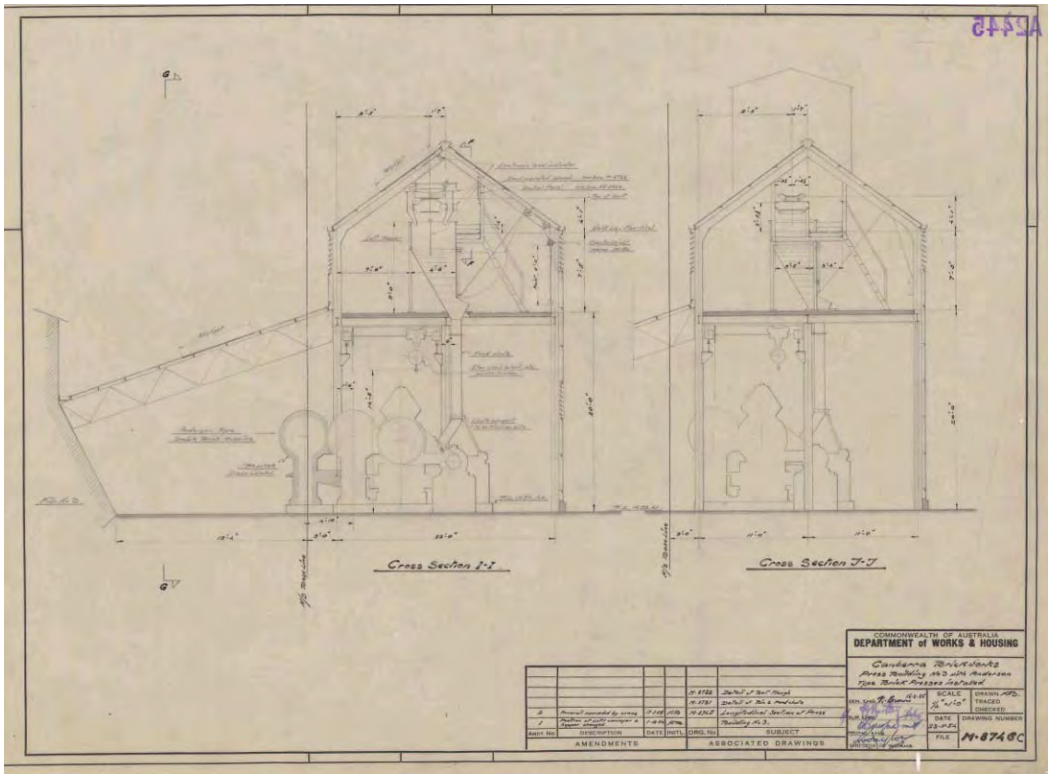

Figure 113 Canberra Brickworks Press Building III, 23 November 1954. Cross-sections showing internal structure and machinery installation, Machine Bay III. Source: National Archives of Australia.

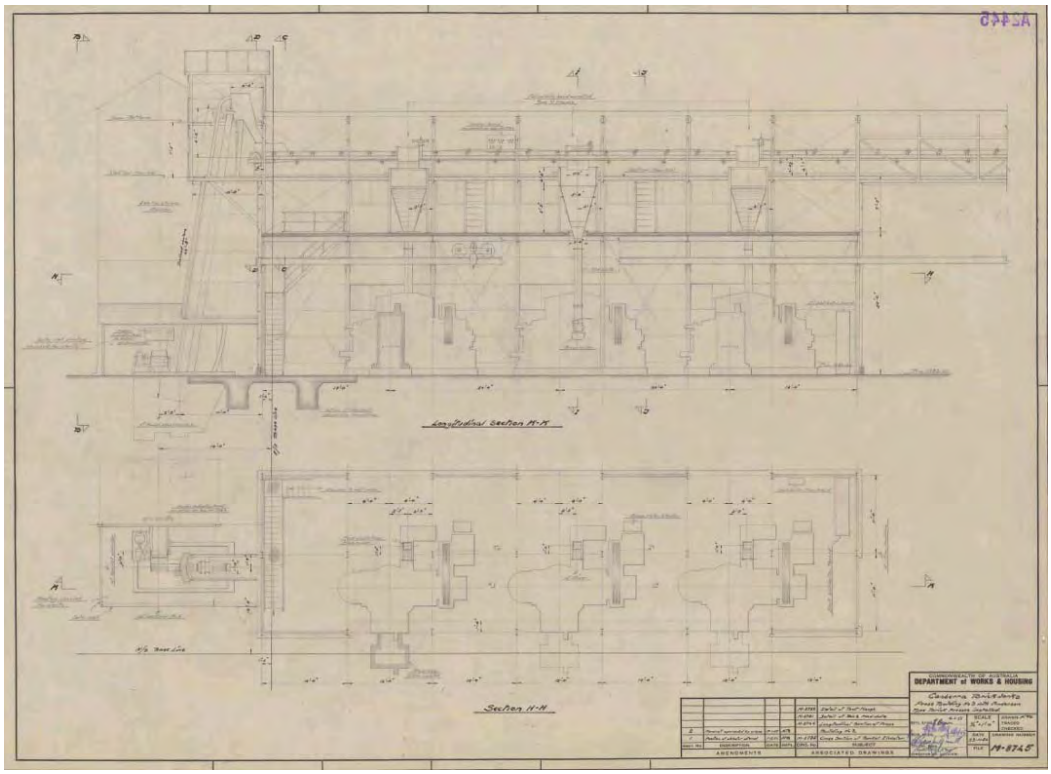

Figure 114 Canberra Brickworks Press Building III, 23 November 1954. Longitudinal sections showing internal structure and machinery installation, Machine Bay III. Source: National Archives of Australia.

Figure 115 Machine Bay III, east elevation, with the remains of the conveyor in the foreground.

Figure 116 Machine Bays II (left) and III (right), looking west, showing the conveyor 'bridge' and open walkway between the two structures.

Figure 117 From left: north end Machine Bay III showing remains of headgear housing for the loft conveyor; interior with remnants of the Anderson brick machinery at north end.

Figure 118 Interior of the Machine Bay III shop floor, looking north.

Historical background

Machine Bay III was built in 1955 as part of the upgrade of the Brickworks to meet post World War II production increases. It is interlinked with Machine Bays I and II as well as the workshop (Building 17). After grinding and processing through the crusher houses and pan rooms, raw materials were fed along the top level conveyor system, housed within the lofts of the three machine bays and passing through the upper roof area of the Workshop (Building 17) to hoppers and gravity fed via chutes to the brick presses below. After pressing, the bricks were transported by forklift to the adjoining kiln – in this case the Hardy patent kiln II – for firing. Machine Bay III received raw materials directly from the 400 ton hopper (now demolished) which adjoined the north end of the structure.

The former brick-making floor is utilised by the present timber-working tenant as a storage area for recycled timber.

Description & Integrity

Machine Bay III is a three level steel-framed and corrugated galvanised steel-clad structure. The structure comprises the loft gallery containing the overhead conveyor which extends through the loft space of all three machine bays and the workshop, and hoppers which fed the brick presses housed on the 'shop floor' below. The loft space has a concrete floor and the conveyor, housed within the peak of the roof space is accessed by steel ladder-form stairs from this level. The conveyor level walkway is of timber, some sections of which are in poor condition. The northernmost section is blocked off as it approaches the site of the part-demolished headgear housing and site of the removed hopper. There is an open walkway at the height of the concrete floor level which interconnects this building with Machine Bay II, to the south. There is a row of windows, previously fitted with glass louvers to the east and west sides of the loft space, and a row of windows to the east (rear) wall of the shop floor below. The shop floor is raised on a concrete slab, and the space between the end (west) wall of the kiln and the machine bay is roofed by a skillion roof, clad in corrugated steel over a series of warren trusses. A number of skylights have been let into the roof. This roof form is thought to be original – refer to the section drawing at Figure 113.

Some elements of the dismantled brick making machinery have been relocated to this building, and are sited in its north-east corner. The removal of the hopper and part of the headgear for the loft conveyors has also occurred.

Name	Workshop	**Reference No**	17
Construction	Corrugated galvanised steel over steel frame	**Survey Date**	3 December 2009
Historical Phase	Post-war phase, 1944-1976	**Date**	1955

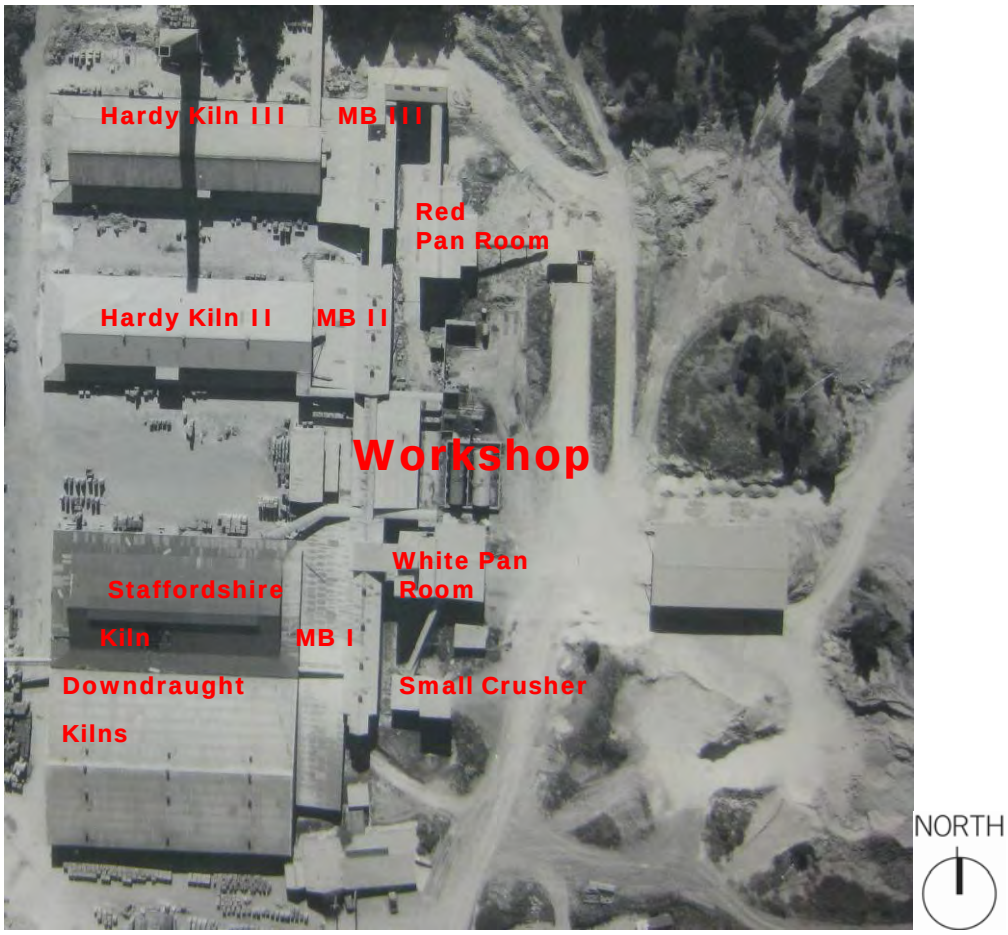

Figure 119 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. The Workshop is indicated by a larger font.
Source: ACT Heritage Library, Woden ACT.

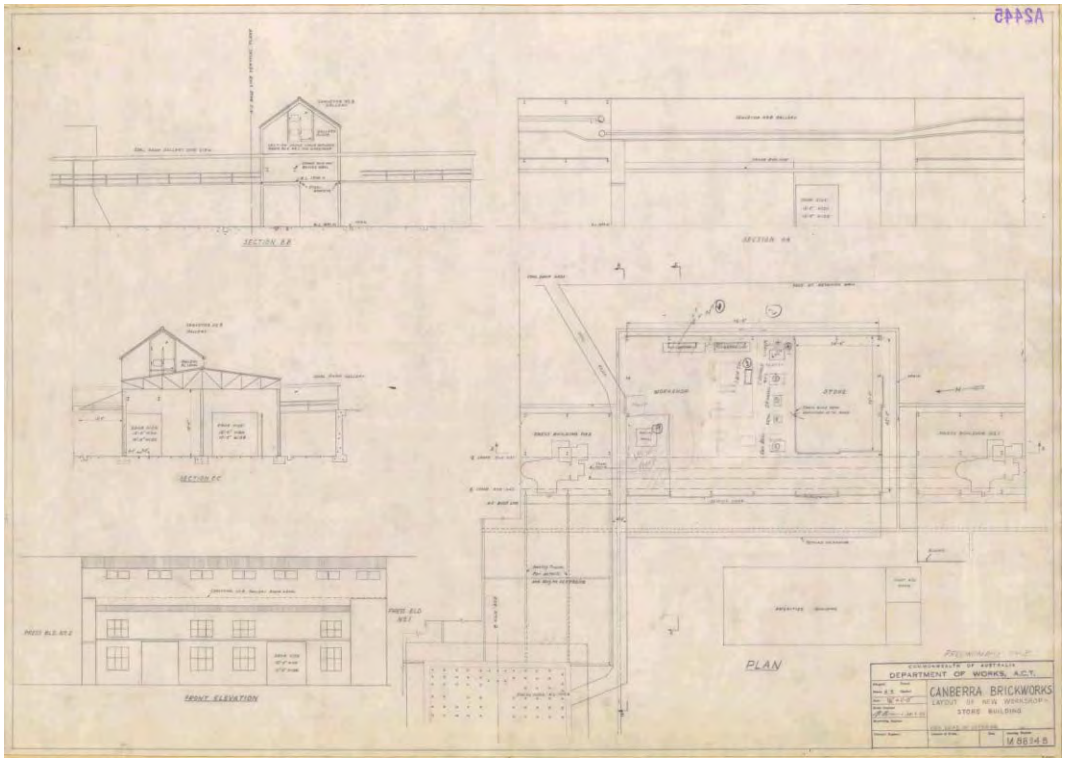

Figure 120 Canberra Brickworks Layout of new Workshop – Store Building, 1955. Source: National Archives of Australia.

Figure 121 Interior of Workshop

Figure 122 West elevation showing entry.

Historical background

The Workshop was constructed in 1955. It was used for general workshop repairs and the maintenance of machinery. It runs north-south across the site in the main built area, and was built on the approximate site of the original Machine Shop, which was constructed in 1915, and demolished in the 1950s.

The conveyor which connects the three machine bays also travels through the gabled roof space within the north side of the building. Within the space the overhead gantry crane remains in situ and operational.

Description & Integrity

The Workshop is a two-storey steel framed building, clad in corrugated steel over a brick base. There is a sliding corrugated steel door in the west elevation and another entry to the north elevation. The original louvred glazing to both the west and east elevation have partly been replaced by corrugated fibreglass sheeting, due to vandalism. The window openings as shown on the original plan differ from those shown today. To the north and south the building is part enclosed at the upper level by walkways with connect the conveyor gallery with the higher ground to the east, where the later model railway sheds (Buildings 33 and 34).

Internally the building has a concrete floor and the walls are unlined. Since 1991, the former workshop has been used as an artist's studio. The tenant has installed some internal partitioning and has also been responsible for the maintenance of the building – at the time of inspection the building appeared to be in reasonable condition.

Name	Small Crusher House (Crusher House I)	**Building No**	18
Construction	Corrugated galvanised steel over steel frame	**Survey Date**	3 December 2009
Historical Phase	Post-war phase, 1944-1976	**Date**	Unknown, c. mid to late 1950s

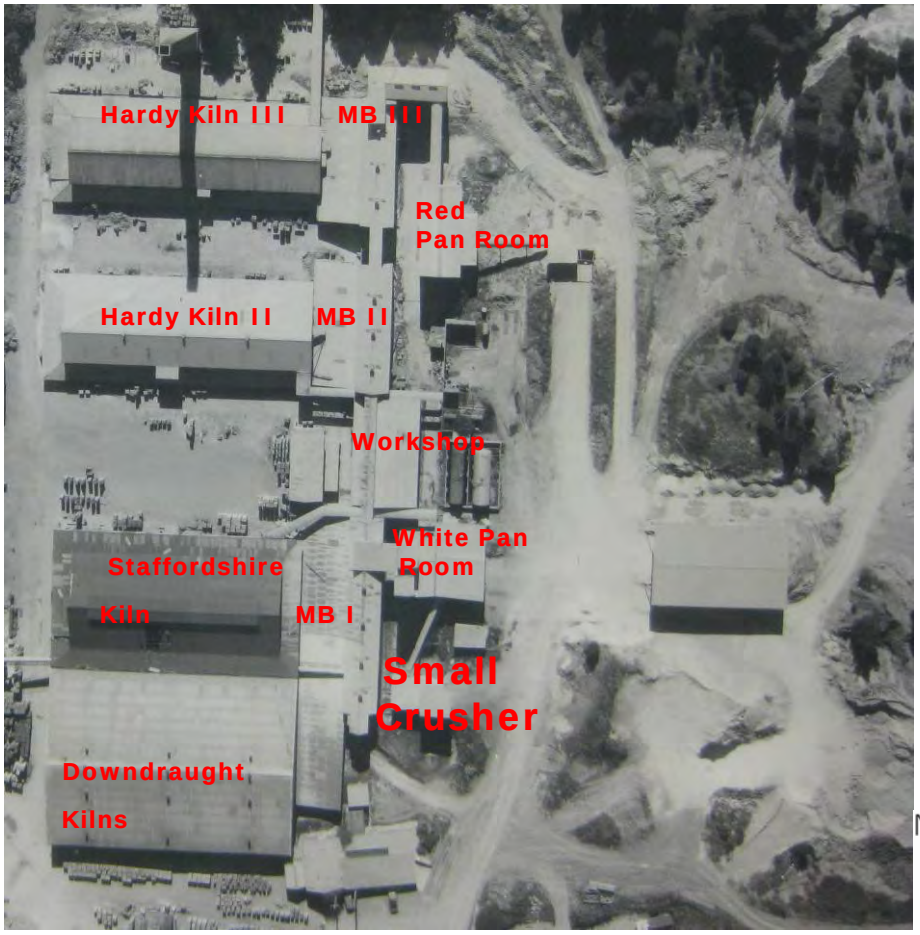

Figure 123 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. The Small Crusher House is indicated by a larger font.
Source: ACT Heritage Library, Woden ACT.

Figure 124 Small Crusher House viewed from the north.

Historical background

Though its construction date has not been confirmed, the Small Crusher House appears to have been constructed as part of the 1950s expansion works.[114] Its later construction date may suggest the requirement to augment the operations of the newly completed crushers (Buildings 19 and 20) at comparatively short notice.

The Small Crusher house was fitted with a 'Hazemag' brand crusher and a single hopper. Raw materials could be unloaded directly from the truck bay at the higher level, into the hopper and thence into the crusher. The 'Hazemag' crusher was a rotary crusher which ground and screened the raw material through a perforated plate. Material was then transported by conveyor to the Large Crusher House or White Pan Room, (Building 19) so named because it solely processed white clay for further refining. Here materials would be further ground and screened. Crushed clay would then be conveyed by elevator to the three machine bays which immediately adjoin the crusher houses to the west.

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114 The building is not shown on a site layout plan prepared in 1955 which comprehensively documented site elements relating to this significant phase of works: *Canberra Brickworks re-arrangement of Plant Layout of Site Works for Dept of the Interior 11 July 1955* ,ref. no. M8788K, National Archives of Australia.

Description & Integrity

The Small Crusher House is a steel-framed, corrugated galvanised steel-clad machinery house. The building at the upper (driveway) level is flanked by low sloping walls of off-form concrete, which frame the unloading bay. At the lower level the structure presents as a two-storey building, with some of the machinery platforms and framing including the hopper in place. The conveyor connecting the crusher to Building 19 has been removed. Part of the roof cladding and lower sections of the wall cladding and the internal flooring have been removed.

The Small Crusher House is in poor condition and its connection to the White Pan Room removed.

Name	White Pan Room (Large Crusher House II)	**Building No**	20
Construction	Corrugated galvanised steel over steel frame	**Survey Date**	3 December 2009
Historical Phase	Post-war phase, 1944-1976	**Date**	c. 1955

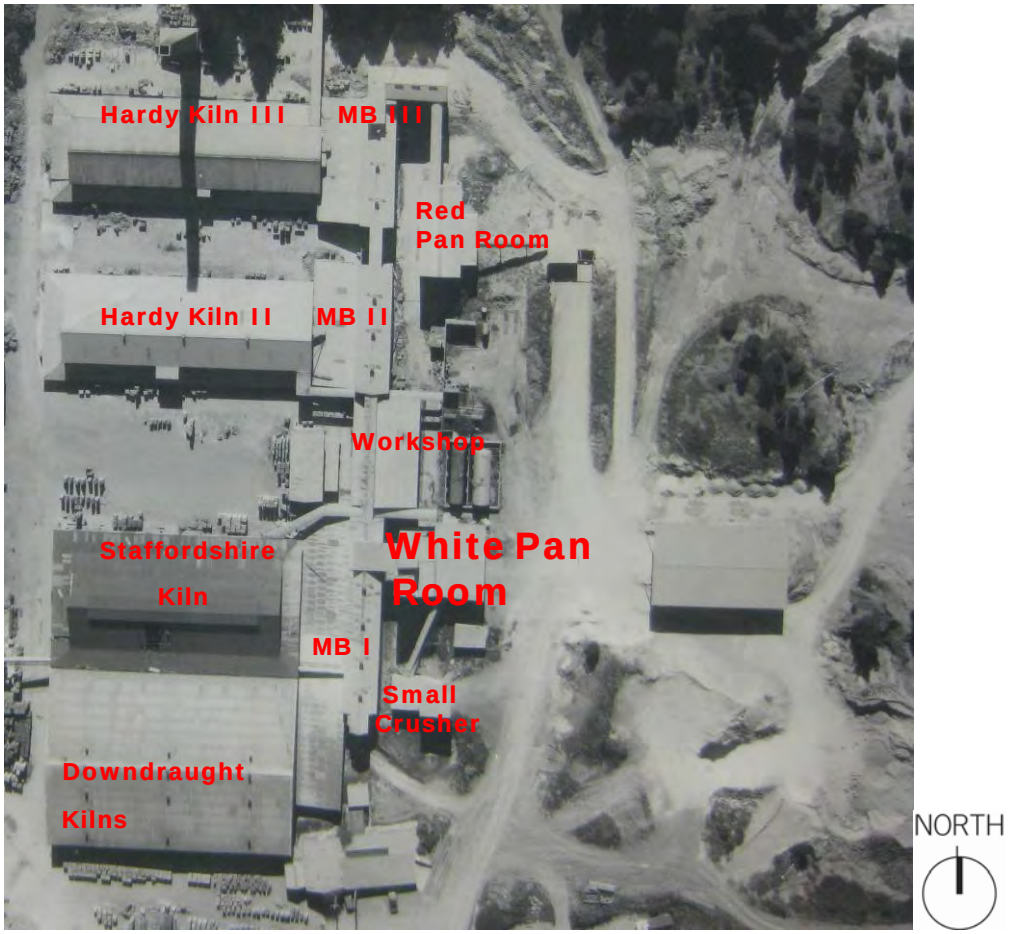

Figure 125 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. The White Pan Room is indicated by a larger font.
Source: ACT Heritage Library, Woden ACT.

Figure 126 The White Pan Room viewed from the east. The shed in the foreground is Building 34.

Figure 127 Interior of the White Pan Room looking west. The site of the now-removed hoppers is in the foreground.

Figure 128 South elevation showing the high-level connection to Machine Bay I, which is shown at left.

Historical background

The White Pan Room is thought to have been constructed in c. 1955 as part of the expansion and modernisation of the Brickworks plant.[115] With the now-demolished pan house, sited further north, the White Pan Room further refined raw materials including shale and white clay prior to processing and feeding into the brick presses, housed in the Machine Bays. Located to the east of Machine Bay 1 (Building 14), this facility was solely used for the crushing and refining of white clay. The white clay was brought to the pan house by truck where it was placed in the two hoppers ready to be fed into grinding pans. The grinding pans comprised a rotating perforated metal disc or pan over which large rollers crushed the clay through the perforations. After grinding the raw material was elevated, screened where material still too coarse was returned to the grinding pans and then elevated to the top of the adjoining machine bay to be fed into the brick presses contained within.

The building was also later connected to the Small Crusher House (Building 18), by a conveyor which transported crushed raw materials to be further refined in the White Pan

115 The White Pan Room is described as undergoing renovation in 1955 in Lester Firth Associates 1986, Datasheet C2, but the source for this statement is not cited.

Room, thus increasing the processing capacity of the works. The relationship between Buildings 18 and 19 generally mirrored that of the Primary Crusher House (Building 20) and a now-demolished pan building previously sited behind Machine Bay 3 (Building 16), known as the Red Pan Room. However, unlike the demolished pan house, the subject building also had a hopper for direct raw materials loading.

Description & Integrity

The White Pan Room is a steel framed corrugated steel clad machinery house, with a distinctive roofline of skillion forms of varying heights. Like the Small Crusher House, there is an unloading bay at a higher level where white clay material was directly unloaded into one of two hoppers, both now removed. The structure is framed by off-form concrete walls and the interior has been gutted with the majority of the machinery removed. The removal has exposed large holes in the concrete surrounding the former location of the hoppers.

The machinery house remains generally intact, but the removal of much of the machinery and the interconnections between the White Pan Room and the smaller crusher house have diminished its ability to demonstrate the processes it accommodates.

Name	Primary Crusher House (Crusher House III)	**Reference No**	20
Construction	Corrugated galvanised steel over steel frame, retaining wall of concrete	**Survey Date**	3 December 2009
Historical Phase	Post-war phase, 1944-1976	**Date**	c. 1955

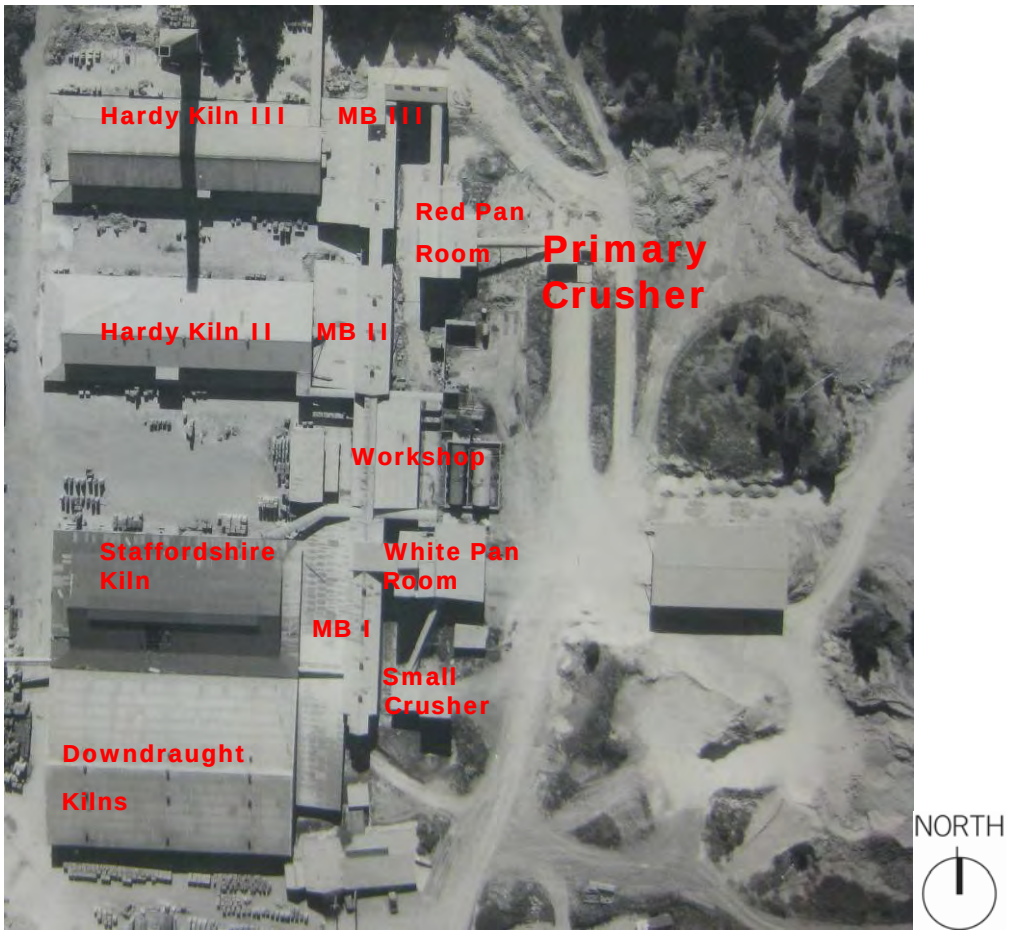

Figure 129 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. The Primary Crusher House is indicated by a larger font. Source: ACT Heritage Library, Woden ACT.

Figure 130 The Primary Crusher House viewed from the west. The concrete footings in the foreground supported the now demolished conveyor which transported crushed material to the Red Pan Room (also demolished) for further refining.

Historical background

The Primary Crusher House was constructed in c. 1955 to process raw materials, which were crushed and then conveyed to the Pan building (demolished) for further screening and grinding. A ramp attached to the crusher provided truck access. The Primary Crusher House contained a Ross feeder for raw shale, with 32" and 18" Jaw Crusher, (Jaques swing jaw crusher) and also a grizzly feeder. It was an integral element of the raw materials processing operations in the expansion of the Brickworks in the post-War period.

Description & Integrity

The Primary Crusher House is of steel framed construction with corrugated galvanised steel cladding. The structure is raised on steel posts and there is a concrete retaining wall to its eastern side. The machinery housing is accessed by a metal ladder from the excavated ground level and there is a truck bay and hopper chute for the delivery of raw material at the higher level.

The structure is in a ruinous state. Parts of the crushing machinery and conveyor are still in evidence. The timber decking within the structure is in a hazardous condition. The building is impacted by a copse of pine trees which appear to have self-seeded in front of the chute.

Name	Elevator/Conveyor	**Reference No**	21
Construction	Corrugated galvanised steel over steel frame, partially dismantled	**Survey Date**	3 December 2009
Historical Phase	Post-war phase, 1944-1976	**Date**	c. 1955

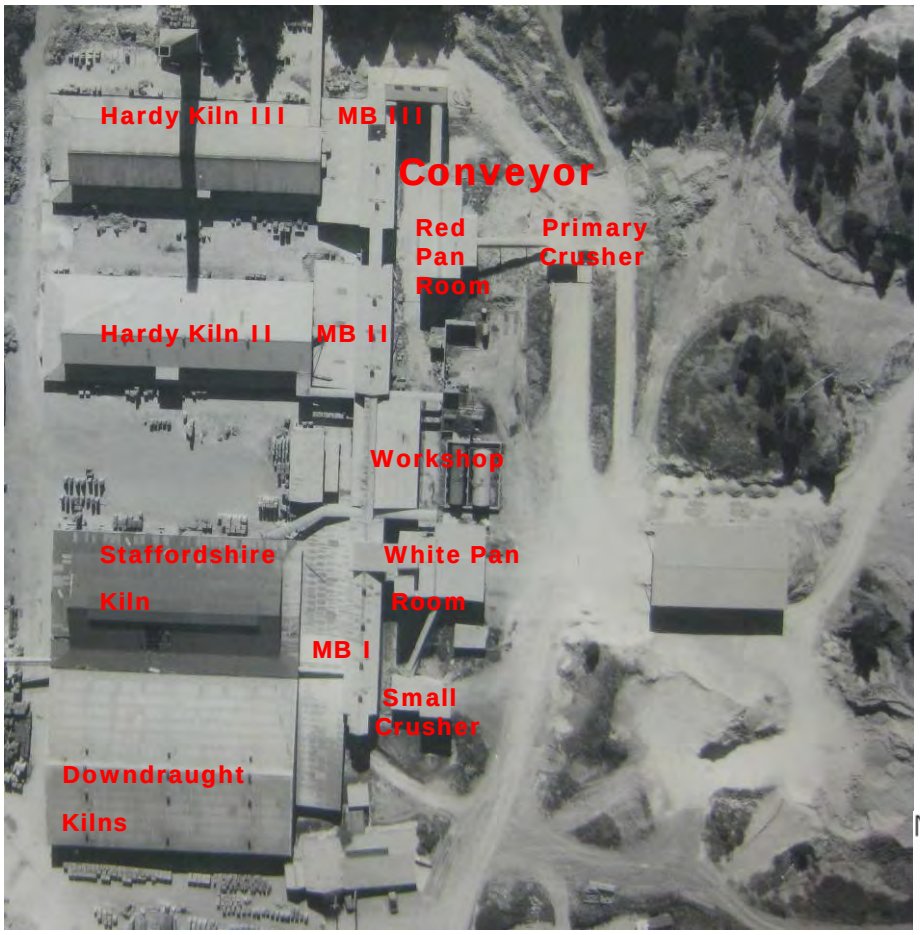

Figure 131 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. The Conveyor is indicated by a larger font.
Source: ACT Heritage Library, Woden ACT.

Figure 132 Extant section of the elevator/conveyor looking north-east.

Figure 133 Looking south-west. Machine Bay III (Building 16) is in the background.

Historical background

The Elevator/Conveyor was constructed in c. 1955 as part of the post-War expansion and modernisation of the works. The conveyor, in two parts, transported the crushed shale from the Primary Crusher House (Building 20) to the now demolished White Pan Room building – the site of which is immediately to the rear (east) of Machine Bay II and Machine Bay III (Buildings 15 and 16 respectively). The Pan building ground and screened the crushed shale, and the other section of the conveyor transported it to a distribution hopper which adjoined Machine Bay III. From this point the shale travelled vertically down to the table measures where it was then conveyed by elevator to the top of Machine Bay III joining the loft conveyors to be distributed to the brick presses, housed within the machine bays which serviced each of kilns.

Description & Integrity

The Elevator/Conveyor is a steel-framed structure, clad in corrugated galvanised steel supported on steel stanchions. Part of the conveyor remains in-situ. In the immediate, vicinity footings of the demolished structures, including sections of the dismantled gangway which led from the firing floor of the second Hardy patent kiln (Building 12) to an oil storage depot, the present-day site of the houses in Lane Poole Place, are also present.

The Conveyor is in poor condition. The section linking the demolished pan house to the distribution hopper is only partly intact and the section linking the pan house to the crusher has been demolished. The adjoining distribution hopper structure has also been demolished.

Name	Downdraught Kilns (three kilns and roofed enclosure)	**Reference No**	22
Construction	Brick (kilns) with corrugated steel roof enclosure (shed)	**Survey Date**	3 December 2009
Historical Phase	Post-war phase 1944-1976	**Date**	c. 1960-61

Figure 134 Detail from a 1929 photograph of the brickworks, with the chimney of the temporary downdraught kilns highlighted.
Source: National Archives of Australia.

Figure 135 Interior of enclosure showing the north elevation of two of the three kilns.

Figure 136 Kiln roof with brick walkway to sides.

Figure 137 Kiln entry showing stepped side wall.

Figure 138 Side elevation showing steel framing and fireholes.

Figure 139 From left: interior of kiln showing entry and deteriorating fire bricks; interior of kiln showing later cement paving.

Historical background

A series of three downdraught kilns, also known as dome kilns, were built in the early 1960s. Initially coal-fired; they were subsequently converted to oil-firing. The kilns were used almost exclusively for the production of face and special bricks.

The kilns were constructed close to the site of two 'temporary' downdraught kilns with a brick stack (see Figure 134), which had been built in 1925 to cope with the increasing demands for Canberra's growth after the decision of the Hughes government to pursue the construction of the National Capital after World War I. These temporary kilns were demolished around in c. 1958.

Description & Integrity

The three kilns are oriented north-south and are constructed of face brick laid in an English bond and fitted with large fire brick faced metal doors to either end. There are feedholes along both the east and west sides, for the ingress of fuel, in this case coal, and later oil, each of which is topped with a segmented brick arch and infilled with brickwork. Each kiln is enclosed by steel framing which extends above each of the kilns, and reinforced by a system of tensioned tie rods. The kilns in section have a stepped profile, with the domed roof surface enclosed to the east and west sides by a traversable brick pier. The kilns are numbered 1 through 3 from east to west, with 1 being closest to the Power House (Building 3).

Internally, the kilns are designed to be accessed via metal doors to either end. None of the three kilns are accessible from the north end. With the exception of Kiln 1, the doors to the south end comprise metal cladding to the exterior face and a wall of firebricks, held in place to the surface of the metal door by a heavy duty metal mesh. These are in reasonable condition albeit some of the brick is friable and deteriorating. The doors to Kiln 1 are of metal without the firebrick lining. The doors are fitted with easy clean hinges, enabling them to be folded fully back flat against the kiln wall to permit access to the interior. Internally the north doors are either bricked over or, as for Kiln 1, a false stud wall with plaster has been installed.

The three kilns have each been altered internally to serve as antique market stalls or storage areas in the period immediately following on form the closure and relocation of the brickworks in 1976. Works typically involved the paving of the interior floors with brick, the installation of electric wiring and of lighting –generally in the form of spotlights which have reused the hot air off-takes, or suspended fluorescent fittings. Between the three kilns, racks have been installed by the current site tenant for the storage of salvaged timber. A secure display space has been created to the east of the Kiln1, within the form of the open-sided corrugated steel roof structure. It is a metal framed corrugated steel enclosure with corrugated laserlite let into the east wall.

The whole is enclosed by an open-sided metal framed corrugated steel canopy. The date of construction of this has not been confirmed, however it is thought to be contemporary with the kilns themselves. The structure appears on the 1976 aerial photograph. The roof cladding has been replaced by the current site tenant since the 1986 report was compiled.

Name	Downdraught Kiln control room	**Reference No**	23
Construction	Brick, corrugated asbestos cement sheet	**Survey Date**	3 December 2009
Historical Phase	Post-war phase 1944-1976	**Date**	c. 1961

Figure 140 The downdraught kiln control room is the cream brick building adjoining the larger terracotta-tiled Power House (Building 3).

Historical background

The downdraught kiln control room was constructed during the early 1960s, at the time of the construction of the three downdraught kilns (Building 22).

Description & Integrity

The control room is constructed of cream brick with a gable roof of corrugated asbestos cement. There are timber framed louvre windows to both the south and west which have been broken and are now boarded over internally with plywood. There is a brick stair with concrete treads to the west elevation, leading to the entry in the north elevation. The building is in poor condition and there are holes in the roof. The lining boards to the gable to the south are damaged.

Name	Chimney Stack for Downdraught Kilns	**Reference No**	24
Construction	Brick	**Survey Date**	3 December 2009
Historical Phase	Post-war phase 1944-1976	**Date**	c.1961

Figure 141 Chimney stack viewed from the north-west.

Historical background

The brick chimney stack located north-west of the three early 1960s downdraught kilns was linked by underground tunnels from the three kilns to a now-demolished fan house. The large opening in the east face of the stack is thought to for a large duct – now removed – from the fan house. The method of operation is thought to have been similar to that of the fan house and stack associated with the Hardy patent kiln.

There is no obvious evidence of the fan house today and at the time of inspection.

Description & Integrity

The chimney stack, constructed of red brick, is located approximately 30 metres south of the downdraught kilns. The stack is surrounded by a gravelled car parking area and with timbers stored at its base. The design of the stack is a simpler version of the Staffordshire and Hardy patent kiln stacks, without the corbelled brickwork. At the time of the compilation of the 1986 *Conservation Plan*, the stack was being used as an incinerator by the site's tenants.

There is evidence of brickwork spalling, particularly to the west and north faces. There is a large oblong opening approximately three metres above the ground in the north face, indicating where a duct channelled spent fuel and heat to the stack for dispersal. There is an opening at low level in the south face, set within a steel door surround – the door is missing.

Name	Toilet Block	**Reference No**	25
Construction	Brick, steel roof decking	**Survey Date**	3 December 2009
Historical Phase	Post-war phase 1944-1976	**Date**	c. 1960s

Figure 142 The toilet facility is indicated by the arrow.

Historical background

This small brick toilet adjoins the rear of the former office building (Building 7) and is sited adjacent to a storage building (Building 31). It is similar in size and uses similar materials to the amenities block which adjoined the brick extrusion plant at the other side of the works. It contained a toilet cubicle and at time of the 1986 *Conservation Plan* it was utilised by the tenants of the former office building.

Its construction of vari-coloured brickwork suggests it was built from materials at hand, as needs dictated.

Description & Integrity

The toilet is constructed of vari-coloured brickwork, and has a skillion roof of metal roof decking. There is a window in the north wall and a door (boarded up) in the east elevation. The interior of the building was not inspected as access was not available.

The building is in poor condition.

Name	Amenities Block	**Reference No**	26
Construction	Brick, metal roof decking	**Survey Date**	3 December 2009
Historical Phase	Post-war phase 1944-1976	**Date**	c. 1960s

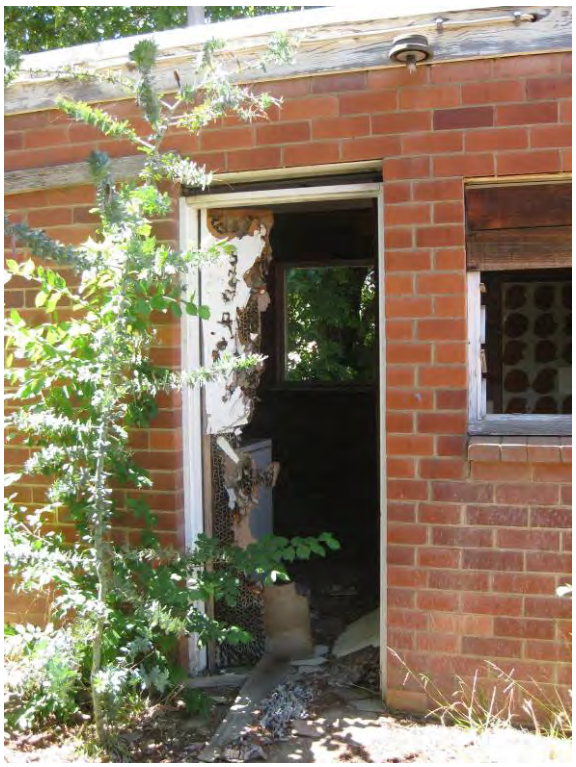

Figure 143 From left: the amenities block is the small red brick building at right; entry.

Historical background

This small brick amenities block is sited at the eastern edge of the brick extrusion plant (Building 30). It adjoins a small tan brick ancillary storage building (Building 29) which it predates. It is similar in size and is constructed of similar materials to the storage shed (Building 32) on the southern edge of the quarry, behind the White Pan Room (Building 19). It contained a toilet cubicle and shower recess and may also have functioned as a laundry, post-closure of the brickworks. At the time of the 1986 report it was utilised by the tenants of the former substation/control room and boiler house (Buildings 27 and 28 respectively).

Its construction of vari-coloured brickwork suggests it was built from materials at hand, as needs dictated.

Description & Integrity

The amenities block is of vari-coloured brickwork, and has a skillion roof of metal roof decking. Internally it has a concrete floor and there are window openings to the north, east and south. The entry is from the south. The interior has been heavily vandalised with all fittings and finishes in poor condition.

Name	Substation/control room	**Reference No**	27
Construction	Brick, corrugated galvanised steel	**Survey Date**	3 December 2009
Historical Phase	Post-war phase 1944-1976	**Date**	c. 1971

Figure 144 Substation/control room building, showing north elevation.

Figure 145 The former boiler house and adjoining substation/control room, photographed from the site of the former extrusion plant. The substation building is at left.

Historical background

During 1971 a new building was constructed to house the new extrusion brick making plant as well as a series of brick drying kilns. The extrusion plant was connected to the machine shed complex at the east side of the site by an overhead conveyor which passed between the Staffordshire and downdraught kilns Buildings 4 and 22 respectively. The *Canberra Times* reported in August 1972 that the $500,000.00 extrusion machine raised the Brickworks total production capacity from around 20 million bricks per year to more than 40 million per year.[116]

To service the new plant, the subject building – originally constructed as a substation/ control room – and the adjoining boiler house (Building 28) were erected. After the closure of the plant, both buildings were refitted to serve as stalls as part of a larger antique market which operated from the site during the late 1970s-early 1980s.

Description & Integrity

The former substation/control room building is sited to the north of the boiler room, and is positioned at right angles to it.

The building is constructed of brick and has a gabled roof form clad in corrugated steel. The gable is also infilled with corrugated steel to both the front and rear. The structure is accessed by a steel roller door in the east elevation, and there is a crude corrugated steel canopy above the roller door entry in supported on timber posts with angled brackets. The verandah element extends further to the south than the extent of the building, almost abutting the verandah of the adjoining boiler house. This last element is thought to date from the use of the building as an antique stall. A painted timber sign fixed to the building's façade adjoining the louvre window next to the roller door reads 'Nicky's Antiques'. There is a single door entry in the north elevation and a window, with metal bars fixed to its outside face. The door is a painted timber ledged door set within a timber frame. A metal cable tray which previously extended from the rear (west) wall into the extrusion plant proper has been crushed against the wall.

The building is of painted brickwork internally, has a concrete floor and painted concrete ceiling. The space is largely stripped out, and at the time of inspection a number of rusted metal brick barrows were *in-situ*.

The building is in fair condition, apart from the impacts of minor vandalism, including the breaking of windows, painted graffiti and smoke damage. The corrugated galvanised steel roofing is in very good condition.

The verandah element and signage date from the post-closure phase and are related to its subsequent use as an antique stall.

116 Cited in Lester Firth and Associates, 1986, datasheet DH.

Name	Boiler House	**Reference No**	28
Construction	Brick, corrugated galvanised steel	**Survey Date**	3 December 2009
Historical Phase	Post-war phase 1944-1976	**Date**	c. 1971

Figure 146 Former boiler house building showing east entry and later verandah addition.

Figure 147 The former boiler house and adjoining substation/control room, viewed from the site of the former extrusion plant. The boiler house is at right.

Historical background

During 1971 a new building was constructed to house the extrusion brick making plant as well as a series of brick drying kilns. The extrusion plant was connected to the machine shed complex at the east side of the site by an overhead conveyor which passed between the Staffordshire and downdraught kilns. The *Canberra Times* reported in August 1972 that the $500,000.00 extrusion machine raised the Brickworks total production capacity from around 20 million bricks per year to more than 40 million per year.[117]

To service the new plant, the subject building – originally constructed as a boiler house – and the adjoining substation/control room (Building 27) were erected. After the closure of the plant, both buildings were refitted to serve as stalls as part of a larger antique market which operated from the site during the late 1970s-early 1980s.

Description & Integrity

The former boiler house is a double-height structure, constructed of brick and has a gabled roof form clad in corrugated steel. The gable is also infilled with corrugated steel to both the front and rear. The structure is accessed by a steel roller door. There is a crude corrugated steel canopy above the roller door entry in the east elevation, supported on timber posts. This last element is thought to date from the use of the building as an antique stall. There is a crudely laid brick and concrete paver apron to the entry.

The building is of painted brickwork internally, and has a concrete floor and painted ceiling lining boards with a narrow bead. There are two fixed pane windows to the east and west walls, approximately 2.5 metres above the internal floor level. No machinery or equipment relating to its original use remains.

The building is in good condition, apart from the impacts of minor vandalism, including the breaking of windows.

The verandah element is thought to date from the post-closure phase and related to its subsequent use as an antique stall.

117 Cited in Lester Firth and Associates, 1986, datasheet DH.

Name	Ancillary storage building	**Reference No**	29
Construction	Brick, corrugated galvanised steel	**Survey Date**	3 December 2009
Historical Phase	Post-war phase 1944-1976	**Date**	c. 1971

Figure 148 The storage building, adjoining the site of the brick extrusion plant site.

Historical background

This is a small structure located on the edge of the brick extrusion plant site, and its date of construction is thought to be contemporary or soon after the construction of this facility c. 1971. Its original function is not known. At the time of the 1986 *Conservation Plan* it was in use as a studio space by an artist/craftsperson. At present it is vacant and unsecured.

Description & Integrity

The building is constructed of tan wire-cut brick, and has a skillion roof of metal roof decking. Internally it has a concrete floor and window openings to both the south and east elevations. There is a doorway in the east elevation. The glazing and window framing as well as the door have been removed. Internally the building has a concrete floor and the walls are partly of painted brickwork with some areas of painted wall lining panels. The ceiling is also lined and painted.

The building is vacant and in poor condition.

Name	Slab for Brick Extrusion Plant	**Reference No**	30
Construction	Concrete slab	**Survey Date**	3 December 2009
Historical Phase	Post-war phase 1944-1976	**Date**	c. 1971

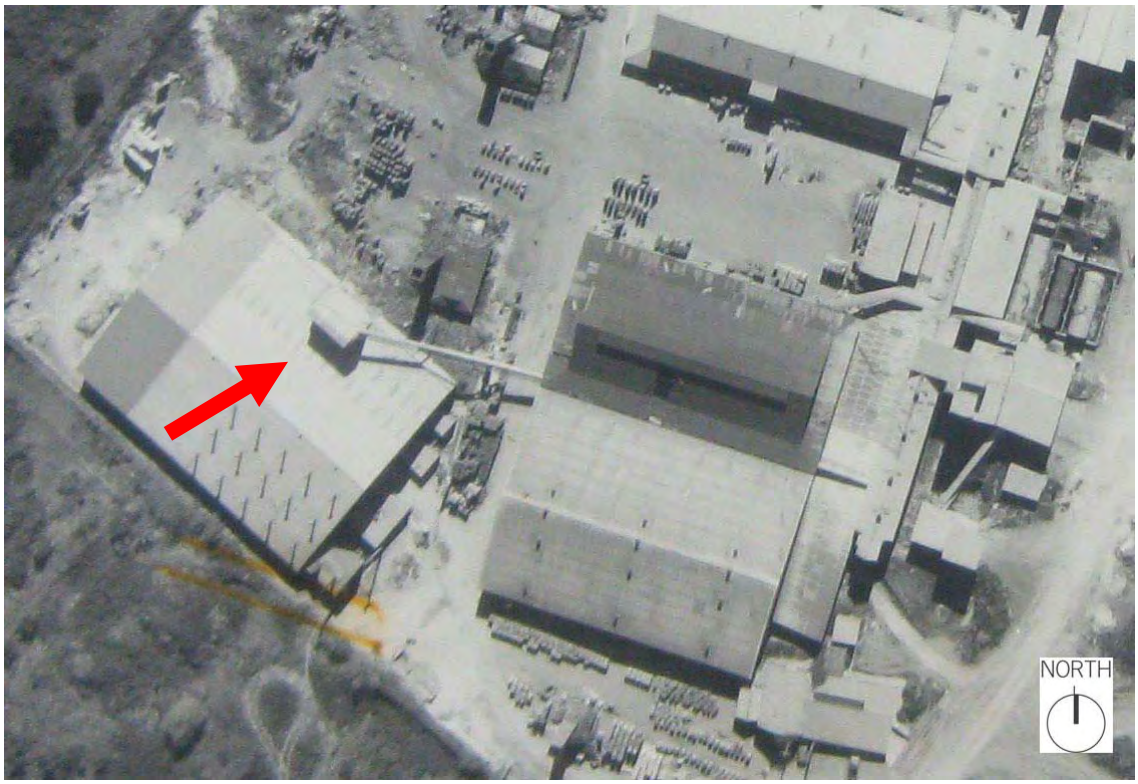

Figure 149 Detail of a 1976 aerial photograph showing the extrusion plant and overhead conveyor (indicated).
Source: ACT Heritage Library, Woden ACT.

Figure 150 Brick extrusion plant site, looking north-east.

Historical background

During 1971, a new building was constructed to house the extrusion brick making plant as well as a series of brick drying kilns. The extrusion plant was connected to the machine shed complex at the east side of the site by an overhead conveyor which passed between the Staffordshire and Downdraught kilns. This is shown in an aerial photograph of the brickworks site, taken in May 1976. The *Canberra Times* reported in August 1972 that the $0.5 million extrusion machine raised the total production capacity of the plant from c. 20 million bricks per year to over 40 million per year.

After the closure of the brickworks the shed building which enclosed the drying kilns and brick making machinery was relocated to the Canberra Showgrounds and the conveyor was dismantled. Since the compilation of the 1986 report the drying kilns have also been demolished. The slab is now used as a timber store.

Description & Integrity

The concrete floor slab is the remaining element of the short-lived extrusion plant. Buildings 27 and 28 – the substation/control room and boiler house respectively which abut the site to the south-east - were constructed to service the extrusion plant.

Name	Ancillary storage building	**Reference No**	31
Construction	Brick, corrugated galvanised steel	**Survey Date**	3 December 2009
Historical Phase	Post-war phase 1944-1976	**Date**	c. 1960s

Figure 151 The ancillary storage building is sited behind the former offices (Building 7).

Historical background

This small brick storage building abuts a brick toilet (Building 25) behind the former office building (Building 7). It uses similar materials to the storage shed which adjoins the White Pan Room (Building 19), further to the north. It appears to have been built as a store, related to the nearby office building.

Description & Integrity

The structure is of orange face brick with a timber framed door and window to the south elevation. It has a skillion roof of metal roof decking. The interior walls are lined and part-fitted with shelving unit brackets. The building is unsecured, vandalized and in poor condition.

Name	Storage shed	**Reference No**	32
Construction	Brick, corrugated galvanised steel	**Survey Date**	3 December 2009
Historical Phase	Post-war phase 1944-1976	**Date**	c. 1960s

Figure 152 Storage shed.

Historical background

This small brick storage shed is sited on the southern edge of the quarry, and behind the White Pan Room (Building 19). It is similar in size and uses similar materials to the toilet and storage building behind the office building, further south and the amenities block adjacent to the brick extrusion plant. The original function of the shed is not known. Its construction of vari-coloured brickwork suggests it was built from materials at hand, as needs dictated.

Description & Integrity

The shed is of vari-coloured brickwork, and has a skillion roof of metal roof decking. Internally it has a concrete floor and the timber door to the large opening on its north face is stored within the building. The walls are not lined internally and the reflective insulation has been damaged by vandals. The shed is vacant and in fair condition.

6.0 HISTORY & PHYSICAL ANALYSIS: POST CLOSURE PHASE 1976-2010

6.1 Introduction

The following section summarises the uses, and some of the proposed uses, of the Canberra Brickworks since the site was decommissioned in 1976. As noted at Chapter 1, the site is presently occupied by a recycled timber merchant and a number of artists.

6.1.1 *A.R. Marr redevelopment proposals (1976-84)*

In September 1976 all removable structures at the Canberra Brickworks were offered 'for sale for removal,' and the extrusion plant shed to the south-west of the site was relocated to the Canberra Showgrounds.[1] The National Capital Development Commission (NCDC) anticipated that costs incurred during the relocation process would be recovered during the subsequent adaptive re-use of the site, which the NCDC initially proposed to achieve by redeveloping the site with medium density housing.[2]

Also in 1976, local developer and businessman Alan Marr (A R Marr Pty Ltd) put forward a proposal to develop the brickworks as an integrated tourist, recreation and retail centre. Uses envisaged included manufacturing (including a pottery, winery and crafts), speciality shops, an antiques market, plant nursery, restaurant and tavern, offices, art displays (in the upper levels of the three continuous kilns) and museums, including collections of vintage cars and fire engines. Medium density housing was proposed to the east and north of the site. Under Marr's scheme, the quarry was to be landscaped to include picnic areas, walking trails and a miniature railway.[3] Marr succeeded in having the land re-zoned to accommodate his vision for a mixed-use tourism, recreation and residential development. The present zoning at the site dates from this period.[4]

Works undertaken by Marr on the existing buildings included re-roofing the Staffordshire and downdraught kilns; re-constructing the external brick walls of the Staffordshire kiln; some internal lining to the Staffordshire kiln; electrical work to the Hardy patent kilns; paving to some areas of the Hardy patent kilns; and re-roofing of ancillary buildings.[5] Work on the quarry commenced towards the end of 1978, including land fill and the creation of the reflection lake (see Figure 153).

The redeveloped brickworks was opened to the public as a tourist attraction in July 1979. However, limited income opportunities and high capital costs (over $1 million was invested in works to the site[6]), forced A R Marr into provisional liquidation.[7] Auctions of the vintage car

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1 Lester Firth and Associates, 1986, Section 2.1.5, sources uncited.

2 'Proposed Land Uses for Undeveloped Land in Inner Canberra,' National Capital Development Committee, cited in Lester Firth and Associates, 1986, Section 2.1.5.

3 Lester Firth and Associates, 1986, Section 2.1.5.

4 Connell Wagner Pty Ltd, *The Old Canberra Brickworks and Environs Development Control Plan*, February 2001, p. 4.

5 Lester Firth and Associates, 1986, Section 2.1.5.

6 Lester Firth and Associates, 1986, Section 2.1.5, uncited reference.

collection and site equipment took place in September and November 1980. Two of the items, a 1913 Austral Otis Steam Roller and a 1925 Fowler Road locomotive, both associated with Canberra's early development, were purchased for the National Museum of Australia.[8]

At this time Marr also held an option to develop up to 212 townhouses on parts of the brickworks site. In 1980 the first stage, comprising 20 houses on the eastern side of the site, was commenced. Work on houses to the north of the brickworks (now Lane Poole Place) began the following year.[9]

In the early 1980s, Alan Marr was seriously injured in a fall at the brickworks, and later died of complications.[10] On 18 September 1984, the Commonwealth accepted surrender of A R Marr Pty Ltd's lease and paid $1.1 million for the lessee's interest in the site.[11] The surrender included options to acquire adjoining land for the construction of 151 townhouses. The Commonwealth paid the lessee $1.1 million for its interests.[12]

A number of tenants from the Marr lease, including artists, the antiques market and a timber recycling merchant, Thor's Hammer, remained at the site. In the mid-1990s, due to concerns about the safety of some of the buildings[13] and in anticipation that the site was going to be redeveloped (see below), the tenants were required to leave. The role of the caretaker (Bruce McDonald), who had been responsible for the management of the site since the Marr lease, was also abolished. In recognition of the considerable volume of its timber stock, Thor's Hammer was granted an extended period to relocate. The company was still at the site by the time it was clear that the development proposal was not going to come to fruition. Thor's Hammer remains at the site today.

6.1.2 *Hooker projects proposal (1988)*

In February 1979, the NCDC issued the *Yarralumla Policy Plan: Report on Environmental Issues Incorporating Draft EIS and the Development of Section 100 Yarralumla*. This document was, 'intended to provide additional demands for housing, recreation, tourism and national capital uses which were deemed compatible with the existing use and character of Yarralumla.'[14] The recommendations of the *Yarralumla Policy Plan* were poorly received by

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7 A R Marr Pty Ltd was put into provisional liquidation on 9 January 1980. Lester Firth and Associates, 1986, Section 2.1.5.

8 Lester Firth and Associates, 1986, Section 2.1.5.

9 Lester Firth and Associates, 1986, Section 2.1.5.

10 Pers comm., Peter Vandermark (artist based at the Canberra Brickworks) and Adam Mornement, Lovell Chen, 4 December 2009.

11 Susan Conroy & Munns Sly Architects, *The Yarralumla Brickworks & Environs Planning Review*, March 2005, pp. 21-22, and Lester Firth and Associates, 1986, Section 2.1.5.

12 Lester Firth and Associates, 1986, Section 2.1.5.

13 A brick is rumored to have fallen from the ceiling of one of the downdraught kilns. Pers comm., Thor Diesondorf, Thor's Hammer and Adam Mornement, Lovell Chen, 4 December 2009.

14 Susan Conroy & Munns Sly Architects, *The Yarralumla Brickworks & Environs Planning Review*, March 2005, p. 21.

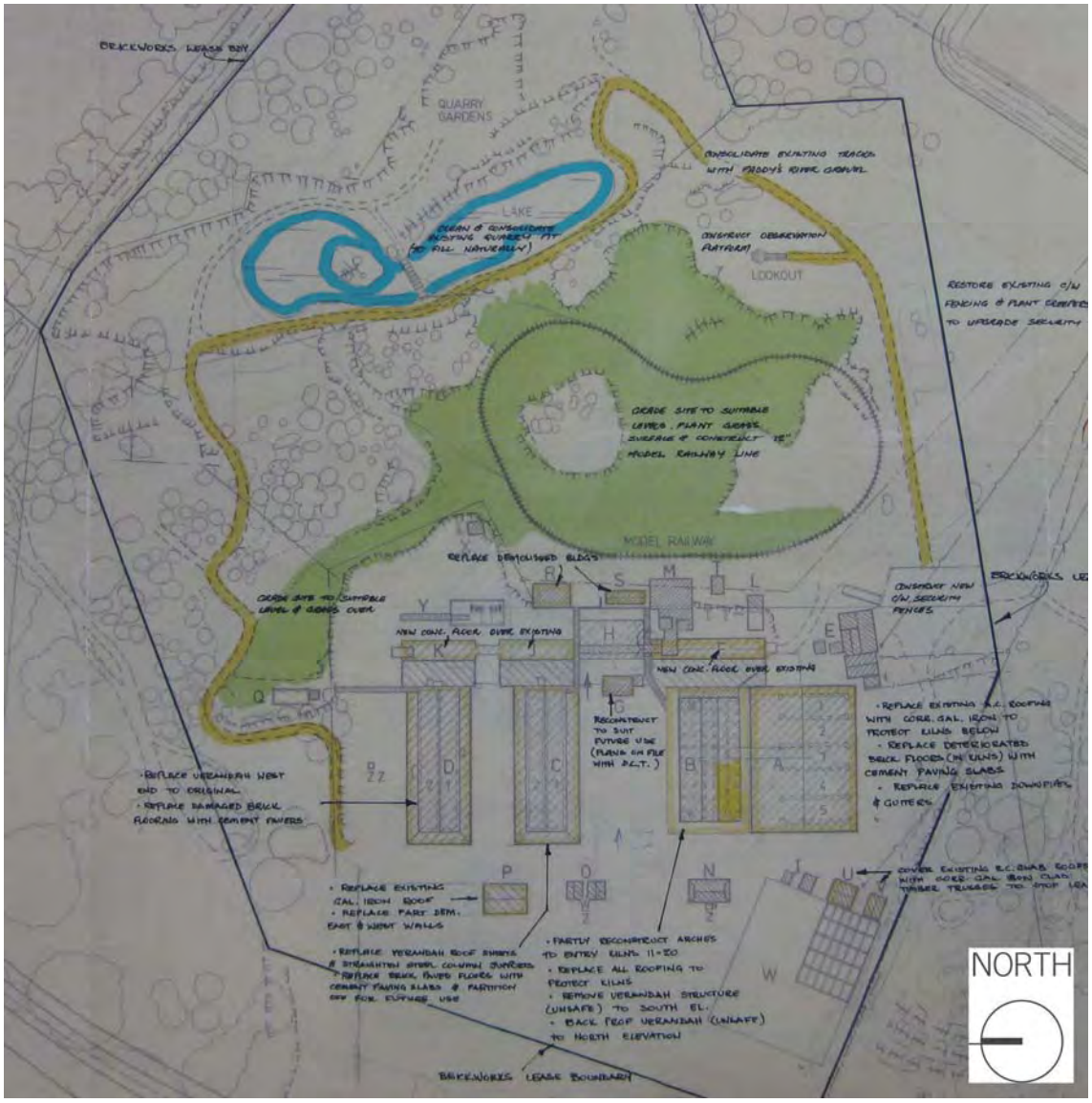

Figure 153 The A R Marr proposed for Canberra Brickworks, c. 1977.
Source: ACT Heritage Library, Woden ACT.

the local community, with objections relating to the loss of open space, the scale of the tourism and recreation development and medium density development.[15]

The *Yarralumla Policy Plan* (1979) was followed in 1988 by the *Canberra Brickworks South Canberra Policy Plan*. This document suggested a range of potential uses for the site, including:

- Medium density housing in the western and southern areas of the brickworks: c. 250 dwellings of 30 households per hectare (4.2.1);
- Commercial accommodation in some of the historic buildings at the site (4.2.1); and

15 *Yarralumla Section 94, Brickworks Redevelopment Section 2, variation no. 5* (anonymous and undated), a compilation of responses to the *Draft Yarralumla Policy Plan*, held in ACT Assembly Library, cited by Susan Conroy & Munns Sly Architects, p. 21.

- Limited amounts of office and retail space (4.2.2 and 4.2.4, respectively)

In addition, it was noted that a combination of the above uses would be appropriate in the development of the brickworks as a tourism destination, and that future uses of the site needed to be financially self-sufficient.[16]

Susan Conroy and Munns Sly Architects suggest that the 1988 *Policy Plan*: 'Appears to have been instigated by the Commonwealth because of what it considered an innovative plan [the Hooker proposal, described below] for redevelopment and use of the Canberra Brickworks Site [sic]'.[17]

Once again, the Policy Plan was poorly received by the community, and led to the establishment of the Yarralumla Residents Association (YRA), in November 1988. The Association took the view that the *Plan* had been hastily prepared and failed to address key issues.[18]

Regardless of the YRA's views, the *Plan* was adopted, and formed the basis of calls for Expressions of Interest (EOI) for the development of the site in November 1988. The preferred EOI was submitted by Hooker Projects, which proposed a sports precinct in the south and the south-west of the site, with the kilns adapted to multiple uses, including a museum, restaurant, hotel and visitor attractions. Sections of the machine bays were proposed for adaptive re-use, including the conveyor belt in the roof space as a 'museum walkway' (see Figure 154).

By 1990, however, with the economy depressed, Hookers had been placed in provisional liquidation. Susan Conroy and Munns Sly Architects note that, 'negotiations continued with the liquidator, Halwood Corporation Ltd, who transferred development rights to a subsidiary Hooker Projects (Castlereagh Management), to allow progress on the project … [However] by August 1992, the Hookers proposal was defunct'.[19]

6.1.3 *Local Area Planning Committee proposal (1998)*

In 1998, following a failed development proposal by the Canberra Theatre,[20] the Burley Griffin Local Area Planning Committee (LAPAC) was invited by the Government to submit its recommendations with regard to the future development of the brickworks. The committee that developed the proposal comprised representatives of the LAPAC and Yarralumla Residents Association,[21] with assistance from local architect Ric Butt.[22]

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16 NCDC, *Yarralumla Brickworks South Canberra, Policy Plan*, October 1988, pp. 14-15.

17 Susan Conroy & Munns Sly Architects, p. 21.

18 Susan Conroy & Munns Sly Architects, p. 22, citing a letter (December 1988) from the Yarralumla Residents Association to the Hon Clive Holding.

19 Susan Conroy & Munns Sly Architects, p. 23.

20 See, Cameron Chisholm and Nicol Architects, *A Proposal for the redevelopment of the Old Canberra Brickworks*, prepared for Canberra Theatre, instructed by Allied Projects (ACT), July 1996, cited in Susan Conroy & Munns Sly Architects, p. 23.

21 Connell Wagner Pty Ltd, 2001, p. 5

22 Susan Conroy & Munns Sly Architects, p. 23.

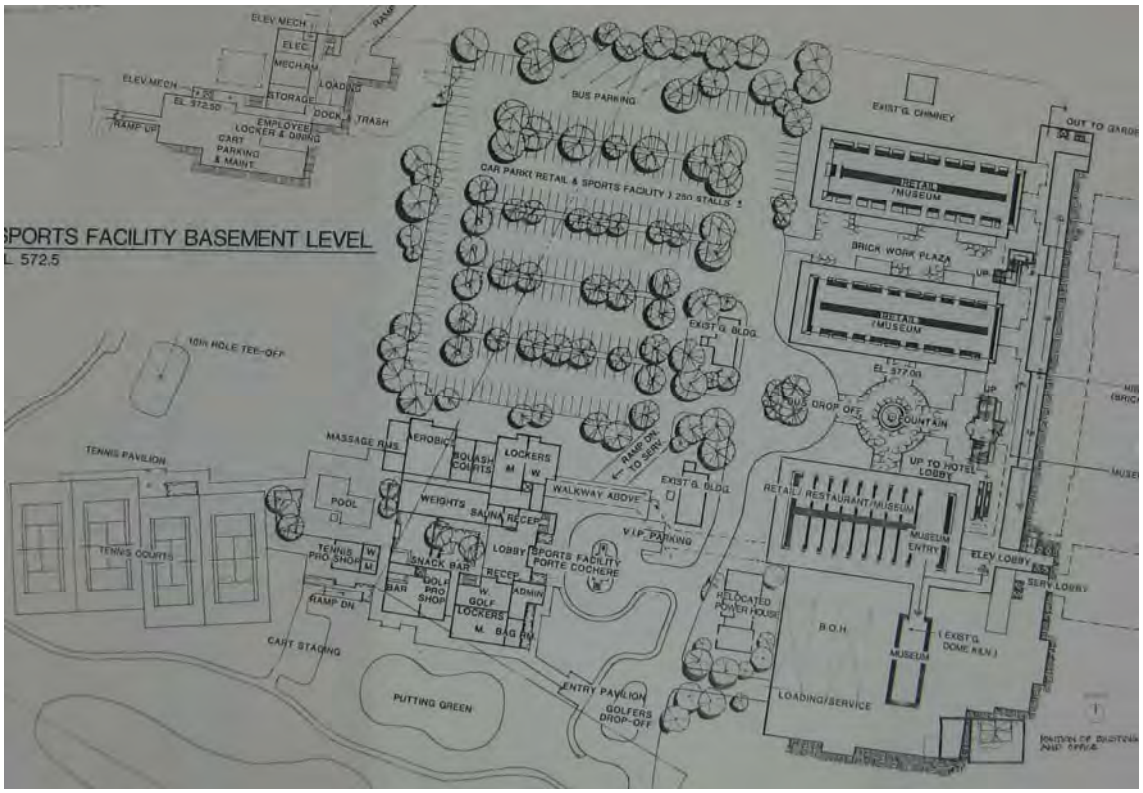

Figure 154 Ground level plan of Hooker Project's proposal for the Canberra Brickworks, 25 November 1988. North is at top.
Source: ACT Heritage Library, Woden ACT.

The LAPAC scheme recommended that, following stabilization, the brickworks should be retained as a ruin and that the site should be developed as an industrial archaeology park with a heritage centre and public gardens. Other uses included low intensity commercial uses (such as markets and performance venues between kilns), and 'landscape buffers linking to surrounding recreation and open space'.[23] Mixed residential and commercial areas, including limited manufacturing, were proposed for sites adjacent to the brickworks. In these areas, housing density was proposed at c.15 dwellings per hectare. On this basis, the LAPAC anticipated a total of c. 100 dwellings.

The ACT's planning body (PALM) subsequently worked with the local community on the development of the site based on the LAPAC recommendations.[24] The LAPAC proposal also formed the basis of the *Brief for a Development Control Plan* (DCP)[25] for the Canberra Brickworks and surrounding un-leased land which was initiated in 2000 by Office of

23 Susan Conroy & Munns Sly Architects, p. 24.

24 Connell Wagner Pty Ltd, 2001, p. 5. See also, PALM, *Expressions of Interest Old Canberra Brickworks* (Blocks 1, 7, 20, Section 102, Yarralumla (undated), c. 1997), cited in Susan Conroy & Munns Sly Architects, p. 24.

25 Connell Wagner Pty Ltd, 2001, p. 5, and Susan Conroy & Munns Sly Architects, p. 24.

Infrastructure and Asset Management. Connell Wagner was commissioned to prepare the DCP.[26]

Options identified by the DCP included the development of the site for housing; the creation of fenced gardens in the former quarry; adaptive re-use of the brickworks, dependent on remediation; the potential for adaptive re-use for aged care accommodation; and leaving the site substantially undeveloped.[27]

The YRA responded to the DCP with a recommendation that a maximum of 25 units be developed, to the south of the brickworks. As noted by Susan Conroy and Munns Sly Architects, the YRA also proposed that the Defense Housing Authority develop and manage the site. The ACT Government entertained the proposal, but concluded that any development should be based on a competitive process for land sales.[28]

In May 2002 the ACT Land and Property Group engaged a firm of civil consultants to evaluate the YRA's 25 dwelling proposal, including costings and consideration of an access road from Dudley Street to the south.[29]

26 Connell Wagner Pty Ltd, *The Old Canberra Brickworks and Environs Development Control Plan*, February 2001.

27 Connell Wagner Pty Ltd, 2001, chapters 6 and 7.

28 Susan Conroy & Munns Sly Architects, pp. 24-25. .

29 Ribeny F J & Associates, *Multi-Unit Site, The Old Canberra Brickworks Yarralumla* DUS, 26/05/02, cited by Susan Conroy & Munns Sly Architects.

6.2 Datasheets for Post-closure phase elements

No.	Name / Description	Date of construction
33	Model railway workshop	c. 1979
34	Model railway storage shed	c. 1979

Figure 155 Location of elements surviving from the Post-closure Phase. Refer to the larger scale site plan in Chapter 1 for more detail.

Name	Model Railway Workshop	**Reference No**	33
Construction	Brick, corrugated galvanised steel	**Survey Date**	3 December 2009
Historical Phase	Post-closure phase 1976-2009	**Date**	c. 1979

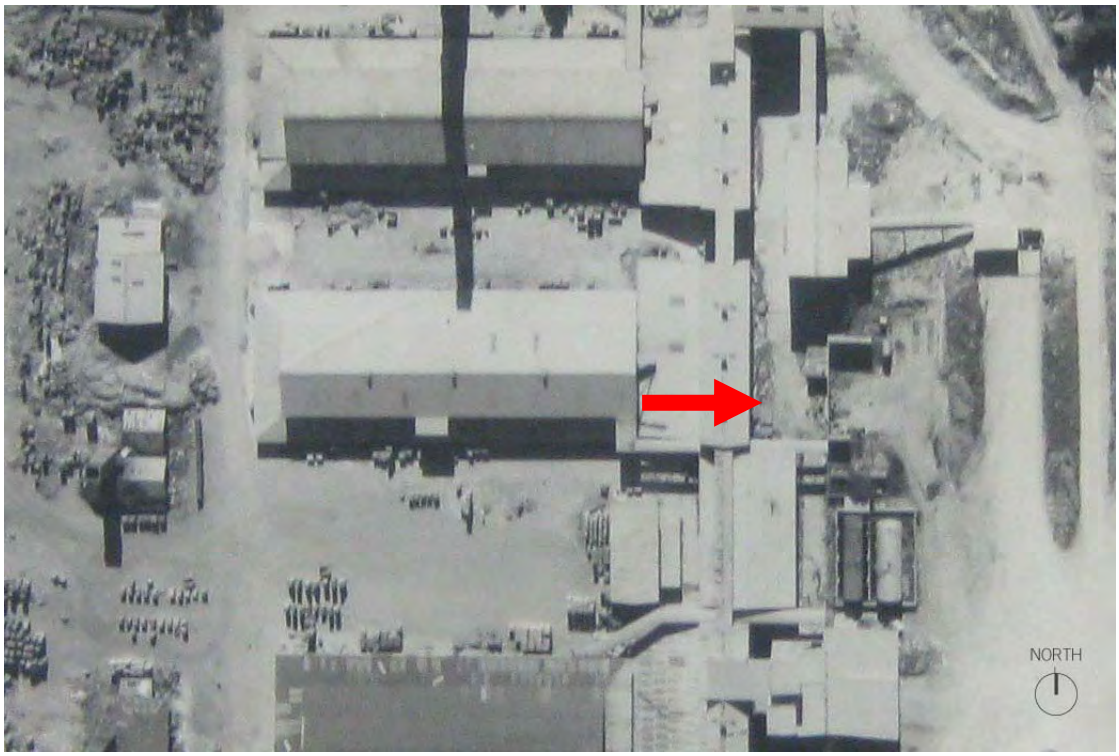

Figure 156 Detail of a 1976 aerial photograph, with the brick component of Building 33 – at that time a storage bunker - indicated.
Source: ACT Heritage Library, Woden ACT.

Figure 157 Exterior, showing the south and east elevations. The brick wall is an earlier element incorporated into the workshop building.

Historical background

Similar to the model railway storage shed (Building 34), the model railway workshop was constructed in 1979, utilizing the brick walls of a former oil storage facility /coal storage bay, associated with the brickworks (see Figure 156). The workshop relates to the post-closure phase and housed an engine and carriages for a narrow gauge railway, which was established as part of A R Marr Pty Ltd's operation of the site. A site plan prepared in the 1970s showing works relating to the proposed reuse of the site outlines the sites of both Building 33 and 34 and annotates the drawing 'replace demolished buildings'.[30]

Description & Integrity

Located to the west of the quarry, the shed is a steel framed skillion-roofed structure, clad in corrugated galvanised steel. To the west, north and south the building incorporates the brick walls of a former fuel storage facility or coal bay. The structure abuts a deep excavation to its west, and the brick wall to the north and west is atop a concrete retaining wall to the lower (brickworks) level. It has a row of windows (louvred glazing all broken/removed) running along the northern wall looking out onto the quarry. There is a roller door entry and a single door entry to the south elevation.

Internally the corrugated galvanised steel walls are lined, with much of the lining panels damaged and the brick is not lined. The floor is of concrete and the roof is not lined.

30 Site plan held in the collection of the ACT Heritage Library, Woden ACT.

Name	Model Railway storage shed	**Reference No**	34
Construction	Corrugated galvanised steel on brick plinth	**Survey Date**	3 December 2009
Historical Phase	Post-closure phase 1976-2009	**Date**	c. 1979

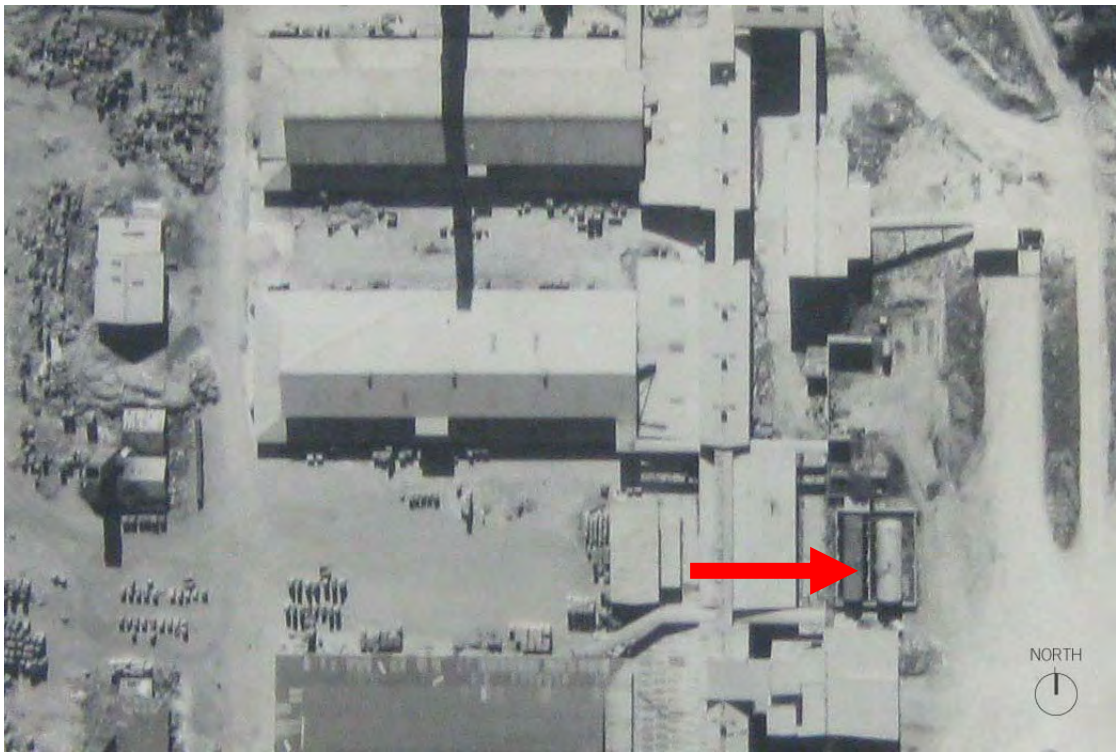

Figure 158 Detail of a 1976 aerial photograph, with the site of Building 34 – at that time an oil storage facility - indicated.
Source: ACT Heritage Library.

Figure 159 Exterior, showing east and north elevations.

Historical background

The storage shed was constructed in 1979, utilizing the brick footings and dwarf walls of a former oil storage facility /coal storage bay, associated with the brickworks, and shown on the 1976 aerial photograph containing two storage tanks (see Figure 158). It is an element relating to the post-closure phase and housed an engine and carriages for a narrow gauge railway which formed part of A R Marr Pty Ltd's operation of the site. A site plan prepared in the 1970s showing works relating to the proposed reuse of the site outlines the sites of both Building 33 and 34 and annotates the drawing 'replace demolished buildings'.[31]

Description & Integrity

The storage shed is of steel frame construction over an earlier brick base and is similar in scale to a domestic garage with corrugated galvanised steel cladding on the walls and roof. It has a tilt-up metal garage door and is presently used for timber storage. It is in good condition.

31 Site plan held in the collection of the ACT Heritage Library, Woden ACT.

6.3 Demolished structures

The 1986 *Conservation Plan* provides background information, with varying degrees of detail, on a number of structures associated with the development of the brickworks. As well as a number of structures relating to the establishment phase of site, it is noted that there were also structures relating to the post-war phase of development. These include a clay storage shed, carpenter's workshop, oil and coal bunkers, weighbridge and a forklift shed, demolished since the 1986 *Conservation Plan*. They are described briefly below. While the significance of these later demolished structures is considered to be relatively limited, they should be investigated as part of a broader archaeological assessment of the site and abutting land. Refer to Chapter 8.

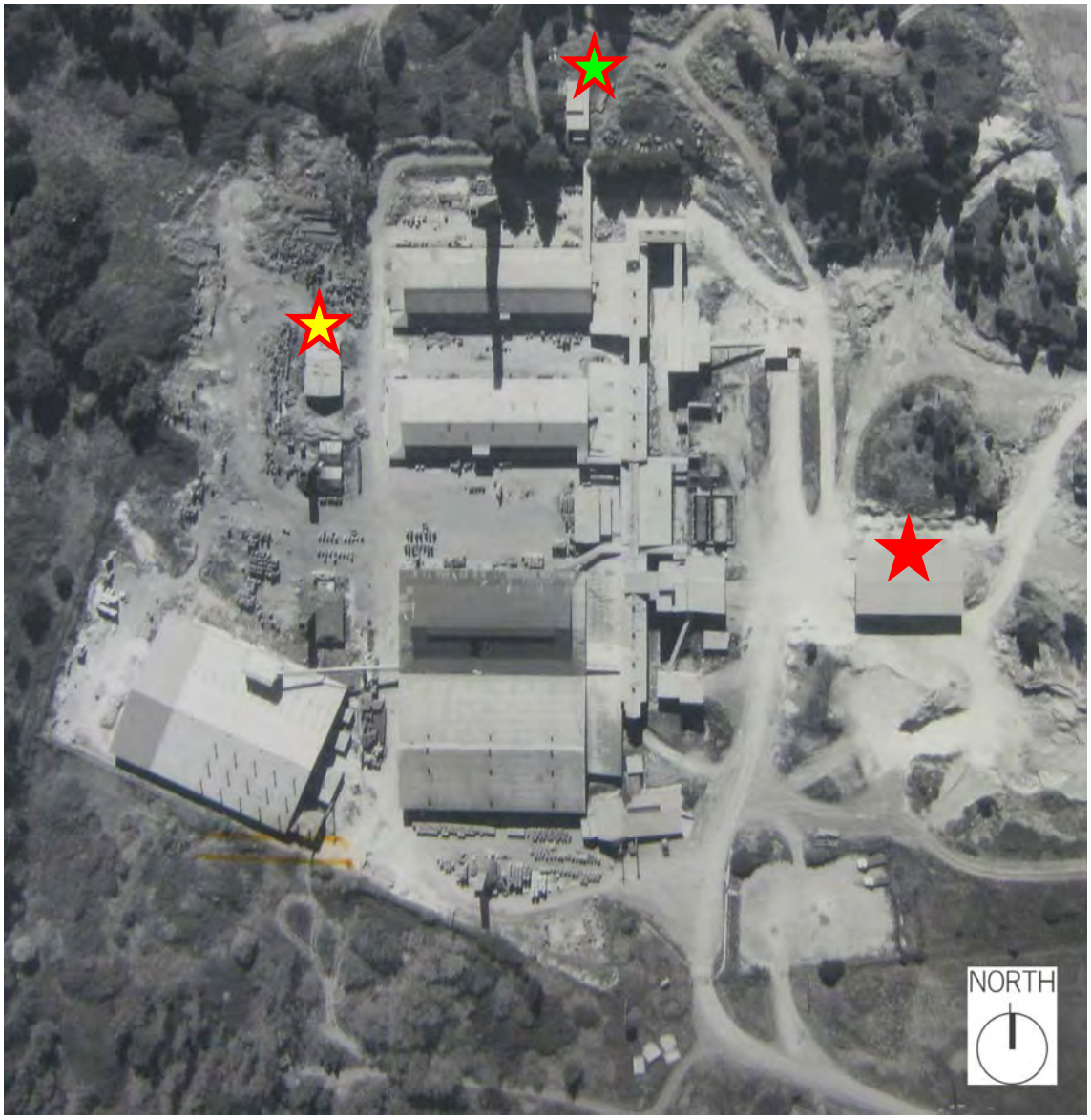

Figure 160 Aerial photograph, 1976, with the following later site elements indicated; clay storage shed (red star); coal storage bunker (red/green star) and former forklift shed (red/yellow star).
Source: ACT Heritage Library, Woden.

6.3.1 *Clay storage shed*

The storage shed was located within the quarry area to the immediate east of the brickworks. It stored clay, bought to the site by trucks prior to crushing. It is visible in 1976 aerial photograph of the site (see Figure 160).

6.3.2 *Coal storage bunker*

The coal storage bunker was located on an elevated site to the north of the Hardy patent kiln II chimney stack (Building 13), as indicated at Figure 160. The site today forms part of the Lane Poole Place housing complex and is outside the study area.

6.3.3 *Former forklift shed*

The forklift shed was extant at the time of the compilation of the 1986 *Conservation Plan*. The building was constructed in c. 1965 to house forklifts and replaced an earlier shed structure. The forklift shed was a brick structure with a corrugated galvanised steel roof. The structure contained a petrol bowser linked to a large underground tank sited between the shed and the fan house associated with the Hardy patent kiln I (Building 9). The description of the building provided in the 1986 *Conservation Plan* noted that it was in poor condition. The site of the building today is overgrown with little evidence of its form, apart from some remnant brickwork and rubble (Figure 161). As noted, the structure replaced an earlier shed building, the date or purpose of which is not known.

Figure 161 The approximate site of the former forklift shed indicated by the arrow.

7.0 ASSESSMENT OF SIGNIFICANCE

7.1 Introduction

The following assessment of cultural heritage significance for the Canberra Brickworks includes:

- a comparative analysis of related urban brickworks sites;
- an assessment of the historical and technological values of the site as an evolved brickmaking complex of the early to mid /late twentieth century;
- an assessment of the site in the context of the establishment and early history of the Australian Capital Territory (ACT) and the national capital (Canberra);
- a description of the identified scientific (geological) values of the place;
- an assessment of the aesthetic values of the place;
- a consideration of the issue of social values that may attach to the place;
- an assessment of the brickworks against the ACT Heritage Significance Criteria, and the National Heritage List criteria; and
- a new Statement of Significance for the site based in part on the existing statement in the ACT Heritage Register.

7.2 Comparative analysis

7.2.1 *Late 19th and 20th century urban brickworks in Australia*

Brickworks were once a common feature of Australian urban landscapes. The introduction of continuous kilns from the 1870s saw the replacement of small-scale enterprises with larger works of which the Canberra Brickworks is an example. As noted in Chapter 2, the development of the continuous kiln marked a major shift in firing technology, enabling mechanised production on an industrial scale, and signalling the end of the era of small-scale brick manufacturers. The increased speed of the brick making process also encouraged the mechanisation of brick preparation, and improvements in related technologies and processes, including brick presses.

Brickyards with continuous Hoffman-type kilns proliferated from the late-nineteenth century to the interwar period. These yards closed progressively from the end of World War II, with further waves of closures in the mid-1960s, and in the 1980s. The majority of these sites had been demolished by the 1990s.[149] Today, there are no Hoffman-type or 'patent' continuous kilns in operation as originally designed in Australia (other than a single example at Bowral which has been modified to operate as a downdraught kiln).

The following section provides an overview of brickworks in major Australian cities that include, or previously included, continuous kilns. The majority of these sites are either redundant, disused or have been adapted to an alternative use. Brickworks that have been demolished in their entirety and redeveloped are not included. Every effort has been made

149 Pers comm., Stephen Wall, NSW Manufacturing Manager, Austral Brick Co Ltd, and Adam Mornement, Lovell Chen, 10 February 2010.

to confirm the currency of the information provided, however with the exception of the Victorian examples and one example in South Australia, none of the sites have been inspected as part of the review. The comparative analysis describes brickworks complexes.

It does not include potteries or facilities that produced other fired products (tiles, piles and the like). See Figure 165.

New South Wales

Goodlet and Smith Brickworks (fmr)150, Granville, Parramatta

In 1884 hardware and building supplier Goodlet and Smith acquired the Junction Brick Company Ltd at Granville, west of Sydney. Production of building products, including bricks, finials, tiles and capping, and pottery, continued at the works until 1985.[151] Early development of the brickworks included a Hoffman kiln with a 45m-tall stack and associated technologies and support structures.[152] By the early twentieth century, the brickworks had evolved to become one of the largest in the Sydney region.

In 2002, infrastructure related to brick production at the site included the Hoffman kiln, by then truncated and adapted to two long downdraught kilns, with an associated stack; two downdraught kilns; two stacks; a conveyor; brick maker's smithy; and ancillary buildings, including the old tile works.[153]

These elements have been retained and integrated into the 'Brickworks Square' interpretive component of the Holroyd Gardens residential development (Delfin Lend Lease). The former quarry has been filled.

150 The former Goodlet and Smith Brickworks have also been known as Junction, Merrylands and Granville brickworks.

151 Ron Ringer, *The Brickmasters, 1788-2008*, pp. 75-77.

152 Ron Ringer, *The Brickmasters, 1788-2008*, p. 77.

153 Eric Martin and Associates, 'Former Goodlet & Smith Brickworks as part of the Holroyd Gardens Development: Heritage Report & Statement of Heritage Impact for the Heritage Precinct Buildings,' July 2002.

Figure 162 The Holroyd Gardens redevelopment at the former Goodlet and Smith Brickworks, pictured 2008.
Source: Flickr

Figure 163 Interpretive signage and industrial relics at the former Goodlet and Smith Brickworks, pictured 2008.
Source: Flickr.

Bedford Brick Works (fmr), St Peter's, Sydney

The Bedford Brick Works (also known as the Josiah Gentle Brickworks) was among the largest in the St Peter's district, which was the centre of Sydney's brickmaking industry from the 1840s. The complex was established in 1893, and taken over by the Austral Brick Company in 1933. It closed in 1970.[154] At its height (c. 1930s), the Bedford Brick Works included two Hoffman kilns, one with curved ends and a centralised stack, the other with a squared ends and a stack attached at the south end. The later 'Hoffman' has been described as a Hardy patent kiln.[155] The site also included six downdraught kilns in two clusters, brick sheds, a site office/entry building and machine shed, with a clay pit to the north (see Figure 164).

The site has been conserved within a public open space (Sydney Park). One of the downdraught kilns and the west end of the Hoffman kiln with rounded ends has been demolished to accommodate a road widening scheme. The site office/entry has also been removed. The Hoffman (Hardy patent?) with squared ends, five downdraught kilns, a crushing mill and boiler house have been retained.[156]

The four surviving chimney stacks at the site have a strong presence in the local streetscape (see Figure 166). The site is included in the South Sydney Amending Local Environmental Plan, 2000.

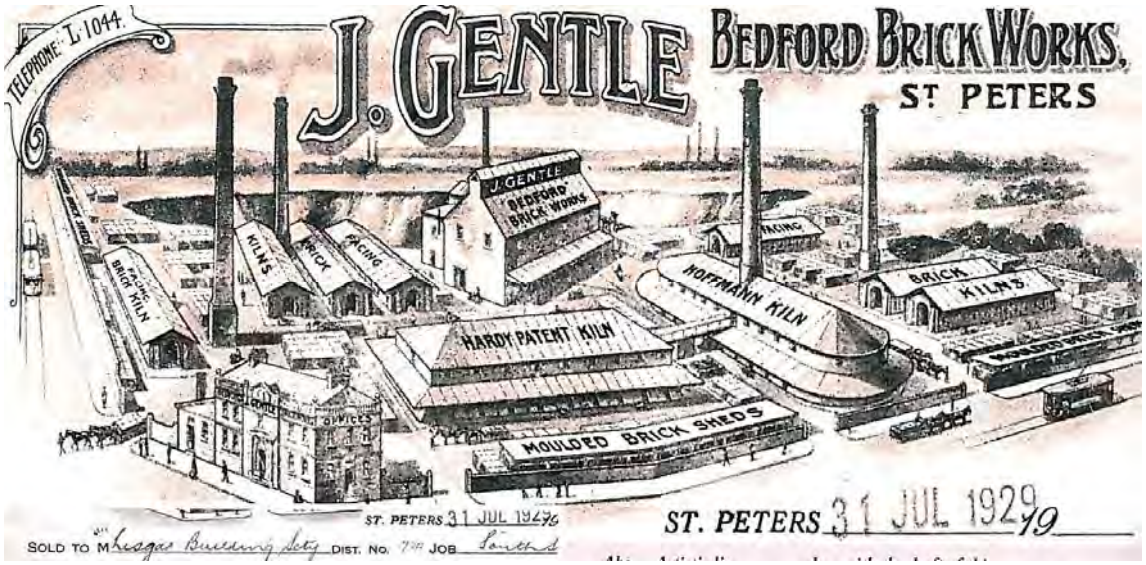

Figure 164 Letterhead for Bedford Brick Works, 1929.
Source: Ron Ringer, *The Brickmasters*, 1788-2008, p. 166.

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154 Anne-Maree Whitaker, 'Sydney Park [2008]' www.dictionaryofsydney.org, accessed 15 January 2010.

155 Dictionary of Sydney online, 'Bricks', entry by Ron Ringer, www.dictionaryofsydney.org, accessed 9 February 2010. See also Figure 164.

156 Otto Cserhalmi & Partners Pty Ltd Architects, *Sydney Park, Brick Kiln & Chimney Precinct, Repairs & Remediation Study*, Stage 1 Return Brief, February 2007, p. 3.

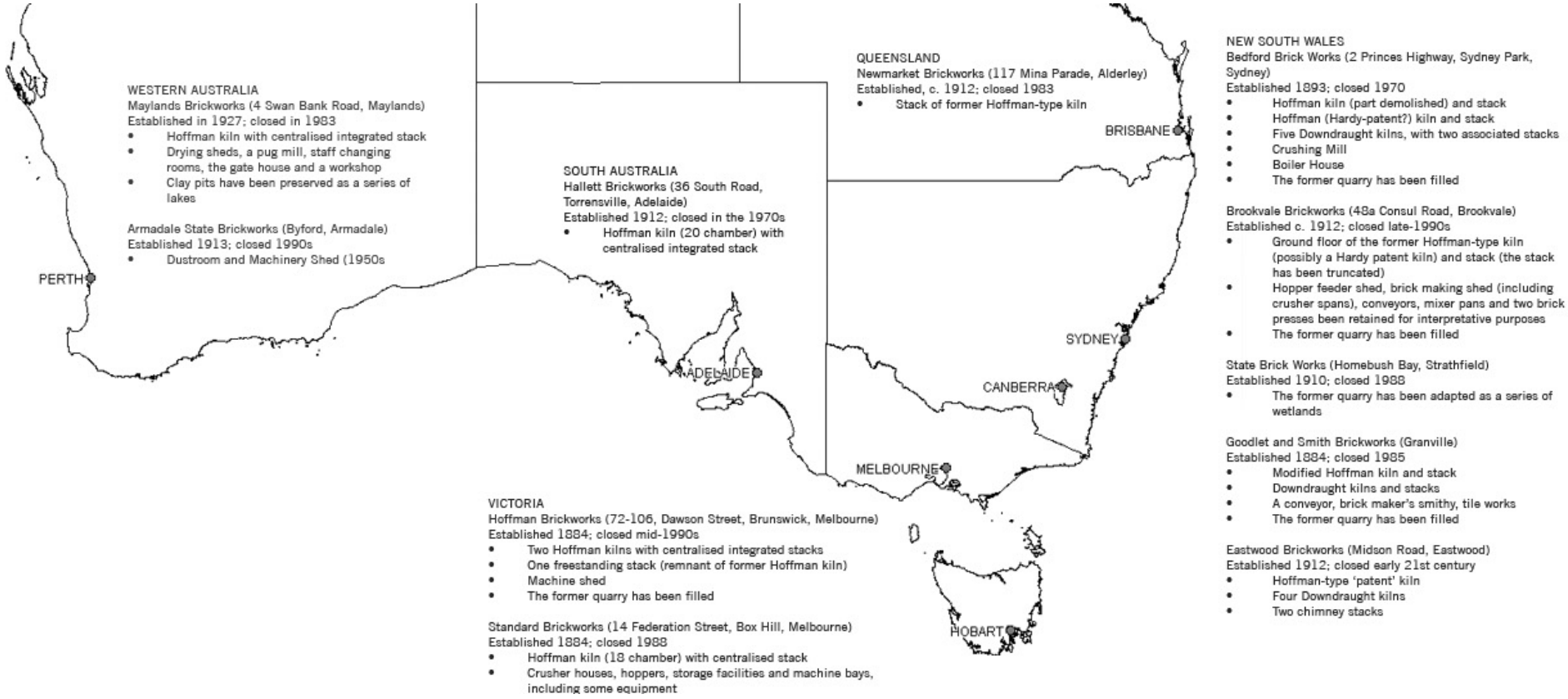

Figure 165 Surviving brickworks in Australia with continuous kilns dating to the late 19th and early 20th century. Note, there are no sites in northern WA, the Northern Territory and northern Queensland.

Figure 166 Stacks of the former Bedford Brick Works, with Sydney Park in the foreground, pictured 2008.
Source: Flickr.

Brookvale Brickworks (fmr) Brookvale

The Manly Brick and Tile Company built the Brookvale brickworks from 1910-12. The company was taken over by Brickworks Ltd in 1936. Austral managed the plant from the end of World War II to the late-1990s.[157]

At its height, the Brookvale Brickworks included six downdraught kilns, located to the north and west of the site, and a large Hoffman-type kiln, with a square stack attached at one end (see Figure 167).[158] The arrangement of the Hoffman kiln is the same as the kiln at the Bedford Brickworks (fmr), which has been described as a Hardy patent kiln.

157 'The Kilns' development, www.thekilns.com.au, 'History of the site,' accessed 19 January 2010.

158 'The Kilns' development, www.thekilns.com.au, 'History of the site,' accessed 19 January 2010.

Figure 167 Brookvale Brickworks prior to redevelopment (undated).
Source: Warringah Image Library.

Figure 168 The adapted/redeveloped kiln and truncated stack at Brookvale Brickworks.
Source: www.marchesepartners.com.au

Following the closure of the brickworks in the late 1990s, and a CMP prepared by Pratten and Irving (1996), consent was granted for the re-zoning of the site[159] and its redevelopment as 71 townhouses and apartments. All the kilns have been demolished, with the exception of the lower section of the Hoffman-type kiln and the stack, whose height has been reduced by 11m from c. 50m (see Figure 168).[160] In addition, a hopper feeder shed, brick making shed (including crusher spans), conveyors, mixer pans and two brick presses been retained for interpretative purposes.

The site is included in the Warringah Local Environmental Plan, 2000 (listing number 80984).

State Brickworks (fmr), Homebush Bay, Strathfield

In 1910, Arthur Griffith, NSW Minister for Public Works, proposed the establishment of a Government brickworks that could produce cheap bricks and break the monopoly of private manufacturers. A 9.5ha site was purchased at Homebush Bay (also referred to as the Enfield Brickworks) and the site was operational by the end of the following year. Three Hoffman-type kilns were constructed in the first phase of development at the State Brickworks. The site was subsequently expanded (c. 1920) with the acquisition of 9.2ha, and construction of five further Hoffman kilns and six open kilns. Production continued intermittently at the State Brickworks until 1988.161 Clay extraction at the site ceased in the 1960s, from which point the brick pits were used as a municipal waste depot. [162]The former brick pits were developed as a freshwater wetland during preparations for the Sydney 2000 Olympics. The Enfield Brick Pits are included in the Strathfield LEP (1999), listing number 256.

Eastwood Brickworks (fmr), Parramatta

The Great Northern Brick Co Ltd established the former Eastwood Brickworks in 1912, to produce dry press bricks using locally available shale. A brickmaking shed and Downdraught kilns (possibly two) were built soon afterward. Expansion from the 1920s saw the addition of a 'patent' kiln, an additional Downdraught kiln, three grinding pans, and four Platt, one Clayton and two Whittaker presses. A 2002 description of the site referenced five Downdraught kilns, one Hoffman-type continuous 'patent' kiln and two chimney stacks.[163]

The Hoffman-type kiln at the former Eastwood works appears likely to have been the last operational kiln of its type in Australia, ceasing operations at the beginning of the twenty-

159 The area occupied by the former brickworks has been re-zoned Residential 2(e); the land surrounding the brickworks has been designated an Environment Protection 7(a) zone. Brookvale Brickworks and Surrounds – Draft Land Use Study, report to the Strategy Committee Meeting, Warringah Council, 27 May 1997. See, www.warringah.nsw.gov.au/council/documents/81270597.pdf, accessed 19 January 2010.

160 Minutes of the Heritage Council Approvals Committee [NSW], 17 May 2001, item 7.1.

161 Ron Ringer, *The Brickmasters, 1788-2008*, p. 353.

162 Sydney Olympic Park, www.sydneyolympicpark.com.au, 'State Brickworks: 18901-1988,' accessed 19 January 2010.

163 Eric Martin & Associates, 'Eastwood Brickworks Project: Heritage Report,' 2002.

Figure 169 Continuous kilns at State Brickworks, pictured 1957.
Source: NSW Heritage Register.

Figure 170 Continuous kilns at State Brickworks, pictured 1957.
Source: NSW Heritage Register.

first century (by then the site was commonly known as the Austral Brickworks).[164] The site is being developed for housing, including the filling of the former shale pit. The patent kiln

164 Pers comm., Eric Martin of Eric Martin & Associates, and Adam Mornement, Lovell Chen, 4 February 2010.

and four of the Downdraught kilns are to be stabilised and retained as interpretive elements.[165]

The site is included in the Parramatta Council Local Environment Plan 2001 as a Heritage item. (See Figure 171)

Figure 171 Recent aerial view of Eastwood Brickworks (fmr).
Source: Google Earth.

165 Pers comm., Parramatta City Council planning department, and Adam Mornement (Lovell Chen), 11 March 2010.

Figure 172 Recent aerial view of Bowral Bricks.
Source: Google Earth.

Bowral Bricks, Bowral, Southern Highlands (operational)

Bowral Bricks was established in 1922,[166] and grew expanded into the major enterprise it is today (see Figure 172). A Hoffman-type kiln with a centralised integrated stack was constructed at the works (date unknown), and has subsequently been converted internally to two downdraught kilns. Externally, the kiln has 22 openings to chambers.[167] (See Figure 172)

Queensland

Newmarket Brickworks (fmr)

In c.1912, the Brisbane Brick and Builders Supply Co Ltd constructed a Hoffman kiln at the Newmarket brickworks, outside Brisbane. The kiln was built with a 50m-high stack with a

166 Bowral Brick, www.bowralbricks.com.au, 'History,' accessed 8 February 2010.

167 Pers comm., Stephen Wall, NSW Manufacturing Manager, Austral Brick Co Ltd, and Adam Mornement, Lovell Chen, 10 February 2010.

square plan, located approximately 15m from the kiln. This follows the model of the Hardy-patent and Staffordshire kilns at the Canberra Brickworks.

The Newmarket Brickworks closed in the 1970s, and was redeveloped for alternative industrial uses from 1987. The stack was retained, but all other elements at the site demolished. The chimney stack is identified as an Indicative Place in the RNE (ID 101989), and included in the Queensland Heritage Register (Place ID 601357).

Figure 173 Panorama of Newmarket, c. 1925, with brickworks chimney visible to the left.
Source: State Library of Queensland.

Figure 174 Hoffman stack at the former Newmarket Brickworks.
Source: Queensland Heritage Register.

South Australia

Hallett Brickworks (fmr), Torrensville, South Australia

The Hallett Brickworks was established by Hallett Brick Industries at Torrensville in 1912. A 20-chamber Hoffman kiln, with rounded ends and centralised stack (circular), was built at the site later that year. It is believed to have been the first of its kind in South Australia. The kiln operated until 1975.

Since 1983, the former brickworks has operated as a market ('Brickworks Market'), which is open on Fridays, Saturdays, Sundays and public holidays. The kiln has been adapted to accommodate stalls and the like over two levels.[168] All machine sheds and ancillary buildings have been demolished.

Hallett Brickworks is included in the South Australian State Heritage Register.

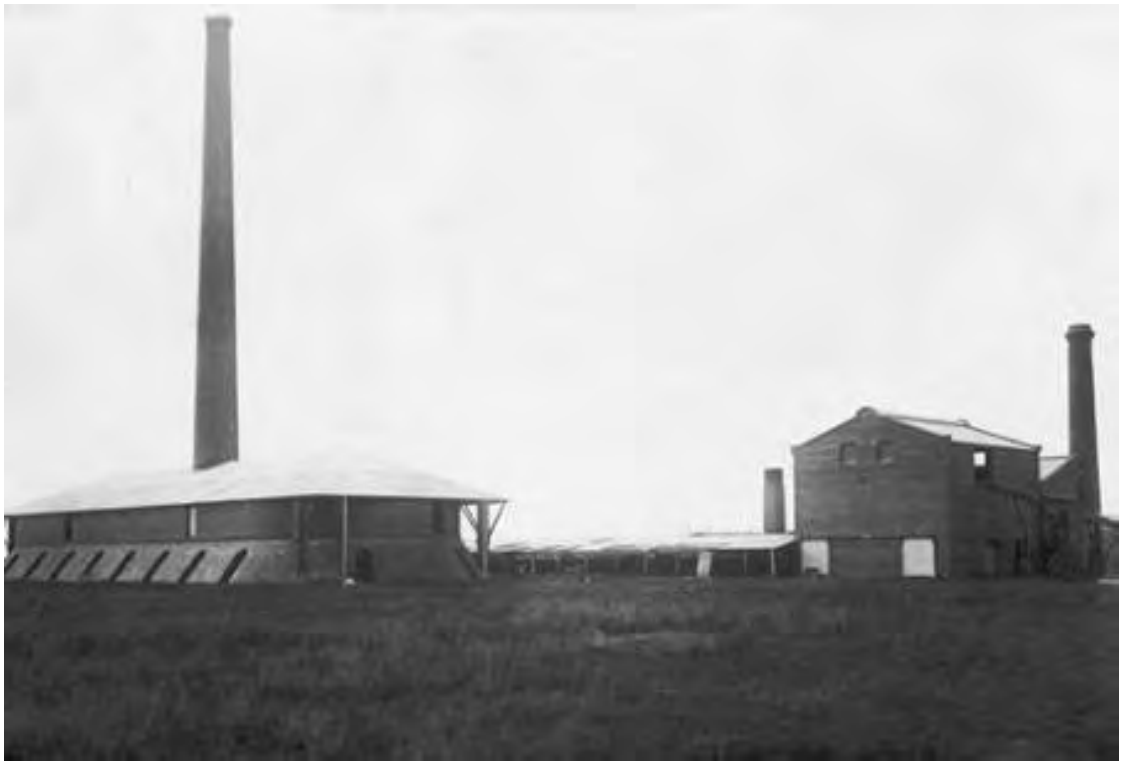

Figure 175 Hallett Brickworks (undated).
Source: www.brickworksmarket.com.au

168 Brickworks Market, 'History,' www.brickworksmarkets.com.au, accessed 18 January 2010.

Figure 176 Brickworks Market (January 2010).
Source: Lovell Chen

Figure 177 Brickworks Market (January 2010).
Source: Lovell Chen

Victoria

Hoffman Brickworks (fmr), Brunswick, Victoria

The Hoffman Patent Brick and Tile Company was established at premises in Albert Street, Brunswick in 1870. The company held the patent rights to import the Hoffman kiln. In 1884 the company established premises at Dawson Street in Brunswick (the Albert Street premises were subsequently vacated). Production at the Dawson Street plant ceased in the mid 1990s.

From 1884 the Hoffman Patent Brick and Tile Company built the following at its Dawson Street works: three elliptical Hoffman kilns (16, 18 and 20 chambers) with integrated stacks and associated technologies, including clay grinding sheds, brick pressing sheds, stores and warehouses. Pottery works and related facilities, including small circular bottle pottery kilns (demolished) were located to the east of the site. A clay pit was located to the north of site.

Land to the north of the kilns at the Hoffman Brickworks has been adapted as a residential development. As part of the adaptive reuse of the site, the northern-most Hoffman kiln has been demolished; only its stack survives. The two surviving kilns, and the former engine house, brick pressing shed and grindings sheds to the west of the site have been retained and approval has been given for their conversion for residential use. The Hoffman Brickworks site is included in the Victorian Heritage Register (H0703).

Figure 178 Hoffman Brickworks, 1930s.
Source: State Library of Victoria.

Figure 179 Former Hoffman works at Brunswick, pictured January 2010.
Source: Lovell Chen.

Figure 180 Former Hoffman works at Brunswick, pictured January 2010.
Source: Lovell Chen.

Figure 181 Hoffman kiln at the former Standard Brickworks, pictured in January 2010. Source: Lovell Chen.

Figure 182 Former machinery sheds at the former Standard Brickworks, January 2010. Source: Lovell Chen.

Standard Brickworks (fmr), Box Hill, Victoria

The former Standard Brickworks at 14 Federation Street, Box Hill, Victoria operated from 1884, as the Haughton Park Brick Company, until its closure in 1988. From 1913 until 1938, the site was owned and operated by the Standard Brick and Tile Company and it was during this period that the majority of existing buildings and fabric were completed.

An 18-chamber Hoffman kiln with a centralised integrated stack (circular) was built in c. 1913. Four brick presses were installed at the same time.[169] As existing, the site includes crusher houses, hoppers, storage facilities and bays, including some equipment. Despite a number of proposals for adaptive reuse/development, the site remains disused and the buildings are in poor condition, having been subject to extensive vandalism and graffiti. The ground level openings to the kiln have been boarded up.

The Standard Brickworks site is included in the Victorian Heritage Register (VHR H0720).

Western Australia

Armadale State Brickworks (fmr), Byford, Armadale

The State Brickworks at Armadale was established in 1913, following the *Government Trading Concerns Act* of 1912. The site operated intermittently until the 1990s. The Brickworks had been in private ownership since 1961.[170]

A Hoffman kiln with integrated stack was built at the Armadale works in 1913-14. The next major phase of development was in the early post-WWII period, when 'No. 2 Pressed Brickworks' and 'No. 3 Wire-Cut Brickworks' were constructed at the site. Two 'Zigzag' kilns, a form of transverse arch continuous kiln, were constructed at the site during the post-WWII period.[171] No.2 Brickworks, which included a dustroom and machinery shed, replaced the earlier facility.

All kilns at the site have been demolished. Only the Dustroom and Machinery Shed, built during the 1950s, survive. The machinery associated with these structures is also extant. The Dustroom and Machinery Shed are included in the Heritage Council of Western Australian Register of Heritage Places (place ID 15829). The site was included in the National Trust of Australia (WA) list of endangered heritage sites for 2008.

169 Victorian Heritage Database, Former Standard Brickworks citation, VHR no. 0720.

170 Heritage Council of Western Australia, Register of Heritage Places, Armadale State Brickworks Dustroom & Machinery Shed citation, place ID 15829.

171 A 'Zigzag' is a type of continuous kiln invented in Germany during the 1920s. It features a long fire zone advanced by suction fan. See, www.hablakilns.com/industry.htm, accessed 3 February 2010.

Figure 183 Armadale brickworks c. 1905.
Source: State Library of WA.

Maylands Brickworks (fmr), Maylands, Perth

The Maylands Brickworks was developed by Messrs Atkins and Law from 1927.

The first phase of development included a Hoffman kiln and drying sheds, pug mill and brick making extruder. The plant was expanded in 1936, with an additional Hoffman kiln, pug mill and drying sheds. As existing the site includes one Hoffman kiln with 18 chambers and centralised integrated stack (34m high). The second kiln was demolished following damage sustained during the 'Meckering' earthquake of 1968. Brick production ceased at the site in 1983.[172]

The kiln, stack and some ancillary buildings have been preserved. The site is included in the Heritage Council of WA database (no. 2410), and the Register of the National Estate, as an Indicative Place (ID 17340), in response to a public outcry against a proposal to develop them for residential use.[173]

172 Heritage Council of Western Australia, Register of Heritage Places Assessment Documentation, place no. 2410 (Maylands Brickworks).

173 Heritage Council of Western Australia, Register of Heritage Places Assessment Documentation, place no. 2410 (Maylands Brickworks).

Figure 184 Maylands Brickworks, 1950s.
Source: State Library of WA.

Figure 185 Recent shot of the Hoffman kiln and integrated stack at the former Maylands works.
Source: Flickr

Midland Brick, Bassett Road, Middle Swan

Midland Brick is a major brick production company located at Middle Swan, north of Perth. It was established in 1946 by brothers Ric and Gerry New, and has operated consistently since that time. The first kiln at the site was built in 1946. This may have been a Downdraught kiln, but this has not been established. The first of nine tunnel kilns at the site was constructed in 1962. The most recent (Kiln 11) was completed in 2006. The site covers an area of 100ha, and the company claims to produce approximately 60 per cent of WA's total brick output. [174]

7.2.2 *Conclusion*

Each of the surviving complexes identified above has particular qualities and characteristics, including kiln types, dates of construction and expansion, retention of plant and other attributes, and on this basis it is difficult to draw direct comparisons between them.

Accepting this, it is evident that the brickworks at Canberra is now one of a relatively small number of surviving sites which are able to demonstrate aspects of the operation of large-scale twentieth century urban brickworks. Compared with the majority of other sites reviewed, the Canberra site retains more evidence of the brick making processes, site layout and principal building components typically found on such sites, albeit expressed through a range of buildings of vastly different dates of construction rather than a coherent complex of elements constructed in one or more key phases. Conversely, the ability of the site to meaningfully demonstrate some of these processes has been compromised by the removal of the majority of the manufacturing plant itself (crushing and pressing plant). While through their form and construction, the kilns themselves (together with their related structures, fan houses and stacks) are evocative of the process that occurred within them, this is not the case for the simple steel-clad machinery bays, following the removal of the brick presses and other machinery and plant they accommodated. Only remnants of the conveying systems (conveyors and hoppers) remain in these buildings in a form that can be readily understood. The crusher houses similarly have had the majority of their plant removed.

In considering the kiln types remaining on site, in summary, the continuous kilns (Staffordshire and Hardy patent) sit within what is a now relatively limited group of surviving kilns – predominantly of the early to mid-twentieth century - which are either of or are based on the Hoffman continuous kiln typology. Within Australia there are now approximately 12 surviving kilns of this type, including Hoffmans, Hardy patent and others. Within the typology of continuous kilns the Staffordshire kiln was a rare – if not unique - design in Australia and is the only surviving example of this design. On this basis it is considered to be of additional interest.

Downdraught kilns of varying ages and design are found at a number of brickworks and related sites across Australia including three at the Sydney Park site and a number at the Bristile site in Perth. They are not rare as a building type.

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174 Midland Brick, 'About Midland Brick,' www.midlandbrick.com.au, accessed 3 February 2010.

7.3 Historic value

Historic value is defined in the guidelines to the Burra Charter as follows:

> Historic value encompasses the history of aesthetics, science and society, and therefore to a large extent underlies aesthetic, social and scientific value. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives *in situ*, or where the settings are substantially intact, then where it has been changed or evidence does not survive. However, some evidence or associations may be so important that the place retains significance regardless of subsequent treatment.

The Commonwealth Brickworks at Yarralumla was developed specifically to facilitate the construction of Canberra. The complex provides evidence of the establishment of the city following the decision to construct the National Capital in the Yass-Canberra district in October 1908. Subsequent phases in the development of the brickworks, until its closure, reflect the broader political context that determined the ebb and flow of the construction of the Federal Capital, with major phases of the development in the 1920s and post-World War II period.

The decision taken in 1914 decision to construct Australia's new Federal capital in an isolated bushland setting necessarily was followed by discussions relating to the provision of essentials such as water, power (electricity) and construction materials. The outcomes, respectively, were the Cotter Dam and pumping station, the Kingston Power House and the Commonwealth Brickworks. The first of these to be constructed was the brickworks at Yarralumla, which was then able to supply bricks for the construction of the Kingston Power House complex. However, as noted at Chapter 3, the bricks from the temporary works disintegrated and a decision was made to clad the steel frame of the Power House in un-reinforced in situ concrete made with river gravel.[175]

Prior to the closure of the Canberra Brickworks it had been estimated that c. 600 million bricks were produced at the plant for the construction of Canberra.[176] Early Canberra landmarks constructed of locally produced bricks include the Hotel Canberra (1925), the Provisional Parliament House (1927, see Figure 187) and Albert Hall (1928). From 1923, the brickworks was linked to these sites by a narrow gauge railway (removed).

The foundation stone of Canberra was laid on 12 March 1913, making Canberra the only Australian state or territory capital with twentieth century origins. Its foundation post-dated the introduction of continuous kiln technology in Australia (1870s), which facilitated the firing of bricks on a massive scale. Continuous firing heralded the demise of small scale brick manufacturing works, particularly in urban areas where demand was greatest. Brickworks and potteries were a common feature of all nineteenth century settlements of scale, typically

175 Pers comm., Jocelyn Jackson, Project Director/Architect for the adaptive reuse of the Kingston Power House, Tanner Architects, and Adam Mornement, Lovell Chen, 3 February 2010.

176 Lester Firth Associates Pty Ltd, *Old Canberra Brickworks, Conservation Plan*, June 1986, Section 2.1.4 (Post War Growth). The source for this estimate is not cited.

being located adjacent to deposits of raw materials. The Brickworks at Yarralumla is the only facility of its type ever developed within Canberra's city boundary. It was replaced, in 1976, by a brickworks at Mitchell, north of the Federal Capital.

The Brickworks has also had a major part to play in the history of the local Yarralumla area. Along with the Westbourne Woods arboretum, the location and form of the Brickworks complex (the development of which predated Walter Burley Griffin's arrival in Australia) has clearly influenced the layout and historical development of the suburb in a physical/spatial sense. Additionally, the Brickworks has been a major employer in Canberra and while not investigated in the course of this report, it is reasonable to assume that many of the brickworks workers were local residents.

Conclusion:

The Commonwealth Brickworks is of historical significance at a Territory level as the first industrial or manufacturing facility constructed in the Australian Capital Territory and one of few early industrial complexes. This is in contrast with the other major Australian capital cities which have a more varied history of industrial and manufacturing activity and retain a range of surviving industrial buildings and complexes of different ages and types.

The site is also of significance for its role in the history and early development of Australia's national capital, Canberra, in the period to 1940. Bricks manufactured at the site were used to construct the majority of buildings in Canberra, including the major public buildings of the early period, such as Parliament House, the Hotel Canberra and many others.

The site is also of local historical significance for its role in the history and development of the suburb of Yarralumla (known originally as Westridge), including as a major employer in the local area.

Figure 186 Kingston Power House, with brickworks railway in foreground.
Source: NAA.

Figure 187 Parliament House prior to rendering (1926), with brickworks railway in foreground.
Source: NAA.

7.4 Scientific value

7.4.1 *Introduction*

Scientific value is defined in the guidelines to the Burra Charter as follows:

> The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute to further substantial information.

For the purposes of this analysis, scientific value is considered to encompass both the geological values of the place, as well as issues of technology and the ability of the place to demonstrate manufacturing processes and technologies. These are discussed in turn.

7.4.2 *Geological significance*

The geology of the Canberra region has been the subject of extensive investigation and is well understood. It consists of a range of both sedimentary and volcanic rock types which are relatively common in south-east New South Wales. The main rock types are:

- Deep water sediments of late Ordovician and early Silurian age
- Shallow water sediments of middle to late Silurian age
- Volcanic rocks of middle Silurian to early Devonian age[177]

177 Lovell Chen, Nomination of Canberra to the National Heritage List: An examination of the merits,› prepared for the National Capital Authority, April 2008, pp. 85-88.

There are also minor outcrops of recent river gravels and stream deposits.

The issue of geological significance was recently considered as part of a broader assessment of Canberra against the criteria for inclusion in the National Heritage List. This assessment concluded that while the underlying geology of the city and surrounds are not of national significance when considered as a whole, there are a number of individual sites in the regional that are of a high order of significance. [178] These sites include the deep water sediments of late Ordovician and early Silurian age at the Ginninderra Road Cutting; and the Acton Limestone; the Coppins Crossing trilobite sites; and the Deakin Anticlines. The Canberra Brickworks pit was also noted as one of this group of individually significant sites. One site in the region was considered to be of national significance; this was the State Circle Cutting and Capital Hill unconformity beneath Parliament House. [179]

The site at Yarralumla was originally selected for development as a brickworks because of its readily available shale deposits. The shale was extracted from the quarry east of the brickmaking complex and was used in production at the site from 1913 to the mid-1930s, after which time, the raw materials were sourced elsewhere. Unlike many other disused quarries, or brickpits, the one at this site was not filled following its closure and a series of rock formations incorporating fossils remained exposed. As a result, from at least as early as the 1950s, the brickworks quarry was identified by geologists and became known more widely as a site where aspects of the local geology could be viewed and analysed.

The geological significance of the site derives from it being the 'type locality' of the Yarralumla Formation, the origins and characteristics of which are summarised in the recently published *Geological Guide to Canberra Region and Namadgi National Park* (Geological Society of Australia (ACT Division):

> During the Tabberabberan Cycle there were episodes of volcanism and these provided source rocks for continued sediment deposition into shallow seas. In the period 424-423 Ma the Yarralumla Formation (calcareous and tuffaceous mudstone and siltstone) was deposited within the Canberra Rift.
>
> These Yarralumla Formation sedimentary sequences are now evident in central Canberra, principally at the old Canberra Brickworks near Weston Park and on Red Hill but also at outcrops in the suburbs of Deakin, Hughes and in road cuttings along the Tuggeranong Parkway west of Curtin. The Yarralumla Formation (mudstone, siltstone, about 424-423 Ma) was deposited in a shallow sea following the eruption of the Mount Painter Volcanics (about 425-424 Ma), and at about the same as the eruption of the Deakin Volcanics (about 423-422 Ma).[180]

178 Lovell Chen, Nomination of Canberra to the National Heritage List: An examination of the merits,, prepared for the National Capital Authority, April 2008, pp. 86.

179 Lovell Chen, Nomination of Canberra to the National Heritage List: An examination of the merits,, prepared for the National Capital Authority, April 2008, pp. 86.

180 Geological Society of Australia (ACT Division), DM Finlayson (comp.). *A Geological Guide to Canberra Region and Namadgi National Park*, pp. 33-34.

The Yarralumla Formation is fossiliferous in places including brachiopods, trilobites, corals, bivalves, bryozoans, and crinoids.[181]

In geological terms a 'type locality' is a place at which a stratigraphic unit is typically displayed and from which it derives its name and/or the place where a geologic feature was first recognized and described. The brickpits at Yarralumla were identified as the type locality for the Yarralumla Formation by geologist A A Öpik as early as 1954 and again in his 1958 work for the Bureau of Mineral Resources (the precursor to Geoscience Australia), *Geology of the Canberra City District*.[182]

The Canberra Brickworks site is among Canberra's oldest identified Geological Monuments, having being designated as such by the Geological Society of Australia in the 1960s. The Brickworks pit site is complemented by another site, an outcrop in what is known as the Deakin Anticline, behind the Deakin Shopping Centre.

Together, the two sites are able to demonstrate the key characteristics of the Yarralumla Formation.[183]

Within the quarry, four specific locations (A, B, C D) have been identified which demonstrate particular aspects of the site and the Yarralumla formation (see Figure 189). These are mapped in Figure 188 as 12A, 12B, 12C and 12D. Of these, Sites A and D show excellent examples of anticline in calcareous siltstone and Site B shows a typical tuffaceous mudstone and siltstone of the Yarralumla Formation. Site C shows abundant fossils of mainly brachiopods [note, not *gracitiopods*], trilobites and crinoids preserved in a bedding plane.[184]

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181 G A M Henderson. Geology of Canberra, Queanbeyan & Environs; Notes to Accompany the 1980 1:50,000 Geological Map, AGPS (Bureau of Mineral resources, Geology and Geophysics), 1981, p. 5.

182 G A M Henderson, Commentary on the Coppins Crossing 1:10,000 Engineering Geology Sheet, Canberra, Canberra, Australian Capital Territory, Bureau of Mineral Resources, Geology and Geophysics, AGPS, Canberra, 1980, p. 27, referencing A A Öpik, *Geology of the Canberra City District*, Bureau of Mineral Resources, Australia, Bulletin 32, 1958. See also A A Öpik 'The Geology of the Canberra City District', in Canberra: A Nation's Capital (ed., H L White), Angus & Robertson, Sydney, 1954, p. 142.

183 DL Strusz, pers. comm. K Gray, Lovell Chen, 29 January 2010. Des Strusz is a geologist who retired from Geoscience Australia in 1996. Since his retirement he has been a Visiting Fellow at the Australian National University. He is a corresponding member of the International Sub-commission on Silurian Stratigraphy, has authored and co-authored a number of publications on the geology of the Canberra region and is a long standing member of the Geological Society of Australia. *A Geological Guide to Canberra Region and Namadgi National Park*, p. 139.

184 Register of the National Estate entry for Yarralumla Brickworks (extended area), Denman St, Yarralumla, ACT, Australia (file no. 101439).

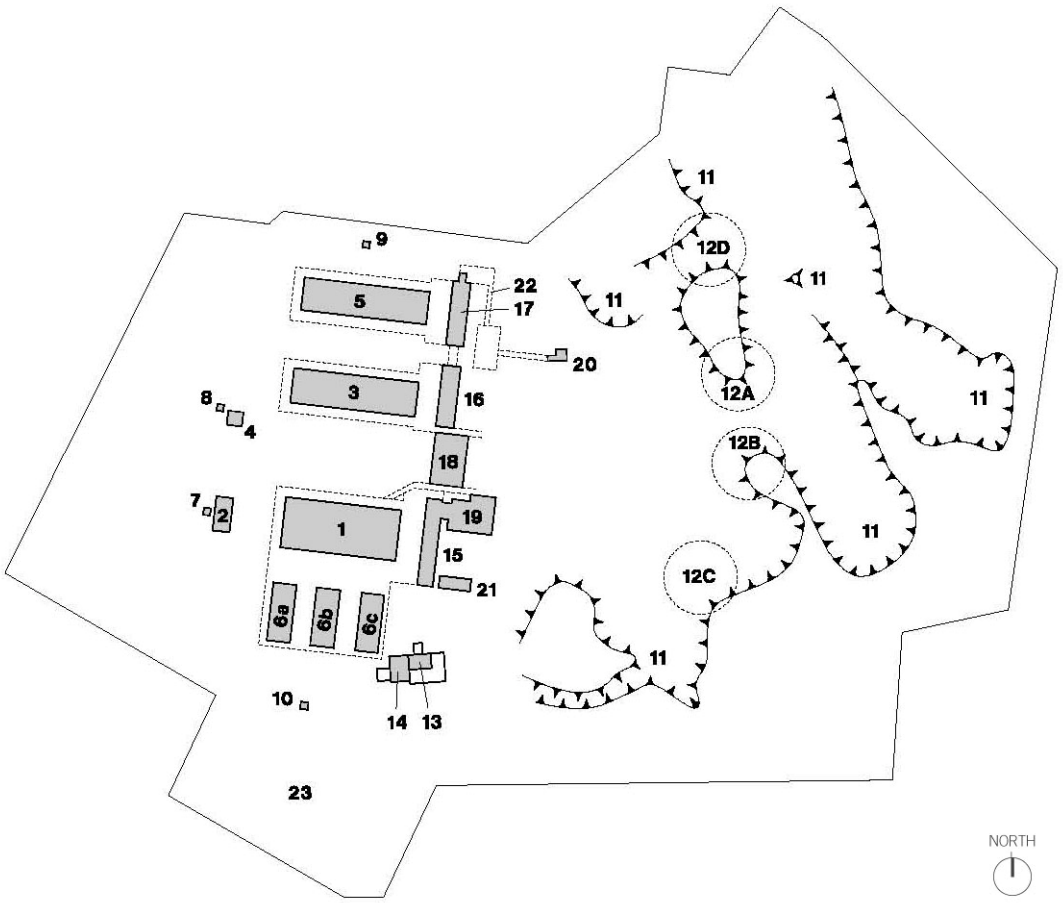

Figure 188 ACT Heritage Register plan of the site, showing the location of the specified geological features, 12A-12D.

Figure 189 Formations A (left) and B (right).

7.4.3 *Technological significance*

Ability to demonstrate

The technological significance of the Canberra Brickworks derives in part from the ability of the complex to demonstrate aspects of the manufacturing processes that occurred on the site. Refer to Chapter 2 for a description of these.

As noted, aspects of the brickmaking process as it occurred in the earlier period (1913-1940s) of the site's history remain legible through the overall site layout and key buildings and site elements remaining from the establishment and expansion periods, however the early crushing, grinding and pressing buildings have all been removed as has much of the associated plant.

To the extent that the majority of process buildings on the site from the 1950s through to the 1970s still remain (in addition to the earlier kilns, fan houses and stacks), more substantial evidence remains of the brick making processes as they occurred on the site in this later period. While the complex as it existed in this period is not complete (the Red Pan Room and the conveyor linking this with the Primary Crusher have been demolished), the majority of buildings and elements remain. Again, however, while sections of the conveying system and associated hoppers remain in the Machine Bays, the ability of the complex to demonstrate process has been diminished by the removal of the majority of manufacturing plant itself (crushing and pressing machinery).

The movement of processes across the site in a broadly east-west direction remains evident for both phases. In the first phase, this originated with the extraction of the shale from the quarry on the eastern half of the site, and its movement west across the site through the process buildings (now demolished) to the kilns. In the later phase, while the raw materials were sourced elsewhere and brought onto the site they were delivered (access to the site has always been in the vicinity of the current entry) into the area to the east of the Machinery Bays and were also stored within the quarry and so the processes occurred following a similar pattern across the site.

In considering the ability of the complex to demonstrate processes and layout, this relies on key characteristics of the layout of the site as well as the combination and arrangement of elements and the relationship between them. For example, an appreciation of the operation of the kilns themselves relies not just on the surviving kilns but also on their relationship with their associated fan houses and stacks. The location and form of the Machinery Bays and Crusher Houses and their relationship with the kilns demonstrate other aspects of the process. The large open spaces between the kilns are the brick yards and are also key to an understanding of process.

The surviving kilns and associated stacks and fan houses

Six types of kilns are known to have been constructed (or - as in the vase of the aborted tunnel kiln - partially constructed) at the Canberra Brickworks, of which three types survive: the Staffordshire, Hardy patent and Downdraughts kilns. Each type is of some technological interest as an example of brick kiln design, though they vary both in terms of the level of interest and their relative rarity.

Regardless of their specific design attributes, all three of the continuous kilns (Staffordshire and Hardy patent kilns) are considered to be of technological significance as increasingly rare

examples of such kilns. There are now thought to be in the order of 12 kilns of this typology nationally. Relatively few of these retain their associated fan houses and stacks (in many cases, stacks remain but fan houses are demolished). Furthermore, some of the kilns themselves appear to have been modified in the course of adaptation works (see, for example the Brookvale example). While altered to a greater or lesser extent during and after their working life, the Canberra examples are distinguished by the survival of their associated fan houses and are also assumed to retain all their associated underground workings (flues etc).

In addition, the Staffordshire kiln and its associated stack and fan house, is of particular interest on the basis it is understood to be the only surviving example of the type in Australia. There has been a suggestion that Staffordshire kilns were constructed at the State Brickworks at Homebush Bay, in 1911-12, but if this was the case, the kilns have now been demolished. Plans by the Australian Tesselated Tile Works to construct a Staffordshire kiln at its works in Mitcham, in Victoria appear not to have come to fruition.[185]

The intermittent Downdraught kiln, introduced in the late nineteenth century, quickly became popular. However, by the time of the construction of the three extant Downdraughts at Yarralumla (early 1960s), it was more commonly associated with smaller country works. These kilns are not rare and there are numerous examples surviving across Australia.

7.4.4 *Conclusion*

The Canberra Brickworks site as a whole is of historical and scientific (technological) significance for its ability to demonstrate aspects of brick production processes in the twentieth century. While individual brickworks varied in their layout and building forms, including variation in kiln types, there were common elements and building types and the majority of these (ranging in date from 1915 to the 1970s) are represented in some form or another at this site. When compared with other surviving complexes, the Canberra Brickworks retains a relatively greater range of production and ancillary buildings, though crusher houses, power houses and the like also remain on a number of other former brickworks sites. Importantly, other than for the conveying system, the Yarralumla site has had the majority of its plant and machinery removed, diminishing its ability to demonstrate key aspects of the brick making process and the associated technologies.

The individual kilns themselves are of varying levels of technological interest and significance as examples of kiln design.

- The Staffordshire kiln (completed 1915) is the only known example in Australia of this particular type of continuous kiln. It is of interest for its design which through a relatively complex system of dampers and flues offered more control and flexibility than earlier types.

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185 Based on a review of historic photographs. A letter from R E Odd, patentee of Staffordshire and Manchester continuous brick kilns in Australia, to Andrew Christie, Consulting engineer who inspected the new Homebush kilns in association with P T Owen, Director-General of Works for the Federal Capital, dates 21 July 1911,refers to the Mitcham kiln. A copy of the letter is included in Lester Firth Associates (1986), Staffordshire Kiln, c. 1916 Data Sheet (unpaginated).

- The Hardy patent kilns are considered to be of a lesser order of technological significance, though they are of interest as an example of a patented variation on the Hoffman kiln design originating from the late nineteenth century. There are a number of examples of Hoffman and patent kilns dating from the first half of the twentieth century in Australia. Of the two kilns the later one (Kiln 3) is more intact.
- The three downdraught kilns are of limited technological interest. They are relatively late examples of this type of intermittent kiln design and there are numerous other and earlier examples surviving elsewhere.

The fact that three different kiln types exist on the one site is of interest but is not considered to be of particular technical or technological significance. The sequence of kiln types constructed on the site over its 63-year history does not reflect in any sense any progression or advancement in kiln design; both the Hardy patent kilns and the downdraught kilns were long-established kiln types when constructed on this site.

The Canberra Brickworks site is considered to be of scientific (geological) significance as the type locality for the Yarralumla Formation, a major sedimentary sequence dating from the Silurian Period, 424-423 million years ago. The rock units at the site provide the reference section for comparison of other outcrops within the Yarralumla Formation and in this context are of both research and educative value.

7.5 Aesthetic value

Aesthetic value is defined in the guidelines to the Burra Charter as follows:

> A place may have aesthetic value because of the form, scale, colour, texture and material of the fabric; the smell and sounds associated with the place and its use.

In 1912, when the Commonwealth Government acquired the site of the brickworks, the site was located in a gently undulating agrarian landscape. The site acquired for the brickworks in 1912 comprised a gentle hill, rising from the south-east and sloping down to the north-west. The brickworks were developed to the north-west of the incline, concealing the site in views from the south and east (see Figure 190) and this remains the case today. In the immediate vicinity, while the viewer is aware of the site to a greater or lesser degree, depending on the vantage point, the site does not have a particularly strong visual presence or aesthetic quality beyond its site boundaries. The one exception is the 1953 chimney which is a prominent element in the immediate vicinity and a marker for the site.

In more distant views comparatively flat landscape leading to the Molonglo River allows some limited glimpses to the site from the north shore of Lake Burley Griffin and Black Mountain (see Figure 191, Figure 192 and Figure 193). The taller chimney stack (Building 13 built 1953) is visible in these views from the north shore of the Lake (refer Figure 193) but is not considered particularly prominent in such views.

The aesthetic qualities of the complex are generally experienced from within the site itself and relate to the robust industrial quality of the buildings, particularly as expressed through the scale and distinctive forms of the kilns and chimneys and to a degree also through the materiality of the building complex as a whole (predominantly a combination of red brick and corrugated iron). The quarry itself also has a particular aesthetic quality, deriving from the combination of open landscape and striking exposed rock outcrops.

Figure 190 View of site from crest of hill on Denman Street.

Figure 191 Distant view towards Canberra Brickworks from Telstra Tower, Black Mountain.

Figure 192 Detail view.

Figure 193 Canberra viewed from the north bank of Lake Burley Griffin. The 1953 stack at Canberra Brickworks and Parliament House are highlighted.

While residential and other development abuts to the site to the east and north, the landscape both within and beyond the site boundaries to the south and west has an open woodland quality. The understated siting of the complex and the relatively open landscaped nature of this setting contribute to a sense of remoteness from the urban environment which is distinctive and imparts a particular aesthetic quality experienced from within the site.

7.5.1 *Conclusion*

The complex is considered to be of aesthetic significance for its combination of distinctive and robust industrial building forms and the open landscape quality and striking rock outcrops of the quarry. The 1953 chimney is a landmark in the local area.

7.6 Social value

Social value is defined in the guidelines to the Burra Charter as follows:

> Social value embraces the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a majority or minority group.

7.6.1 *Assessing social value*

The social value of a heritage place has been described as, 'the special meanings attached to places by groups of people (rather than by individuals)'.[186] A critical consideration in establishing the social significance of a place is its value to the present community. This sense of communal attachment is typically associated with places that are publicly accessible, or have otherwise been, '*appropriated* [sic] into the daily lives of people'.[187] Places recognised as having social value include those that:

- Provide a spiritual or traditional connection between past and present;
- Tie the past affectionately to the present;
- Help give a disempowered group back its history;
- Provide an essential reference point in a community's identity or sense of itself;
- Loom large in the daily comings and goings of life;
- Provide an essential community function that over time develops into a deeper attachment that is more than utility value;
- Have shaped some aspect of community behaviour or attitudes';
- Are distinctive - the old clock tower in a town or an architectural folly – features that lift a place above the crowd, making it likely that special meanings have been attached to that place;
- Are accessible to the public and offer the possibility of repeated use to build up associations and value to the community of users; and

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186 Chris Johnston (Ms), *What is Social Value? A Discussion Paper*, Australian Government Publishing Service, Canberra, 1994, Foreword.

187 Chris Johnston (Ms), *What is Social Value?,* pp. 7-11.

- Places where people gather and act as a community, for example places of public ritual, public meeting or congregation, and informal gathering places.[188]

Indications of a community's attachment to a place might be reflected in a history of communal action to protect the place from development; inclusion in local walking tours; and representation in postcards or websites for the area.

Social significance or value is typically established through community consultation, sometimes in the form of survey questionnaires, interviews with members of the relevant communities or public discussion workshops. Opinion pieces in the local print media, and views expressed in talk-back radio shows can also be forums for the expression of community sentiment. Community consultation is rarely a 'scientific' process, although it is generally the case that the broader the cross-section of the community invited to express opinions, the greater the certainty about the outcomes.

7.6.2 *Yarralumla Residents Association*

The Yarralumla Residents Association (YRA) was formed in 1988, in response to concerns that the *Yarralumla Brickworks South Canberra Policy Plan* (1988) was thought by many in the community to be poorly resolved to have failed to address key issues with regard to the site. The YRA has subsequently been prominent in discussions about the future development of the Brickworks.

7.6.3 *Yarralumla Neighbourhood Plan*

In 2003, during the preparation of the *Yarralumla Neighbourhood Plan* by the ACT Planning and Land Authority, people who 'live, work, play and invest' in Yarralumla were invited to comment on the future of the suburb. [189] Techniques used to engage with the community included: a 'values survey letterboxed to all residents'; a 'future character survey letterboxed to all residents'; a Neighbourhood Character Discovery' process, in which residents used disposable camera to take pictures of valued features; and a series of community workshops and forums.[190]

An assessment of the 'Values of the Yarralumla Community' found that 1% of those questioned described 'Community Facilities' as a valued aspect of the suburb. Community facilities in this context include the childcare and primary school, shops, churches, medical facilities and the Canberra Brickworks. A total of 69% of respondents described the suburb's 'Open Space & Environment' as valued features of the community. The top three responses to the question, 'What are Yarralumla's Favourite Places?' were: Lake Burley Griffin, Weston Park and Stirling Ridge.[191]

A discussion of 'Future strategies' in relation to the Brickworks Precinct noted that a 'Conservation and Management Plan' for the site had yet to be prepared, and that future uses of the site were likely to be informed by the site's, 'cultural heritage importance,' 'the location beside the treed inter-town buffer space for Inner South Canberra' and the tall

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188 Chris Johnston (Ms), *What is Social Value?,* p. 7.

189 ACT Planning & Land Authority, *Yarralumla Neighbourhood Plan*, 2004.

190 *Yarralumla Neighbourhood Plan*, 2004, p. 3.

191 *Yarralumla Neighbourhood Plan*, 2004, pp. 8-10.

chimney as a 'landscape landmark'.[192] The possibility of linking the Yarralumla Centre retail and residential area with a 'heritage walk' to the Brickworks was also raised.[193]

7.6.4 *Conclusion*

The scope of this CMP has not allowed for a detailed investigation of the social values that might attach to the place. Notwithstanding, it is reasonable to assume that the place well may be the subject of social value and attachment to people who have worked at the site, whether that be during its operational life as a brickworks, or in more recent times. Beyond this, the site may also have some social value for the activities that occurred at the site in the period when it was publicly accessible (during the 1980s and 1990s when it was in use as an antiques market and other uses).

Beyond this, however, the site is not one which is currently accessible to the public and so is not experienced directly. It is not a place where people gather or where community activities take place. It is a major site in the local area, although interestingly, it has no major public presence and other than from the private properties directly abutting the site, is glimpsed rather than viewed. This is with the exception of the 1950s chimney, which is a local landmark and marker for the site.

Unsurprisingly, given its scale, heritage values and location, the Brickworks is a place which has been the focus of major interest for the local community focusing largely on the issue of potential future development (but including a consideration of the issue of heritage). Such interest can be reflective of social value as it is understood in a context of cultural heritage, but can also be linked to other concerns relating to development and its associated impacts.

While not assessed in detail, any social value that attaches to the site is considered likely to be at a local, rather than Territory level.

In order to confirm the extent and nature of any such social value, any future community consultation project should include an investigation of this issue.

7.7 Assessment against the ACT Heritage Significance Criteria

The following table contains an assessment against the ACT Heritage Significance criteria, drawing on the preceding analysis and assessment.

Criterion	**Comment**
(Criterion A) It demonstrates a high degree of technical or creative achievement (or both), by showing qualities of innovation, discovery, invention or an exceptionally fine level of application of existing techniques or approaches.	Does not meet criterion. None of the kiln types on the site were innovative in terms of their design at the time of construction.

192 *Yarralumla Neighbourhood Plan*, 2004, p. 31.

193 *Yarralumla Neighbourhood Plan*, 2004, p. 33.

Criterion	Comment
(Criterion B) It exhibits outstanding design or aesthetic qualities valued by the community or a cultural group.	Meets criterion at a local and Territory level. The site has a distinctive industrial aesthetic deriving from the robust and distinctive industrial building forms and their materiality, combined with the visual qualities of the quarry and the open landscape character of its setting. The 1953 chimney is a local landmark.
(Criterion C) It is important as evidence of a distinctive way of life, taste, tradition, religion, land use, custom, process, design or function that is no longer practised, is in danger of being lost or is of exceptional interest.	Meets criterion at a Territory level. The complex is an unusually complete large-scale urban brickworks of the twentieth century, comparing well with other examples in other states. Despite the removal of most of the manufacturing plant, the buildings and other site elements and the layout of the site combine to demonstrate aspects of the processes and operations common to large scale brickworks.
(Criterion D) It is highly valued by the community or a cultural group for reasons of strong or special religious, spiritual, cultural, educational or social associations.	Not investigated in detail in this CMP. Assumed to meet this criterion at a local level.
(Criterion E) It is significant to the ACT because of its importance as part of local Aboriginal tradition.	Not investigated.
(Criterion F) It is a rare or unique example of its kind, or is rare or unique in its comparative intactness.	Meets criterion at a Territory level. The continuous kilns represented on the site are part of a relatively small group surviving in a national context. The Staffordshire kiln is the only known example of this particular design of continuous kiln in Australia. See also comment above against Criterion C. The site is an unusually complete complex of its type.
(Criterion H) It has strong or special associations with a person, group, event, development or cultural phase in local or	Meets criterion at both a Territory and local level. The Commonwealth Brickworks was the

Criterion	Comment
national history.	first manufacturing facility commissioned for and constructed in the Australian Capital Territory. It was developed specifically to facilitate the construction of the Federal Capital. The brickworks is of historical significance in providing tangible evidence of the establishment of the city following the decision to construct the National Capital in the Yass-Canberra district in October 1908. Subsequent phases in the development of the brickworks, until its closure, reflect the broader political context that determined the ebb and flow of the construction of the Federal Capital, with major phases of the development in the 1920s and post-World War II period. At a local level the site has been a major determinant in the physical and historical development of the suburb of Yarralumla. It also had a long history as a major employer in the local area.
(Criterion I) It is significant for understanding the evolution of natural landscapes, including significant geological features, landforms, biota or natural processes.	Meets the criterion at a Territory level. The Brickworks site is of scientific (geological) significance as the type locality for the Yarralumla Formation, a major sedimentary sequence dating from the Silurian Period, 424-423 million years ago. The rock units at the site provide the reference section for comparison of other outcrops within the Yarralumla Formation and in this context are of both research and educative value.
(Criterion J) It has provided, or is likely to provide, information that will contribute significantly to a wider understanding of the natural or cultural history of the ACT because of its use or potential use as a research site or object, teaching site or object, type locality or benchmark site.	Meets the criterion at a Territory level. Refer to comments above in relation to Criterion I. The rock units at the site provide the reference section for comparison of other outcrops within the Yarralumla Formation and in this context are of both research

Criterion	Comment
	and educative value.
(Criterion K) The place exhibits unusual richness, diversity or significant transitions of flora, fauna or natural landscapes and their elements.	Not investigated.
(Criterion L) The place is a significant ecological community, habitat or locality for any of the following: • the life cycle of native species; • rare, threatened or uncommon species; • species at the limits of their natural range; or • distinct occurrences of species.	Not investigated.

7.8 Assessment against National Heritage List criteria

The following table contains an assessment against the National Heritage List criteria, drawing on the preceding analysis and assessment.

Criterion	Comment
(Criterion A) The place has outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history.	Does not meet the criterion at the level required for the National Heritage List. The association with the early history of the Federal capital is considered to be at a Territory level. Refer to ACT Heritage Significance criterion H.
(Criterion B) The place has outstanding heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history.	Does not meet the criterion at the level required for the National Heritage List. As noted, the continuous kilns are now relatively rare in a national context, and the Staffordshire kiln is the only example of its type. This rarity is, is however, not considered to elevate either the place as a whole or the kilns and their associated structures to the level of 'outstanding heritage value to the nation'. While the complex as a whole is also

Criterion	Comment
	now an unusual example of a relatively complete brickworks complex, it is not considered to meet the test of 'outstanding heritage value to the nation'.
(Criterion C) The place has outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history.	Does not meet the criterion at the level required for the National Heritage List. The rock units at the site provide the reference section for comparison of other outcrops within the Yarralumla Formation and in this context are of both research and educative value. The site has some archaeological potential relating to demolished structures however this is considered to be of limited significance. The place has research potential in terms of further understanding of the technologies and processes related to brickmaking. This could be explored further through a project involving oral history and historical research related to the place.
(Criterion D) The place has outstanding heritage value to the nation because of the place's importance in demonstrating the principal characteristics of: • a class of Australia's natural or cultural places; or • a class of Australia's natural or cultural environments.	Does not meet the criterion at the level required for the National Heritage List. The complex is an unusually complete large-scale urban brickworks of the twentieth century, comparing well with other examples in other states, however, this not considered to be at a level indicative of 'outstanding heritage value to the nation'. Refer to ACT Heritage Significance Criterion C above.
(Criterion E) The place has outstanding heritage value to the nation because of the place's importance in exhibiting particular aesthetic characteristics valued by a community or cultural group.	Does not meet the criterion at the level required for the National Heritage List. Refer to ACT Heritage Significance Criterion B above.

Criterion	Comment
(Criterion F) The place has outstanding heritage value to the nation because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period.	Does not meet criterion. None of the kiln types on the site were innovative in terms of their design at the time of construction and there are no other aspects of the place which demonstrate a high level of creative of technical achievement.
(Criterion G) The place has outstanding heritage value to the nation because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.	Not investigated in detail in this CMP. Assumed to meet this criterion at a local level.
(Criterion H) The place has outstanding heritage value to the nation because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.	Does not meet criterion.
(Criterion I) The place has outstanding heritage value to the nation because of the place's importance as part of Indigenous tradition.	Not assessed in this CMP.

7.9 Statement of significance

The Statement of Significance for the site in the ACT Heritage Register has been reviewed and a new statement has been prepared.

> Operational from 1913 to 1976, the Canberra Brickworks is of historical significance at a state / territory level as the first industrial manufacturing facility within the ACT, and for its integral role in providing the base material used in the construction of the early buildings in the National Capital. The Canberra Brickworks is one of a small group of remnant industrial and engineering heritage places that were built to facilitate the initial development of Canberra, with the other key sites being the Cotter Dam and Pumping Station and the Kingston Power House.
>
> The site is also of local historical significance for its role in the early history and subsequent development of the suburb of Yarralumla. It has been a major presence in the suburb and has had a significant influence on its physical development. It has also been a major employer in the local area. More recently, the site has been the focus of local interest and action and broader community sensitivity in relation to its future management and development and in this context is considered of some social value at the local level.

The quarry is of scientific (geological) significance at a state / territory level as the type locality for the Yarralumla Formation, a major sedimentary sequence dating from the Silurian Period, 424-423 million years ago. The rock units at the site provide the reference section for comparison of other outcrops within the Yarralumla Formation and in this context are of both research and educative value. Sites A and D show excellent examples of anticline in calcareous siltstone and Site B shows a typical tuffaceous mudstone and siltstone of the Yarralumla Formation. Site C shows abundant fossils of mainly brachiopods, trilobites and crinoids preserved in a bedding plane.[194]

The Canberra Brickworks site as a whole is of historical and scientific (technological) significance for its ability to demonstrate aspects of the process of brick production in the twentieth century. While individual brickworks varied in their layout and building forms, including variations in kiln types, there were common elements and building types and the majority of these (ranging in date from 1915 to the 1970s) are represented in some form or another at this site. When compared with other surviving complexes, the Canberra Brickworks retains a relatively wide range of production and ancillary buildings, though crusher houses, power houses and the like also remain on a number of other former brickworks sites. Conversely, the Yarralumla site has had virtually all the specific brickmaking plant and machinery removed, greatly diminishing its ability to demonstrate key aspects of the brickmaking process and the associated technologies.

The individual kilns themselves are of varying levels of technological interest and significance as examples of kiln design. The Staffordshire kiln (completed 1915) is the only known example in Australia of this particular type. It is distinguished by a relatively complex system of dampers and flues which offered more control and flexibility than earlier types and which was thought to particularly suitable to the Canberra context, where a range of different products might be required. The Hardy-Patent kilns are considered to be of a lesser order of technological significance, though they are of interest as an example of a patented variation on the Hoffman kiln design originating from the late nineteenth century. A number of examples exist in Australia of Hoffman and patent kilns dating from the first half of the twentieth century. The three downdraught kilns are of limited technological interest. They are very late examples of this type of intermittent kiln design and there are numerous other and earlier examples surviving elsewhere.

The place is of aesthetic significance for its combination of distinctive and robust industrial building forms and the open landscape quality and striking rock outcrops of the quarry. The understated siting of the complex and the relatively open landscaped nature of its setting contribute to a sense of remoteness from the urban environment which is distinctive and imparts a particular aesthetic quality experienced from

194 Register of the National Estate entry for Yarralumla Brickworks (extended area), Denman St, Yarralumla, ACT, Australia (file no. 101439).

within the site. The 1953 chimney is of aesthetic significance as a landmark in the local area.

8.0 CONSERVATION POLICY AND MANAGEMENT PLAN

8.1 Introduction

This conservation policy is based on the preceding assessment of the significance of the Canberra Brickworks. It has been developed with an understanding of:

- The heritage values of the complex;
- The relative contribution of the individual elements within the complex to these heritage values; and
- Statutory and other constraints.

The intention of the conservation policy is to provide direction and guidance on future use, conservation and physical management of the brickworks; and to inform consideration of potential future change and adaptation works,.

As relevant, the conservation policy also has regard for the land adjacent to the brickworks.

The chapter includes significant fabric and conservation focussed policies including those relating to the care and conservation of significant fabric, maintenance and repairs, retention of significant heritage values, and adaptation and site development issues.

The chapter also includes policies that address matters relating to the management of the place including statutory frameworks and other matters of a more practical nature which have the potential to impact on heritage significance and values.

8.2 Policy objectives

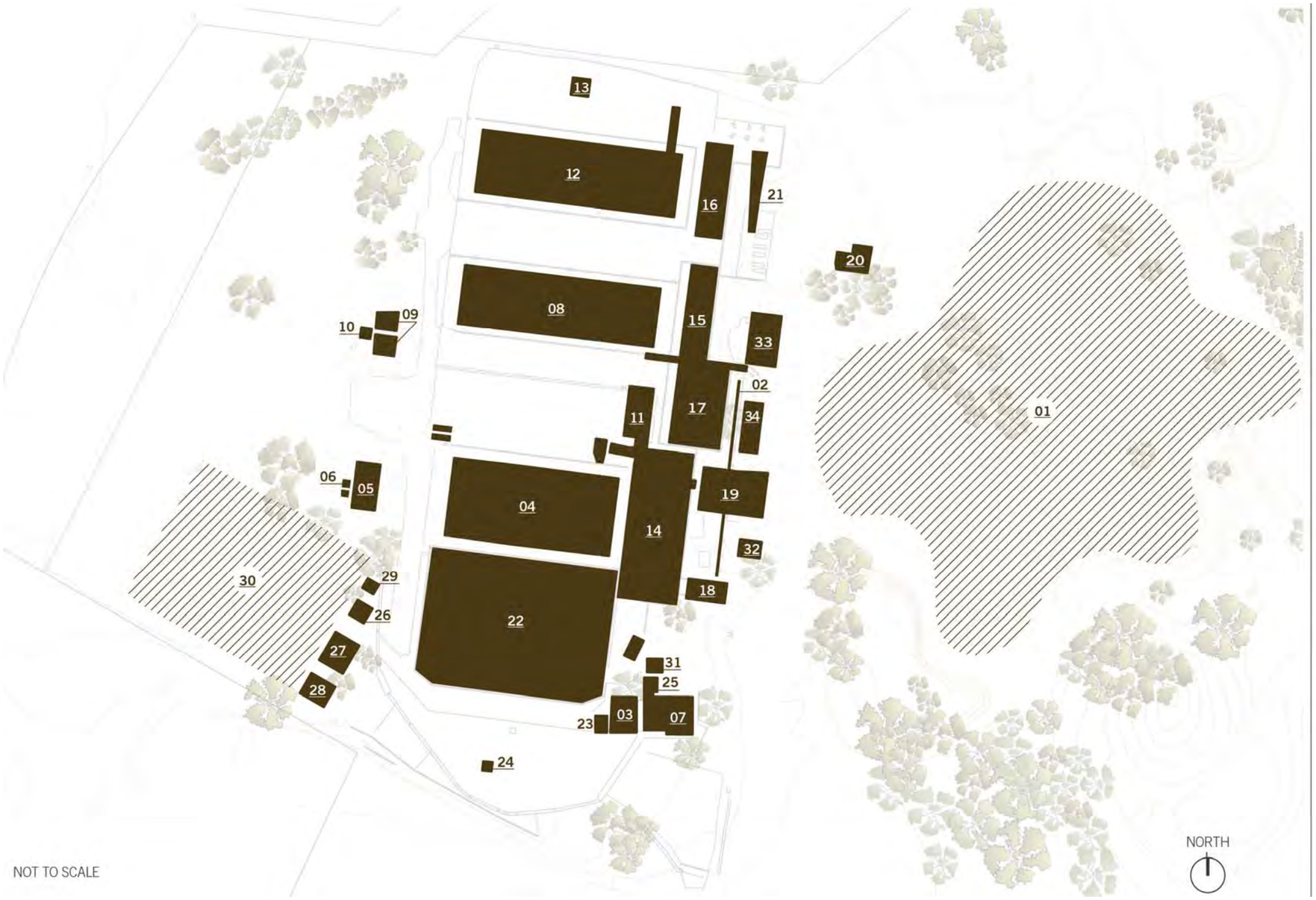
The principal objectives of the conservation policy are:

- The conservation (preservation, restoration, reconstruction and adaptation) of fabric of core and supporting significance, within a policy framework that is robust, easily understood, and consistent in its approach;
- To ensure that future works to the site are compliant with Burra Charter principles and responsive to the statutory heritage constraints;
- To maintain an understanding of the original function of the site;
- In support of a sensitive approach to potential future change and the implementation of an adaptive reuse and redevelopment strategy that is both feasible and will support the long-term conservation of the core heritage values of the place.

8.3 Implications of the assessment of significance

The assessment of significance for the Canberra Brickworks in this CMP has identified a number of values that relate to and are expressed by the site and complex as a whole. It has also identified values which are embodied in and/or expressed by particular elements or groups of elements within the complex. In developing the conservation policy consideration has been given to these different values and their expression through particular site elements and the complex as a whole. These are summarised in the following table.

Value	Level	Key related elements
Historic		
• Role in the early history of Canberra • Commonwealth brickworks – first Territory based industrial facility	State/Territory	Pre-1940 buildings and features, including quarry.
• Role in the history of the local Yarralumla area	Local	Primary focus is on the pre-1940 buildings and features. Archaeological evidence relating to early demolished buildings and structures.
Scientific		
• Geological	State/Territory	Quarry, with particular reference to identified geological features.
• Technological		
Kiln design	State/Territory	Staffordshire kiln Hardy patent kilns
Extensive surviving brickworks complex	State/Territory	Overall complex including quarry, does not include post-1970s buildings. Archaeological evidence relating to early demolished buildings and structures.
Aesthetic		
• Industrial complex	State/Territory Local	Key production buildings (kilns, chimneys, machinery bays, crushers, conveyor) Quarry 1953 chimney
Social		
• Focus of local interest and action and broader community sensitivity	Local	Entire complex
Spiritual	*N/A*	*N/A*



Number	Element
01	Quarry
02	Concrete retaining wall
03	Power House
04	Staffordshire Kiln (Kiln 1)
05	Fan house for Kiln 1
06	Chimney stack for Kiln1
07	Offices
08	Hardy patent Kiln (Kiln 2)
09	Fan house for Kiln 2
10	Chimney stack for Kiln 2
11	Amenities block
12	Hardy patent Kiln (Kiln 3)
13	Chimney stack for Kiln 3
14	Machine Bay I for Kiln 1
15	Machine Bay II for Kiln 2
16	Machine Bay III for Kiln 3
17	Workshop
18	Small Crusher House (Crusher House I)
19	Large Crusher House (White pan room / Crusher House II)
20	Primary Crusher House (Crusher House III)
21	Elevator / Conveyor
22	Downdraft Kilns (Kiln 4-6)
23	Downdraft kiln control room
24	Chimney stack for Kilns 4-6
25	Toilet block
26	Amenities block
27	Substation/control room
28	Boiler house
29	Ancillary storage building
30	Remnant of Extrusion plant (concrete pad)
31	Ancillary storage building
32	Storage shed
33	Model railway workshop
34	Model railway storage shed

Figure 194 Site plan showing location of elements

8.4 Significant site elements

Given the multiple values associated with the site, it is recognised that in addressing the conservation policy objectives, there will be options for future management, including for restoration and reconstruction, demolition, adaptation and site development.

It is also recognised that various elements can be identified on the basis of their role in the history, operation and development of the place and/or on the basis of their contribution to particular values associated with the place or with the individual elements themselves.

The elements have variously been identified as 'core' or 'supporting' elements, and 'incidental' elements (Figure 195). These designations recognise that:

- A group of elements is associated with the establishment and operation of the Canberra Brickworks in the period 1915-1940. These elements are central to an understanding and appreciation of the operation and history of the site in this early period including its relationship with the early history and development of Canberra. These are generally designated as core elements.
- A number of elements are of individual scientific (geological or technological) significance in their own right. These have also been designated as core elements.
- A group of elements relate to the further development of the brickworks complex as it was expanded and evolved from the 1940s through to the 1970s and are able to demonstrate aspects of this expansion and the operation of the site in this period. These elements are generally designated as supporting elements.
- A further group has been designated as incidental elements. This group comprises buildings of the post-WWII period which while related to the expansion of the complex, were originally minor in nature, reflect ancillary uses rather than core manufacturing processes and/or are altered. In addition this group includes a small number of buildings that were introduced to the site following its closure as a brickworks.

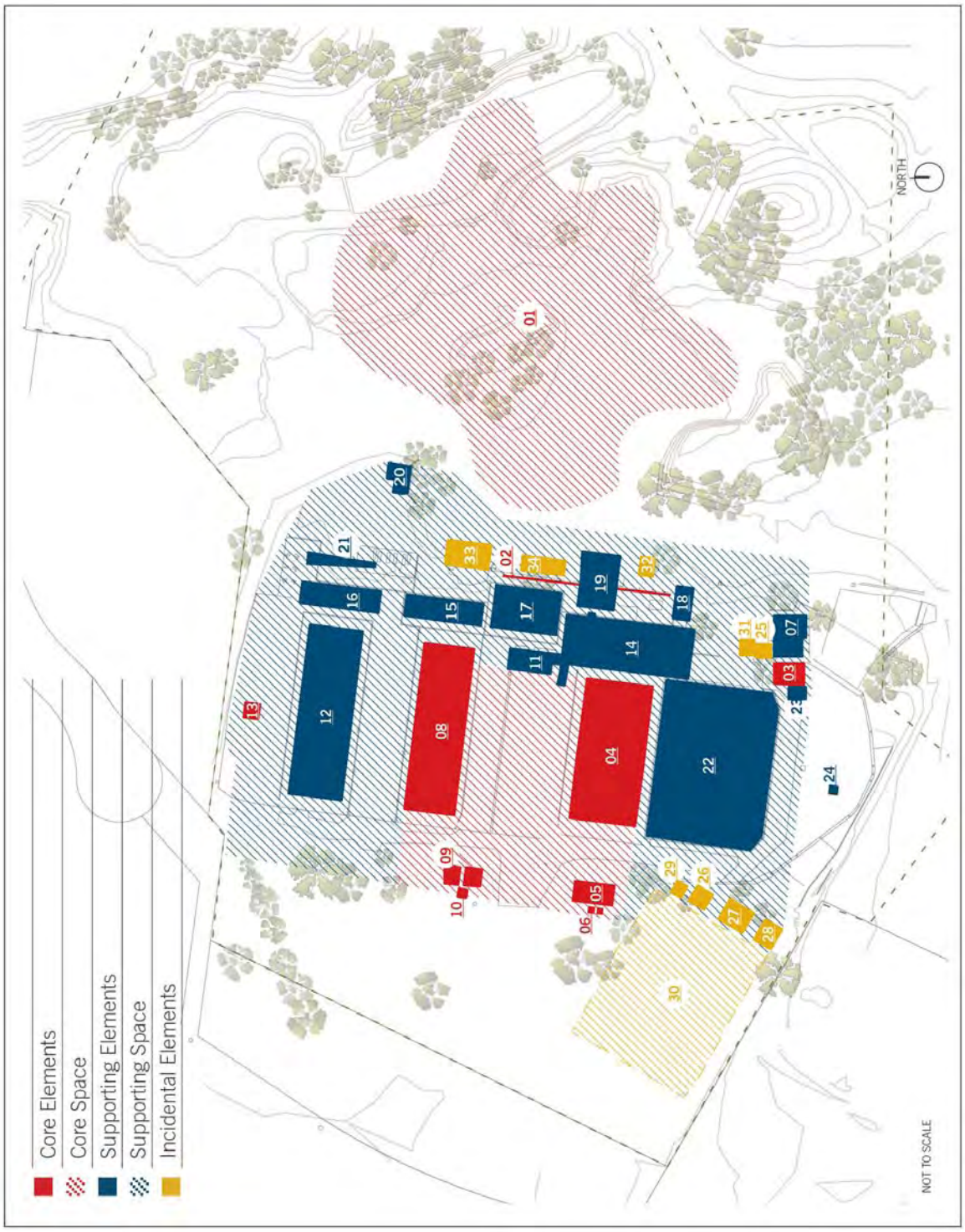


Figure 195 Significant site elements

8.4.1 *Core elements*

All surviving fabric associated with the establishment and expansion phases of development on the site, including the following site elements:

No.	Name / Description	Phase	Date of construction
01	Quarry including exposed geological features	Establishment (1911-1920)	Shale extraction from 1913
02	Concrete retaining wall	Establishment (1911-1920)	1915
03	Power House	Establishment (1911-1920)	1915-16
04	Staffordshire kiln and associated underground workings	Establishment (1911-1920)	1914-15
05	Fan house for Staffordshire kiln	Establishment (1911-1920)	1914-15
06	Chimney stack for Staffordshire kiln	Establishment (1911-1920)	1914-15
08	Hardy patent kiln I and associated underground workings	Expansion (1921-1940)	c. 1926, c. 1955
09	Fan house for Hardy patent kiln I	Expansion (1921-1940)	c. 1927, c.1955
10	Chimney stack for Hardy patent kiln I	Expansion (1921-1940)	c. 1927
12	Chimney stack for Hardy patent kiln II	Post-war phase (1944-1976)	c. 1953, c. 2005
unnumbered	Original brickyard area between Staffordshire and Hardy patent kiln I kilns and around fan houses	Establishment (1911-1920)	c.1911-1927

In addition to these elements, there is potential for archaeological evidence to survive of a range of early buildings and site elements associated with the earlier phases of development on the site, notably the Brickworks Camp, the quarry tramway, and the light railway from the site to the city. Some of these features were located on land outside the current boundaries of the site. The archaeological potential, both of the subject site and the abutting sites, requires further assessment (refer to Policy 8.6.7).

Quarry (01)

The quarry dates from the establishment of the Brickworks and demonstrates a key aspect of the original brick making operation and as it existed up until c. 1940.

The quarry is also considered to be of scientific (geological) significance as the type locality for the Yarralumla Formation, a major sedimentary sequence dating from the Silurian Period, 424-423 million years ago. The rock units at the site provide the reference section for comparison with other outcrops within the Yarralumla Formation and in this context are of both research and educative value.

Concrete retaining wall (02)

The concrete retaining wall is an early feature of the site and is demonstrative of the planning and operation of the site in this first phase.

Power house (03)

The Power House is associated with the earliest phase of the permanent brickworks and was a key element in the development of the site, providing power to the site after the Kingston Power House came on line in 1915.

The provision of continuous power supply was fundamental to the operation of the plant.

Staffordshire kiln including associated underground workings, fan house and stack (04, 05, 06)

The Staffordshire kiln together with its associated structures and underground workings is an element of core significance. It was the first permanent kiln structure on the site and is a key surviving element from the earliest phase of development. The choice of this relatively elaborate kiln type with its capacity to fire multiple types of products simultaneously reflected the requirements of the brickworks as the sole provider to the new national capital. While extensively modified and rebuilt in some areas, this kiln is the only example of a Staffordshire kiln remaining in Australia.

The fan house and stack were both integral to the operation of the Staffordshire kiln. While only remnants of dismantled equipment remain in the fan house, the arrangement of the interior demonstrates the function of the building and its relationship to the kiln and the associated chimney.

Hardy patent kiln 1 and associated underground workings, associated fan houses and stack (08, 09, 10)

Together with its fan houses and chimney (Buildings 9 and 10), the Hardy patent kiln demonstrates the expansion of the works in the 1920s in response to the increased demand for building materials for the development of the National Capital in this period. The kiln was commissioned prior to the relocation to Canberra of the Australian Parliament in May 1927. The kiln has been extensively modified and extended (including extensive rebuilding) but still provides an important link to this phase in the history of the site.

The Hardy patent kiln is also of interest as an example of an Australian patent kiln design thought to date from the late nineteenth century, one of a large number of variations of the Hoffman kiln typology developed in this period.

The associated fan houses and stack are integral to the operation of the kiln, including in its expanded form post-WWII.

Original brickyard (between the Staffordshire kiln and Hardy patent kiln I, unnumbered)

The open yard area between the two earlier kilns historically was the early brickyard and was a key space within the complex. It demonstrates key aspects of the layout of the site and its operation.

8.4.2 *Supporting elements*

Supporting elements include those key structures associated with the expansion of the manufacturing plant in the post-WWII period, which demonstrate the pattern of this expansion, the arrangement of various elements of the process across the site, and aspects of the brickmaking process itself. Minor non-specific process or ancillary buildings have not been included. The heavily modified office building of c.1925 has also been included in this group.

Supporting elements are as follows:

No.	Name / Description	Phase	Date of construction
07	Offices	Expansion (1921-1940)	c. 1925 with extensive alterations and additions
11	Amenities block	Post-war phase (1944-1976)	c. 1950, c. 1977
12	Hardy patent kiln II and associated underground workings	Post-war phase (1944-1976)	c. 1953
14	Machine Bay I for Staffordshire kiln	Post-war phase (1944-1976)	c. 1955
15	Machine Bay II for Hardy patent kiln I	Post-war phase (1944-1976)	c. 1955
16	Machine Bay III for Hardy patent kiln II	Post-war phase (1944-1976)	c. 1955
17	Workshop	Post-war phase (1944-1976)	1955
18	Small Crusher House (Crusher House I)	Post-war phase (1944-1976)	c. 1958
19	Large Crusher House (White pan room/ Crusher House II)	Post-war phase (1944-1976)	c. 1955
20	Primary Crusher House (Crusher House III)	Post-war phase (1944-1976)	c. 1955
21	Elevator / Conveyor	Post-war phase (1944-1976)	c. 1955

No.	Name/Description	Phase	Date of construction
22	Downdraught kilns (3) and associated underground workings	Post-war phase (1944-1976)	c. 1960-3
23	Downdraught kiln control room	Post-war phase (1944-1976)	c. 1963
24	Chimney stack for Downdraught kilns	Post-war phase (1944-1976)	c. 1950s
unnumbered	Expanded brickyard	Post-war phase (1944-1976)	(1950s-1970s)

Offices (07)

While the original section of the office building is associated with an early phase of development at the site, the building has been extensively modified and overbuilt, the result being the original form is substantially obscured.

Amenities block (11)

The amenities block was constructed as part of a major consolidation and expansion of the brickworks in the 1950s and reflects the need to provide improved facilities for workers on site.

Hardy patent kiln II and chimney stack (12 and 13)

The second Hardy patent kiln together with its underground workings and associated chimney stack are key elements of a major expansion and upgrade of the Brickworks during the 1950s, along with the new crusher houses, grinding facilities, automatic conveyors, new brick presses and machine bays. The construction of this kiln greatly expanded the production capacity of the works. The kiln is relatively intact, including when compared with the earlier Hardy patent kiln on this site and is a good representative example of this typology of continuous kilns.

In addition to its role as a key element in the post-WWII expansion of the Brickworks, the 1953 chimney for the Hardy patent kiln is also of aesthetic significance as a prominent element in the immediate vicinity and a marker for the site. While not prominent in these views, it is also visible more distant views from the north shore of Lake Burley Griffin and Black Mountain.

Machine bays I, II and II (14, 15, 16)

Replacing earlier structures in this general area of the site(between the kilns and the quarry), the Machine Bays present as a series of utilitarian steel-framed and clad process buildings constructed as part of the post World War II expansion and modernisation of the complex. The form and siting of these related structures and the conveyor that connects them demonstrate important aspects of the historical pattern and layout of the complex. Despite the removal of the majority of the equipment including the brick presses, the Machine Bays also demonstrate aspects of the brick making process in the post-WWII period.

Workshop (17)

Replacing earlier structures in this general area of the site (between the kilns and the quarry), the Workshop is one of a series of utilitarian steel-framed buildings constructed as part of the post World War II expansion and modernisation of the complex. The form and siting of these related structures and the conveyor that connects them demonstrate important aspects of the historical pattern and layout of the complex. While not a process building *per se*, the Workshop performed a key function in the operation of the complex.

Crusher houses (18, 19, 20)

Along with the Machine Bays, the three related crusher houses were new process buildings constructed as part of the post World War II expansion and modernisation of the complex. The form and siting of these related structures demonstrate important aspects of the historical pattern and layout of the complex. Despite the removal of most of the equipment, the form of the buildings and the various remnant hopper and other elements internally also reflect aspects of the brickmaking process in the post-WWII period. In the case of the Primary Crusher House, following the demolition of both the conveyor structure and the Red Pan Room, which interconnected the Primary Crusher House with the Machine Bays and the conveyor 'spine' which served the brick presses, the subject building is now somewhat isolated from these related buildings. Despite this, it is still demonstrative of its original function and role in the process.

The White Pan Room is a particularly prominent site element, with its collection of skillion roofed forms rising above the machine bays.

Elevator/Conveyor (21)

The Conveyor was an integral element in the transport and refining of raw material from the Primary Crusher House (Building 20) to the brick kilns.

While much of the fabric of this structure is missing and it is in a semi-derelict condition, the remaining portion demonstrates aspects of the layout and sequence of processes on the site.

Downdraught kilns and associated underground workings, control room and chimney (22, 23, 24)

The downdraught kilns are part of the evolved brickworks complex and date from one of the last phases of expansion on this site. They contribute to an understanding of the operation of such complexes; in this case the choice of downdraught kilns appears likely to have been made on the basis of their suitability for specialist lines.

The kilns are of limited interest in their own right; they are relatively late examples and there are many surviving elsewhere.

The downdraught kilns are supporting elements on the site.

Expanded brickyard (unnumbered)

As for the earlier brickyard, the spaces around and between the key process buildings, considered to represent the expanded brickyard, are important features of the planning and layout of the complex and therefore, the processes that occurred there. Of particular importance is the open space between the Hardy patent kilns.

8.4.3 *Incidental elements*

Incidental elements include a series of relatively minor ancillary and service buildings of the post-WWII period. This group also includes buildings associated with the extrusion plant on the basis the plant itself has been demolished. It also includes buildings constructed following the closure of the brickworks. A number of these buildings are typical of the support functions found on any industrial site and do not inform about the process.

No.	Name / Description	Phase	Date of construction
25	Toilet block	Post-war phase (1944-1976)	c. 1960s
26	Amenities block	Post-war phase (1944-1976)	c. 1960s
27	Substation/control room	Post-war phase (1944-1976)	c. 1971
28	Boiler house	Post-war phase (1944-1976)	c. 1971
29	Ancillary storage building	Post-war phase (1944-1976)	c. 1971
30	Demolished slab for extrusion plant	Post-war phase (1944-1976)	c. 1971
31	Ancillary storage building	Post-war phase (1944-1976)	c. 1960s
32	Storage shed	Post-war phase (1944-1976)	c. 1960s
33	Model railway workshop	Post-closure phase (1976-2009)	c. 1979
34	Model railway storage shed	Post-closure phase (1976-2009)	c. 1979

8.5 Options for the management of core and supporting elements

8.5.1 *Discussion*

One of the primary heritage objectives for this site is the establishment of a viable future use that will ensure its physical conservation and the retention of key heritage values in the long term. It is often difficult to establish a viable long-term use for such industrial sites and this is reflected in the varying approaches and outcomes that have occurred on such sites, including redundant brickworks in New South Wales, Western Australia, South Australia and Victoria. As evidenced in some of these projects, achieving a sustainable and meaningful heritage outcome in the context of major redevelopment is challenging.

The two key questions in assessing any adaptive reuse/redevelopment proposal for this and other similar sites are:

- what is the impact of the proposal on the cultural heritage significance of the heritage place?; and
- what is a reasonable and economic use of the heritage place?

The buildings on this site are generally in fair to poor condition and some are in a relatively advanced state of decay. Any adaptive reuse proposal for this site which involves the substantial retention and conservation, repair and refurbishment and adaptation of significant fabric so as to maintain the heritage values of the place will also involve substantial cost, both up-front and ongoing. These costs ultimately will be required to be assessed against the positive heritage outcomes and the investment in the cultural capital embodied in the site, but also against an economic return that is generated by a new use or uses. In this case they may also include consideration of the ability to generate funds to support active conservation of the heritage place which can be generated by peripheral and associated development.

On this basis and having regard to the assessed significance of the place, the conservation policy recognises that there are two broad approaches that reasonably could be contemplated. Both involve intervention by way of new development and adaptation of retained buildings, recognising that both actions are likely to be required if a feasible reuse strategy for this site is to be realised.

The two options are consistent in many respects but vary in the extent of demolition and site development contemplated, and (albeit to a lesser degree), the approach to adaptation of retained buildings.

The two options are summarised below.

In providing the summary, it is noted that clearly within these options there is scope for variations in approach to specific issues. For example, while both options propose the adaptation of the retained buildings, the specific approach to adaptation could be varied within the parameters of the conservation policies in this document. Similarly, both options also contemplate a level of site development; again, the CMP allows for scope for variations in the approach to this issue.

The general conservation policies in this CMP apply equally to both options. Where appropriate, reference to the options is made in specific policies, including policies for specific site elements.

8.5.2 *Option 1 - whole of site conservation*

Option 1 focuses on the conservation of the complex as a whole as was developed to the 1970s. This option prioritises not only the heritage values that are embodied in the pre-1940 fabric of the place, but relative to Option 2 following, also seeks to conserve the evolved form of the complex and its ability to demonstrate aspects of the brickmaking process as it occurred in the later phases of the site's operational history.

Option 1 contemplates the retention of all buildings of core and supporting significance, including all of the kilns, together with their associated fan houses and chimneys. The lighter-weight process buildings (Machine Bays and Crusher buildings) to the east of the kilns would also be retained. Recognising the majority of plant specific to the brickmaking process

(presses, crushers and the like) has been removed from the site, preferably this option would also include retention of the limited remaining plant (conveyors and hoppers) in the Machinery Bays and Crusher Houses. This plant suggests the movement of the crushed materials through this area, and down to the brick pressing area.

In this option the preference would also be to retain the 1950 amenities building on the basis it reflects the broader operation of the site, though this would be a lesser priority relative to the retention of the process buildings.

The original and expanded brick yard area would be retained as open area with limited scope for the insertion of new buildings.

The quarry would be retained, sufficient to demonstrate its significant geological features, as well as its general form and relationship to the building complex and role in the process.

This option contemplates the internal adaptation of the kiln, process and other retained buildings, within the parameters described in the building-specific policies for these elements. In the case of the Machine Bays any internal adaptation would be constrained by the retention of the plant and equipment at the upper level.

This option contemplates a level of site development as identified in the Site Development policies at 8.6.12.

Heritage impact

Option 1 is directed at the retention of all buildings and site elements identified as of cultural heritage significance (core and supporting) and would result in an outcome that should maintain the key heritage values associated with the site. It would allow for the adaptation within certain constraints of individual buildings and for site development. It could be expected that the most compatible uses if such an approach were adopted would be low level industrial and commercial uses, particularly in the core elements, which could largely make use of the existing fabric without extensive intervention.

8.5.3 *Option 2 - partial site conservation*

Option 2 focuses on the core elements as identified in the Conservation Management Plan. The objective in this option is to conserve those elements that relate to the earlier phase of development of the Brickworks and/or that are of a high order of significance in their own right.

This option would retain and conserve two of the three kiln types on the site:

- Staffordshire kiln (Kiln 1, 1915) and associated fan house and chimney
- Hardy patent kiln (Kiln 2, c. 1926) and associated fan house and chimney

It would also retain the original Power House (1915-16).

As for Option 1, the quarry would be retained, sufficient to demonstrate its significant geological features, as well as its general form and relationship to the building complex and role in the process.

The 1953 chimney, which has been identified for its landmark qualities both in the local area and to a degree in the wider area of central Canberra, would also be retained in this option.

Either demolition or a more interventionist adaptation of the balance of the process and ancillary buildings on the site, including those buildings identified as supporting elements, could be contemplated in this option.

The internal adaptation of the kilns and other retained structures could occur within the parameters described in the building-specific policies for these elements.

This option contemplates a greater level of site development as identified in the Site Development policies at 8.6.12.

Heritage impact

Option 2 could result in the loss of a number buildings and elements identified as supporting elements. It is noted that the completeness of the complex as a brickmaking plant is already compromised by the demolition of some building elements and the removal of the main manufacturing plant (crushing and pressing machinery). The demolition of the supporting elements, which generally date from the mid- to late- twentieth century, would further diminish the ability of the complex to demonstrate the manufacturing processes that occurred on this site in the later phase of its history.

The other heritage values associated with the complex would generally be retained in this option. Those elements which remain from the establishment and expansion phases of the site's history would be retained - including the two kiln types of most interest in terms of their technology and rarity (the Staffordshire kiln and the Hardy patent kiln) - along with the quarry itself (refer Figure 196). This early grouping would demonstrate key aspects of the layout of the site and the process as it occurred in the period (1913-1940). This period has been assessed as of most historical significance both in the local context and in terms of the associations with the establishment of Canberra. As for Option 1, the scientific (geological) values of the place would be maintained.

The Option 2 approach is the one which has typically been applied on other brickworks and related industrial sites where the development balance has required more wholesale site clearance. Retained fabric has either been heavily adapted and modified or retained and presented as an industrial archaeological artefact.

8.5.4 *Conclusion*

The choice of one option over another will be the outcome of the consideration of many factors and ultimately determined by those responsible for approving works. While this report focuses on the heritage issue, the reality of a site of this nature is that many other forces will come into play in finding a balanced outcome. The fact that the site has remained in a semi-derelict and gradually decaying state for some decades reflects the challenge of such sites. The scale of the site and nature of the fabric will inevitably require a level of intervention that will change the physical and visual nature of the place. The intent of the options approach is to provide points between which a solution needs to be found if heritage is to be meaningfully addressed.

Figure 196 View west of the complex in 1929, including part of the quarry, the kilns and their stacks (albeit the Staffordshire kiln obscured), and the office and Power House (on left). The original crushing and pressing buildings (now demolished) are in the centre of this view, to the left of the Hardy patent kiln and in the background (far left) is the Brickworks Camp complex, now demolished. Source: National Library of Australia.

8.6 General conservation policies

8.6.1 *Setting and curtilage*

Setting

Setting is defined in the Burra Charter (Definitions, Article 1.12) as 'the area around the place which may include the visual catchment'. The Charter's Conservation Principles for 'setting' (Article 8) expand on the definition:

> Conservation requires the retention of an appropriate visual setting and other relationships that contribute to the cultural significance of the place.

The original setting of the brickworks was an open pastoral area surrounded by grazing land and juvenile plantations of radiata pine. The brickworks had no urban context and remained as such until well into the interwar period (with only relatively sparse residential development at some distance from the site) and the later twentieth century when the residential development of Yarralumla took full force. Because of the relatively sunken location the brickworks was a place concealed from view and seen only when approached over the as yet not full excavated quarry or from the north and west through what are now the wooded areas of the Canberra Golf Course and Dunrossil Drive. As vegetation matured and development occurred, the brickworks increasingly became an unseen place; only

visually evidenced by smoke from the chimney stacks and, after 1953, by the landmark chimney.

As has occurred throughout Canberra the visual setting has changed over time and while the site still exists with a treed and open grassed backdrop to the west and south, to the north and east expanding residential development provides a very much altered context.

From a heritage perspective the most distinctive aspect of the evolved setting is that the site still retains a degree of concealment and a 'removed-ness' from the character of the residential city. The setting is still one of a degree of open unkempt landscape, wooded and plantation areas, and limited visible perimeter form. Uniquely in the Australian context it is a brickworks which still conveys the sense of remoteness of the location in which it was built.

Policy 1

While the setting has contributed to a sense of isolation and a sense of discovery upon arrival, the brickworks has evolved over time with discrete additive elements located to create a bold and orthogonal spatial sequence and order. Any new development should complement the reading of the brickworks as a complex of buildings and have regard to its inherent spatial qualities

Heritage curtilage

The 'heritage curtilage' for a building, complex or site has been defined as meaning;

> the area of land (including land covered by water) surrounding an item or area of heritage significance which is essential for retaining and interpreting its heritage significance. It can apply to either:
>
> - land which is integral to the heritage significance of items of the built heritage; or
> - a precinct which includes buildings, works, relics trees or places and their setting.1

The concept of heritage curtilage recognises that on occasions there is a requirement for an expanded curtilage which goes beyond legal or other boundaries to take into account views and vistas, the visual relationship between the place and its surrounds and the need to provide a 'buffer' between the heritage elements and surrounding land. A curtilage can also provide for the conservation of the sensitive heritage values immediately surrounding the heritage place, and where appropriate, can maintain a setting of aesthetic value for the heritage place.

Having regard for the above, the two issues that arise are the inclusion within the heritage curtilage of all features and elements that contribute to the significance of the place and that of establishing an appropriate setting for the place.

1 Heritage Office, *Heritage Curtilages*, Department of Urban Affairs and Planning, 1996, p.3.

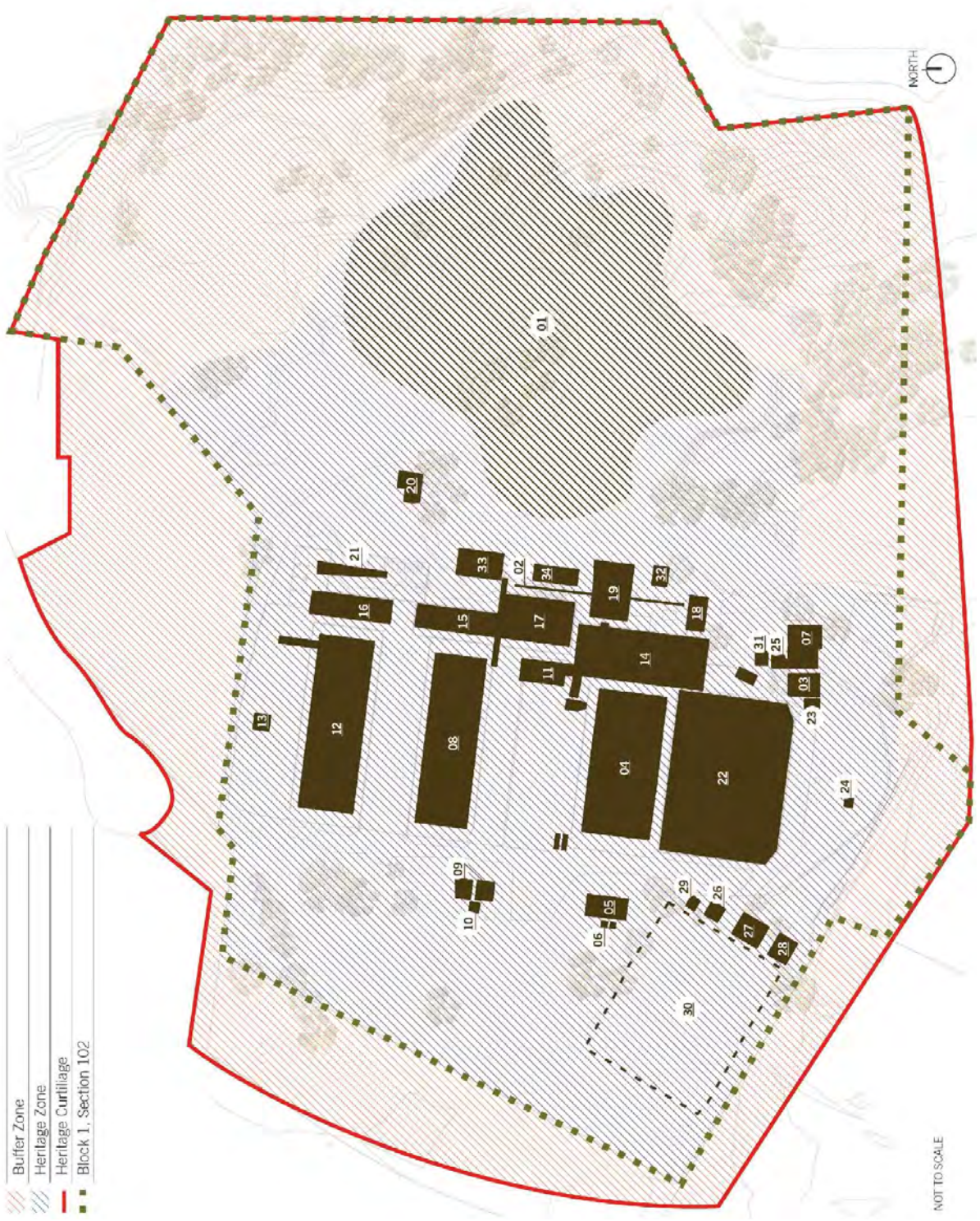


Figure 197 Heritage curtilage and management zones

In considering the first issue, it is noted there is potential for there to be archaeological evidence of related structures such as the Married Quarters surviving outside the currently enclosed site. Such archaeological evidence, if it exists, would be of interest in documenting the history of the site and should be investigated should future works occur in this area (refer to Policy 8.6.7). In considering the nature of the assessed significance of the place as a whole, however, it is not considered necessary to include these more distant potential archaeological sites within the curtilage for the place.

In considering the broader issue of setting, the immediate surrounds of the Brickworks vary considerably. Abutting the site are the remnants of the Westbourne Wood arboretum to the west of the site, medium density housing is to the east and north of the site and to the south is the lightly treed ridge north of Dudley Street. The recent housing to the north is in close proximity and has encroached on the setting of the brickworks complex. The topography of the immediate area also varies and has a major influence in defining a setting (and heritage curtilage), particularly with reference to the potential for future development to have an impact on setting.

The current boundaries of the Brickworks site are those of the irregularly shaped Block 1, Section 102 (Figure 197). The boundaries are also those which have been used in defining the registered site. This does not reflect the original extent of the site which was larger and which was reduced in size both before and after the closure of the works in the 1970s.

As an outcome of this study a heritage curtilage has been defined which extends beyond this legal boundary and the registered land to include additional land to the north, west and south. This heritage curtilage (Figure 197) is considered to reflect appropriately the area that requires management for heritage reasons, including management of potential impacts of future development. It is recognised that this expanded heritage curtilage includes land that has been subdivided and developed and is now privately owned (to the north). Notwithstanding, it is still considered desirable that this area be considered to be part of the defined heritage curtilage and any future redevelopment consider the impact on the brickworks.

In recommending a heritage curtilage that extends beyond the current registered area (Block 1), there is no requirement to expand the extent of registration under the *Heritage Act*. Rather, it is recommended that the management of the additional land on abutting sites be through an alternative mechanism – planning overlay or similar – which includes objectives that have regard for the setting of the brickworks complex.

Management zones

In establishing a heritage curtilage for this site, it is noted that there is potential for development to occur within this curtilage, but that this should be managed appropriately having regard for any impact on the heritage values of the place and within the relevant and appropriate statutory heritage frameworks.

Given its scale, complexity and layout, it is reasonable to consider different levels of management across the heritage curtilage as a whole, and to this end, two management zones have been defined (Figure 197). The zone boundaries are soft boundaries which should be treated as indicative rather than absolute.

Primary heritage zone

The Primary Heritage Zone is the area of the site which is considered to be of the highest level of heritage sensitivity. Adaptive reuse and new works need to have particular regard to the assessed significance of the relevant element or area and heritage impacts. The Primary Heritage Zone includes the main brickworks complex and a large part of the quarry.

Buffer heritage zone

The Buffer Heritage Zone includes those parts of the site which are within the curtilage but which are more removed, visually and/or physically, from the key elements of the complex. The Buffer Heritage Zone includes areas that support the significance of the site in providing a setting. In this zone, more intensive development could be contemplated but the scale, form and spatial characteristics of this development needs to be appropriately managed having regard for any adverse impact on the place as a whole. The Buffer Heritage Zone includes substantial areas of the quarry on its eastern and southern sides and additional land to the east, north and south.

Reference is made to the management zones in the policies for Site Development and New Works (8.6.12).

Policy 2

The heritage curtilage for the Canberra Brickworks includes the land in Block 1, Section 102, Block 20, Section 102 and additional land to the north and south. Block 1, Section 102 should continue to be controlled under the Heritage Act. Alternative controls under the Planning and Development Act should be considered for the land to the north, west and south.

Policy 3

Management of land within the heritage curtilage should have regard to the identified heritage zones and for the identified significance of the subject site and complex.

8.6.2 *Care of Significant Fabric*

All works

The Brickworks has been assessed as a place of a relatively high level of cultural heritage significance, variously at either a local or State / Territory level, for historic, scientific (technological and geological) reasons, aesthetic and social values.

The policy objectives set down in this chapter identify the approach to conserving fabric of core and supporting significance, and ensure that works to the place are compliant with Burra Charter principles. While the multiple values ascribed to the place allow for the consideration of different approaches to its conservation and adaptation, it is important that any conservation or adaptation works undertaken are in accordance with these Burra Charter principles.

This study did not involve a detailed assessment of the current condition of the significant structures and fabric on this site and such an assessment should be undertaken in order to inform future conservation and maintenance works. As a general comment, however, the physical condition of the buildings and structures varies from fair to poor, with the majority

appearing to be in need of extensive maintenance and conservation works, ranging from replacement of cladding and the like to – in the case of a number of kilns – potentially significant structural remediation works.

Policy 5

All future conservation works which affect fabric and elements of significance (core and supporting elements) should be carried out having regard for the principles of the Australia ICOMOS Burra Charter, 1999 (see Appendix A).

Policy 6

Undertake a detailed assessment of the current physical condition of all significant fabric and use this assessment to inform all future conservation and maintenance works. Establish a priority list of works to ensure the long term conservation of the place.

General repairs and maintenance

A consistent and regular approach to the maintenance of fabric is recommended. The approach should firstly be to maintain and ensure that significant fabric does not deteriorate and secondly to conserve significant existing fabric. An ongoing cyclical inspection and maintenance program should be instigated to ensure that the significant fabric is maintained in good physical condition and its integrity is not jeopardised.

The site generally suffers from a lack of regular maintenance and is subject to sporadic vandalism. A programme of immediate repair and maintenance works should be undertaken in accordance with the recommendations of this plan (refer Appendix B).

Policy 7

Introduce an ongoing cyclical inspection and maintenance program to ensure that the significant fabric is maintained in good condition and its integrity is not jeopardised. Institute at least annual maintenance inspections and five yearly inspections to address longer term capital works.

Policy 8

Core elements should be retained and conserved.

If alterations or changes are proposed, then the works should have regard for the identified aspects of heritage significance, and should be guided by the policies and recommendations included in this report. A key consideration is the impact of any proposed change on the legibility and presentation of the complex as a whole.

Policy 9

Generally, retention of supporting elements is preferred however these elements provide greater flexibility than core elements with regard to change and alteration, particularly internally. Where alterations or changes are proposed, these should be guided by the policies and recommendations included in this report, and should have regard for the identified aspects of heritage significance both for the specific element and the values of the complex as a whole. A key consideration is the impact of any proposed change on the legibility and presentation of the complex as a whole.

Policy 10

Incidental elements typically can be retained, altered or removed. This is a general policy, however, and specific works or proposals relating to these elements, including replacement or alteration, should also have regard for policies and recommendations included elsewhere in this report which either address the specific element, or address matters to do with site presentation, new development, etc.

8.6.3 *Reinstatement/ reconstruction works*

The Brickworks complex is an evolved place with both core and supporting buildings and elements ranging in their construction dates between 1913 and the 1960s. In addition, the current structures have been modified, in many cases, extensively, as the complex has evolved and expanded and reflecting changes in work practices and processes on the site. In many cases, original or early openings have been altered, including enlargement of openings and in some cases, the infilling of openings. There are also buildings which have undergone significant rebuilding and in some cases inaccurate or conjectural reconstruction works (see, for example, the Staffordshire and 1927 Hardy patent kiln).

In some cases, the works that have occurred are such that they demonstrate major changes in work practices (such as the widening of the entries to the kiln chambers to allow for the use of fork lifts). In other cases, however, alterations have been made on a more ad hoc basis and do detract from the presentation and/or legibility of particular elements.

As a general principle, while reinstatement and/or reconstruction works could be undertaken, either to individual buildings or to reconstruct missing elements on the site, there is no requirement to undertake such works across the site as a whole, nor would such an approach be recommended.

Any reinstatement or reconstruction works which are proposed should be assessed against the specific recommendations for individual elements and as part of a broader strategy for site interpretation and presentation. For individual buildings there may be cases where the reversal of particular alterations or additions would improve the presentation and legibility of the building, but in all cases there is a need to ensure there is clarity about the evolved nature of the fabric. Refer also to the policy for Site Interpretation (8.6.16).

Policy 11

Any reinstatement or reconstruction works which are proposed should be assessed against the specific recommendations for individual elements in this CMP and as part of a broader strategy for site interpretation and presentation.

8.6.4 *Relocation*

The relocation of particular structures within the site would obscure an understanding of the layout and processes on this site and is not supported. The majority of supporting elements on the site are of limited significance in their own right, instead deriving their meaning and significance from their contribution to the complex as a whole.

Policy 12

Relocation of individual buildings and structures is not supported.

8.6.5 *Plant and machinery*

The majority of the brickmaking plant from this complex has been removed, including the brick presses and crushers. Surviving machinery *in situ* is generally limited to conveyers and hoppers of the post-WWII period surviving in the Machine Bays. This is not of particular interest in its own right, nor is it specific to the brickmaking process. Notwithstanding, this remnant plant and supporting structure partly demonstrates the movement and handling of crushed material from the two Pan Houses through the Machine Bays and down to the brick presses and preferably should be retained in any adaptation of these buildings.

There is also remnant equipment in the Power House, which appears possibly to be early in origins. Its retention is not required on heritage grounds.

Similarly, it is noted that the Workshop retains a gantry crane, this is unrelated to the brickmaking process itself and is not considered of any note in the context of this site.

The fan houses generally do not retain plant *per se* but there is some remnant ducting which should be retained if possible.

The firing floors of the Staffordshire and Hardy patent kilns retain remnants of the equipment used to fire and feed the chambers on the levels below. In any adaptation of these buildings, a representative area or areas of the firing floors should be retained with this equipment intact.

All underground workings related to the kiln operations should be retained; this includes flue systems and connections to the fan houses and stacks.

Elsewhere across the site there are remnant components/elements of plant and equipment still present. Generally, however, these are neither intact nor *in situ*, but rather, represent remnants of disassembled/dismantled plant left in buildings or elsewhere on site and in this context do not provide coherent evidence of specific brickmaking processes. It is also noted that the provenance of the remnant items distributed around the site - see, for example, the items in Machine Bay III - is unknown. A list of 'Artifacts/Relics' was prepared by Mr Bruce McDonald (former site caretaker) for the purposes of the 1986 Conservation Plan (refer data

sheet appendix in this document); and this list appears to include items brought onto the site from other brickworks. Some of the items on Mr McDonald's list –not all - remain on site, though a complete inventory has not been prepared as part of this Conservation Management Plan.

Policy 13

All underground workings related to the kiln operations should be retained; this includes flue systems and connections to the fan houses and stacks.

In the event the Machine Bays are retained and adapted, the remnant conveyors and hoppers on the upper level of the building should be retained in situ.

Other remnant and/or dismantled items of plant and equipment on site should be further investigated. Where appropriate and feasible these could be retained for interpretive purposes. Where these objects are to be removed, they should be recorded (refer to 8.6.8) prior to removal.

8.6.6 *Ephemera*

While not documented in this CMP, there are a number of examples of remnant brickmaking ephemera located around the site, including painted numbers and similar within the kilns and elsewhere. All such ephemera should be retained, even in cases where its origins are unknown.

Policy 14

All brickmaking ephemera should be retained wherever possible.

8.6.7 *Archaeology*

This site has historical archaeological potential in the form of the evidence that is likely to remain of the numerous buildings and structures that are documented as having been constructed on the site but that have been demolished. Refer to the Demolished Buildings sections in Chapters 2-5 of this CMP.

While on the basis of the research undertaken for this CMP, none of this evidence is considered likely to be of a level of significance that necessarily would warrant retention in situ, or would preclude development on the site, it has the potential to provide further detail on the history and operation of the site. A predictive archaeological assessment should be prepared for the site.

Policy 15

A predictive historical archaeological assessment should be undertaken for the study area and abutting sites. This study should identify the relative potential for sub-surface remains on the site and their likely nature and significance. Depending on the outcome of such a study, an Archaeological Management Plan should be prepared prior to any development or disturbance of the site.

8.6.8 *Landscape elements*

The area surrounding the subject site has been heavily treed and still has a strong landscape quality, and landscape and tree cultivation have been important themes in the history of abutting sites. Specifically, the Commonwealth nursery and Westbourne Woods arboretum were established in the 1910s to the west of the site, and the Commonwealth Forestry School was established in 1926 to its east.

The landscape on the Brickworks site itself includes large numbers of trees scattered through and around the quarry, which appear to be mostly self-seeded conifers (species vary but predominantly *Pinus radiata*). While not investigated in detail, there may also be some consciously planted specimens in this part of the site, possibly of some age; photographs of the 1920s show what appear to be newly planted trees as well as some more mature trees on the ridge to the north-east of the site. There are other trees planted around the site, a mix of predominantly deciduous trees of varying ages. The site is infested with weeds including blackberries.

Historically, while trees appear to have been deliberately planted on the site, there is no evidence of a consciously designed landscape treatment implemented across the site, nor would one be expected on an industrial site such as this one with no public presentation. Trees are more likely to have been planted within the site for their amenity value and on a more *ad hoc* basis.

Land to the south and west has a landscape quality that contributes to the setting of the place. Refer to the policies at 8.6.

Policy 16

The existing plantings at the site are not of heritage significance. The landscaped quality of the immediate surrounds forms part of the setting of the place and should be maintained as far as possible. Refer to the policies at 8.6.

8.6.9 *Use and public access*

The Brickworks site has not been operated for the manufacture of bricks since its closure in 1976, and its cultural heritage significance does not depend on the ongoing use of the site for a brickworks or a related industrial purpose (though the latter would be an option if feasible). Proposed future uses for the site should be assessed on the basis of their feasibility and the likely nature and level of impact on the identified heritage values and significant fabric. Compatible uses are those which are not in conflict with these values or the significant fabric.

Possible future uses would include any of the following or – most likely - a combination of more than one use:

- Institutional/educational, includes potential government use
- Residential
- Retail/other commercial including office
- Tourism-related uses
- Industrial – light manufacturing – processing, storage and sales
- Arts-related uses including studio spaces and performance facilities
- Community facilities.

Figure 198 View of the brickworks, looking south-west toward the new Hardy patent kiln, c. 1927. Note the young conifers in the foreground.
Source: National Library of Australia

Public access into this site is not a major theme in the operational history of the place, however, parts of the site have been accessible to the public at different times in post-closure period. While not a key heritage objective, as an important heritage asset in Canberra, it would be desirable that there be some public access to at least parts of the site.

Given the scientific and educative value of the quarry as the type locality for the Yarralumla Formation, it would also be desirable that there be some public access to the quarry and its significant geological sites as identified.

Policy 17

A range of possible future uses could be considered. Future uses for the site should be assessed on the basis of their feasibility and the likely nature and level of impact on the identified heritage values and significant fabric.

It would be desirable that in any new use or uses, consideration be given to allowing public access to all or part of the site

Figure 199 Hardy patent kiln under construction, looking north-east. Note the plantings on the ridge.
Source: National Library of Australia.

8.6.10 *Views and vistas*

Notwithstanding the 1953 chimney stack provides a marker for the site in the local area and can also be viewed from more distant locations, the Canberra Brickworks site is one which overall has a relatively understated presence in the surrounding area. Views are available into the site from the abutting sites, but these are relatively incidental and of no particular heritage significance. While some urban industrial complexes of a comparable age were designed with a conscious more formal presentation to one or more street frontages, this is not the case for the Brickworks, and it is a site that is completely utilitarian in its physical/architectural conception.

Figure 200 View westward from within the quarry, late 1920s, showing the earlier machine bays and the newly constructed Hardy patent kiln on the right.
Source: National Archives of Australia

Figure 201 Current view to the south-west from within the quarry.

Figure 202 Another view westward into the site.

Figure 203 View southward between the kilns and their associated fan houses.

As noted earlier, the site is one where its historic and aesthetic qualities and the relationships between the different elements within the complex are experienced from within the site boundaries themselves and in moving around the site.

Rather than key views *per se*, generally it is the relationship between the different elements that is important (see, for example, the relationship between the brickpit (quarry) and the manufacturing buildings to the west and the relationship between the kilns and their associated fan houses and chimneys). There are interesting views toward the building complex from within the quarry including views from the north-east toward the corrugated iron clad process buildings along the eastern edge of the complex. In the latter case the relationship is evident in the view northward between the kilns and their associated fan houses and chimneys and this view preferably should be maintained.

Policy 18

An appreciation of the relationships between key elements of the complex should be maintained, including the link between the kilns and their fan houses and chimneys and the relationship between the brickmaking complex and the brickpit (quarry).

Policy 19

The view northward between the kilns and the fan houses and their associated chimneys should be maintained.

The visual links between the building complex and the quarry should be maintained.

8.6.11 *Adaptation*

The approach to adaptation on this site should be one that seeks to maintain an understanding of the history of the site and its operation while introducing feasible new uses that will support the heritage values of the place in the long term.

The reality is that the form, scale and configuration of a number of the buildings on the site is such that they offer limited scope for adaptation. This group would include the chimneys, the fan houses and a number of the smaller steel-clad process buildings, including those where remnant plant, platforms and other infrastructure survives internally and where the conservation policy is for retention of these elements.

The balance of buildings on the site, including the kilns and some of the larger process buildings, have good potential for the adaptation of internal spaces and in most cases potential also for external modifications to facilitate a new use. In considering this issue, however, it is recognised that in many cases, adaptation for a feasible use will necessarily alter the buildings in a relatively fundamental manner, and in some cases would be likely to result in an outcome that may challenge the assessed heritage value. For example, the White Pan Room (Large Crusher House, Building 19) is a building where adaptation for any new use other than as a basic shed would involve major physical change - enclosure of the partly open structure, introduction of new floor levels, vertical connections, services and the like – and would fundamentally alter the presentation and configuration of the structure. For many of the buildings on this site there would also be such substantial costs associated with adaptation such that reuse may not be feasible when considered on a building-by-building basis.

While the CMP provides specific conservation policies and comments on the adaptation potential for each building of core and supporting significance (refer 8.7), it is preferable the consideration of adaptive reuse be undertaken as an integrated exercise for the site as a whole rather than on a building-by-building basis. The objective is that key aspects of the history and operation of the site are represented rather than focusing on any one particular building, particularly given their repetitive nature. This would allow for a more effective management of the balance between conservation and adaptive reuse. It also allows for a more liberal or interventionist approach to adaptation in some cases, on the basis that in other cases more of the significant fabric, external presentation and internal volumes are retained intact.

In doing so, the following overriding objectives should be considered, with reference to the options identified at 8.5:

Option 1 - whole of site conservation

- Retention of a representative area of the firing floor (including firing holes and any remnant equipment) to at least one kiln;
- Retention of a sense of the large internal volumes to one or more of the larger steel-clad process buildings east of the kilns;
- Retention of an understanding of the physical and functional connections between the process buildings to the east of the kilns; and
- Retention of a proportion of remnant process plant and/or related structure in the larger steel-clad process buildings east of the kilns.

Option 2 – partial site conservation

- Retention of a representative area of the firing floors to one or both of the Staffordshire or Hardy patent kilns (including firing holes and any remnant equipment); and
- Retention of representative areas of the kiln chambers to both kilns.

Refer also to the building-specific policies at 8.7 and 8.8.

Building connectivity

There is an established history of connections/links between buildings on this site, both below ground, at ground and elevated. While not an issue that is discussed on a building-by building basis in the building-specific policies at (refer 8.7 and 8.8), in considering the related issues of adaptive use and site development there is an opportunity to continue these patterns of connectedness and multiple levels of activity in any future works.

Policy 20

Proposals for adaptive reuse should consider the complex as a whole and ensure that an appropriate balance is achieved between retention and conservation of fabric and delivery of a long term sustainable use. A key objective should be to ensure that the operation of the place as a brickworks can be readily understood in the retained and reused fabric without being reliant upon complex added interpretation.

8.6.12 *Site development and new works*

Key considerations

The area within the heritage curtilage has considerable potential for new development subject to that development being responsive to the cultural heritage values of the place.

In considering the location, scale, form and design of any new building/s and landscaping treatments, important considerations include the following:

- The overall legibility of the place as an industrial complex, including the planning, layout and spatial qualities of the site, and the relationship between key elements and building groupings (the quarry, process buildings, and kilns, represent the historic pattern/sequence of use of the site – zones for extracting, production, firing etc);
- Important views within the site (view northward between the kilns and the fan houses and their associated chimneys, views to and from the quarry); and
- The strong industrial aesthetic quality of the place;

The nature and location of site development contemplated will vary depending on the overall approach to the site. Refer to the discussion of Option 1 and Option 2 at 8.5.

In addition, all site development should have regard to the two heritage management zones identified at section 8.6.1 and as discussed below.

Primary heritage zone

In addition to the key considerations listed above, within the Primary Heritage Zone (refer 8.6.1), the following principles should apply to all new development:

The area of the quarry included within the Heritage Zone should generally be retained as an open landscape zone. New built form should be limited to incidental 'garden' structures other than along the north-south spine at the interface between the quarry and the plant area. In this area development could occur which reinforces this spine while maintaining some connection between the quarry and plant.

No new development should occur in the original brickyard space between the Staffordshire and Hardy Patent 1 kilns.

Any new buildings within the Primary Heritage Zone should be of a scale and nature that relates to the existing building forms on the site. They should be of a relatively massive in their scale and form, reflecting the existing industrial forms. The introduction of multiple domestic-scaled building forms (individual houses) should generally be avoided.

New development should respect and respond to the site planning principles of the existing complex including the orthogonal and gridded qualities of the layout and the pattern of access and circulation (refer to 8.6.14). To the west of the fan houses there is greater scope to explore a more diverse response.

As noted earlier, there is an established history of connections/links between buildings on this site, both below ground, at ground and elevated. In considering the related issues of adaptive use and site development there is an opportunity to continue these patterns of connectedness and multiple levels of activity in any future works. In this regard, subject to

other objectives in this CMP, there may be scope for new buildings on the site to connect to retained buildings at one or more levels in order to facilitate access and circulation.

Buffer heritage zone

In addition to the key considerations listed above, within the Buffer Heritage Zone (refer 8.6.1), the following principles should apply to new development:

- Development within the eastern section of the Buffer Heritage Zone could adopt a wider range of different forms without an adverse impact on the heritage values of the Brickworks. This could include the use of the quarry floor for recreation and associated activities.
- The impact of new development in this eastern section on the views into the quarry and along the western edge of the Brickworks buildings complex should be considered.
- Development to the west, south and northern areas of the Buffer Heritage Zone should have regard to the identified setting of the brickworks.

Policy 21

All site development should be undertaken in accordance with the guidelines in this Conservation Management Plan.

8.6.13 *Site presentation*

In considering any new development or reuse of this complex, there is a need to consider the issue of the presentation of the place as a whole with reference to its valued industrial aesthetic character.

This is an issue that should be considered in the retention of elements that contribute to this character, to the design of any new buildings, to the adaptation of existing buildings and in any urban design/landscape planning undertaken for the site.

While there is a need to make the site safe, appropriately accessible and code-compliant (refer to 8.6.18), within these parameters as much as is possible of the industrial character of the place should be maintained, including not only the buildings and elements of core or supporting significance, but also the various remnants of plant and other features, including painted numbers/signs and other ephemeral elements that may not be of particular significance in their own right but that reference and support the character and presentation of the place. This also includes the infrastructure related to site drainage which is a distinctive feature of this site and presents as a series of grid lines around and between the main kilns.

In addition, any new landscaping / urban design treatment at the ground plane preferably should adopt an aesthetic that is in keeping with the history of the site and should not introduce an aesthetic that is at odds with that history (for example, an overly domestic treatment would not be appropriate in the vicinity of the main building complex or within the open spaces of the quarry). Any new treatment will require careful management of hard and soft landscaping elements so as to provide an appropriate setting for the retained buildings.

Policy 22

In considering any new development or reuse of this complex, there is a need to consider the issue of the presentation of the place as a whole with reference to its valued industrial aesthetic character.

8.6.14 *Access and circulation*

Documentary and photographic evidence suggests that the principal road access to the site historically has generally been from the south and south-west (though not necessarily exactly on the current alignment). There is also a strong tradition of connecting roadways along the west of the kilns and, in the post-1940 period, between the process buildings and the quarry (the latter reflecting the delivery of raw materials onto the site following the closure of the quarry).

The 1976 aerial photograph shows a more complex arrangement of roads within and around the site, including routes through and around the quarry reflecting the complex nature of truck movements in and out of the site in this later phase of operations.

Policy 23

The traditional principal approach to the Brickworks complex from the south should be maintained. Additional access points could be developed if required.

Within the site, the historic circulation pattern should be referenced in any future site planning, including the roadway along the western edge of the kilns and the space (roadway now removed) along the western edge of the quarry.

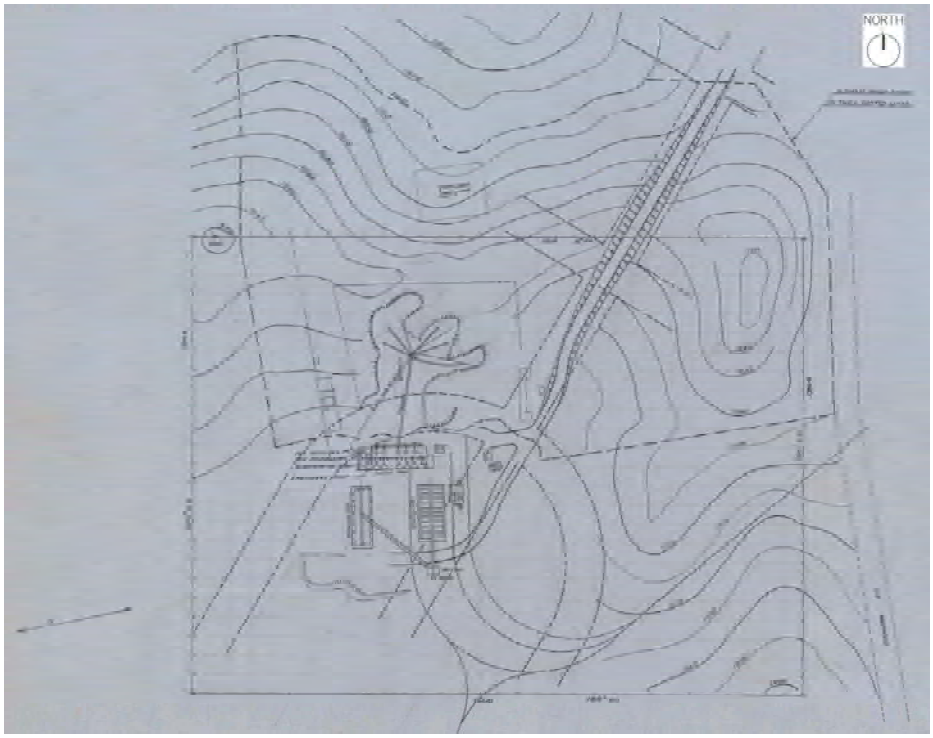


Figure 204 1926 site plan.
Source: National Archives of Australia

Figure 205 Site plan 1947.
Source: National Archives of Australia

Figure 206 Aerial view of the brickworks, 1950.
Source: ACT Planning and Land Authority.

Figure 207 Aerial view, 1976.
Source: ACT Heritage Library.

8.6.15 *Site recording*

In the situation where major change is proposed for the site, or where significant structures or elements are proposed for demolition or archaeological sites for disturbance or removal, it is recommended that a recording program be undertaken. This might include, but would not necessarily be restricted to, measured drawings and a black and white archival quality photographic record (the latter is still regarded as a sound and archivally reliable form of recording); a digital or video record may also be undertaken. The records should be lodged with an appropriate repository, for future research purposes. A copy should also be retained and used, where appropriate, in any future site interpretation.

It is also recommended that all works to the site, including maintenance, conservation or other works-related activities, be recorded, with records maintained centrally by the body responsible for the site.

It would also be desirable that an oral history project be undertaken for the site. Such a project should focus on the operation of the site as a brickworks and involve interviews with former employees. There are a number of reasons for undertaking such a project, including:

- expanding the scope of the existing archival record of the site;
- providing more specific information (including technical information) about the operation of the brickworks; and
- providing material that could potentially be used in an interpretation plan for the site (refer 8.6.16).

Preferably, the oral history project should also include interviews with local residents about the history of the brickworks both pre- and post-closure and the relationship of the local community to the site. Given there was no scope in this CMP to undertake a full social values assessment, such a project could further inform the understanding of any social values which might attach to the site.

In addition to this, it would be desirable that more detailed documentary research be undertaken into the brickmaking processes and equipment used on this site. This would include more detailed research into the documentation held by the National Archives of Australia and elsewhere.

Policy 24

In the situation where major change is proposed for the site or significant structures or elements are proposed for demolition or archaeological sites for disturbance or removal, ensure an archival record is made prior to the works.

Maintain records of all works to the site, including maintenance, conservation or other works-related activities.

Undertake an oral history project for the site.

Undertake a more detailed research project into the processes and equipment used on this site.

8.6.16 *Site interpretation*

Any adaptive reuse or redevelopment proposal for the site should include the development and implementation of an interpretation plan for the site.

The form any interpretation plan will take will be dependant to a large degree on the nature of the new use or uses for the site and the level of public access that will be available to the site. Different interpretive devices are suited to different contexts.

Whatever its form, the interpretation plan should be developed on the basis it augments the physical evidence at the site and allows for a better understanding of the fabric and processes that occurred here historically.

It is important the plan work to improve the legibility of the site, including an understanding of the evolved nature of the buildings and complex as responsive to changes in brickmaking processes. It should also make reference to those features at the site that have been demolished, including site features which are evidenced through the archaeological record. The plan should also focus on the key historical themes associated with the site, the most important of which is its role in the early development of Canberra, as well, potentially as the experience of workers at the site (refer to the policy for site recording 8.6.8).

Policy 25

An interpretation plan should be developed for the site.

8.6.17 *Risk Management*

The most obvious and immediate risks to this site are considered to be those of fire and vandalism. To the extent that both can be related to unauthorised access into the site, these risks are to a degree interrelated. Unauthorised access also poses public safety risks; there are some limited areas of the building complex, including but not limited to the elevated walkways, which have structural and other issues of non-compliance and are not safe.

It is commented that the ongoing presence of the current tenant, Thor's Hammer, on the site, has a major positive benefit in terms of managing a number of these risks as it substantially reduces the risk of unauthorised access and activity within the main building complex. In the event the site is adapted and/or redeveloped, the pattern of access to the site will change and the security/vandalism risk should be reviewed at that time.

While the quarry is fenced off from the main building complex and approach road, access to this area is currently available via abutting residential properties. This access does not currently appear to pose major issues in terms of vandalism or other unwanted activity.

There are also site contamination (hazardous materials) issues which require management currently and into the future.

Threat	**Probability**	**Preparation / Response**
Vandalism	Moderate	Review site security for the building complex. Consider the provision of additional security measures to prevent access to individual buildings and structures.
Public safety	Moderate	Refer to recommendations above for reviewing site security, particularly those areas of the building complex that are not safe.
Fire	Always present	Refer to the recommendations of the 2007 and 2009 fire services and safety reports (by Steve Coomes and Ross Turton respectively) and review current arrangements against the recommendations in these reports. Fully compliant fire services will be required depending on the nature of any future use.

Threat	Probability	Preparation / Response
Site contamination	High	Review the status of site against the findings and recommendations of the earlier environmental audits (Robson Laboratories, 2006) and implement these recommendations. Pending removal of hazardous materials secure areas against access as per the recommendations of these audits.

Policy 26

Identify risks and prepare an appropriate strategy.

8.6.18 *Statutory constraints*

Statutory heritage framework

The Canberra Brickworks is currently and will continue to be managed within a statutory framework established under the *Heritage Act* 2004 and the Planning and Development Act 2007 which acknowledges the heritage values of the place.

This is an appropriate level of statutory control having regard for the nature and level of significance of the place.

In terms of statutory processes, pursuant to Part 10 of the *Heritage Act* and s. 148 of the *Planning and Development Act*, for any registered (or nominated) place the ACT Planning and Land Authority (ACTPLA) is required to give a copy of any development proposal (in the merit or impact tract under that Act) to the Heritage Council. The Heritage Council provides advice (within 15 working days) to the ACTPLA about the effect of a development on the heritage significance of the place. This advice must be considered by ACTPLA in approving or refusing to approve a development application. The Heritage Council's advice to the ACTPLA is required to follow a prescribed format (s.60 of the *Heritage Act*). This advice must be considered by the ACTPLA in approving or refusing to approve a development application. There are appeal or review procedures to the Administrative Appeals Tribunal. These may be pursued by the Heritage Council (review of a decision by the ACTPLA to approve or refuse the application) or by the proponent or other interested party (review of a decision by the ACTPLA to refuse a development application or approve with conditions).

The *Heritage Act* also contains provisions enabling the Heritage Council to make Heritage Guidelines (refer Part 5 of the *Heritage Act*). Heritage Guidelines are a statutory instrument and made subject to a public consultation process under the Act. Pursuant to s.27 of the *Heritage Act*, a function under the Act that relates, directly or indirectly, to the conservation of a place or object must be exercised in accordance with any applicable heritage guidelines.

There are Heritage Guidelines prepared by the Heritage Council in place for the Canberra Brickworks. These include 'Specific Requirements' or guidelines addressing a range of activities and adaptation/development actions. These guidelines are directed at the implementation of a specified conservation policy developed by the Council, which reads as follows:

> The identified heritage values and intrinsic features of the place shall be conserved whilst allowing for the integrated and sympathetic redevelopment of the place as a single entity, consistent with contemporary practices for the adaptive reuse of industrial and commercial heritage places. In conserving and developing the place its significant historical use as an industrial site for the production of bricks and clay products shall continue to be evident and accessible to the public.
>
> Redevelopment of all or part of the place shall be in accordance with a Conservation and Management Plan endorsed by the ACT Heritage Council.

The Specific Requirements themselves are in a guideline format arranged under a series of headings:

i. Landscape Setting

ii. Built Structures – including alterations and additions

iii. Industrial Equipment

iv. Demolition

While not necessarily addressing all elements on the site individually, the guidelines are relatively detailed and address issues of conservation, demolition, alterations and additions to retained buildings, and site development, including prescribing setbacks from particular elements of any new landscaping or built elements.

The document makes reference to the need for a Conservation Management Plan endorsed by the Heritage Council to further direct the management of the site.

This Conservation Management Plan should be endorsed by the Heritage Council and the Heritage Guidelines revised both to make explicit reference to the CMP and to be in accordance with the CMP assessment (statement of significance) and conservation policies.

While there is much common ground between the Specific Requirements and the CMP, there are equally a number of key areas where there are inconsistencies and differences of approach. It would clearly be undesirable to have contradictory policy documents with recognised status under the *Heritage Act*.

Policy 27

The Canberra Brickworks should remain as a registered place in the ACT Heritage Register with its current extent of registration.

The Entry to the ACT Heritage Register should be reviewed and amended to make specific reference to the assessment and conservation policies contained in this Conservation Management Plan.

The Conservation Management Plan should be endorsed by the ACT Heritage Council as the key document underpinning the future management, adaptation and development of the Canberra Brickworks site.

National Capital Plan

The National Capital Plan (NCP) is the strategic plan for Canberra and the Australian Capital Territory, established by the Australian Government under the Australian Capital Territory (Planning and Land Management) Act 1988. The overarching objective of the plan is to ensure that, 'Canberra and the Territory are planned and developed in accordance with their national significance'. The key aspects of national significance include:

- The pre-eminence of the role of Canberra and the Territory as the National Capital;
- Preservation and enhancement of the landscape features which give the National Capital its character and setting;
- Respect for the key elements of Walter Burley Griffin's formally adopted plan for Canberra;
- Creation, preservation and enhancement of fitting sites, approaches and backdrops for national institutions and ceremonies as well as National Capital Uses; and
- The development of a city which both respects environmental values and reflects national concerns with the sustainability of Australia's urban areas.

The NCP identifies 'designated land' within Canberra. This is, 'land that has the special characteristics of the National Capital'. The Canberra Brickworks is not designated land (Figure 209). However, land to the south, north and west (Sections 103, 113, 119 and 123) is designated, and forms part of the National Capital Open Space system: Sections 103 and 119 are designated land within the National Capital Area; sections 113 and 123 are identified as uncommitted. The Open Space system includes the inner hills that form the setting for the National Capital, and Lake Burley Griffin and its foreshore. The principal of visual separation between the main town centres within the National Capital is a key element of the Open Space system. The ridgeline to the south of the brickworks forms an effective barrier between Yarralumla and Woden to the south.

Specific recommendations with implications for the Canberra Brickworks in the NCP are:

- Any new road servicing the Canberra Brickworks be located off Dudley Street and not Cotter Road so as not to conflict with Dunrossil Drive as the formal entrance to the Governor General's residence.
- Any new residential areas should be contained to the north of the ridge line running from the Cotter Road / Dunrossil Drive intersection through to Denman Street so as to assist in maintaining visual separation between Central Canberra and Woden Valley.
- Existing amenity / inter-town visual separation planting be maintained within the blocks currently identified as 3/94, 1/123 and 1/113.

While of relevance to the planning of the abutting sites and surrounding area, these recommendations are not considered to have major implications for the management of the cultural heritage values of the Canberra Brickworks site.

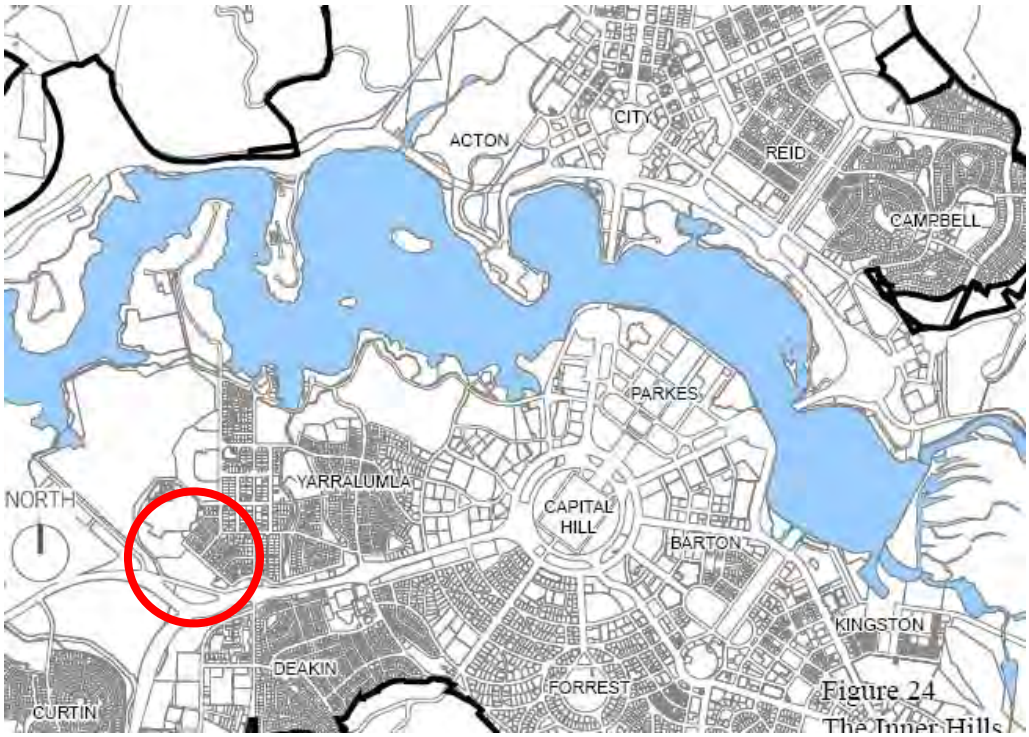


Figure 208 Plan of the National Capital showing the inner hills. The Brickworks is highlighted.
Source: National Capital Plan (consolidated, September 2009), p. 24.

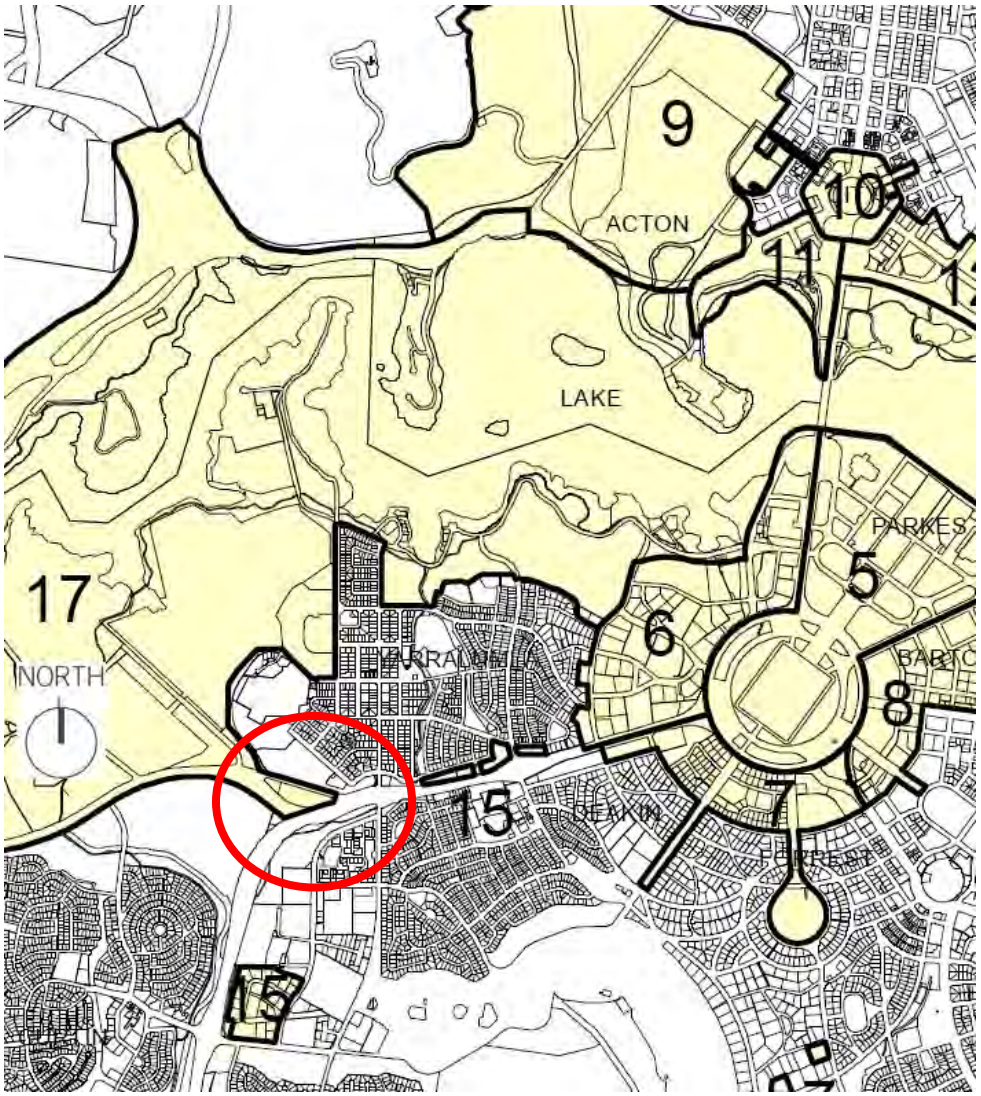


Figure 209 Designated land within the National Capital Plan. The Canberra Brickworks (highlighted) is excluded, but land to the south, north and west is included as part of the National Capital Open Space system.
Source: National Capital Plan (consolidated, September 2009), p. 28.

Territory Plan

The Territory Plan (TP), which is required to be consistent with the NCP, is the primary statutory planning document in the Australian Capital Territory and is established under the Planning and Development Act 2007. The overarching purpose of the TP is to manage development and land use change in a manner consistent with strategic directions set by the ACT Government, Legislative Assembly and the community.

The Canberra Brickworks and land immediately to the south and west (Blocks 7 and 20) are zoned Leisure and Accommodation.

Residential areas to the north (Lane-Poole Place) and east are designated RZ1 (suburban). The land between Dudley Street and the ridgeline to the north, and the section of Westbourne Woods to the west of the site is designated 'Restricted Access Recreation' (PRZ2) (Figure 210).

Figure 210 Land use plan (Territory Plan), with the Brickworks highlighted. Orange is Suburban (RZ1), dark green is Restricted Access Recreation (PRZ2) and blue is Leisure and Accommodation (CZ6).
Source: Territory Plan online.

The current zoning of the Brickworks (Leisure and Accommodation, CZ6) does not reflect the historic use of the site. While the zoning is wide-ranging in the uses that can be considered, it also does not necessarily capture all potential compatible uses. One or more alternative zonings could be considered to allow for an appropriate adaptive reuse and development on the site.

Consideration should be given to implementation of controls that would assist in the management of the Buffer Heritage Zone as identified in this Conservation Management Plan (refer 8.6.1)

Policy 28

Having regard for the Conservation Management Plan policies in relation to use, the Territory Plan could be amended to provide for consideration of a range of alternative uses at and within the registered site.

Consideration should be given to implementation of controls that would assist in the management of the Buffer Heritage Zone as identified in this Conservation Management Plan (refer 8.6.1)

Building Code of Australia

The Building Code of Australia (BCA) is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government and state and territory governments. The BCA has been given the status of building regulations by all States and Territories.

The BCA is the definitive regulatory resource for building construction, providing a nationally accepted and uniform approach to technical requirements for the building industry. It contains technical provisions for the design and construction of buildings and other structures, covering such matters as structure, fire resistance, access and egress, environmental sustainability, services and equipment, and certain aspects of health and amenity.

In addition to the requirement for new work to comply with the BCA, in cases of existing buildings undergoing alterations and/or additions (including buildings with heritage controls), some discretion may be available with regard to upgrading the existing part of the building to meet the BCA, based on either fire safety or volume of work. This means that for an existing building where no work is being proposed, the building is not subject to the BCA and therefore, is not required by legislation to be upgraded whenever the BCA is amended. For an existing building undergoing alterations and/or additions, including buildings with heritage controls, the new work must comply with the BCA although the existing part of the building may be subject to discretion on the basis of a fire safety matter or where the development involves less than 50 per cent of the building. To ensure that this advice on BCA compliance and requirements remains up to date, property managers of the Canberra Brickworks should also make reference to the Australian Building Codes Board.

With specific reference to the heritage implications of achieving BCA compliance, the advice of a heritage practitioner should be sought.

Disability Discrimination Act 1992

The Disability Discrimination Act 1992 (DDA) makes it illegal to discriminate against a person on the basis of their disability. It is not specifically about buildings, however it has an effect on buildings in which the design and construction prevents access by people with a disability, as the owners of those buildings are deemed to be discriminating against people on the basis of a disability.

The DDA is philosophical in approach and:

- Is complaints based
- Has no construction standards
- Applies to actions of discrimination wherever they occur, and
- Can apply retrospectively to both new and existing buildings, wherever the discrimination occurs.

The 'access to buildings component' of the DDA is applied only to buildings that are available for the general public to enter and use, as employees, patrons, customers or the general public. Depending on the nature of future uses contemplated on this site, DDA compliance is likely to be an important issue.

8.6.19 *Adoption and Review*

Policy 29

It is recommended that the conservation policies in this report be endorsed by the Heritage Council, the ACT Property Group and the Land Development Agency, as the basis for the future planning and management of the Canberra Brickworks.

Where there is ambiguity or doubt as to the meaning of a policy, or concern with the practical implication or outcome of a policy's implementation, then this should be clarified with the authors of the report.

Policy 30

The conservation policy should be subject to review, normally at not less than five yearly intervals. Should the circumstances affecting the site alter in any significant way, the policy should be reviewed at that time.

8.7 Specific policies for core elements

Introduction

The following policies are intended to be read and interpreted with reference also to the general conservation and adaptation policies in this document.

8.7.1 *Quarry (01)*

Conservation policy:

The Quarry should be retained as a landscape element that reflects in its form and presentation its origins as an excavated brickpit.

The identified geological features (rock outcrops) should be retained and protected.

Adaptation:

There would be scope for part of the quarry to be developed. The preferred approach would be one in which the western section of the quarry – closest to the brickworks buildings –and including all four of the identified geological sites of significance, was retained as an open landscape feature. While at least two small process-related buildings (clay storage shed and another, specific use unknown) are known to have been built on the levelled floor of this part of the quarry, the preference is for no new buildings to be constructed in this area.

Any new development should be confined to the area to the east and south (within the Heritage Buffer Zone), and should be of a siting, scale and form which will not compromise the presentation of the retained section of the quarry. Refer to the policy for New Works and Site Development (8.6.12).

8.7.2 *Power House (03)*

Conservation policy:

The Power House should be retained and conserved to the extent of the external fabric.

Consideration could be given to the reinstatement of infilled openings to the exterior.

The remnant equipment could be retained or removed as required.

Adaptation:

The building could be adapted internally for a new use.

8.7.3 *Staffordshire Kiln (04)*

Conservation policy:

The kiln should be retained and conserved.

Externally, while the building is highly modified and sections have been substantially rebuilt, the policy is that the fabric generally be retained.

Given the extent of modification that has occurred to the building over the life of the complex and the nature of these changes, there is no strong conservation imperative to reinstate missing or altered elements, including the 1915 single-storey verandah, for example (as was recommended in the 1986 Conservation Plan). Reconstruction or reinstatement of particular elements of the building to a particular phase when other elements and areas are extensively modified has the potential to distort an understanding of the evolved form of the building.

Internally, in order to demonstrate the nature and operation of the firing floors of the continuous kilns on the site, an area of the firing floor of either this kiln or one of the two Hardy patent kilns should be retained intact as a single volume and with all fabric intact including exposed roof trusses, floor with firing holes and examples of remnant control mechanisms. Refer also to the policies at 8.6.11).

It is highly desirable that the evolved nature of the kiln be interpreted so that the sequence of alterations is understood.

Adaptation:

Externally, there is scope for minor changes including new openings. Any new openings that are contemplated at first floor level (in the rebuilt external walls) preferably should be of a form and configuration that references the original.

Roof lights could be introduced though these should be limited in their scale and number.

At ground level, the entries to the kiln chambers generally should be retained intact (i.e. to their current modified form), though there is scope to enclose the chambers with doors recessed into the openings if required. The kiln chambers could be subdivided internally if required, though a representative group of chambers should remain open and un-subdivided.

The derelict remnant verandah structure could be removed and replaced with a new verandah if required. This could be a simple timber structure with corrugated iron roof

based on the original single-storey verandah. It should be clearly identifiable as a contemporary structure and preferably interpreted as such.

Internally, there is scope to adapt the first floor level for a new use or uses. Adaptation works could include internal subdivision and fitout works within the constraints of the conservation policy.

8.7.4 *Fan House for Staffordshire Kiln (05)*

Conservation policy:

The fan house should be retained and conserved including original window openings and joinery.

The internal configuration preferably should be retained as evidence of the original function of the building as the fan house to the Staffordshire kiln, including the lowered floor level and the tunnel connections with both the kiln itself and the associated chimney stack.

The remnant substantially dismantled plant could be retained for interpretive purposes or removed as required. If removed, it should be fully recorded.

Adaptation:

Externally, no new openings should be introduced.

The internal adaptation of the building is constrained by the recommendation that its internal configuration be retained.

There is little or no scope for adaptation of this building.

8.7.5 *Chimney stack for Staffordshire Kiln (06)*

Conservation policy:

The chimney stack and attached kiln should be retained and conserved.

Adaptation:

There is no scope to adapt the chimney or attached kiln.

8.7.6 *Offices (07)*

Conservation policy:

The office building preferably should be retained (refer to 8.5) and conserved and the feasibility of removing the additions and reinstating the original form of the building investigated.

Adaptation:

The building could be adapted internally.

8.7.7 *Hardy patent kiln I (08)*

Conservation policy:

The Hardy patent kiln should be retained and conserved.

Externally, while the building is highly modified and sections have been substantially rebuilt, the policy is that the fabric generally be retained.

As for the Staffordshire kiln (Building 4, given the extent of modification that has occurred to the building and the nature of these changes, there is no strong conservation imperative to reinstate/reconstruct missing or altered elements.

Internally, in order to demonstrate the nature and operation of the firing floors of the continuous kilns on the site, an area of the firing floor either the Staffordshire kiln or one of the two Hardy patent kilns should be retained intact as a single volume and with all fabric intact including exposed roof trusses, floor with firing holes and examples of remnant control mechanisms.

It is highly desirable that the evolved nature of the kiln be interpreted so that the sequence of alterations is understood.

Adaptation:

Externally there is scope for the introduction of new openings at first floor level and in the roof if required.

At ground level, the entries to the kiln chambers generally should be retained in their current modified form, though there is scope to introduce doors recessed into the openings if required. Where openings have been infilled with brickwork this could be removed if required. The current verandah is not original and could be replaced if required, preferably with a simple steel or timber posted structure.

Internally, the kiln chambers could be subdivided internally if required and the firing floor adapted (within the constraints of the conservation policy).

8.7.8 *Hardy patent kiln fan houses (09)*

Conservation policy:

The Hardy patent kiln fan houses should be retained and conserved including the internal configuration and connecting ducts.

Adaptation:

There is no scope for adaptation of these buildings.

8.7.9 *Chimney Stack for Hardy patent kiln I (10)*

Conservation policy:

The chimney stack should be retained and conserved.

Adaptation:

There is no scope to adapt the chimney.

8.7.10 *Chimney Stack for Hardy patent kiln II (13)*

Conservation policy:

The chimney stack should be retained and conserved.

Adaptation:

There is no scope to adapt the chimney.

8.8 Specific policies for supporting elements

8.8.1 *Amenities block (11)*

Conservation policy:

While retention is preferred (refer to 8.5) as part of the larger group of 1950s buildings reflecting the operation of the complex in the post-WWII period, the amenities block is considered a lesser element as an ancillary building unrelated to process.

Adaptation:

The building could be adapted internally.

8.8.2 *Hardy patent kiln II (12)*

Conservation policy:

The Hardy patent kiln II preferably should be retained (refer to 8.5) and conserved to the extent of its external form and fabric including the first floor steel-framed windows.

Internally, in order to demonstrate the nature and operation of the firing floors of the continuous kilns on the site, an area of the firing floor either the Staffordshire kiln or one of the two Hardy patent kilns should be retained intact as a single volume and with all fabric intact including exposed roof trusses, floor with firing holes and examples of remnant control mechanisms.

Other than for the modifications to the wickets to allow fork lift access, and the alterations at the west end, this kiln appears to be relatively intact as built in 1953 and it would be desirable no significant changes be made to the exterior.

Adaptation:

At ground level, the entries to the kiln chambers generally should be retained in their current modified form, though there is scope to introduce doors recessed into the openings if required. Where openings have been infilled with brickwork, this could be removed if required.

The building could be adapted internally, including subdivision of the kiln chambers and first floor.

8.8.3 *Machine Bay I for Staffordshire Kiln and Downdraught Kilns (14)*

Conservation policy:

Machine Bay I preferably should be retained and conserved (refer 8.5) including the skillion form connection to the Staffordshire and Downdraught kilns.

The conveyors, hoppers, walkways etc at the upper level preferably should be retained in situ.

Adaptation:

Externally, there is scope for modifications to be made while still retaining the overall form and presentation of the building.

It would be desirable to retain a sense of the internal volumes in this building and the other related structures. Refer to the policy objectives at 8.6.11.

8.8.4 *Machine Bay II for Hardy patent kiln I (15)*

Conservation policy:

Machine Bay II preferably should be retained and conserved (refer 8.5) including the skillion form connection to the Hardy patent kiln and the elevated conveyor 'bridge' that connects this building to Machine Bay III.

The conveyors, hoppers, walkways etc at the upper level preferably should be retained in situ.

Adaptation:

Externally, there is scope for modifications to be made while still retaining the overall form and presentation of the building.

The building could be adapted internally. It would be desirable to retain a sense of the internal volumes in this building and the other related structures. Refer to the policy objectives at 8.6.11.

8.8.5 *Machine Bay III for Hardy patent Kiln II (16)*

Conservation policy:

Machine Bay III preferably should be retained and conserved (refer 8.5) including the skillion form connection to the Hardy patent kiln and the elevated conveyor' bridge' that connects this building to Machine Bay II.

The conveyors, hoppers, walkways etc at the upper level preferably should be retained in situ.

Adaptation:

Externally, there is scope for modifications to be made while still retaining the overall form and presentation of the building.

The building could be adapted internally.

It would be desirable to retain a sense of the internal volumes in this building and the other related structures. Refer to the policy objectives at 8.6.11.

8.8.6 *Workshop (17)*

Conservation Policy:

The Workshop preferably should be retained and conserved (refer 8.5).

The conveyor that connects this building to the others in this sequence preferably should be retained in situ. There is no requirement to retain the gantry crane or other remnant equipment or internal structure.

Adaptation:

The building could be adapted internally. External modifications could be made if required.

8.8.7 *Small Crusher House (Crusher House I) (18)*

Conservation Policy:

The Small Crusher House preferably should be retained and conserved (refer 8.5).

The remnant platforms and hopper preferably should be retained.

Adaptation:

There is no scope to adapt this building.

8.8.8 *White Pan Room (Large Crusher House II) (19)*

Conservation Policy:

The White Pan Room preferably should be retained and conserved (refer 8.5), though it is recognised in its current condition, this objective may be difficult to achieve.

While not essential, consideration should be given to the retention of the remnant platforms and hopper.

Adaptation:

There is limited scope to adapt this building other than with extensive intervention.

8.8.9 *Primary Crusher House (Crusher House III) (20)*

Conservation Policy:

The Primary Crusher House preferably should be retained and conserved (refer 8.5).

The remnant machinery and conveyor preferably should be retained.

Adaptation:

There is limited scope to adapt this building.

8.8.10 *Elevator/Conveyor (21)*

Conservation Policy:

The Elevator/Conveyor preferably should be retained and conserved (refer 8.5).

Adaptation:

There is no scope to adapt this building.

8.8.11 *Downdraught kilns and associated enclosure (22)*

Conservation Policy:

The Downdraught kilns preferably should be retained and conserved (refer 8.5). While thought to be broadly contemporary with the kilns, the enclosing shed roof structure could be retained or demolished as required.

Adaptation:

There is scope to adapt the Downdraught kilns, including internal subdivision.

The enclosing shed roof structure could be modified as required.

8.8.12 *Downdraught kiln control room*

Conservation Policy:

The control room preferably should be retained and conserved (refer 8.5).

Adaptation:

There is no scope to adapt this building.

8.8.13 *Chimney Stack for Downdraught kilns (24)*

Conservation Policy:

The chimney stack preferably should be retained and conserved (refer 8.5).

Adaptation:

There is no scope to adapt this building.

8.9 Incidental elements

Incidental elements could be retained or demolished as required.

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APPENDIX A ACT HERITAGE REGISTER ENTRY & RNE CITATIONS

ACT Heritage Council

Entry to the ACT Heritage Register

Heritage Act 2004

20068. Yarralumla Brickworks

Section 102 Block 1

YARRALUMLA

This document has been prepared by the ACT Heritage Council.

This entry which was previously part of the old heritage places or the old heritage objects registers (as defined in the ***Heritage Act 2004***), as the case may be, is taken to be registered under the ***Heritage Act 2004***.

Conservation Requirements (including Specific Requirements), as defined under the ***Heritage Act 2004,*** that are contained within this document are taken to be Heritage Guidelines applying to this place or object, as the case may be.

Information restricted under ***the old heritage places register or old heritage objects register*** is restricted under the ***Heritage Act 2004***.

Contact: ***ACT Heritage Council*** ***c/o Secretary*** ***PO Box 144*** ***Lyneham ACT 2602***
Enquiries: ***phone 02 6207 2164*** ***fax 02 6207 5715*** ***e-mail heritage@act.gov.au***

68. Yarralumla Brickworks, Yarralumla [V118][1]

Location

District of Canberra Central, Division of Yarralumla, Section 102 Block 1 as identified in Figure 68 and indicated on the Territory Plan Map by the Heritage Places Register Overlay H68.

Features Intrinsic To The Heritage Significance Of The Place
The place comprises the elements listed in Schedule 1 (rated as possessing exceptional significance) and Schedule 2 (rated as possessing considerable significance), as identified in Figure 68a.

Schedule 1 Elements Of Exceptional Significance

1) Kiln - Staffordshire (1915)
2) Fan House for Staffordshire Kiln (1915)
3) Kiln - Hardy-Patent (1927)
4) Fan House for Hardy Patent Kiln (1953)
5) Kiln - Hardy-Patent (1953)
6) Kilns - Downdraft a, b, c (1963)
7) Chimney Stacks for Staffordshire Kiln (1915)
8) Chimney Stack for Hardy Patent Kiln (1927)
9) Chimney Stack for Hardy Patent Kiln (1953)
10) Chimney Stack for Downdraft Kiln (1963)
11) Quarry
12) Geological features A, B, C, D

Schedule 2 Elements Of Moderate Significance

13) Office (1916)
14) Power House (1915)
15) Machine Bay for Staffordshire and Downdraft Kilns (1955)
16) Machine Bay for Hardy-Patent (1955)
17) Machine Bay for Hardy-Patent (1955)
18) Workshop (1955)
19) Large Crusher House (1955)
20) Primary Crusher House (1955)
21) Small Crusher House
22) Elevator Conveyor (1955)
23) Remains of the Brickworks Accommodation Village

Statement Of Significance

Operational from 1913 to 1976, the Yarralumla Brickworks is of historical value as the first industrial manufacturing facility within the ACT, and for its integral role in providing the base material used in the construction of the early buildings in the National Capital.

The Yarralumla Brickworks is a relatively intact representative example of large urban brickworks from the early 20th Century, a type that is becoming increasingly rare nationally and internationally. The Brickworks comprise a cultural landscape where the remaining buildings, structures, equipment and landscape features have the ability to demonstrate the evolution of a range of industrial processes associated with brick and clay production-over a 60 year period.

The Yarralumla Brickworks is of considerable technical value from the presence in the one location of a number of different kiln types: Staffordshire (1915), Hardy-Patent (1927) and Downdraft (1953) kilns, which demonstrate an unusually wide range of firing processes. The Staffordshire kiln is especially significant as the only surviving example of this kiln type in Australia. The Staffordshire kiln variation to the Hoffman design of kiln allowed bricks, tiles and pipes to be fired in cycles and utilises an unusual fan-forced draft system to aid firing.

[1] [V118: Added to Heritage Places Register Number 68 10/05/2001 (Variation Number 118)]

The largest chimney stack (element 9) is of aesthetic and social value as a prominent landmark in the central urban area, visible from the Lake Burley Griffin foreshores, New Parliament House and mountain lookouts around the City. Additional aesthetic value is associated with the composition and sculptural forms of the built elements, specifically the kilns, stacks and larger elements of equipment.

The Yarralumla Brickworks is one of a broad thematic group of remnant industrial and engineering heritage places that were built to facilitate the initial development of Canberra including the Cotter Dam and Pumping Station and the Kingston Power House.

The brickpits have historical value as a primary source of clay and are also of considerable geological value as the type locality for the 'Yarralumla Formation', dating from the Silurian Period 425 million years ago. The scheduled stratigraphic rock units constitute the reference section against which all other outcrops within the Formation are compared. It is the only fossil marine unit within the extensive volcanic marker horizons of South Canberra. Sites A and D show excellent examples of an anticline in calcareous siltstone, Site B shows a typical tuffaceous mudstone and siltstone of the Yarralumla Formation and Site C shows abundant fossils of mainly gracitiopods, trilobites, coral and a simple crinoid preserved in a bedding plane.

Specific Requirements

In accordance with s54 (1) of the *Land (Planning and Environment) Act 1991* the following requirements are identified as essential to the conservation of the heritage significance of the place. These requirements are prepared to implement the following conservation policy for the place:

The identified heritage values and intrinsic features of the place shall be conserved whilst allowing for the integrated and sympathetic redevelopment of the place as a single entity, consistent with contemporary practices for the adaptive reuse of industrial and commercial heritage places. In conserving and developing the place, its significant historical use as an industrial site for the production of bricks and clay products shall continue to be evident and accessible to the public.

Redevelopment of all or part of the place shall be in accordance with a Conservation and Management Plan endorsed by the ACT Heritage Council.

i) Landscape Setting

a) The quarry landform (11) should be retained in a manner whereby it is clearly evident to be a man made excavation, associated with the industrial use of the site. Subject to the recommendations of the Conservation and Management Plan, revegetation, enhanced hard and soft landscaping and low-medium height buildings with a high proportion of landscape open space may be permitted in the vicinity of the quarry, including on land overlooking the quarry and within the quarry excavation. The shape of the quarry may be altered in a minor manner, however access points into and out of the quarry area should utilise existing openings and gradients within the landform. The historical linkage between the quarry and kiln areas shall be expressed in any new development.

b) The geological features (12 A-D) shall be integrated within any site landscaping treatment. Disturbance of the immediate surface shall be limited to works that protect, stabilise or enhance the interpretation of the geological values. The immediate environs of the geological features to a distance of approximately 10 metres shall be retained as landscape open space.

c) To reflect historical usage patterns at the site and protect the setting of significant elements, the immediate environs of the kilns (1, 3, 5, 6) as identified below shall be retained as landscape open space, clear of any major structures. Minor structures and landscaping treatments that retain the kilns, stacks and fan houses as the dominant visual elements to the space may be permitted within:

- The open concourse running north-south from the Hardy Patent Kiln (Element 5) to the Downdraft Kilns (6a-c), between the kilns and fan houses (2, 4),
- The spaces between the kilns: (5-3, 3-1, 1-6)
- The immediate environs of the chimney stacks (7, 8, 9, 10), fan houses (2, 4) and primary crusher house and elevator conveyor (20, 22) to a distance of generally 10m.

d) New hard and soft landscaping treatment should generally express the historical spatial relationships and movement patterns of brick making operations about the site.

ii) Built Structures - including alterations and additions

a) The existing large chimney stack (9) shall be conserved and maintained in its current form as a prominent urban landmark.

b) The external form, including the arrangement of openings and detailing that reflects the industrial use of the built elements in Schedule 1 (1-10) and the Primary Crusher House (Schedule 2: 20) shall be retained.

c) Minor external alterations and additions and major internal alterations to the built elements in Schedule 1 may be permitted to suit a new use where the proposed works will not adversely affect the heritage significance of the elements or the place as a whole.

d) Alterations and additions to the original built fabric of elements in Schedule 1, including alterations to external finishes, shall complement the historical industrial use and architectural style of the place.

e) Subject to the recommendations of the Conservation and Management Plan, the elements in Schedule 2 may be conserved to interpret the historical use of the place or adapted to suit a new use for the place.

f) Elements in Schedule 2 that no longer include substantial evidence to describe industrial processes (15, 16, 17, 18, 19 and 21) may be replaced with new development that is generally consistent with the scale, form, external materials and industrial character of the place. The Office, the Powerhouse, Primary Crusher House and the Elevator Conveyor (13, 14, 20 and 22) may be relocated elsewhere within the place, subject to the relocation process being fully documented and full reconstruction of the buildings taking place within a specified period. Development may occur on the site of the remains of the Brickworks Accommodation Village (23), subject to detailed recording and suitable interpretation of the historical significance of the site.

g) Construction of new buildings or elements in the place may be permitted if any new building(s) or element(s) do not significantly diminish the heritage value of the place. The scale, form, detailing and external materials of any new buildings or structures shall be consistent with the architectural style and industrial character of the built elements in Schedule 1.

iii) Industrial Equipment

a) Major equipment and machinery associated with the historical industrial use of the place shall be retained and conserved in situ. Minor equipment should be retained and conserved but may be relocated to a new location within the site for interpretative purposes and/or its own protection.

b) The Primary Crusher House (20), including the integral equipment and machinery, and the Elevator Conveyor (22) shall be conserved for their ability to demonstrate and interpret industrial processes and secondary aesthetic values.

iv) Demolition

a) Subject to (iv)(b) (c) and (d) demolition of elements listed in Schedule 1 and 2 shall not be permitted, other than in exceptional circumstances, including circumstances in which the building or structure is structurally unsound and beyond economic repair or where there are significant public health and safety reasons to warrant demolition. Demolition shall not be permitted unless it can be demonstrated that there is no prudent and feasible alternative.

b) The demolition of the original internal fabric of buildings within Schedule 1 shall only be permitted in the context of sympathetic alteration and additions, as identified within the Conservation and Management Plan.

c) Elements in Schedule 2 may be demolished only to allow for new development in accordance with the Conservation and Management Plan and specific requirements (ii) (e) and (f).

d) Comprehensive recording of a building or structure shall be undertaken prior to any demolition or removal of fabric.

Figure 68: Yarralumla Brickworks, Yarralumla: Location

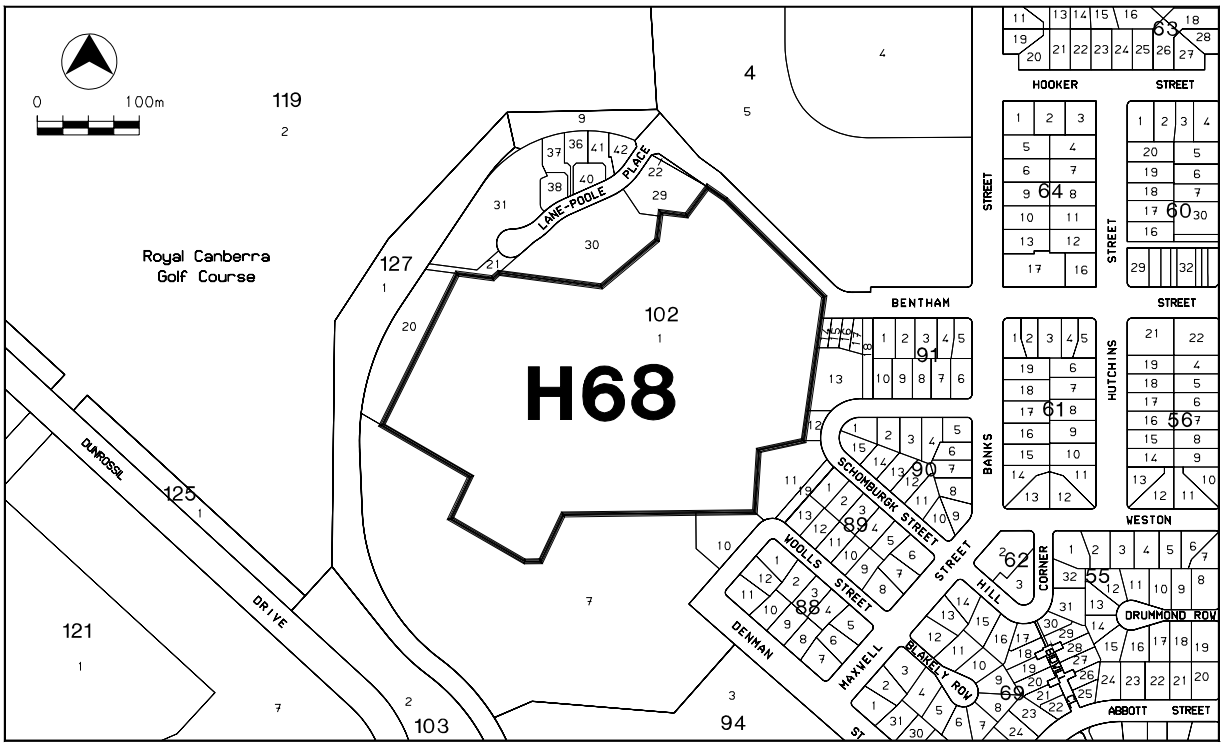
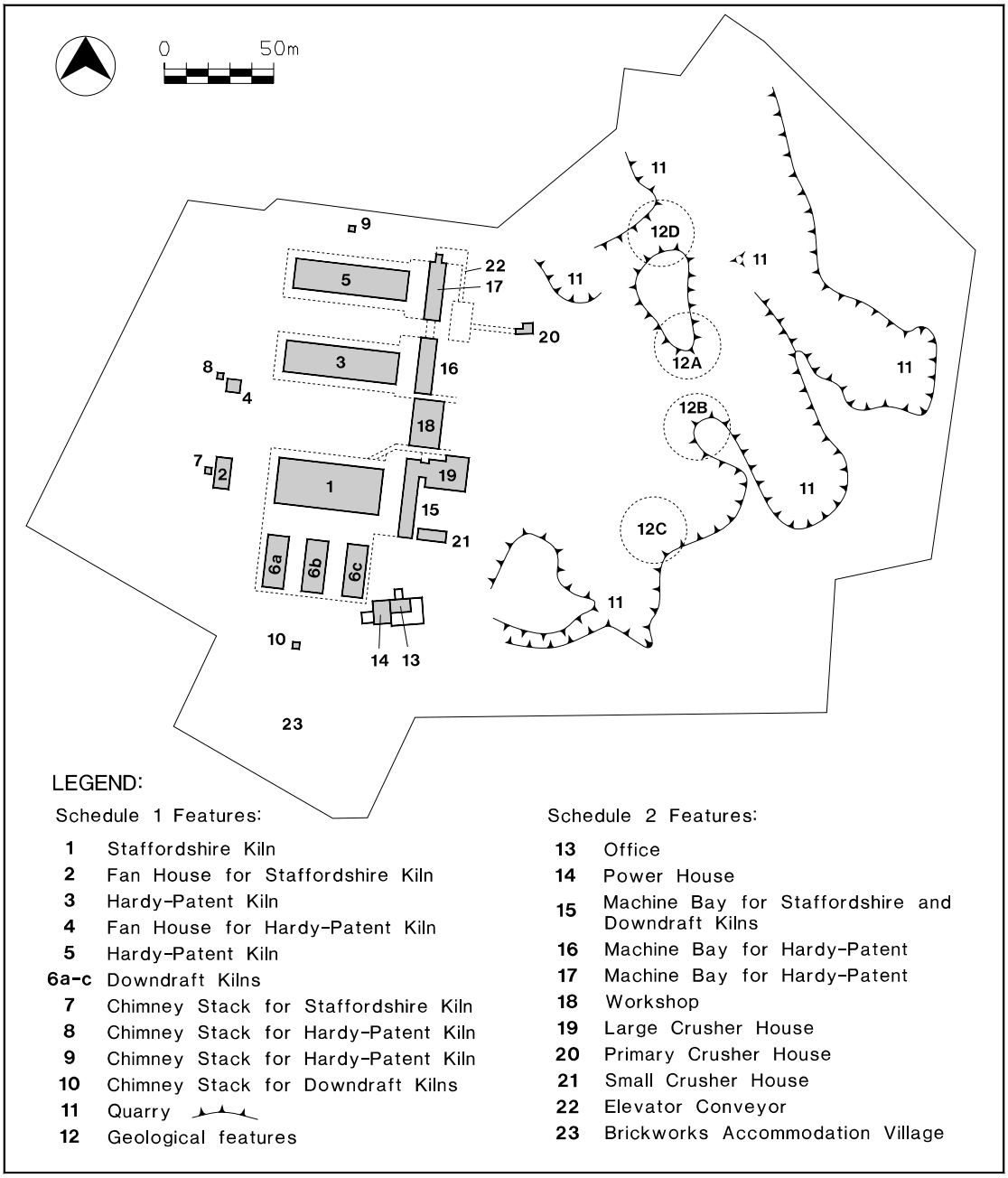


Figure 68a: Yarralumla Brickworks, Yarralumla: Significant Features



Place Details

Send Feedback

Yarralumla Brickworks (extended area), Denman St, Yarralumla, ACT, Australia

Photographs:	None
List:	Register of the National Estate
Class:	Historic
Legal Status:	Registered (26/10/1999)
Place ID:	101439
Place File No:	8/01/000/0039

Statement of Significance:

Yarralumla Brickworks is significant as one of three initial industrial and service complexes built to facilitate Canberra's construction, the Brickworks provides a tangible evidence of the city's construction. The Kingston Powerhouse and the Cotter Dam and pumping station were the other initial complexes and are entered in the Register of the National Estate. Their values are described in RR013364 and RR013623 respectively. (Criterion A.4) (Themes 3.10 Altering the environment for economic development, 4.6 Remembering significant phases in the development of towns and suburbs, 5.2 Organising workers and work places)

The Yarralumla Brickworks are significant as one of the few remaining examples of a large urban brickworks, which are becoming increasingly rare both nationally and internationally. The Brickworks are significant for the presence in the one location of a number of different kiln types: Staffordshire, Hardy-Patent and Downdraft kilns. Consequently presenting a wide range of firing processes, which are readily comprehensible. The kilns, together with the ancillary brickworks buildings, are important in demonstrating the changing processes of brick and clay production. The Staffordshire kiln was the first of its kind to be used in Australia and is believed to be the only surviving example of this kiln type in Australia.(Criterion B.2)

Operating as a brickworks from 1913 to 1976, Yarralumla Brickworks is significant as a representative example of a large urban brickworks. (Criterion D.2)

The industrial site in its woodland setting, and particularly the brick chimney (S3), Kilns, and quarry, has considerable aesthetic qualities. (Criterion E.1)

The geological features at the brickworks site are important as expressions of the type locality of the Yarralumla Formation from the Silurian Period of 425 million years ago. Sites A and D show excellent examples of anticline in calcareous siltstone, Site B shows a typical tuffaceous mudstone and siltstone of the Yarralumla Formation and Site C shows abundant fossils of mainly gracitiopods, trilobites and crinoids preserved in a bedding plane. (Criterion C.1) (Themes 1.1 Tracing climatic and topographical change, 1.2 Tracing the emergence of and development of Australian plants and animals).

Official Values: Not Available

Description:

The features intrinsic to the heritage significance of the place are as follows (the numbering is consistent with the Old Canberra Brickworks Conservation Plan and the ACT Heritage Council citation):-
Kiln - Staffordshire (K1), Fan House for Staffordshire Kiln (F1), Office (O), Power House (PH), Quarry (Q), Geological Feature A, Geological Feature B, Geological Feature C, Geological Feature D, Fan House for Hardy Patent Kiln (F2), Chimney Stacks (S1-4), Kiln - Hardy-Patent (K2), Kiln - Hardy-Patent (K3), Kilns

- Downdraft (K4), Machine Bay for Staffordshire and Downdraft Kilns (M1), Machine Bay for Hardy-Patent (M2), Machine Bay for Hardy-Patent (M3), Workshop (W), Large Crusher House (C2), Primary Crusher House (C3), Small Crusher House (C1) and the Elevator Conveyor (E).

The brickworks consists of a range of buildings, machinery and equipment associated with the production of bricks. Archaeological remains would also exist at the site. There are other buildings on the site, which relate to subsequent uses of the place. To the east of the buildings are the remnants of the clay pits or quarry. There is a small lake at the northern end of the pits.

The Staffordshire Kiln (K1) is a two storey structure originally built in 1914/15 with a brick base and upper walls and a galvanised iron roof. It was one of the first of this type to be built in Australia. In c1924 it was surrounded by an upper verandah for drying tiles. The Staffordshire kiln type is characterised by a series of separate side by side chambers which enabled a single chamber to give special treatment to its contents. Prior to this, separate kilns had been needed. Other advantages to this kiln were complete quality of control over temperatures, a cost reducing drying technique and lower fuel consumption.

The Staffordshire Kiln fan house (F1) was constructed in conjunction with the Staffordshire Kiln approximately 20 metres to the west. The use of fans enabled kilns to be fired independently of atmospheric conditions, which had previously restricted firing times. The building is a single storey brick Federation style.

The Hardy Patent Kiln (K2), also known as a modified Hoffman Kiln type, is a two storey building dating from 1927. The lower storey is constructed of brick and the upper storey of corrugated iron. Due to the collapse of some major walls, the kiln was almost totally rebuilt in 1955 and extended from 18 to 20 chambers with the openings enlarged to enable access for forklift vehicles.

The Fan House (F2) is comprised of two identical small scale galvanised iron sheds constructed 25 years apart to house fan equipment for the Hardy Patent Kiln. They are located approximately 20 metres west of the kiln. The other Hardy Patent Kiln (K3) constructed in 1953 is almost identical, but retains its original second storey superstructure.

In the early 1960s three down draft (dome) kilns (K4) were constructed of brick with large fire brick lined metal doors with a number of penetrations along the sides of the kilns enabling the kilns to be fired and checked.

There are four chimney stacks on the site. The first (S1) is constructed of red bricks and was built adjacent to the Staffordshire kiln in 1915. Another chimney stack (S2) was built in conjunction with the fan house in 1927 to service the Hardy-Patent kiln. In about 1953 a further stack (S3) was built. Its height of 55 metres was to allow for the use of natural drafts to exhaust heat and fumes from the kiln (K3). This was unsuccessful, as drafts to the chimney were blocked by the surrounding terrain and a fan house had to be installed twelve months later. The fourth stack is associated with the three down draft kilns and was built in 1925 for the two earlier down-draft kilns. About 15 metres tall, it has a small steel door on the southern wall and a large opening in the eastern wall approximately 2.5 metres above ground level.

As part of the upgrading of the brickworks in 1955 and to meet the post World War Two production increases, three machine bays were built. One was a galvanised iron clad steel and concrete structure built on the site of the 1915 workshop and tile plant. Two others were built to service the Hardy-Patent kilns, both two storey steel framed structures clad in corrugated iron with concrete slab floors. As part of the upgrading a workshop (W) for general repairs and maintenance of machinery was also built. It is steel frame construction with metal cladding on the walls and roof. A crusher house (C1) of steel framed construction with corrugated iron cladding was also built as part of the upgrade. A second crusher room (C2) housing a crusher on the site of the original crusher is located to the east of the first Machine Bay. The primary crusher house (C3) is a small building located on the site of the original crusher to the east of Machine Bay 1. Material was crushed here in the first instance and then conveyed to the other crushers for recrushing. The building was a steel frame construction with metal cladding and a large concrete retaining wall on the eastern side.

In 1955, a conveyer elevator (E) was constructed. Shale was conveyed to the pan room where it was ground and screened then loaded onto the conveyor/elevator, which carried the raw material to a distribution hopper. The distribution hopper is an enclosed elevator system with walkway constructed with steel frame and supports.

The original galvanised office for the brickworks was removed for uses associated with the original machine shed. The construction of the present office building (O) is believed to date from 1916, the same date as the powerhouse (PH). The office is constructed as a small brick and tile gable ended building. Over the years, extensions have been added mostly with flat roofs to meet the needs of the expanding brickworks.

Prior to the commissioning of the Kingston Powerhouse in 1916, the brickworks was powered by a steam engine housed in a temporary detached corrugated iron building. The 1916 permanent building has an exposed concrete floor, exposed brick walls and high corrugated metal ceiling. The western wall had two screened openings. Entry to the substation is through two pairs of doors at either end of the building.

Earthworks outside the brickworks delineate the route of the Brickworks railway, which once connected the brickworks to the Kingston railway yards, the Provisional Parliament House and Civic. The track exits the brickworks at the southern boundary and is identified by the ditch and bank formation. As the track turns eastwards it follows a manmade bank.

Land located in the far west of the site is reported to have been the site of an early quarry, and has subsequently been used for waste from the brickworks operation.

The quarry lies to the east of the brickworks building from which shale was extracted for the brickmaking process. A 2ft (610mm) narrow gauge tramway was constructed in the quarry area so that loaded trucks ran downhill to the works. The empty trucks were returned to the quarry area using manpower. The tramway was very portable requiring little effort to move as the quarry face advanced.

The quarry site is the type locality for the Yarralumla formation. It is the locality where the formation is considered to be most developed and is thus the reference section against which all other outcrops of that unit are compared. Its importance results from its being the only fossiliferous, marine unit within the extensive volcanic marker horizons of South Canberra. The stratigraphy of the volcanic rocks and its fossil fauna provide evidence for the age of these volcanic. Within this place, three localities are of particular significance.

History:

The Minister for Home Affairs, Mr O'Malley, announced Government plans in 1910 to erect brickworks to provide bricks for the construction of the new Federal Capital. Following experiments on shale in the region, Campbell's Yarralumla property was found to be the most suitable and in 1913 the land was acquired for the brickworks site. In June 1913 a temporary plant was established and operational, comprising a grinding pan, brickmaking machine, elevator and portable steam engine. By August 1913 four open kilns were in use. This temporary plant had an output of 44,000-50,000 bricks per week, producing bricks for the Kingston powerhouse and setting aside others for the permanent brickworks.

A temporary plant was established and operating in June 1913. The first stage of the permanent brickworks, consisting of a single Staffordshire kiln, was approved in December 1913. This kiln was to produce bricks for two further kilns. The Staffordshire kiln, crushing and processing equipment and brick presses were completed and ready for production in 1916, however the commitments of the First World War and a restricted Canberra works program and coal strike led to the brickworks closing in late 1916.

In 1917, a Royal Commission investigated the brickworks following complaints from Walter Burley Griffin. A number of interesting points emerged as a result of the Commission's investigation. It found that 250,000 bricks made in the temporary kiln were of inferior and defective quality, so were used for filling and lining drains and for the new kilns, and not for building work as planned. In addition, the

Staffordshire kiln contained substantial evidence of construction errors in estimating and design.

At the end of 1920, the Government decided to proceed with the building of Canberra and the brickworks reopened in 1921. The brickworks railway was constructed in 1923 linking the works to the provisional Parliament House, the Kingston Power House and Hotel Canberra. A tramway also extended into the Civic Centre. The tramway was removed prior to the opening of Parliament House in 1927.

Throughout the 1920s the brickworks was expanded. Production was severely curtailed in 1929 however with the economic depression, and the railway was fully removed. Production subsequently ceased with the brickworks closing in February 1931. The brickworks opened again in 1935 only to close with World War Two as activity was diverted to works associated with the War.

The brickworks reopened in 1944 and beginning in 1954 major upgrading of the brickmaking facilities was undertaken including the construction of a 20 chamber 'Hoffman' kiln. Following the creation of the National Capital Development Commission in 1958, the two temporary downdraft kilns were demolished and replaced with three new kilns.

In 1960 the control of the brickworks was transferred to Commonwealth Brickworks (Canberra) Ltd. By 1973 the brickworks were considered to be in need of extensive modernisation. However upgrading proposals prepared by Commonwealth Brickworks were rejected by the National Capital Development Commission on environmental grounds and, in 1976, all reusable material was moved to a new site in Mitchell, ACT. The decision to relocate the brickworks was justified economically by anticipating the redevelopment of the site in a way which would recover relocation costs.

A private developer, A R Marr Pty Ltd, proposed to redevelop the site and adjacent land as a major tourist complex and in July 1979 the brickworks reopened as a tourist attraction. Extensive work was undertaken at the site but by 1980 A R Marr Pty Ltd was in provisional liquidation and in 1984 the lease was surrendered to the Commonwealth.

Condition and Integrity:

The structures comprising the brickworks range from good to poor condition. (1997)

Location:

About 9.6ha, off Denman Street, Yarralumla. Area comprises the whole of Blocks 1 and 20, Section 102. Includes former kilns, chimneys, fan houses and brickpits.

Bibliography:

Lester Firth Associates Pty Ltd 1986 'Old Canberra Brickworks Conservation Plan'
ACT Heritage Council, Citation for Yarralumla Brickworks, Yarralumla

Report Produced: Fri Mar 12 09:14:46 2010

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Place Details

Send Feedback

Yarralumla Brickpits, Denman St, Yarralumla, ACT, Australia

Photographs:	None
List:	Register of the National Estate
Class:	Natural
Legal Status:	Registered (28/09/1982)
Place ID:	13319
Place File No:	8/01/000/0039

Statement of Significance:

The brickpits are of geological significance as the type locality for the Yarralumla Formation, a marine sequence of tuffaceous siltstone, sandstone, mudstone and limestone. Here the Yarralumla formation is considered to be most typically developed and is therefore the reference section against which all other outcrops are compared.

Official Values: Not Available

Description:

The four sites occur in the disused quarry of the Canberra Brickworks and all belong to the Yarralumla Formation. The rocks of the Yarralumla Formation are a sequence of tuffaceous siltstone, sandstone, mudstone and limestone, deposited in marine conditions during the Silurian period.

History: Not Available

Condition and Integrity:

The condition of the area is generally good though the anticline at Site A is obscured by pine trees and scree slopes.

Location:

Within the Yarralumla Brickworks, refer record 13318.

Bibliography:

HENDERSON, G.A.M., (IN PREP) - COMMENTARY ON THE COPPINS CROSSING 1:10,000 CANBERRA ENGINEERING GEOLOGY SHEET. TOWNLEY, K.A. & VEEVERS, J.J., 1966 REVISED STRUSZ, D.L., 1974 - ROCKS AND FOSSILS AROUND CANBERRA BUR. MINER. RESOUR. AUST.

Report Produced: Fri Mar 12 09:18:14 2010

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APPENDIX B CONSERVATION WORKS SCHEDULES

Scope and Methodology

A site survey of the remaining buildings at the former Canberra Brickworks was carried out on 17 February 2010 to assess the existing conditions and identify remedial work required to make the buildings stable and weather tight. The works identified are intended to conserve the buildings and slow any further deterioration in the short to medium term. The works are not intended to restore any of the buildings. Ongoing maintenance works will still be required.

All accessible areas of each building were inspected. No access was available to the interiors of the three downdraft kilns (Building 22) or the Workshop Building (Building 17). The vaulted kilns and firing floors were inspected for each of the three large kilns.

Summary of Condition

The buildings are mostly in reasonable condition. A number have suffered vandal damage, including broken windows and roof tiles. Most of the conveyor belt system and other equipment was removed following closure of the Brickworks, leaving openings in walls and roofs. Works, including replacement of some roofs, have been carried out to some of the buildings since the closure of the brickworks. Some of the more recent works were left unfinished, while other works such as the paving in the kilns have been partially removed.

Kiln 1, the Staffordshire Kiln (Building 4), has significant structural issues. Many of the kiln chambers are distorted although they appear to be stable at present. The arched entrance brickwork is failing in many of the chambers. These enlarged openings were later alterations to enable easier mechanical access to the chambers. The arched openings appear to have inadequate footings, probably due to movement in the flue tunnels beneath the outer walls of the kiln. Rebuilding of the worst of these is recommended in the near future.

No works are proposed for the crusher buildings, each of which is part demolished following the removal of conveyors and equipment. The partial demolition has resulted in missing sections of roof and walls but the remaining reinforced concrete and steel structures are likely to remain in fair condition for the medium term.

Conservation Works Schedule

No.	*Building No.*	*Building*	*Element*	*Works*
1	3	Power House	Roof	Replace approx. 50 missing or broken marseilles pattern tiles
2	3	Power House	Gutters	Install new quad gutters
3	3	Power House	Fascias	Prepare and paint fascias and bargeboards
4	3	Power House	Eaves	Replace missing t&g eave lining boards
5	3	Power House	Eaves	Prepare and paint eave linings
6	3	Power House	Walls	Remove spray painted graffiti, wash down walls
7	3	Power House	Louvres	Replace 4 damaged louvres
8	3	Power House	Louvres	Prepare and paint louvres
9	3	Power House	Windows	Replace 6 missing windows
10	3	Power House	Windows	Prepare and paint windows
11	3	Power House	Doors	Replace damaged doors with new panelled doors with fanlight over
12	4	Kiln 1	N verandah	Replace decayed beams, rebuild collapsing north verandah/deck
13	4	Kiln 1	Chamber 1	Demolish recent brick wall and door in kiln entrance
14	4	Kiln 1	Chamber 1	Dismantle and rebuild outer 5 courses entrance arch
15	4	Kiln 1	Chamber 2	Dismantle and rebuild outer 5 courses entrance arch
16	4	Kiln 1	Chamber 3	Repoint entrance arch
17	4	Kiln 1	Chamber 4	Dismantle and rebuild outer 5 courses entrance arch
18	4	Kiln 1	Chamber 5	Dismantle and rebuild outer 5 courses entrance arch
19	4	Kiln 1	Chamber 6	Dismantle and rebuild outer 5 courses entrance arch
20	4	Kiln 1	Chamber 7	Dismantle and rebuild outer 5 courses entrance arch
21	4	Kiln 1	Chamber 8	Repoint entrance arch
22	4	Kiln 1	Chamber 9	Dismantle and rebuild outer 5 courses entrance arch
23	4	Kiln 1	Chamber 10	Dismantle and rebuild outer 5 courses entrance arch
24	4	Kiln 1	Chamber 13	Dismantle and rebuild outer 5 courses entrance arch
25	4	Kiln 1	Chamber 15	Remove concrete pavers from kiln floor
26	4	Kiln 1		Chambers 2, 4, 5, 6, 7 and 8 are significantly distorted but appear stable
27	5	Brick fanhouse	Gutters	Install new quad gutters and downpipes
28	5	Brick fanhouse	Fascias	Replace 5m missing fascia boards
29	5	Brick fanhouse	Fascias	Prepare and paint fascias
30	5	Brick fanhouse	Eaves	Replace 4m2 t&g eaves lining boards
31	5	Brick fanhouse	Eaves	Prepare and paint eaves
32	5	Brick fanhouse	Windows	Install 10 new sashes and reglaze all windows
33	5	Brick fanhouse	Windows	Prepare and paint windows
34	5	Brick fanhouse	Doors	Replace missing doors

No.	*Building No.*	*Building*	*Element*	*Works*
35	5	Brick fanhouse	Doors	Prepare and paint doors
36	5	Brick fanhouse	Ceiling	Replace 60% of t&g ceiling lining boards
37	5	Brick fanhouse	Floor	Drain pits and clear debris
38				
39	6	Chimney & kiln	Chimney	Replace missing bricks and repoint top 8 courses of chimney
40	6	Chimney & kiln	Test kiln	Remove vegetation from roof of kiln, rerender roof and repoint door arch.
41	7	Office	Additions	Demolish flat roofed additions to 3 sides of original office building.
42	7	Office	Roof	Replace missing and broken marseille pattern tiles. Rebatten and install tiles along lower courses following removal of skillion roofs.
43	7	Office	Windows	Install new windows to match original windows
44	7	Office	Doors	Alter brickwork to reopen original doorways. Install new doors to match original doors.
45	7	Office	Joinery	Prepare and paint all external timberwork.
46	8	Kiln 2	Roof	Replace broken fibreglass skylight sheet
47	8	Kiln 2	Gutters	Install gutters.
48	8	Kiln 2	Windows	Reglaze all steel framed windows with Georgian wired glass
49	8	Kiln 2	Windows	Prepare and paint all steel framed windows
50	8	Kiln 2	Wall cladding	Clad centre of south upper wall with corrugated galvanised steel
51	8	Kiln 2	Wall	Remove efflorescence from west end internal kiln wall
52	8	Kiln 2	Internal	Demolish recent brick internal partition walls from within kiln chambers
53	8	Kiln 2	Internal	Remove concrete pavers from kiln floor
54	8	Kiln 2	Internal	Clear plasterboard and damaged insulation from firing floor and ceiling
55	8	Kiln 2	Internal	Remove electrical wiring and conduits
56	9	Fan Houses	Roof A	Replace CGI roof and gutters
57	9	Fan Houses	Roof B	Replace CGI roof and gutters
58	9	Fan Houses	Walls	Replace missing cladding to Fan house 8B
59	9	Fan Houses	Windows	Replace missing windows with matching 4 pane sash windows
60	9	Fan Houses	Doors	Replace missing doors and architraves
61	9	Fan Houses	Exterior	Prepare and paint fascias, windows and doors
62	9	Fan Houses	Interior	Clear out debris and blackberry bushes.
63	9	Fan Houses	Exterior	Clear drain channels and surroundings
64	10	Chimney	Chimney	Repoint top 5 courses of brickwork.
65	11	Amenities	Windows	Replace missing glazing, prepare and paint windows
66	11	Amenities	Doors	Replace/repair doors. Prepare and paint doors
67	11	Amenities	Fascias	Prepare and paint all external joinery
68				
69	12	Kiln 3	Roof	Replace 30m2 fire damaged CGI roof
70	12	Kiln 3	Downpipes	Replace downpipes at west end of south side to drain at outer edge of verandah roofs

No.	*Building No.*	*Building*	*Element*	*Works*
71	12	Kiln 3	Structure	Repair/replace 2 fire damaged Oregon trusses
72	12	Kiln 3	Structure	Replace 30m Oregon purlins
73	12	Kiln 3	Structure	Replace 2 fire damaged 200 x 200 Oregon posts
74	12	Kiln 3	Structure	Replace 10m fire damaged stud wall and doorway
75	12	Kiln 3	Structure	Repair and reroof operators room on north side
76	12	Kiln 3	Windows	Reglaze 33 steel framed windows with frosted Georgian wired glass
77	12	Kiln 3	Windows	Prepare and paint 33 steel framed windows
78	12	Kiln 3	Pipework	Remove and dispose of asbestos lagging from pipes at east end
79	12	Kiln 3	Verandah	Replace missing 12m of north verandah roof with new CGI
80	12	Kiln 3	Verandah	Install roof and structure to west end or demolish steel posts and beam
81	12	Kiln 3	Floor	Remove concrete pavers from kiln floor
82	14	Machine Bldg 1	Skylights	Replace broken glass skylights
83	14	Machine Bldg 1	Windows	Replace missing glass in all windows
84	15	Machine Bldg 2	Skylights	Replace broken glass skylights
85	15	Machine Bldg 2	Windows	Replace missing glass in all windows
86	15	Machine Bldg 2	Roof	Replace missing CGI sheets
87	16	Machine Bldg 3	Skylights	Replace broken glass skylights
88	16	Machine Bldg 3	Windows	Replace missing glass in all windows
89	16	Machine Bldg 3	Cladding	Replace 2 sheets east wall cladding
90	17	Workshop	Note	No Access - Works?
91	18	Crusher 1		Part demolished - no works
92	19	Crusher 2		Part demolished - no works
93	20	Crusher 3	Roof	Replace missing CGI roofing over hopper
94	21	Conveyor		Part demolished - no works
95	22	Downdraft Kilns	*Note*	*No access to kiln interiors*
96	22	Downdraft Kilns	Exterior	Repoint cracks in all 3 kilns
97	24	Chimney	Brickwork	Replace 40 spalling bricks with new matching bricks

Canberra Brickworks, Yarralumla, ACT

Stage 1
Aboriginal Cultural Heritage Assessment

August 2014

A Report to LDA

Navin Officer

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Report Register

The following register documents the development and issue of this document.

Issue No.	Notes/Description	Issue Date
v1	Draft for proponent comment	5 August 2014
v2	Final	14 August 2014

EXECUTIVE SUMMARY

The Canberra Brickworks site is centrally located in Canberra, approximately 6km from Canberra City Centre and 5km from Woden Town Centre. The project area is a 47 hectare site and is located on the edge of the established suburb of Yarralumla.

The project involves the requirement for a Stage 1 Cultural Heritage Assessment in the proposed new project area named as Canberra Brickworks and Environs (CB+E).

This report documents the results of an Aboriginal cultural heritage assessment of the CB+E. The report was commissioned by the Land Development Agency.

The area has been impacted by the construction of roads, the Canberra Brickworks including large areas of excavation to the east, laying of gravel and tarmac, weed infestation, pine plantation and general mechanical disturbance over a majority of the project area.

A search of the ACT Heritage sites database was undertaken; no Aboriginal sites were located within the CB&E project area. No areas of archaeological potential were identified.

Given the location of the area in relation to the past riverine resources associated with the Molonglo River, the project area would be considered to have a relatively low potential for the occurrence of Aboriginal sites. Past landuse practices within the area also indicate that any such materials would be disturbed.

There are no statutory implications regarding cultural heritage for the study area.

It is recommended that:

1. For the unanticipated discovery of Aboriginal sites and burials (during future investigation or development works, including excavation and/or other significant ground disturbance), the protocols detailed in Appendix 2 should be implemented.

2. A copy of this report should be provided to the ACT Heritage for approval.

3. One copy of this report should be provided to each of the ACT RAOs.

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1. INTRODUCTION

1.1 Project Description

The Canberra Brickworks site is centrally located in Canberra, approximately 6km from Canberra City Centre and 5km from Woden Town Centre. The project area is a 47 hectare site and is located on the edges of the established suburbs of Yarralumla and Deakin. It is bounded by the suburb of Yarralumla to the east, Adelaide Avenue and the suburb of Deakin to the southeast, Cotter Road to the south and Westbourne Woods to the west.

The project involves the requirement for a Stage 1 Cultural Heritage Assessment in the proposed new project area named as Canberra Brickworks and Environs (CB+E).

This report documents the results of an Aboriginal cultural heritage assessment of the CB+E. The report was commissioned by the Land Development Agency.

1.2 This Report

1.2.1 Outline

This report:

- Describes the project (Section 1);
- Describes the methodology employed in the study (Section 2);
- Describes the environmental setting of the study area (Section 3);
- Provides information relevant to the Aboriginal cultural context of the study area (Section 4);
- Provides an Aboriginal heritage context for the study area (Sections 5);
- Describes the results of the data review, field survey and Aboriginal consultation program conducted in the context of the assessment (Section 6);
- Provides a statutory information as it relates to the cultural heritage identified within the CB&E project area (Section 7); and
- Provides management recommendations based on the results of the investigation (Section 8).

1.2.2 Copyright

Copyright to this report rests with the LDA except for the following:

- The Navin Officer Heritage Consultants logo and business name (copyright to this rests with Navin Officer Heritage Consultants Pty Ltd);
- Generic content and formatting which is not specific to this project or its results (copyright to this material rests with Navin Officer Heritage Consultants Pty Ltd);
- Descriptive text and data relating to Aboriginal objects which must, by law, be provided to the ACT Heritage for its purposes and use;
- Information which, under Australian law, can be identified as belonging to Aboriginal intellectual property;
- Content which was sourced from and remains part of the public domain

Figure 1.1 Canberra Brickworks and Environs project area

2. STUDY METHODOLOGY

2.1 Literature and Database Review

A range of archaeological and historical data was reviewed for the Canberra Brickworks study area and its surrounds. This literature and data review was used to determine if known Aboriginal sites were located within the area under investigation, to facilitate site prediction on the basis of known regional and local site patterns, and to place the area within an archaeological and heritage management context. The review of documentary sources included heritage registers and schedules, local histories, maps and archaeological reports.

Literature sources included the Heritage Registers and associated reports held by ACT Heritage, ACT Environment and Planning Directorate.

2.2 Fieldwork and Project Personnel

The archaeological survey aimed at identifying material evidence of Aboriginal occupation as revealed by surface artefacts and areas of archaeological potential unassociated with surface artefacts.

Field survey was undertaken on 5th August 2014 by archaeologist Nicola Hayes and Aboriginal representative Wally Bell.

This report was written by Nicola Hayes.

2.3 Recording Parameters

Potential recordings fall into two broad categories: sites and potential archaeological deposits.

A site is defined as any material evidence of past Aboriginal activity that remains within a context or place which can be reliably related to that activity.

Most Aboriginal sites are identified by the presence of three main categories of artefacts: stone or shell artefacts situated on or in a sedimentary matrix, marks located on or in rock surfaces, and scars on trees.

Frequently encountered site types within southeastern Australia include stone artefact occurrences - including isolated finds and open artefact scatters, coastal and freshwater middens, rock shelter sites - including occupation deposit and/or rock art, grinding groove sites and scarred trees. For the purposes of this section, only the methodologies used in basic site identification are outlined.

Stone Artefact Occurrences

Stone artefact occurrences are the most commonly recorded site type in Australia. They may consist of single artefacts - described as isolated finds; or as a distribution of more than one artefact – often described as an artefact scatter or 'open camp site' when recording surface artefacts, or as a subsurface artefact distribution when dealing with an archaeological deposit.

Where artefact incidence is very low, either in terms of areal distribution (artefacts per square metre) or density (artefacts per cubic metre), then the differentiation of the recording from background artefacts counts or *background scatter* may be an issue.

Background scatter

Background scatter is a term used generally by archaeologists to refer to artefacts which cannot be usefully related to a place or focus of past activity (except for the net accumulation of single artefact losses).

There is no single concept for background discard or 'scatter', and therefore no agreed definition. The definitions in current use are based on the postulated nature of prehistoric activity, and often they are phrased in general terms and do not include quantitative criteria. Commonly agreed is that background discard occurs in the absence of 'focused' activity involving the production or discard of stone artefacts in a particular location. An example of unfocused activity is occasional isolated discard of artefacts during travel along a route or pathway. Examples of 'focused activity' are camping, knapping and heat-treating stone, cooking in a hearth, and processing food with stone tools. In practical terms, over a period of thousands of years an accumulation of 'unfocused' discard may result in an archaeological concentration that may be identified as a 'site'. Definitions of background discard comprising only qualitative criteria do not specify the numbers (numerical flux) or 'density' of artefacts required to discriminate site areas from background discard.

Potential Archaeological Deposits

A potential archaeological deposit, or PAD, is defined as any location where the potential for subsurface archaeological material is considered to be moderate or high, relative to the surrounding study area landscape. The potential for subsurface material to be present is assessed using criteria developed from the results of previous surveys and excavations relevant to the region. Where necessary, PADs can be given an indicative rating of their 'archaeological potential' based on a combined assessment of their potential to contain artefacts, and the potential archaeological value of the deposit. Table 3.1 illustrates the matrix on which this assessment is based. Locations with low potential for artefacts fall below the threshold of classification. In such cases the potential incidence of artefactual material is considered to be the same as, or close to that for background scatter. Where there is moderate potential for artefacts, the predicted archaeological potential parallels the potential significance of the deposit. For deposits with high potential for artefacts, the assessed archaeological potential is weighted positively.

The boundaries of PADs are generally defined by the extent of particular micro-landforms known to have high correlations with archaeological material. A PAD may or may not be associated with surface artefacts. In the absence of artefacts, a location with potential will be recorded as a PAD. Where one or more surface artefacts occur on a sedimentary deposit, a PAD may also be identified where there is insufficient evidence to assess the nature and content of the underlying deposit. This situation is due mostly to poor ground surface visibility.

Table 3.1 Matrix showing the basis for assessing the archaeological potential (shown in bolded black text) of a potential archaeological deposit.

		Potential to contain Aboriginal objects		
		Low	*Moderate*	*High*
Potential archaeological significance	*Low*	---	**low**	**moderate**
	Moderate	---	**moderate**	**high**
	High	---	**high**	**high**

3. ENVIRONMENTAL CONTEXT

The project area is located between the suburb of Yarralumla, Westbourne Woods at the Royal Canberra Golf Course and the suburb of Deakin. The area includes the major road construction of Adelaide Avenue, Yarra Glen and Cotter Road. The local topography consists of low spur lines, shallow drainage lines and hills.

A drainage line that leads to Lake Burley Griffin extends from the north east corner of the project area. Lake Burley Griffin, formed by the damming of the Molonglo River is at least 1km north east of the project area. The 1915 Territory feature map shows that the Molonglo River was approximately 1.1km from the project area and that one drainage lines existed in the southern part of the project area in the area (Figure 3.5). There are no significant drainage lines within the project area

The soils in the project area were thin, clay and bedrock gravels were visible at the surface over much of the project area.

The vegetation consists of imported grasses, weeds, pines and other European tree species.

The 1915 Territory feature map shows the location of the Commonwealth brickworks and several tracks and fence lines indicating that the area may have been largely cleared by this time.

The area has been impacted by the construction of roads, the Canberra Brickworks including large areas of excavation to the east, laying of gravel and tarmac, weed infestation and pine plantation and general mechanical disturbance over a majority of the project area.

Figure 3.1 CB&E looking north west with tarmac in foreground

Figure 3.2 CB&E at brickworks showing excavated areas

Figure 3.3 CB&E looking west along pedestrian track

Figure 3.4 CB&E looking west along vehicle track

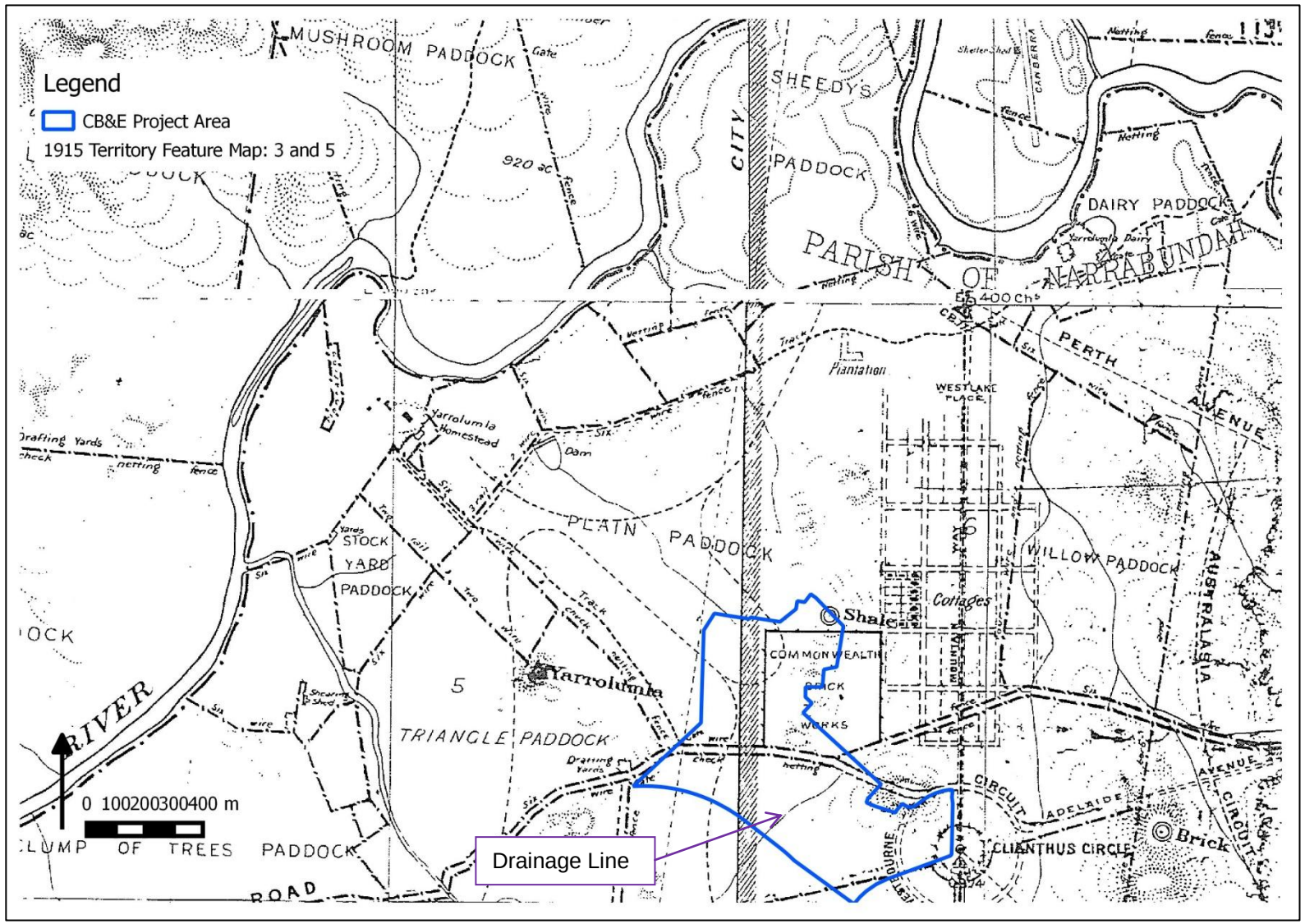

Figure 3.5 1915 Territory feature map showing CB&E project area and its proximity to original location of the Molonglo River

4. ABORIGINAL CULTURAL CONTEXT

4.1 Tribal Boundaries

Tribal boundaries within Australia are based largely on linguistic evidence and it is probable that boundaries, clan estates and band ranges were fluid and varied over time. Consequently 'tribal boundaries' as delineated today must be regarded as approximations only, and relative to the period of, or immediately before, European contact. Social interaction across these language boundaries appears to have been a common occurrence.

A reconstruction of clan boundaries based on Tindale (1974) indicates that the southern Canberra area was close to the tribal boundaries of the Ngunnawal and Walgalu people. Horton's (1999) map shows a Ngarigo tribe in the southern Canberra area.

A reconstruction of clan boundaries based on Tindale (1974) indicates that the northern Canberra area fell within the tribal boundaries of the Ngunnawal people. There is some uncertainty as to which language was spoken by the Aborigines of northern Canberra. This area appears to have been close to the linguistic boundary between the Gundungurra and Ngunnawal languages. Eades (1976) notes that published grammars for these two languages (Mathews 1900, 1901, 1904) are virtually identical. However according to Eades' boundaries, the Ngunnawal of northern Canberra probably spoke the Gundungurra language.

References to the traditional Aboriginal inhabitants of the Canberra region are rare and often difficult to interpret (Flood 1980, Huys 1993). The consistent impression however is one of rapid depopulation and a desperate disintegration of a traditional way of life over little more than fifty years from initial white contact (Officer 1989). The disappearance of the Aborigines from the tablelands was probably accelerated by the impact of European diseases which may have included the smallpox epidemic in 1830, influenza, and a severe measles epidemic by the 1860's (Flood 1980, Butlin 1983).

By the 1850's the traditional Aboriginal economy had largely been replaced by an economy based on European commodities and supply points. Reduced population, isolation from the most productive grasslands, and the destruction of traditional social networks meant that the final decades of the region's Aboriginal culture and economy was centred on white settlements and properties (Officer 1989).

By 1856 the local 'Canberra Tribe', presumably members of the Ngunnawal or Ngarigo, were reported to number around seventy (Schumack 1967) and by 1872 recorded as only five or six 'survivors' (Goulburn Herald 9 Nov 1872). In 1873 one 'pure blood' member remained, known to the white community as Nelly Hamilton or 'Queen Nellie'.

Early accounts of Aboriginal lifestyles in and comparable with the current study localities describe aspects of a successful hunting and gathering economy and eventful social life and inter-group contacts. The material culture, which is partly reflected in the surviving archaeological record, included stone and wooden artefacts, skin clothing and bark and bough temporary dwellings (Flood 1980, Huys 1993).

4.2 Representative Aboriginal Organisations

Four local Aboriginal organisations have stated an objective to represent traditional Aboriginal cultural values and interests within the ACT. These groups have been recognised by the Minister as Representative Aboriginal Organisations (RAOs) as defined under the ACT *Heritage Act 2004.* These groups are the:

- Buru Ngunawal Aboriginal Corporation (Buru Ngunawal);
- King Brown's Tribal Group Pty Ltd (KBTG);
- Little Gudgenby River Tribal Council (LGRTC); and

- Ngarigu Currawong Clan (Ngarigu).

It is the policy of the ACT Heritage Council that the RAOs should be consulted with regard to the management of, and potential impacts to, Aboriginal cultural values and places within the ACT.

4.3 Consultation

Contact was made by phone and email with the RAOs to inform them of this assessment and to organise representation during the field survey.

The following personnel participated in the fieldwork program and represented the interests of their group in the project:

- Wally Bell (Buru Ngunawal)

Records of Aboriginal Field Participation are provided in Appendix 1.

Table 4.1 Consultation Log

Date	Type of Contact (email, phone etc)	Group/Individual	Comment/Action
30/7/14	Email/post	all	Invitation to participate in survey Ngarigu stated they would not be attending
4/8/14	Phone/email	Buru Ngunawal KBTG LGRTC	Phone call regarding attendance. • Confirmation from Buru Ngunawal, KBTG. • LGRTC could not confirm at that time.
5/8/14	Phone	KBTG	KBTG not able to attend

5. ABORIGINAL ARCHAEOLOGICAL CONTEXT

5.1 Regional Overview

Various assessments have been undertaken in the areas surrounding the CB&E project area.

Boot and Bulbeck conducted a cultural resource survey for the Stromlo Forest Management Area in 1990. They sampled 'the great majority of the landscape units which we recognised in Stromlo' (1990:15). Their survey coverage included traverses along forestry tracks situated immediately northeast and east of the woolshed site. Sixty two artefact occurrences were recorded.

Boot and Bulbeck noted that hills and spurs in the Management Area showed moderate artefact density while steep land, and gently sloping land away from watercourses was 'unattractive'. Sites in the Management Area were mainly located along the Molonglo or within the undulating, well-watered ground between the Molonglo and Mount Stromlo and within the Stony Creek catchment

Navin and Officer (1993) completed an archaeological survey of a parcel of land situated southeast of the confluence of Weston Creek with the Molonglo River, as part of investigations into future land use options appropriate for land north of Cotter Road at Weston. The study area was a roughly triangular portion of land, approximately 1.3 km long and up to 750 m wide. The eastern half of the area fell within the immediate catchment of the southern bank of the Molonglo River, but did not extend to the river. The western half was within the western fall of the Weston Creek valley and included a one kilometre section of the eastern creek bank.

One Aboriginal site and one isolated find were located in the course of the survey. The site*, North Cotter 1*, comprised a surface scatter of thirteen visible artefacts on the top of the knoll identified by the Martin trig station. The isolated find was located on an old track at the base of the knoll.

Saunders (1995) undertook a preliminary cultural resource survey of the Lower Molonglo River Corridor. The study area included the corridor from Coppins Crossing in the east to the Lower Molonglo Water Quality Control Centre in the west. 45 Aboriginal sites were recorded including 32 isolated artefacts and 13 open artefact scatters. Saunders concluded that there is a strong tendency for sites to be located near watercourses, all of which give access to the river, and near the termination of low, level spurs and knolls overlooking the river. Sites were also located on the one ridge line that occurred within the study area, at a distance of up to 400m from the river (Saunders 1995).

In 1999 Navin Officer Heritage Consultants (NOHC) completed an archaeological assessment of the Department of Defence extension to their Joint Services Staff College Site, Weston. One Aboriginal site, an open scatter of four stone artefacts, was located.

NOHC also conducted surveys of Stirling Park, Block 1, Section 128, Yarralumla (NOHC 2004), Blocks 2, 3 and 25, Section 44, in Yarralumla (NOHC 2006) and Block 22, Section 32 Yarralumla (NOHC 2007). No Aboriginal heritage sites or objects were identified in the course of these studies.

In 2008 AASC and CHMA completed a detailed heritage assessment of Coombs, Wright and Environs. The study identified two new Aboriginal sites, an isolated artefact and a subsurface deposit of three stone artefacts. No other Aboriginal sites were identified in the study area, indicating that site and artefact densities were very low or non-existent. The findings of the field investigations demonstrated a pattern of site distribution within the study area, with sites tending to be focused on elevated landscape features within a few hundred metres of the Molonglo River.

NOHC conducted a cultural heritage assessment of Block 5, Section 121 in North Curtin ACT in 2011. One Aboriginal site (NC1), an isolated artefact, was recorded in the road reserve opposite the junction of the Cotter Road and Lady Denman Drive. This site is listed on the ACT Heritage Register.

NOHC contributed to the Yarralumla Woolshed CMP in 2011. An archaeological field survey of the Yarralumla Woolshed and surrounds was undertaken in August 2011. The survey found three new Aboriginal sites, all isolated finds.

5.2 The Study Area

A search of the ACT Heritage sites database was undertaken; no Aboriginal sites are located within the CB&E project area.

5.3 Predictive Model

From a regional perspective Bulbeck and Boot (1990:20) suggested that site density distribution patterns indicated an Aboriginal landuse system focussed upon the Molonglo and Queanbeyan River systems and their accompanying resources.

Based upon these previous studies, patterns of Aboriginal occupation which may possibly be evidenced in the survey area would include activities focussed upon permanent stream corridors, and outcrops of siliceous stone materials. Large open camp sites have been recorded in proximity to creeklines, wetlands and in valley floor locations, as well as upon elevated spurs and ridges overlooking water sources. Scarred trees would have been restricted to areas of suitable mature woodland, most of which has been removed from the survey area.

Given the location of the area in relation to the past riverine resources associated with the Molonglo River (see Figure 3.5), it would be considered to have a relatively low potential for the occurrence of Aboriginal sites. Past landuse practices within the area also indicate that any such materials would be disturbed.

6. RESULTS

6.1 Aboriginal Sites

No previously recorded sites are located in the study area.

No Aboriginal sites were located in the study area. No areas of archaeological potential were identified.

6.4 Survey Coverage and Visibility Variables

The effectiveness of archaeological field survey is to a large degree related to the obtrusiveness of the sites being looked for and the incidence and quality of ground surface visibility. Visibility variables were estimated for all areas of comprehensive survey within the study area. These estimates provide a measure with which to gauge the effectiveness of the survey and level of sampling conducted. They can also be used to gauge the number and type of sites that may not have been detected by the survey.

Ground surface visibility is a measure of the bare ground visible to the archaeologist during the survey. There are two main variables used to assess ground surface visibility, the frequency of exposure encountered by the surveyor and the quality of visibility within those exposures. The predominant factors affecting the quality of ground surface visibility within an exposure are the extent of vegetation and ground litter, the depth and origin of exposure, the extent of recent sedimentary deposition, and the level of visual interference from surface gravels.

Generally visibility within the study area was low. The disturbance incidence across the area was approximately 20% with 70% visibility within the disturbed areas. Disturbance has resulted from pedestrian/vehicle tracks.

7. STATUTORY CONTEXT[1]

7.1 Heritage Act 2004

This Act provides for the protection, management and conservation of heritage places and objects in the ACT. The Act establishes a Heritage Register of heritage places and objects and establishes procedures for both provisional and full listing to the Register. The Act establishes the ACT Heritage Council to function as the main advisory body to the Minister on heritage issues. The Council receives administrative support from the ACT Heritage, Environment and Planning Directorate. The Council has the power to provisionally and fully register Heritage places and objects. Under the Act, the ACT Heritage Council is to be responsible for the Heritage Register and the heritage registration process.

An 'Aboriginal Place' and 'Aboriginal Object' are defined as 'a place/object of particular significance to Aboriginal people because of either or both:

(a) Aboriginal Tradition; and/or

(b) The history, including contemporary history, of Aboriginal people (s9).

Under s74 and s75 of the Act a person commits an offence if they engage in conduct that diminishes the heritage significance of a place or object, or engage in conduct that causes damage to an Aboriginal place or object. These offences are graduated according to whether an offender was reckless or negligent 'about whether the conduct would diminish the heritage significance' or 'cause damage' to an Aboriginal Object of Place. To 'cause damage' is inclusive of disturbing or destroying.

A person also commits an offence under the Act if they do not report an Aboriginal place to the Heritage Council, and has 5 working days to do so (s51).

The reporting and offence provisions of the Act apply irrespective of land status or whether registration to the Heritage Register occurs.

The Act provides for the development and application of Heritage Guidelines. These are to be formulated by the Heritage Council and will set the policy for how places and objects are to be conserved, including registered places and objects. The guidelines may control how development is to take place in an area which is a heritage place or contains a heritage object. They will be performance-based but may include mandatory provisions (Part 5). During the transitional phase of the Act a heritage or conservation requirement for a place is taken to be a heritage guideline under the Heritage Act (s129).

The only provisions for legally sanctioned disturbance to an Aboriginal place or object, or the diminution of the heritage value of a Heritage Place or Object is to conform to one of the exceptions listed in s76 of the Act. According to this section, the offence provisions of the Act (s74 and s75) do not apply if conduct is engaged in accordance with a heritage guideline, heritage direction, heritage agreement, a conservation management plan, or an approval for a development under the *Planning and Development Act 2007* (Part 10).

Disturbance to an Aboriginal site or place can only take place if the following conditions have been met:

- The place (or site) has been registered; and the proposed disturbance is compatible with the heritage guidelines for the conservation of that place or object (Part 5); or

[1] The following information is provided as a guide only. Readers are advised to seek qualified legal advice relative to legislative matters.

- The proposed development follows a DA approval under the *Planning and Development Act 2007* (Part 10); or

- The minister has issued a heritage direction for that place or object (Part 11); or

- The minister has entered into an heritage agreement with a person to conserve the heritage significance of a registered place or object (Part 15); or

- The proposed development follows a conservation management plan that has been approved by the Heritage Council (section 110).

Heritage recordings which occur on National Land under the National Land Ordinance 1989 (or subsequent amendments), or which occur in Designated Areas under the National Capital Plan are subject to development approval processes which may be in addition to, or instead of requirements identified as management requirements under the *Planning and Development Act 2007.*

Development approval processes within the ACT can be summarised as follows:

- Work carried out on National Land in Designated Areas is subject to the approval of the National Capital Authority (NCA);

- Work carried out on Territory Land in Designated Areas is generally subject to approval by the NCA but Territory requirements may also apply to development where the Territory is the approving Authority;

- Work carried out on National Land outside of Designated Areas must be in accordance with a Development Control Plan agreed by the NCA that reflects the requirements of the Territory Plan; and

- Work carried out on Territory Land outside Designated Areas is subject to the Territory Plan and Territory Approval processes.

7.2 Implications for the Canberra Brickworks and Environs Project

There are no statutory implications regarding cultural heritage for the study area.

8. CONCLUSIONS AND RECOMMENDATIONS

There are no cultural heritage constraints for the study area.

It is recommended that:

1. For the unanticipated discovery of Aboriginal sites and burials (during future investigation or development works, including excavation and/or other significant ground disturbance), the protocols detailed in Appendix 2 should be implemented.

2. A copy of this report should be provided to the ACT Heritage for approval.

3. One copy of this report should be provided to each of the ACT RAOs.

9. REFERENCES

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APPENDIX 1

RECORD OF ABORIGINAL FIELD PARTICIPATION

Record of Aboriginal Representative Participation*

Name(s) of Aboriginal Representative: Wally Bell

Name of Aboriginal Organisation: .....Buru Ngunawal Aboriginal Corporation .....

Archaeologist(s): name & address Nicola Hayes .....
Navin Officer Heritage Consultants Pty Ltd .....
4/71 Leichhardt Street, Kingston, ACT 2604 .....

Project Name. **Canberra Brickworks – Stage 1 Assessment**

Client: Land Development Agency

Invoicing: Navin Officer Heritage Consultants Pty Ltd
4/71 Leichhardt Street Kingston ACT 2620

Type of participation:

- ☐ Guided inspection of study area and sites
- ☑ Accompanied/participated in archaeological survey
- ☐ Separate inspection or survey
- ☐ Accompanied/participated in excavation program
- ☐ Artefact Collection

Period of participation:

Date(s)	Start	Finish
5 August 2014	9 am	10.30am

Signed *(archaeologist)*: .....

Signed *(Aboriginal representative(s))*: .....

* *please note this form is not an invoice. For payment, please send an invoice from your organisation to the client name and address provided above.*

APPENDIX 2

UNANTICIPATED DISCOVERY PROTOCOLS

Protocol to be followed in the event that previously unrecorded or unanticipated Aboriginal or non Aboriginal archaeological material (objects, artefacts, deposits or relics) are encountered

1. All ground surface disturbance in the area of the finds should cease immediately the finds are uncovered.

    a. The discoverer of the find(s) will notify machinery operators in the immediate vicinity of the find(s) so that work can be halted; and

    b. The site supervisor and the development proponent will be informed of the find(s).

2. If there is substantial doubt regarding a human or Aboriginal or historical European origin for the finds, then consider if it is possible to gain a qualified opinion (such as from the project archaeologist) within a short period of time. If feasible, gain a qualified opinion (this can circumvent proceeding further along the protocol for remains which turn out not to be archaeological). If a quick opinion cannot be gained, or the identification is positive, then proceed to the next step.

3. Immediately notify the following authorities or personnel of the discovery:

    a. The ACT Heritage (ph 6207 2165 or Canberra Connect 132281);

    b. Representatives from the Representative Aboriginal Organisations (RAOs) (where appropriate); and

    c. The project archaeologist (if not already present).

4. Facilitate, in co-operation with the appropriate authorities and stakeholders:

    a. The recording and assessment of the finds by a suitably qualified heritage professional (either the project archaeologist or a member of the ACT Heritage). This will include determining if the find(s) are from a new or previously recorded site, and lodgement of site information for all new recordings with ACT Heritage;

    b. Fulfilling any legal constraints arising from the finds. This will include complying with Heritage Council advice, any Conservation Management Plan (CMP) requirements in the case of a previously recorded site; and

    c. The development and conduct of appropriate management strategies. Strategies will depend on stakeholder requirements and the assessed significance of the find(s).

5. Where the management of find(s) involves the salvage excavation or collection of artefacts, this material will be curated according to the provisions of any relevant CMP, or as directed by the Heritage Council.

6. Where the find(s) are determined to have cultural heritage value according to the criteria specified in the *Heritage Act 2004*, any re-commencement of construction related ground surface disturbance may only resume in the area of the find(s) following compliance with any consequential legal requirements and gaining written approval from the ACT Heritage Council.

Protocol to be followed in the event that suspected human remains are encountered

1. All ground surface disturbance in the area of the finds should cease immediately the finds are uncovered.

    a. The discoverer of the find(s) will notify machinery operators in the immediate vicinity of the find(s) so that work can be temporarily halted; and

    b. The site supervisor and the development proponent will be informed of the find(s).

2. If there is substantial doubt regarding a human origin for the remains, then consider if it is possible to gain a qualified opinion within a short period of time. If feasible, gain a qualified opinion (this can circumvent proceeding further along the protocol for remains which turn out to be non-human). If conducted, this opinion must be gained without further disturbance to any remaining skeletal material and its context as possible (Be aware that the site may be considered a crime scene containing forensic). If a quick opinion cannot be gained, or the identification is positive, then proceed to the next step.

3. Immediately notify the following people of the discovery:

    a) The local Police (this is required by law);

    b) The ACT Heritage (ph 6207 5556 or Canberra Connect 132281);

    c) Representatives from the Representative Aboriginal Organisations (RAOs) (where appropriate); and

    d) The project archaeologist (if not already present).

4. Facilitate the evaluation of the find(s) by the statutory authorities and comply with any stated requirements. Depending on the evaluation of the find(s), the management of the find(s) and their location may become a matter for the Police and/or Coroner.

5. Construction related works in the area of the find(s) may not resume until the development proponent receives written approval from the relevant statutory authority: from the Police or Coroner in the event of an investigation; and from the ACT Heritage Council in the case of human remains outside of the jurisdiction of the Police or Coroner.

6. In the event that the proponent continues an active role in the evaluation and/or management of the find(s), via a direction or advice from the Police, Coroner and/or Heritage Council, then all or some of the following steps may be conducted:

7. Facilitate, in co-operation with the appropriate authorities, the definitive identification of the skeletal material by a specialist (if not already completed). This must be done with as little further disturbance to any remaining skeletal material and its context as possible.

8. If the specialist identifies the bone as non-human then, where appropriate, the protocol for the discovery of historical or Aboriginal artefacts (above) should be followed.

9. If the specialist determines that the bone material is human, then the proceeding course of action may be of three types:

    a. The bone(s) are of an Aboriginal and non-Aboriginal person who died less than 100 years ago and where traumatic death is suspected. Such remains come under the jurisdiction of the *ACT Coroner's Act* 1997. All further decisions and responsibilities regarding the remains and find location rest with the ACT Police, and/or the ACT Coroner.

b. The bone(s) are of a non-Aboriginal person who died more than 100 years ago. In this case, and where the Police have indicated that they have no interest in the find(s), the following steps may be followed:

   i. Ascertain the requirements of the ACT Heritage Council, the development proponent, the project archaeologist, and the views of any relevant community stakeholders;

   ii. Based on the above, determine and conduct an appropriate course of action. Possible strategies could include one or more of the following:

      1. Avoiding further disturbance to the find and conserving the remains *in situ* (this option may require relocating the development and this may not be possible in some contexts);

      2. Conducting (or continuing) archaeological salvage of the finds following receipt of any required statutory approvals;

      3. Scientific description (including excavation where necessary), and possibly also analysis of the remains prior to reburial;

      4. Recovering samples for dating and other analyses; and/or

      5. Subsequent reburial at another place and in an appropriate manner determined by the Heritage Council and in consultation with other relevant stakeholders.

c. The bone(s) are of an Aboriginal person who died more than 100 years ago. In this case the following steps may be followed:

   i. Ascertain the requirements of the local RAOs, the ACT Heritage Council, the development proponent, and the project archaeologist;

   ii. Based on the above, determine and conduct an appropriate course of action. Possible strategies could include one or more of the following:

      1. Avoiding further disturbance to the find and conserving the remains *in situ*, (this option may require relocating the development and this may not be possible in some contexts);

      2. Conducting (or continuing) archaeological salvage of the finds following receipt of any required statutory approvals;

      3. Scientific description (including excavation where necessary), and possibly also analysis of the remains prior to reburial;

      4. Recovering samples for dating and other analyses; and/or

      5. Subsequent reburial at another place and in an appropriate manner determined by the RAOs and the Heritage Council.

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CANBERRA
BRICKWORKS

CONSERVATION DEVELOPMENT STRATEGY

February 2015

Prepared for

LAND DEVELOPMENT AGENCY

Prepared by

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APPENDIX A

Stage 1 - Public and Pedestrian Access Building works

APPENDIX B

Stage 2 - Core elements conservation and development

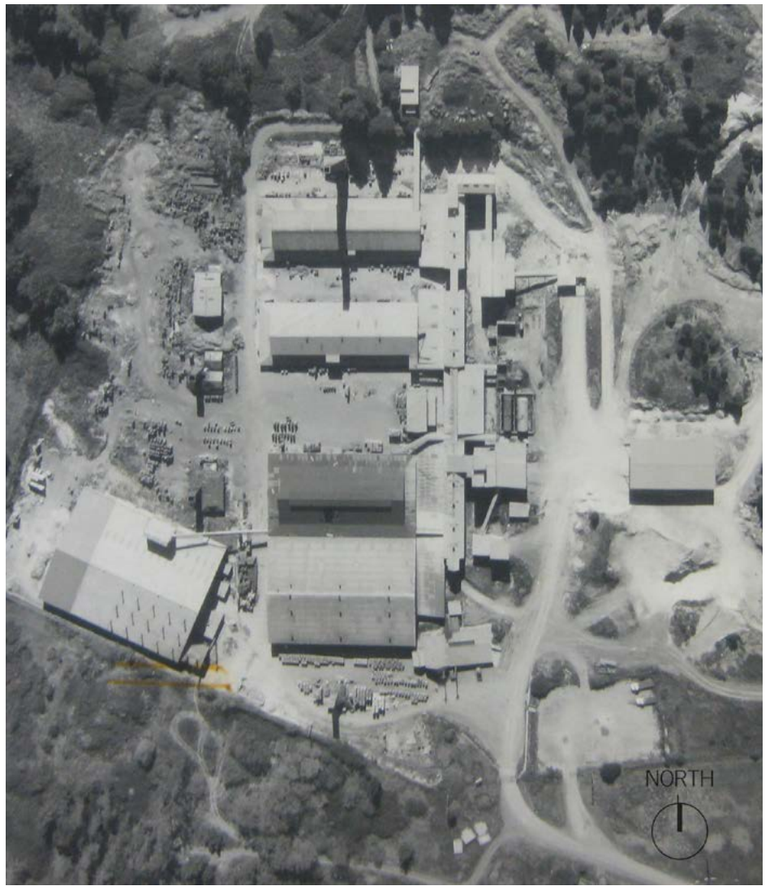
1.0 HISTORIC CONTEXT

1.1 Overview

The Commonwealth Government established the Canberra Brickworks in order to support the development of Canberra as the new Federal Capital. The project was announced in 1910 and work began on the development of the complex in 1913. The complex supplied the bricks for the construction of buildings in Canberra in the early period of the establishment of the capital, including Canberra's major public buildings of the 1920s. Bricks and other specialty lines were produced at the site from this time until the closure of the complex in 1976. Production capacity at the site varied in response to fluctuations in demand for bricks and the Brickworks was expanded in a number of key phases, notably in the 1920s and the 1950s.

Originally steam traction engines were used to transport materials to and from the Brickworks, however these engines which pulled iron-wheeled trailers, were only able to make two round trips per day between the brickworks and Parliament House. In 1923 a narrow gauge railway was constructed to increase the speed of brick delivery, however this line was decommissioned in 1927 prior to the opening of Parliament House. Remnant embankments and cuttings are still evident on site.

Following closure of the plant in the mid-1970s, the site was adapted for a range of uses (of varying duration) but other than for the subdivision of land and associated residential development on the perimeter of the site, relatively little physical change has occurred since this time. The surviving complex includes brick manufacturing infrastructure including kilns, stacks and ancillary buildings, with a quarry (brickpit) to the east. Currently, part of the complex is occupied by a timber recycling company.



Aerial view, at the time of the closure of the Canberra works. , c.1976

1.2 Development Strategy

The Canberra Brickworks site and separately registered remnant railway embankment is to be included as part of the larger Canberra and Brickworks Environs development project. One of the primary heritage objectives for this site is the establishment of a future use that ensures its physical conservation and the retention of key heritage values in the long term. Within the context of the development strategy the intent is to maintain, conserve and develop the Brickworks for public use. The master plan envisages a link between the two separate registered sites through the establishment of a new integrated precinct that enables an appreciation of the heritage past, while creating a viable future.

The time frame for staging of works to the Brickworks site is related to the development of the surrounding areas and the gradual roll out of the residential estate infrastructure. Access to the site which is currently limited and of low grade will be improved in the first stage by the extension of Denman Drive and Brickworks Road, with further development including active conservation and adaptation of the core heritage elements occurring in the second stage followed by the new Quarry Park which will provide the impetus and access for new activities and uses on the site.

View from the north-east towards the brick processing buildings, c. 1927

The first Hardy patent kiln (left) and the Staffordshire kiln in1928

1.3 Existing Condition

The history and significance of the wider site and the Canberra Brickworks Complex has been researched and assessed by Lovell Chen in the Canberra Brickworks Environs Assessment (2011) and Canberra Brickworks Conservation Management Plan (2010), prepared for the LDA.

Through this process conservation policy objectives were established that covered the potential for future management and uses, including for restoration and reconstruction, demolition, adaptation and site development. It was also recognised that any adaptive reuse proposal for the site which involves the substantial retention and conservation, repair and refurbishment and adaptation of significant fabric so as to maintain the heritage values of the place will involve substantial cost, both up-front and ongoing.

These costs ultimately will be required to be assessed against the positive heritage outcomes and the investment in the cultural capital embodied in the site, but also against an economic return that is generated by a new use or uses.

On this basis and having regard to the assessed significance of the place, the conservation policy for the site recognises that there are two broad approaches that reasonably could be contemplated: whole of site conservation; or partial site conservation. Clearly within these options there is scope for variations in the extent of adaptation of the retained buildings and the level of site development.

It is also acknowledged that the ultimate outcome for the site will be influenced by a number of factors, determined by those responsible for approving works. The scale of the site and nature of the fabric will inevitably require a level of intervention that will change the physical and visual nature of the place. The intention is to find a balanced outcome that meaningfully addresses the heritage while achieving a successful sustainable use.

The buildings on this site are generally in fair to poor condition and some are in a relatively advanced state of decay. Therefore there needs to be a tandem process of establishing a long term future use (which will evolve over time) with the need to make the site safe and halt the acceleration of decay.

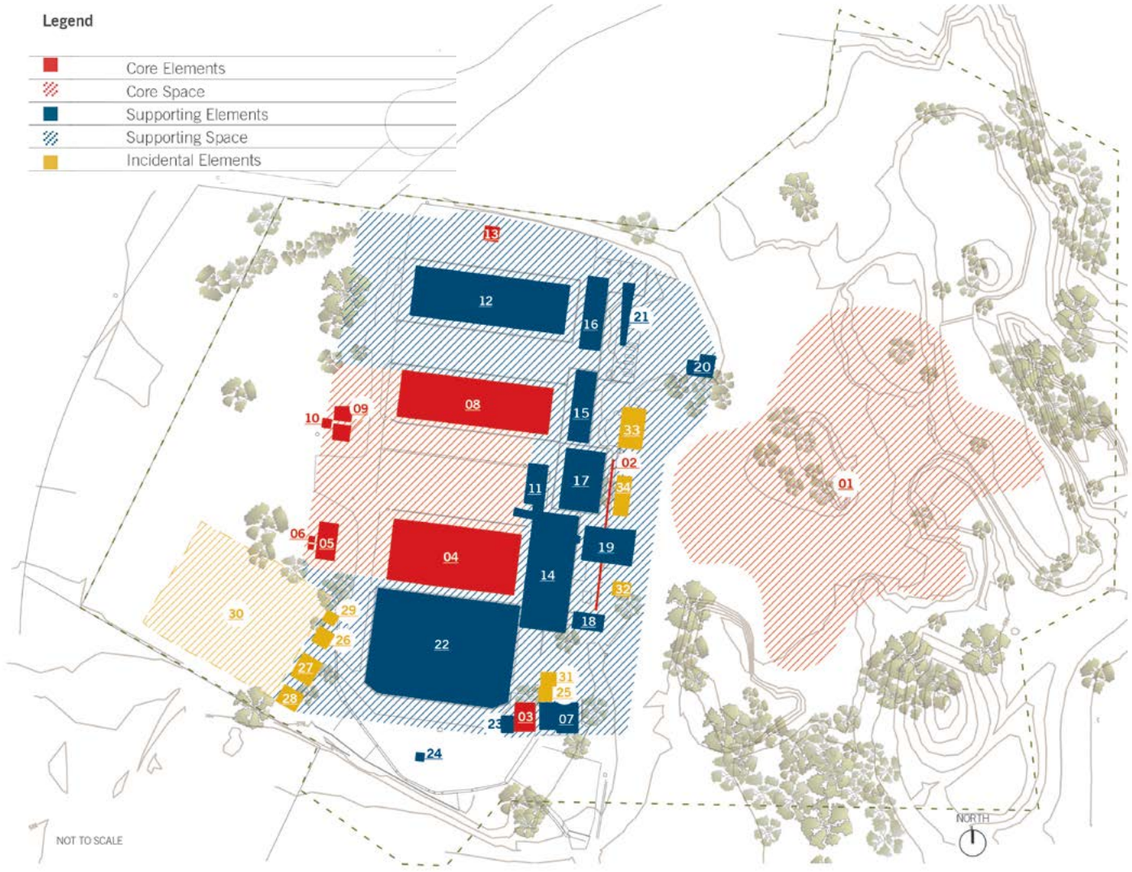
1.4 Conservation policy

The key conservation policies to be considered at this master plan stage are those that go to setting and curtilage; care of significant fabric; extent of fabric to be retained; use and public access; views and vistas; adaptation; site development and new works; site presentation; and access and circulation.

The current master plan strategy acknowledges and supports these policy objectives.

Setting and curtilage:

- sense of discovery upon approach will be retained, including the relationship with Quarry Park
- existing bold orthogonal spatial sequence and order will be retained with any new development beyond the alteration and adaptation of existing structures complementing the reading of the brickwork as a complex of buildings.



Care of significant fabric:

- conservation works to be carried out having regard for the principles of the Australia ICOMOS Burra Charter 1999
- a programme of immediate repair and maintenance works to be undertaken within Stage 1 to conserve significant existing fabric
- Extent of fabric to be retained:
- retention and conservation of 'core' elements
- retention of 'supporting' elements with alteration, adaptation or removal as appropriate to support new uses
- retention, alteration or removal of incidental elements as appropriate to support new uses

Building Number	Element
01	Quarry
02	Concrete retaining wall
03	Power House
04	Staffordshire Kiln (Kiln 1)
05	Fan house for Kiln 1
06	Chimney stack for Kiln1
07	Offices
08	Hardy patent Kiln (Kiln 2)
09	Fan house for Kiln 2
10	Chimney stack for Kiln 2
11	Amenities block
12	Hardy patent Kiln (Kiln 3)
13	Chimney stack for Kiln 3
14	Machine Bay I for Kiln 1
15	Machine Bay II for Kiln 2
16	Machine Bay III for Kiln 3
17	Workshop
18	Small Crusher House (Crusher House
19	Large Crusher House (White pan roon / Crusher House II)
20	Primary Crusher House (Crusher Hou
21	Elevator / Conveyor
22	Downdraft Kilns (Kiln 4-6)
23	Downdraft kiln control room
24	Chimney stack for Kilns 4-6
25	Toilet block
26	Amenities block
27	Substation/control room
28	Boiler house
29	Ancillary storage building
30	Remnant of extrusion plant (concrete
31	Ancillary storage building
32	Storage shed
33	Model railway workshop
34	Model railway storage shed

Use and public access:

- enabling appropriate safe public access to Brickworks complex and particularly to Quarry Park
- enabling use of occupiable spaces which are compatible with retention of the significant fabric
- Views and vistas:
- retention of landmark elements (chimneys) that form markers in the local area
- retention of key internal complex views and vistas and linkages between individual building elements and the quarry beyond

Adaptation

- achieve appropriate balance between retention and conservation of fabric and delivery of a long term sustainable use
- maintain ability to understand the brickworks complex as an operating site within the context of redevelopment for different use(s)

Site development and new works:

- maintain legibility of the place as an industrial complex
- maintain strong industrial aesthetic
- maintain quarry area as an open landscape zone
- no new development in original brickyard space between Staffordshire and Hardy Patent Kilns
- new buildings of a scale and nature that relates to the existing building forms
- continue existing patterns of connectedness at all levels across the site

Site presentation:

- maintain the industrial aesthetic and character throughout

Access and circulation:

- maintain the traditional principal approach from Denman Road
- maintain legibility of rail access connection to site
- maintain roadway along west of the kilns and on east between process buildings and quarry

2.0 DEVELOPMENT STAGES

2.1 Stage 1 – Public and Pedestrian Access (years 3-5)

In the initial stage the focus is necessarily on removing hazardous materials, making the buildings weatherproof and addressing the inevitable decay that occurs to unoccupied buildings. It is desirable that the site remains in a safe condition so that continued access by the public is permissible and possible.
In approaching this initial phase of works the following principles apply to all buildings and structures on the site.

1. Preserving and managing fabric

- Ensure all rainwater goods are in operational state
- Ensure storm water system is in operational state
- Remove all invasive vegetation from buildings
- Remove all invasive vermin (rats, pigeons etc) from buildings and secure buildings from vermin incursion
- Secure openings, particularly on weather side of buildings
- Site enclosure to restrict access to the site other than by authorised personnel

2. Make safe from hazards

- Ensure there are no elements that will fall or detach themselves causing danger to personnel on the site or other building fabric
- Address any evident structural issues that will contribute to the deterioration of fabric or pose a safety hazard
- Restrict access to areas that put people at risk
- Remove hazardous materials particularly those which have been damaged or are in such a deteriorated state they prohibit access to the buildings (friable asbestos, flaking lead paint, pigeon excrement etc.)

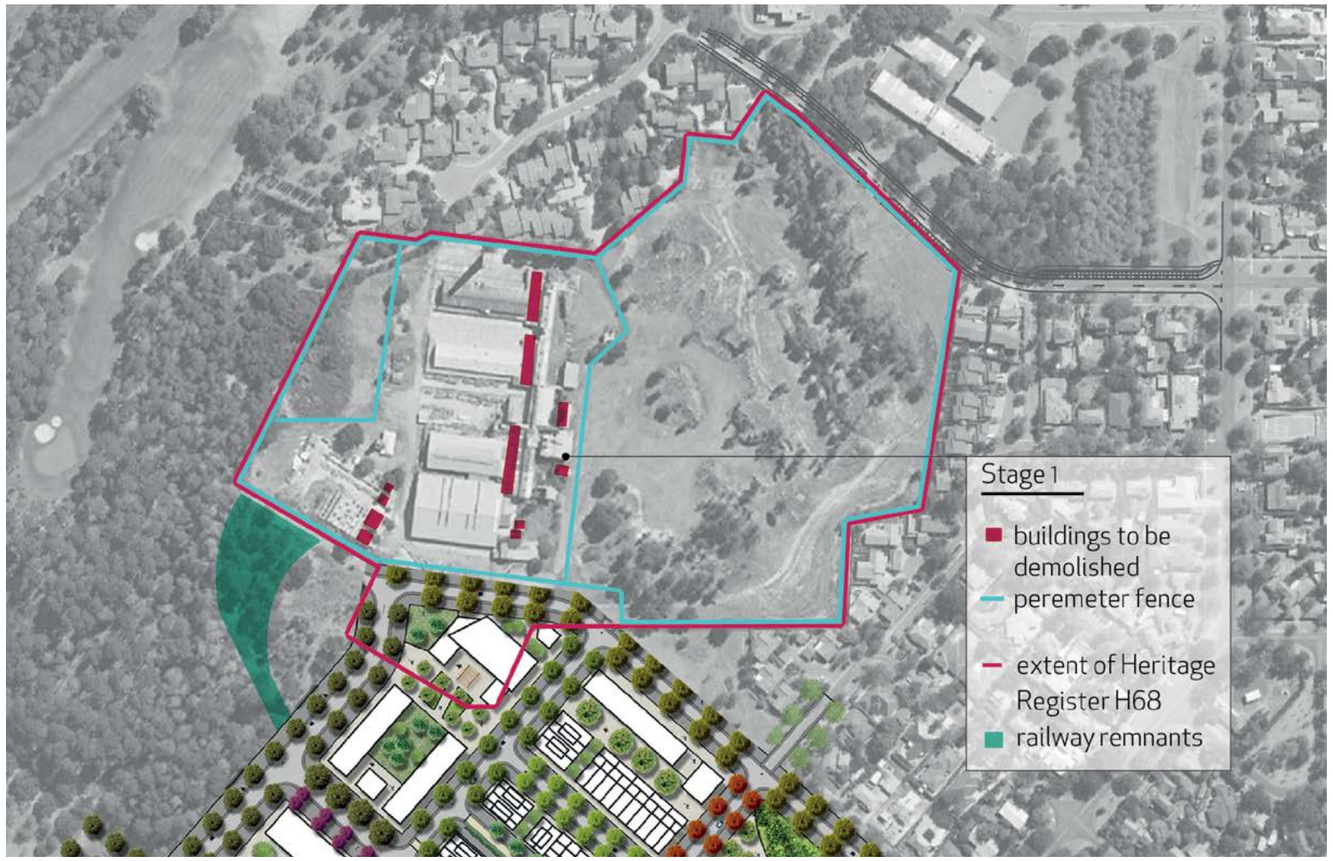
3. Maintain structural integrity

- Make buildings structurally safe addressing deterioration due to wind, rain, gravity or similar forces.

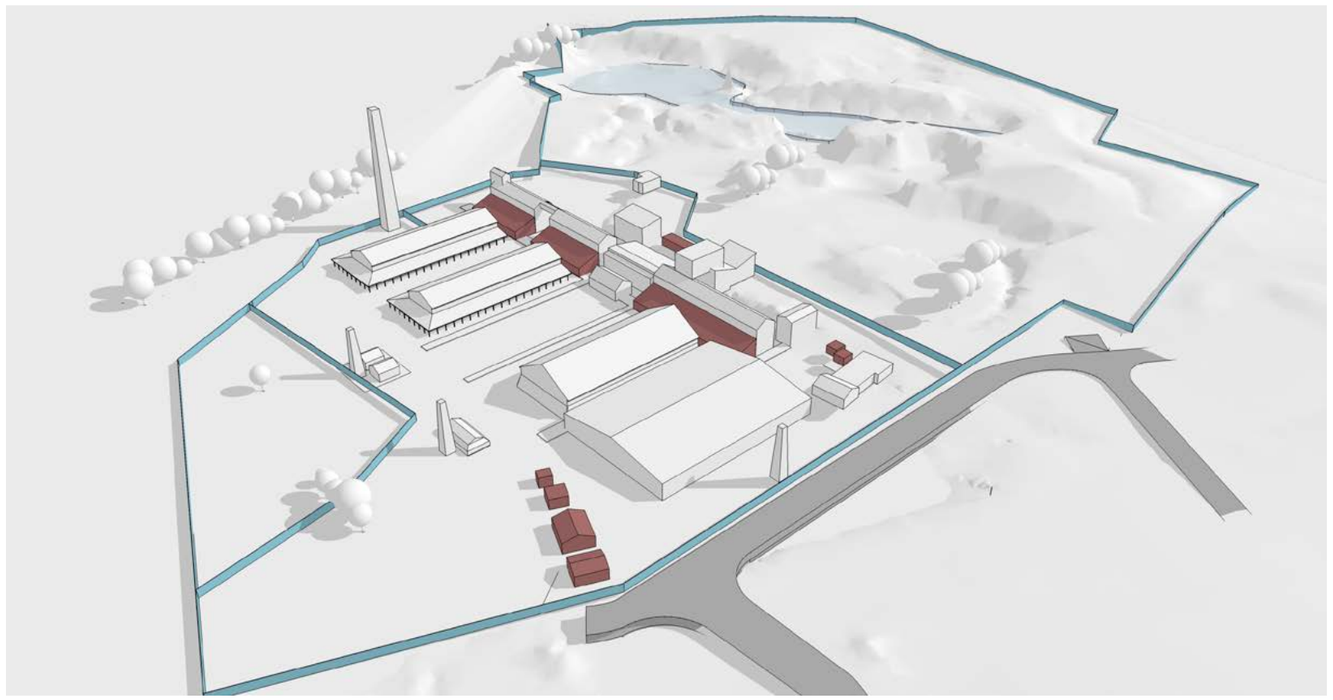
4. Demolition

- Immediate demolition of buildings/structures that are of little or no heritage significance and make little contribution to the understanding of the industrial complex operations.

LDA are committed to undertaking a scope of works across the site that aligns with the principles outlined above.



*Residential built forms in the CB+E master plan are illustrative only and do not correspond to CB+E Staged delivery timeline.



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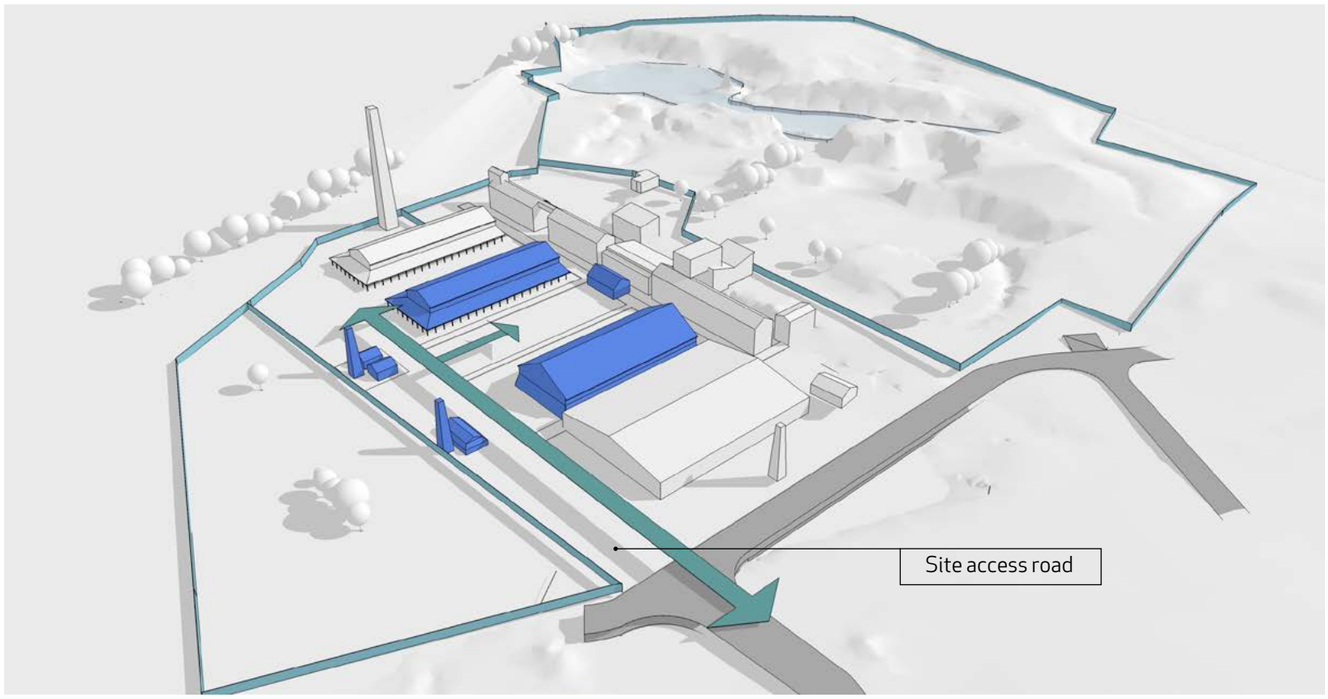


2.2 Stage 2 – Core elements conservation and development (years 6-8)

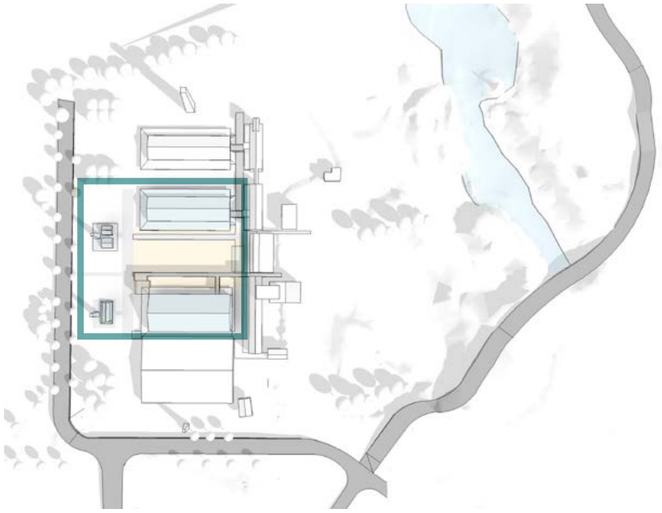
In this initial stage the new formed access roads that will connect the Brickworks site into the new subdivision (Denman Road and Brick-works Road) will be established. This will create a more formal access to the site from the south side and it is envisaged this will act as an impetus for more active use of the site which might include in this early phase pop-up events and safe community access.

As a next step it is proposed to undertake active conservation to the most significant structures on the site, the Staffordshire Kiln (Kiln 1), Fan House and Chimney (1914-15), Hardy Patent Kiln (Kiln 2), Fan House and Chimney (1926 and 1955) and central brickyard. This would enable occupation of the buildings for a range of potential uses including office, studio, and gallery or community space.

Works to the buildings will comprise conservation, reconstruction and adaptation works to bring these structures to a level of fit out and compliance that enables them to be occupied for a range of retail, commercial or public uses. The works will include conservation and reconstruction of the external fabric, provision of compliant access, conservation of existing or new floor, wall and ceiling linings and introduction of basic service infrastructure including power, lights, air conditioning and water.

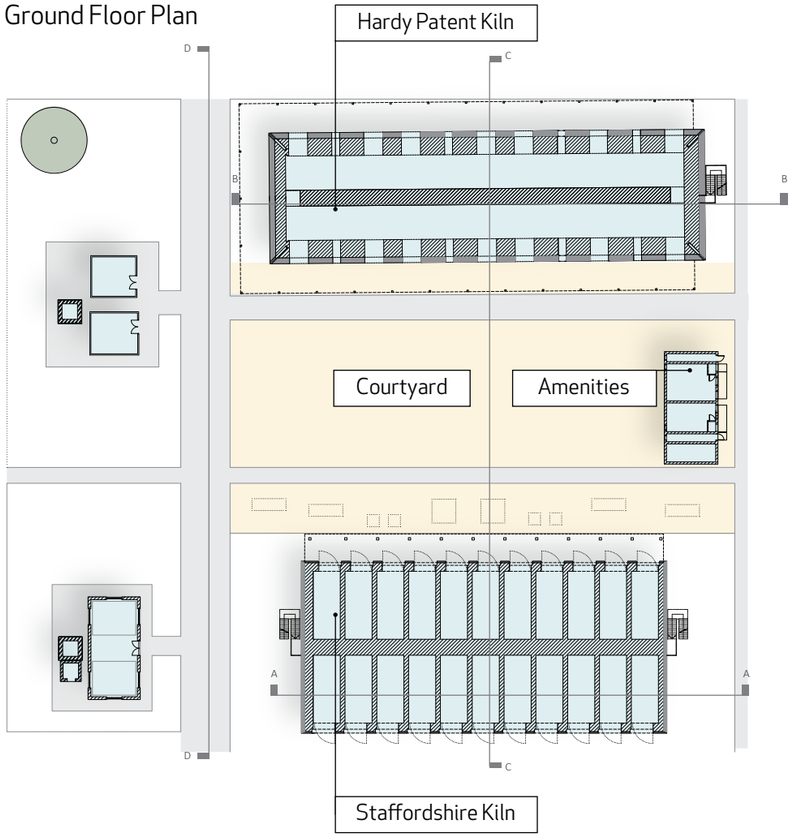
In addition the existing Amenities Block (c. 1955) will be retained and refurbished to provide public facilities and the brick courtyard be-tween the two kilns upgraded as an accessible public space

Staffordshire kiln north elevation c. 1916

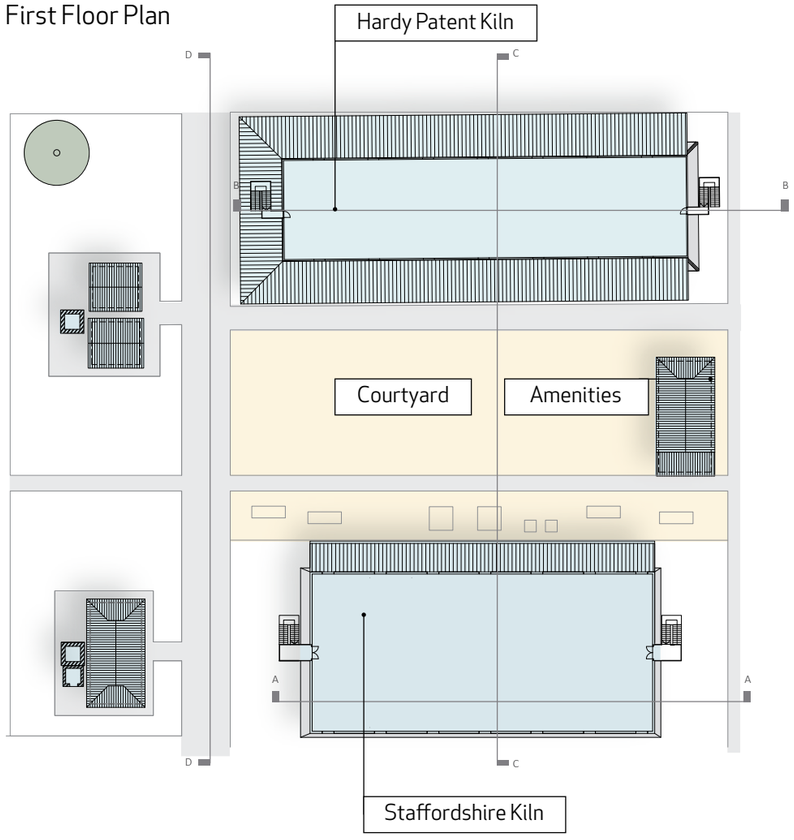


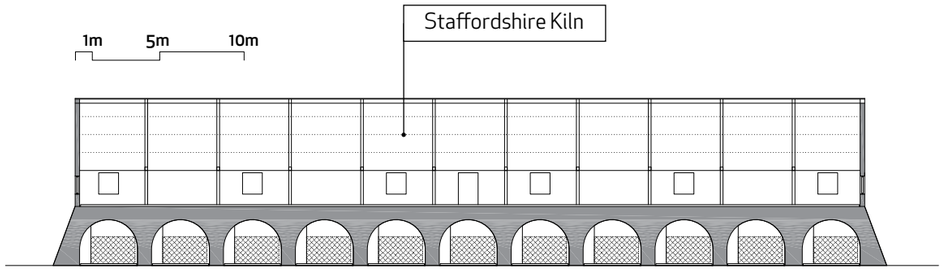
1m 5m 10m

Ground Floor Plan

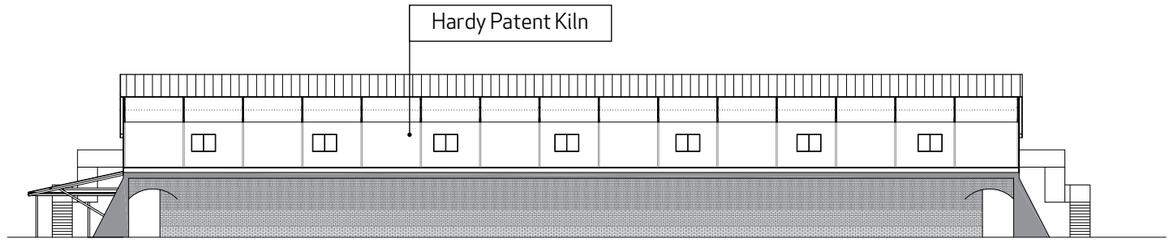


First Floor Plan

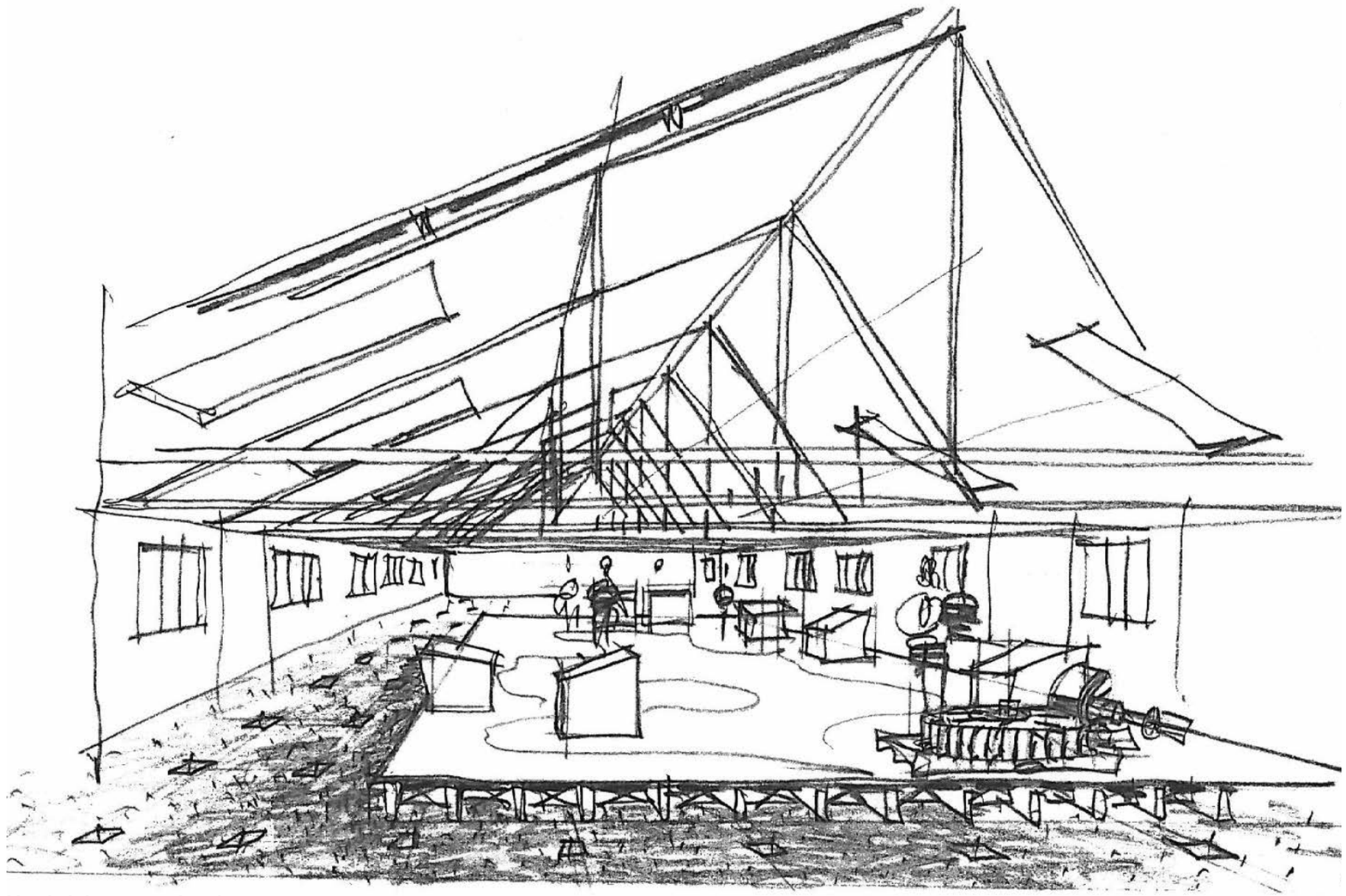




Section A-A



Section B-B



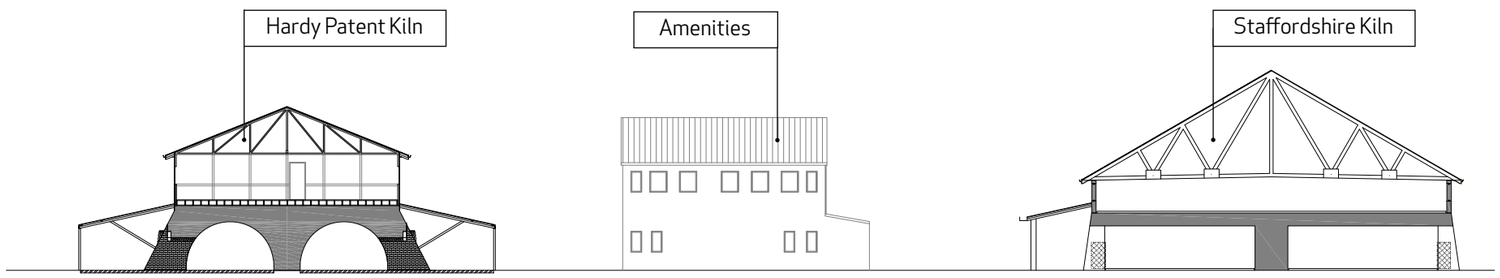
Hardy kiln - upper level interpretation

Accessed by a new pedestrianised roadway between the west end of the kilns and the east side of the fan houses, it is envisaged the central brickyard in a cleaned up and cleared state would provide a central open space which could accommodate pop-up events associated with the use of the Staffordshire and Hardy Patent Kilns and Fan Houses or the development more generally. Interpretation of the railway would be continued through in this location with the insertion of the narrow gauge tracks in their original location on the north and south sides of the Staffordshire Kiln within the paving to visually and physically demonstrate the manner in which the railway terminated at the site.

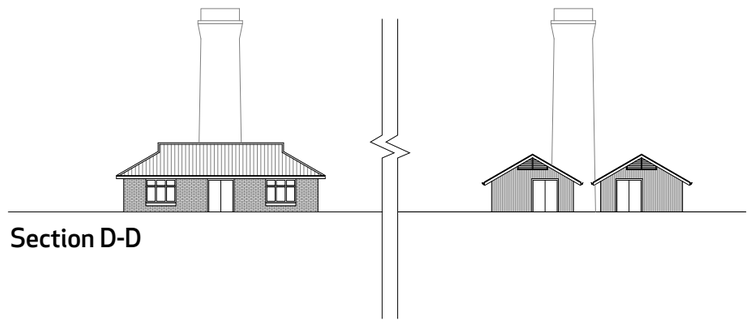
As the Quarry Park development evolves additional access points will occur along the east, west and south edges of the site, although it is proposed the formal "front door" will remain on the south-west end of the site.

Estimated commercial areas

Building	Ground (m2)	Upper (m2)
Staffordshire Kiln	620	850
Hardy Patent Kiln (Kiln 2)	470	620
Fan House (Staffordshire)	70	0
Fan House (Hardy Patent)	70	0
Amenities Block	95	0
	1,325	**1,470**



Section C-C



Section D-D

2.3 Stage 3 – Connecting Heritage Open Spaces (years 9-10)

In this stage the redevelopment of the Quarry as a public park will occur. The linkages with the brickworks site are an important element of this redevelopment as they will provide a further active edge to the Brickworks to the east enabling the public full access to the broader site, completing the reunification of the brick making industrial complex with the source of the essential material.

The Quarry is a core heritage element within the registered site and as such should generally be retained as an open landscape zone. When considering the introduction of new paths and landscape treatments it is important that the most distinctive aspect of the evolved setting which is the degree of concealment and 'removed-ness' from the character of the residential city is retained. The setting is still one of a degree of open unkempt landscape, wooded and plantation areas, and limited visible perimeter form.

New built form should be limited to incidental 'garden' structures other than along the north-south spine at the interface between the quarry and the Brickworks.

As part of this stage additional road access on the east side of the Brickworks with integrated public car parking will be constructed enabling linkages between the more elevated quarry site with the buildings through insertion of new stair access at the top of the retaining wall in structures such as the Large Crusher House (19) and Small Crusher House (18).

At this point the redevelopment of the north-south spine of buildings adjacent to the park would logically occur either as part of or independently of the Quarry Park development.

Further development opportunities at the Brickworks are related to the existing kilns to the north and south of the Hardy Patent and Staffordshire Kiln. These supporting elements may be adapted for use or demolished to make way for new development associated with the brickworks.

Legend

	Development opportunity
	Former railway tracks
	Crusher Houses
	Main external views
	Road and pedestrian connections to site
	Internal site connections

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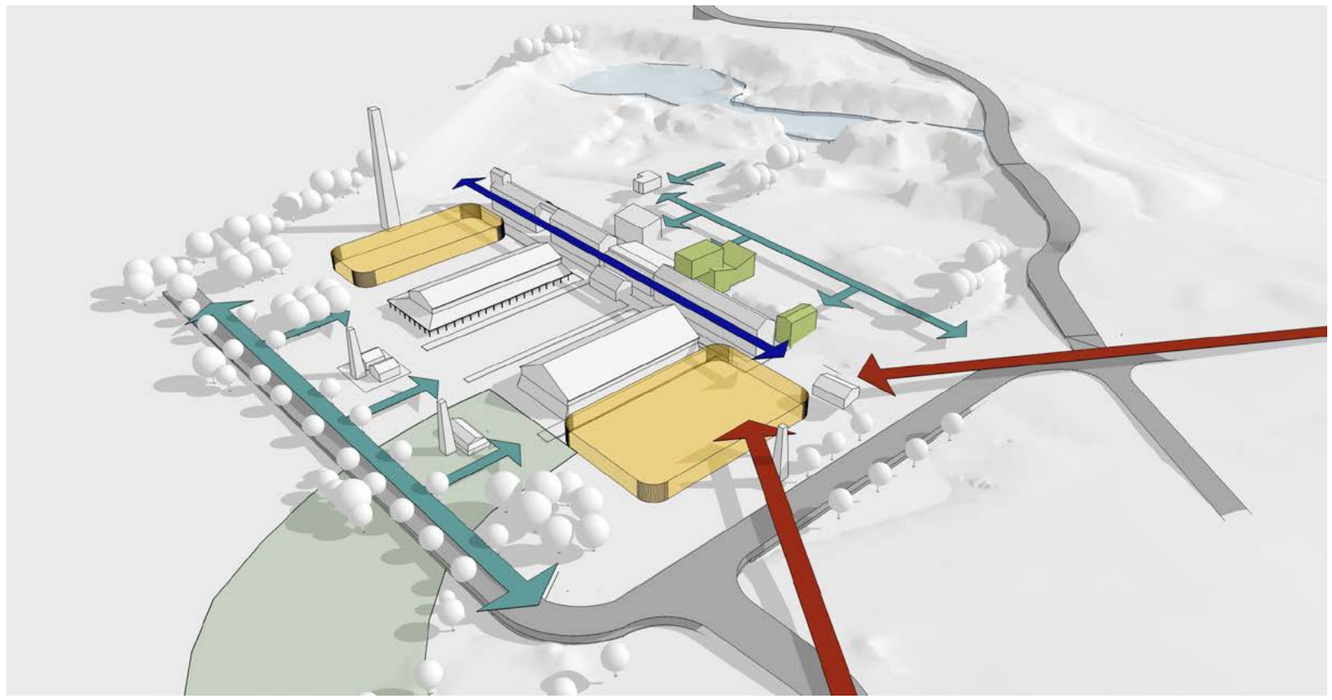

APPENDIX A

STAGE 1

PUBLIC AND PEDESTRIAN ACCESS

BUILDING WORKS

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Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
01	Quarry	Core space	Ensure fencing to perimeter is secure and all existing holes and missing wires made good.		
02	Concrete retaining wall	Core element	Remove all vegetation.	Collapsed brickwork on the upper section of the retaining wall and retained soil should be removed. The tree should also be removed before it becomes too large and collapsed. Earth should be battered at 45 degrees	
03	Power House	Core element	Investigate rainwater goods and make operational ensuring connection to storm water system. Secure openings.	Seal all windows to protect internal elements. Demolish retaining wall. This may also require underpinning of footings or demolition of adjacent small room. Further investigation required once wall has been demolished.	

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
04	Staffordshire Kiln (Kiln 1)	Core element	Remove non-original skillion roof at west end of building. Rebuild fascias and install new eaves gutter and downpipes to upper level roof on north side. Connect to surface storm water drain system. Large capacity eaves gutters on south side abutting Building 22 discharges into galvanised down pipes. These are bent and distorted at base. Rectify damage to ensure direct discharge into open storm water drain. Remove vegetation and debris from open storm water drain to perimeter and ensure operational including discharge to and from pits. Secure all openings with CGI sheet or marine grade plywood to timber frame. Provide temporary covers to the vent pits located in the floors of the kilns to exclude vermin. Provide compliant stair access at west end.	Walls and roof should be waterproofed to prevent damage to the upper timber and steel structure by the elements. This includes completing brick veneer walls on upper floor and sealing west wall louvres. Masonry entry and archway should be reinforced to allow public access (20 off). All loose debris should be removed as necessary. All other members should be re-secured as required. Reinstate buckled steel angle brace. Seal holes from first floor. Ensure flat to remove trip hazard.	

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
05	Fan House for Kiln 1	Core element	Rebuild timber fascias, replace gutters and down pipes, connect to site storm water system. Secure all openings with CGI sheeting or marine grade plywood on timber frames. Retain existing window and door joinery. Remove invasive vegetation (blackberry) from roof. Implement pest control measures to remove pigeon infestation.	Remove and reinstate damaged ceilings if required. Seal all windows and doors from the elements. Provide secure handrails around internal pit. Fill sinkholes with suitable fill.	
06	Chimney stack for Kiln 1	Core element	CCap top of chimney to make chimney weather tight. Check lightning protection and rectify/replace if required. Remove invasive tree and vegetation growing in oven.	Provide steel straps around top of chimney stack. Fence off around 'oven' to restrict access.	

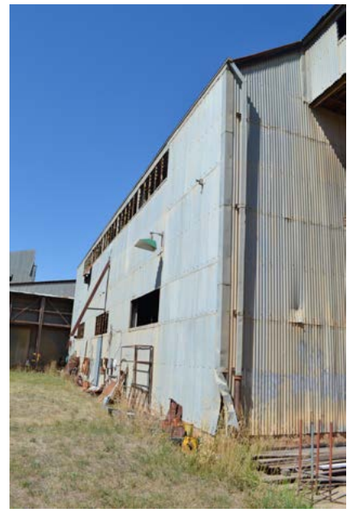
Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
07	Offices	Core element	Investigate rainwater goods and make operational ensuring connection to storm water system. Secure openings. Refix slipped tiles.		

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
08	Hardy patent Kiln (Kiln 2)	Core element	Refix rusted and loose CGI roof sheeting. Reinstate fascias, eaves gutters and down pipes to both roof levels and connect to surface storm water drainage system. Remove vegetation and debris from open storm water drain to perimeter and ensure operational including discharge to pits and from pits. Secure all openings both levels with CGI sheeting or marine grade plywood or similar. Secure entry point /ladder access on south side of building	Walls and roof should be waterproofed to prevent damage to the upper timber and steel structure by the elements. Masonry and entry archways should be reinforced to allow public access (16 off). Masonry archways to kilns at ground floor should be strengthened to allow public access (2 off). Steel roof to timber lean-to (north and south) should be reinstated where panels are missing and rotted timbers replaced. Ceiling battens on first floor should be resecured or removed in their entirety. Seal chimney holes from first floor. Ensure flat to remove trip hazard. All timber members to timber walkway between building 4 and 7 should be replaced with new treated timber. Provide new compliant stair access to first floor.	

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
09	Fan House for Kiln 2	Core element	Refix rusted and loose CGI sheeting to walls. Allow to replace sections of rotted timber framing. Install new eaves gutters and down pipes, connect to storm water system on site. Replace CGI roof sheeting to full extent. Allow to install new battens to full extent. Secure all openings with CGI or marine grade ply. Remove invasive vegetation.	Replace collar ties to each line of rafters. Seal all windows and doors from the elements. Provide secure handrails around the internal pit. Fill sinkholes with suitable fill.	
10	Chimney stack for Kiln 2	Core element	Cap to make weather tight Brick growth to top course, refer Structural Engineer recommendations. Check lightning protection and rectify/replace if required.	Provide steel straps around top of chimney stack.	

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
11	Amenities Block	Supporting element	Remove all damaged internal linings (assumed to be asbestos cement sheet). Remove all pigeon debris from interior (hazardous substance). Secure all openings with CGI sheeting or marine grade ply (note most window sashes glazing is broken or lost). Install new eaves gutters and fascias and downpipes and connect to storm water system.	Seal all windows and doors to prevent further damage from elements.	

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
12	Hardy Patent Kiln (Kiln 3)	Supporting element	Eaves gutters generally in poor condition, install new eaves gutters and downpipes. Allow new fascias throughout. Direct DPs into open storm water drain around perimeter. Rectify all loose CGI sheeting to roof and replace cover flashings to barge ends to gable roofs. Timber skillion at ground level largely dismantled, roof sheeting removed and eaves gutters removed. Record (photography/ measured drawings) and continue dismantling to make safe. Secure all openings both levels with CGI sheeting or marine grade plywood or similar to external face. Provide compliant stair on south side in existing location. Remove loose stone debris from roof. Remove vegetation from open storm water drain to perimeter and ensure operational including discharge to pits and from pits.	Walls and roof should be waterproofed to prevent damage to the upper timber and steel structure by the elements. Broken windows should be sealed as required. Masonry archways to kilns should be reinforced. Entry archways should be reinforced (16 off). Masonry archways should be strengthened to south west main entry (1 off). Sheet roof to timber lean-to should be reinstated where panels are missing and rotted rafters replaced. Replace roof truss where fire damaged (approx 20 m span) Seal holes from first floor. Fence and prevent access to timber walkway to north east. Provide new stair access to first floor.	
13	Chimney stack for Kiln 3	Core element	Cap to make weather tight. Check lightning protection and rectify/replace if required. Openings already secured with steel mesh, make secure.	Provide steel plate strap around top of structure to secure brickwork (5 off).	

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
14	Machine bay I for Kiln 1	Supporting element	Eaves gutters generally in poor condition, install new eaves gutters and downpipes. Allow new fascias throughout. Direct DPs into open storm water drain around perimeter. Remove vegetation and debris from open storm water drain to perimeter and ensure operational including discharge to pits and from pits.	Removed wall braces should be replaced where they have been removed (4 off). Handrails should be provided to first floor penetrations. Reinstate wall framing and lining to south elevation first floor. Restrict public access to raised walkway above first floor.	
15	Machine bay II for Kiln 2	Supporting element	Retain existing box and eaves gutters. Replace missing down pipes and direct into open storm water drain. Check the box gutters are fully lined and flashed – inspection was not possible from roof level. Secure all openings at ground level including rectification of semi-secured CGI lined gates/panels. Secure all window openings with CGI sheeting or marine grade plywood sheeting or similar. Note all louvre windows glazing smashed/removed. Cover openings in floor of upper levels. Remove vegetation and debris from open storm water drain to perimeter and ensure operational including discharge to pits		

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
16	Machine bay III for Kiln 3	Supporting element	Retain existing box and eaves gutters. Replace missing down pipes and direct into open storm water drain. Check the box gutters are fully lined and flashed. Secure all openings at ground level including rectification of semi-secured CGI lined gates/panels. Secure openings with CGI sheeting or marine grade plywood sheeting or similar. Note all louvre windows glazing smashed/removed. Cover and secure openings in floor of upper levels. Remove invasive vegetation and debris from open storm water drain to perimeter and ensure operational including discharge to and from pits.	Repair trusses (2 off). Restrict access to public to timber deck above first floor. New stairway access should be provided to the first floor slab through the existing stairway voids (2 off). Handrails should be installed around the other first floor penetrations. Walls and roof should be waterproofed to prevent damage to the upper timber and steel structure by the elements. Broken windows should be sealed as required. Before waterproofing rotted timber purlins should be replaced with new where damaged. Reinstate wall framing to north elevation and lining to north elevations. Demolish timber deck and remove access to north upper deck. Replace missing wall braces as required (2 off). Treat spalled concrete and reinforcement to underside of floor slab.	
17	Workshop	Supporting element	Install new fascias, eaves gutters and down pipes. Connect to storm water system. Secure openings with CGI sheeting or marine grade plywood sheeting or similar. Note all louvre windows glazing smashed/removed to east side. Remove invasive vegetation and debris from open storm water drain to perimeter and ensure operational including discharge to and from pits	Seal windows to prevent further damage. Restrict access to timber walkway.	

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
18	Small crusher house (Crusher House 1)	Supporting element	This building is unroofed to lower section. No change. Upper section that is roofed retain and ensure connection of existing eaves gutters via down pipes to storm water system Remove all invasive vegetation. Remove vegetation and debris from open storm water drain to perimeter and ensure operational including discharge to and from pits. Remove all equipment and debris that is not associated with the brickworks.	Remove loose and damaged timber elements. Restrict access to public.	
19	Large Crusher House (White pan room/ Crusher House II)	Supporting element	Remove all equipment and debris that is not associated with the brickworks. Retain existing roof, allow refixing loose CGI sheeting and ensuring connection of existing eaves gutters via down pipes to storm water system. Remove invasive vegetation and debris from open storm water drain to perimeter and ensure operational including discharge to and from pits. Remove invasive vegetation. Fence off all levels of building to perimeter to restrict access/entry.	Wall braces should be replaced where they have been removed (3 off). Remove debris from floor and higher levels. Reinstate damaged and removed CGI wall and roof sheeting. Provide fencing around the base of the building to prevent public access.	

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
20	Primary Crusher house (Crusher House III)	Supporting element	Reinstate roofing (structure and CGI sheeting) to upper platform. Replace missing eaves gutters to central section. Fence off structure to prevent access/entry.		
21	Elevator/Conveyor	Supporting element	Fence base of conveyor to remove access.	Clear off any fallen debris and fence off from public access.	

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
22	Downdraft Kilns (Kiln 4-5)	Supporting element	Remove loose stone debris from roof. Rectify damaged galvanised down pipes at base where damaged by traffic to north and south. Remove invasive vegetation from open storm water drain to perimeter and ensure operational including discharge to pits.	Reinstate welds/connections where they have been damaged. Install mesh over brickwork where currently loose to prevent falling debris. Reinstate missing wall braces to match existing. Damaged portal columns should be straightened to original condition.	
23	Downdraft kiln control room	Supporting element	Remove/poison grub out all invasive vegetation (blackberry). Rebuild retaining wall to west side – Refer notes retaining wall in Building #03 Confirm existing storm water system is operational. Secure all openings with CGI steel sheet or marine grade plywood.		

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
24	Chimney stack for Kilns 4-	Supporting element	Check lightning protection and rectify/re-place if required. Cap top of chimney to make weather tight. Cracked brickwork to top courses (outward leaning). Secure all openings in face of chimney with CGI Steel sheet or mesh gates. Remove invasive vegetation.		
25	Toilet block	Incidental element	Demolish and clear site.		

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
26	Amenities block	Incidental element	Demolish and clear site.		
27	Substation/ control room	Incidental element	Demolish and clear site.		

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
28	Boiler House	Incidental element	Demolish		
29	Ancillary storage building	Incidental element	Demolish and clear site		

Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
30	Remnant of Extrusion plant (concrete pad)	Incidental element	Demolish		
31	Ancillary storage building	Incidental element	Demolish		
32	Storage shed	Incidental element	Demolish		

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Building #	Building Name	Significance as identified in the 2010 CMP review	Make Safe - architectural	Make Safe - structural	Photo
33	Model railway workshop	Incidental element	Install new eaves gutters (allow replacement of fascias) and new downpipes. Connect into storm water system. Secure all openings with CGI sheet or marine grade plywood.	Possible underpinning may be required due to the demolition of the adjacent retaining wall. Collapsed brickwork on the upper section of the retaining wall and retained soil should be removed. The tree should also be removed before it collapses. Earth should be battered at 45 degrees away from the top of the wall. The adjacent buildings (33 and 34) should be monitored during the demolition. Building 33 should be underpinned during the wall removal.	
34	Model railway storage shed	Incidental element	Demolish		

APPENDIX B

STAGE 2

CORE ELEMENTS CONSERVATION

AND DEVELOPMENT

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Building #	Building Name	Significance as identified in the 2010 CMP review	Conservation and adaptation works	Photo
04	Staffordshire Kiln (Kiln 1)	Core element	• removal of the skillion roofed infill at the east end of the kiln; • conservation and reconstruction of the skillion roofed timber-framed verandah to the north side to match original detail (reinstatement to the south side requires the demolition of Building 22); • introduction of 2 new complaint access stairs at the east and west end; • reconstruction of original window openings to the north and south elevations at first floor with timber-framed windows (7 each side); • conservation of louvered windows at the west end and external galvanised sheet lining; • construction of new raised floor over original firing floor with sections left unfloored to enable viewing and interpretation; • construction of internal linings over the non original brick veneer to achieve high level of insulation leaving the roof trusses exposed; • lifting of the existing galvanised steel sheet roof to install insulation and services and reinstatement of the galvanised roof; • retention of kiln chambers for use associated with brickyard to the north (market or similar) leaving the openings exposed; • reticulation of new power, data, lighting; • reticulation of domestic cold and hot water; • new heating system. The adaptation will reintroduce the original window openings to the first floor with the internal space maintained as a clear span open space.	

Building #	Building Name	Significance as identified in the 2010 CMP review	Conservation and adaptation works	Photo
05	Fan House for Kiln 1	Core element	Both the Fan Houses and Chimney associated with the kilns are to be similarly conserved and adapted for use as studio or cafe facility coupled with providing an interpretative understanding of the function of the Brickworks complex.	
06	Chimney stack for Kiln 1	Core element	• conservation of brick chimney • conservation and refurbishment of original timber-framed windows including new high performance glazing; • reconstruction of original paired timber entry doors; • construction of new raised timber floor to full extent with openings in floor for interpretation of fan plant and ducts retained below ; • conservation and refurbishment of original timber lined ceiling; • cleaning to existing internal brick walls; • reticulation of new power, data, lighting; • reticulation of domestic cold and hot water; • new heating system; • new external paving to perimeter of the building to provide access.	
08	Hardy patent Kiln (Kiln 2)		• removal of the skillion roofed infill at the east end of the kiln; • conservation of the steel and timber framed skillion verandah to the north, south and west side to match original detail; • introduction of 2 new complaint access stairs at the east and west end; • conservation of original steel-framed windows including new high performance glazing; • construction of new raised floor over original firing floor with sections left unfloored to enable viewing and interpretation; • raising of portal frame structure to achieve compliant height (2400mm) below bottom chord of truss; • construction of new internal linings and insulation to steel and stud-framed walls, retaining original corrugated galvanised sheet to exterior leaving the roof trusses exposed; • lifting of the existing galvanised steel sheet roof to install insulation and services and reinstatement of the galvanised roof; • retention of kiln chambers for use associated with brickyard to the north (market or similar) leaving the openings exposed; • reticulation of new power, data, lighting; • reticulation of domestic cold and hot water; • new heating system.	

Building #	Building Name	Significance as identified in the 2010 CMP review	Conservation and adaptation works	Photo
09 10	Fan House for Kiln 2 Chumney stack for Kiln 2	Core element Core element	• conservation of brick chimney • conservation and refurbishment of original timber-framed windows including new high performance glazing; • new paired timber entry doors to both fan houses; • construction of new raised timber floor to both structures constructed around remnant plant; • new insulated wall and ceiling linings constructed to internal face of timber wall and roof framing; • conservation of retained plant including fan ducts; • reticulation of new power, data, lighting; • reticulation of domestic cold and hot water; • new heating system; • new external paving to perimeter of the building to provide access.	
11	Amenities Block	Supporting Element	The Amenities Block would include a complete refurbishment of the interior including new linings, fittings and fixtures and finishes over the original painted masonry internal walls. In addition all the windows would be refurbished, including reglazing with high performance glass and made operable.	

Building #	Building Name	Significance as identified in the 2010 CMP review	Conservation and adaptation works	Photo
	Courtyard		Accessed by a new pedestrianised roadway between the west end of the kilns and the east side of the fan houses, it is envisaged the central brickyard in a cleaned up and cleared state would provide a central open space which could accommodate pop-up events associated with the use of the Staffordshire and Hardy Patent Kilns and Fan Houses or the development more generally. Interpretation of the railway would be continued through in this location with the insertion of the narrow gauge tracks in their original location on the north and south sides of the Staffordshire Kiln within the paving to visually and physically demonstrate the manner in which the railway terminated at the site. As the Quarry Park development evolves additional access points will occur along the east, west and south edges of the site, although it is proposed the formal "front door" will remain on the south-west end of the site.	