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Project 72811.01
25 June 2012
PMO

Health Infrastructure
c/- TSA Management Pty Ltd
Level 16, 207 Kent Street
SYDNEY NSW 2000

Attention: Ms Catherine Lee

Dear Sirs

Report on Targeted Contamination Assessment of Former Coal Bunker
Proposed Dubbo Base Hospital Redevelopment
Myall Street, Dubbo

1. Introduction

This report presents the results of a targeted contamination assessment of the former Coal Bunker beneath the building currently being used as the Main Switchroom and Generator, adjacent to the Old Boiler House. The work was commissioned by Health Infrastructure, in consultation with TSA Management Pty Ltd.

The redevelopment project involves three main components: construction of medical buildings in the central portion of the site (the 'building works zone'), construction of on-grade vehicle parking areas and internal roads in the north-eastern area of the site (the 'civil works zone'), and the construction of a stormwater detention basin in the north-western portion (the 'stormwater detention zone'). Demolition of the former Coal Bunker will be required as part of the proposed works, and an assessment of the contaminant levels below the bunkers was requested to facilitate planning of these works.

The targeted assessment included coring through the concrete bunker slab in four locations, drilling and sampling of the underlying materials, laboratory analysis of samples obtained from the boreholes and a review of the results. Details of the field work and laboratory testing programme are provided in this report.

Douglas Partners Pty Ltd has undertaken several other assessments for the redevelopment works and these are reported separately. This targeted assessment compliments a Phase 1 Contamination Assessment undertaken on the site as outlined in the *Report on Phase 1 Contamination Assessment Rev0* for Project 72811 dated 18 April 2012.

Both the Phase 1 assessment and this targeted assessment were undertaken to address the requirements of *State Environmental Planning Policy No.55 – Remediation of Land* (SEPP 55). The assessments can be considered part of a Stage 1 – Preliminary Investigation, incorporating limited site sampling, as described in Section 3.5.2 of SEPP 55.

2. Site Description and Geology

Dubbo Base Hospital is located to the north-east of the city centre and is bounded by Myall Street to the south, the Coonamble-Dubbo Railway line to the west, residential dwellings to the east, and vacant land to the north. The natural ground surface levels at the site appear to fall gently to the south and west.

At the time of the current investigation, the main hospital buildings were located in the southern and central portions of the site. A car park was located in the eastern portion, and the western and northern sections of the site were generally vacant. The former Coal Bunker is located in the northern portion of the main hospital campus.

The *Dubbo 1:250 000 Geological Series Sheet* shows that the site is close to a boundary between gravel and ferruginous sandstone, and olivine basalt and dolerite. Both of these geological units are of Cainozoic age.

The portion of the site on which the development works are proposed consists of Lot 12 in DP 1159243 in the Parish of Dubbo, County of Lincoln. A site location plan is shown on Drawing CB1 in Attachment B.

3. Scope of Works

The scope of the targeted contamination assessment was as follows:

- Drill four (4) boreholes to a depth of at least 0.5 m into natural soil or prior refusal. Collect soil samples from the filling and natural material in the bores, and upon signs of obvious contamination;
- Screen soil samples with a calibrated Photoionisation detector (PID) to assess the presence of volatile organic compounds;
- Conduct laboratory analysis on selected soil samples in a NATA accredited analytical laboratory for the following range of potential contaminants:
    - Priority heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni & Zn)
    - Polycyclic Aromatic Hydrocarbons (PAH)
- Provide a targeted contamination assessment report which comments on the recorded levels of contamination in the soils below the former Coal Bunker and recommended follow up action; and
- Store remaining soil samples not analysed for a period of one month pending the need for further analysis.

4. Selected Comparative Guidelines

The hospital site has a mixed-use and incorporates some open-space areas. The Phase 1 assessment suggested that the relevant soil assessment criteria are therefore likely to be the Health-based Investigation Levels for parks and recreational open-space (Column 3) as specified in *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme,* (Department of Environment and Conservation NSW, 2006). The provisional Phytotoxicity-based Investigation Levels (Column 5) will not be relevant for the footprint of the former Coal Bunker as it will be covered by a new building.

The quantitative site assessment criteria relevant for this targeted assessment are shown in Table 1.

Table 1: Quantitative Site Assessment Criteria for this Targeted Assessment

Soil Contaminant	Health-Based Investigation Level (mg/kg)
Arsenic	200
Cadmium	40
Chromium (III)/(VI)	240,000/200
Copper	2,000
Lead	600
Mercury	30
Nickel	600
Zinc	14,000
Total PAHs	40
Benzo(a)pyrene	2

5. Data Quality Objectives

The investigation procedures have been devised in general accordance with the seven-step data quality objective (DQO) process outlined in 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*. The DQO process is outlined below.

State the Problem

The former Coal Bunker is to be demolished as part of redevelopment works on the hospital campus. The aim of the targeted assessment was to provide an indication of contaminant levels below the bunker to assist in planning these works.

Identify the Decision

Four boreholes were drilled to collect soil samples from below the bunker. The number of sampling points was based on a practical assessment of the site and is considered sufficient for assessment of the bunker area. Groundwater assessment was not in the scope of the targeted assessment.

The suite of contaminants tested is outlined in Section 3 of this report. This suite of soil contaminants was devised to detect the presence of heavy metals and hydrocarbons which could be present due to the former coal-storage activities on the site.

The comparative guidelines were selected on the basis of the proposed land use and are outlined in Section 4 of this report.

Identify Inputs to the Decision

The primary inputs in assessing the presence of contamination beneath the former Coal Bunker are:

- Field observations;
- Laboratory test results; and
- Published guidelines appropriate for the proposed land use.

Define the Boundary of the Assessment

The boundary of the targeted assessment is defined as zone beneath the former Coal Bunker. This area is shown on Drawing CB2 in Attachment B.

Develop a Decision Rule

The decision rule is based on the Department of Environment and Climate Change (2006) *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme* (Column 3 – Health-based investigation levels for parks, recreational areas etc. (NEHF E)).

Specify Acceptable Limits on Decision Errors

Appropriate field sampling techniques, as outlined in the *Douglas Partners Field Procedures Manual*, were used in the assessment. Quality assurance and quality control measures were incorporated into the laboratory testing regime to ensure the quality of the assessment data. These measures are outlined in the detailed laboratory test results in Attachment D. Additional field QA/QC was not in the scope of the targeted assessment.

Optimise the Design for Obtaining Data

The sampling locations were selected on the basis of size of the bunker and are considered appropriate for the targeted assessment. The procedures for collecting samples were in general accordance with EPA guidelines and industry best-practice. A NATA accredited analytical laboratory was used to analyse soil samples.

A number of data quality indicators (DQIs) were established to verify that the quality of the investigation data is acceptable. Table 2 summarises how the DQIs are assessed.

Table 2: Data Quality Indicators and Evaluation Procedures

Data Quality Indicator	Evaluation Procedure
Documentation completeness	Completion of field and laboratory documentation including chain of custody sheets and borehole logs.
Data completeness	Analysis of appropriate contaminants. Analysis of appropriate soil horizons.
Data comparability	Use of NATA accredited analytical methods. Use of consistent sampling techniques. Use of disposable/decontaminated sampling equipment. Use of suitable field sample storage techniques.
Data representativeness	Sampling from locations selected on the basis of the size of the bunker which is considered suitable for the targeted assessment.
Precision and accuracy for sampling and analysis	Use of NATA accredited analytical methods. Achievement of suitable results in QA/QC criteria.

The DQIs for sampling and analysis were achieved and the quality of the data satisfactorily meets the objectives of the current targeted assessment.

6. Field Work Procedures

The field work for the targeted assessment included the drilling of four boreholes (BH101 to BH104) to depths of 0.2 m to 0.5 m at the locations shown in Drawing CB2 in Attachment B. The boreholes were commenced using a diamond-edged coring barrel to penetrate the concrete slab in the base of the bunker. A hand-auger was then used to collect samples of the underlying materials.

The ground surface levels at the borehole locations were estimated to AHD.

Soil sampling for contamination assessment purposes was performed in general accordance with the standard sampling procedures outlined in the *Douglas Partners Field Procedures Manual*. All sampling data were recorded on chain of custody information sheets. The sampling generally included:

- Soil sampling using disposable and/or decontaminated equipment;
- Placement of samples into laboratory prepared jars and immediate capping;
- Labelling of sample containers with individual and unique markings including project number, sample location, sample depth and date of sampling; and
- Storage of sample containers in a cooled, insulated and sealed container for transport to the laboratory.

7. Results of Assessment

7.1 Field Work Results

The subsurface conditions encountered in the boreholes are presented in the borehole logs in Attachment C. Notes defining descriptive terms and classification methods are included in Attachment A.

The boreholes encountered:

- CONCRETE – 140 mm to 170 mm thick concrete slab in the base of the bunker;
- FILLING – river gravel/boulder filling beneath the slab to depths of 0.2 m to 0.35 m. Borehole BH102 refused in this material;
- NATURAL SOILS – clayey sand below the filling in BH101, BH103 and BH104 to the base of the bores at 0.5 m depth. Natural soil was not encountered in BH102 due to auger refusal in the gravels.

Free groundwater was not observed in any of the previous or current boreholes at the time that the field work was undertaken.

7.2 Total Photoionisable Compounds Results

Replicate soil samples collected from the boreholes were stored under ambient temperatures before screening for Total Photoionisable Compounds (TOPIC) using a calibrated Photoionisation Detector (PID). The results of the screening are shown on the borehole logs in Attachment C. The PID readings were all very low.

7.3 Analytical Results for Soil Samples

Envirolab Services Pty Ltd was commissioned to undertake analysis of the soil samples. The results of the analysis for heavy metals and PAHs are shown in Table 3. The detailed analytical results, sample receipts and chain of custody documentation are included in Attachment D.

Table 3: Results of Analysis for Heavy Metals and PAHs (mg/kg)

Analyte	HIL[1]	BH101/0.2 m[2]	BH103/0.2 m[2]	BH104/0.2 m[2]	BH104/0.5 m[3]
Arsenic	200	<4	<4	<4	<4
Cadmium	40	<0.5	<0.5	<0.5	<0.5
Chromium (VI)	200	8	7	11	10
Copper	2,000	4	6	6	5
Lead	600	5	5	6	4
Mercury	30	<0.1	<0.1	<0.1	<0.1
Nickel	600	5	7	8	5
Zinc	14,000	12	24	15	7
Total PAHs	40	<1.5	<1.5	<1.5	<1.5
Benzo(a)pyrene	2	<0.05	<0.05	<0.05	<0.05

Note: [1] Health-Based Investigation Level; [2] Sample of filling; [3] Sample of natural soil

7.4 Laboratory Quality Control Procedures

The results of the laboratory QA/QC procedures are provided in the report in Attachment D.

8. Discussion of Results

Four (4) soil samples were selectively analysed from four (4) test locations on the site. Three (3) of these samples were obtained from the filling profile and one (1) sample from the natural soils. All samples had concentrations of analysed contaminants below the adopted health-based investigation levels.

On the basis of this targeted assessment, the filling and soils below the former Coal Bunker do not appear to have been impacted by heavy metal or PAH contamination as a result of the storage of coal prior to its use in the Old Boiler House. As such, specific management practices to deal with remediation associated with the storage of coal in the bunker are considered unnecessary at this stage.

Further, the Phase 1 Contamination Assessment included sampling from a borehole to the west of the bunker (borehole BW1). Analytical results of a sample of filling obtained from this borehole were within the adopted assessment criteria. Advice from hospital staff indicated that the coal was delivered to the site by truck and loaded into the bunker from a hardstand area. This methodology suggests that there is a low risk of significant contamination outside the bunker area as a result of coal storage and handling on the site.

Regardless of the level of assessment undertaken on a site, there is always a risk that contaminated materials will be encountered during construction. This is usually addressed by the contractor incorporating an Unexpected Finds Protocol (UFP) into the Construction Environmental Management Plan (CEMP) for the project. The UFP should list the expected finds, and methodologies to deal with unexpected finds such as general contamination, asbestos, underground tanks, biological waste etc.

9. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for a project at Dubbo Base Hospital in accordance with DP's proposal dated 2 May 2012 and acceptance received from Health Infrastructure. The report is provided for the use of Health Infrastructure for this project only and for the purpose(s) described in the report. It should not be used for other projects or by a third party.

The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Subsurface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be limited by undetected variations in ground conditions between sampling locations. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by a statement, interpretation, outcome or conclusion given in this report.

Yours faithfully,
Douglas Partners Pty Ltd

Reviewed by

Peter Oitmaa
Senior Associate

Michael J Thom
Principal

Attachments:
A: Notes About this Report
B: Drawings
C: Field Work Results
D: Laboratory Test Results

Attachment A

Notes About this Report

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

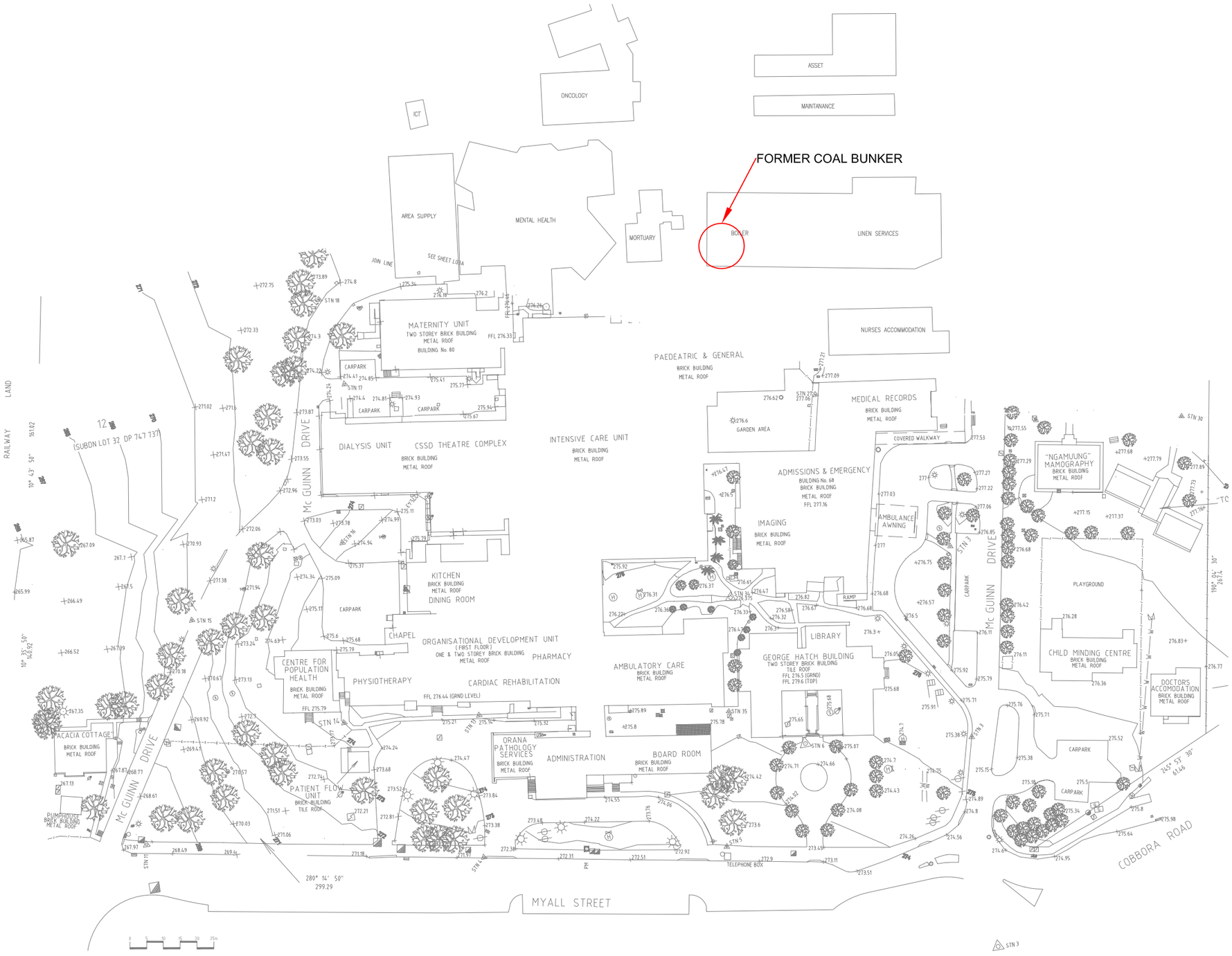
Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

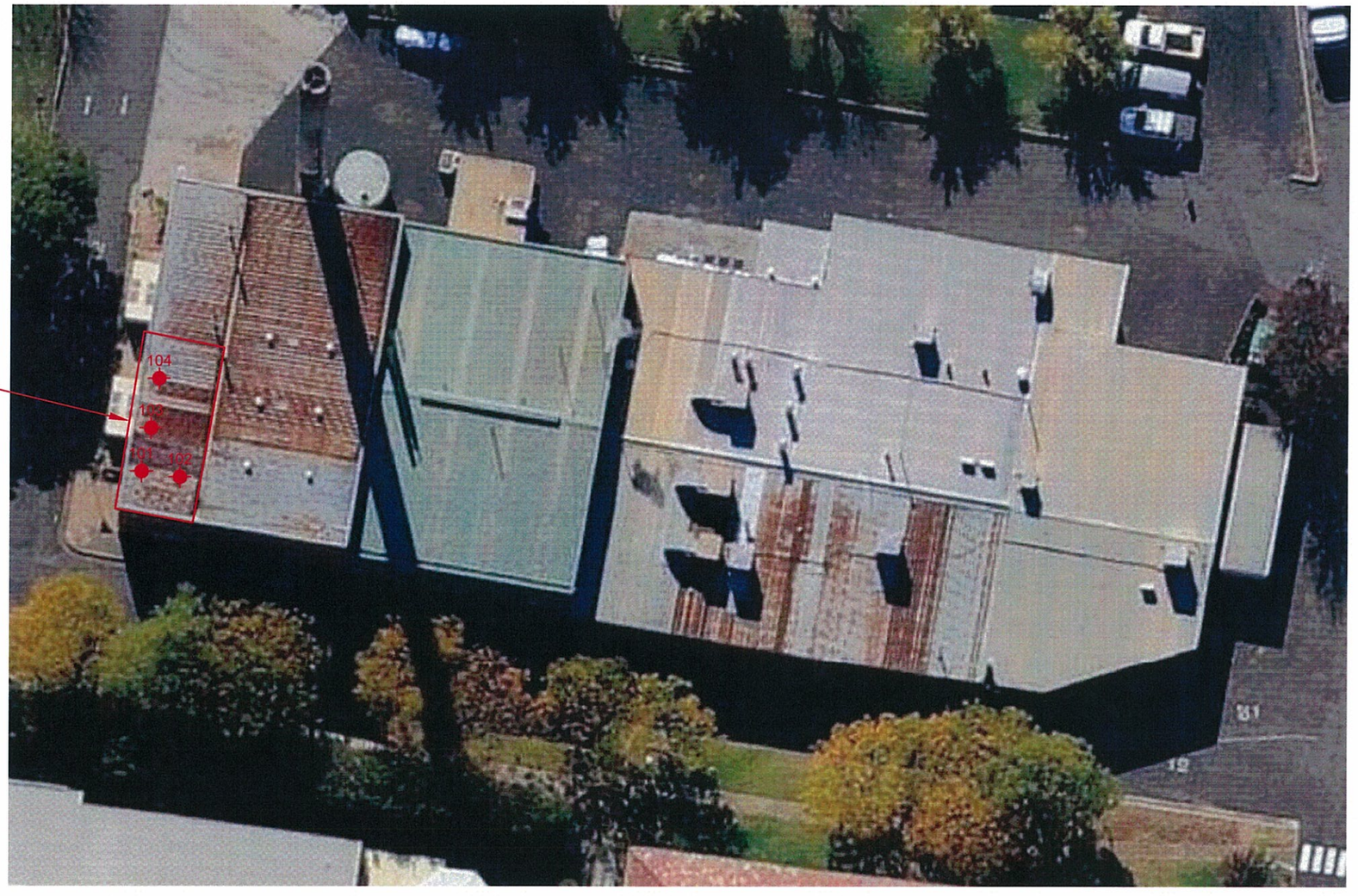
Attachment B

Drawings

Locality Plan



Douglas Partners *Geotechnics / Environment / Groundwater*	CLIENT: Health Infrastructure	TITLE: **Site Layout** **Dubbo Base Hospital Redevelopment** **Myall Street, DUBBO**	PROJECT No: 72811.01
	OFFICE: Sydney DRAWN BY: PSCH		DRAWING No: CB1
	SCALE: 1:1250@A3 DATE: 20.6.2012		REVISION: 0



Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Health Infrastructure	TITLE: **Approximate Borehole Locations** **Dubbo Base Hospital Redevelopment** **Myall Street, DUBBO**	PROJECT No: 72811.01
	OFFICE: Sydney DRAWN BY: PSCH		DRAWING No: CB2
	SCALE: N.T.S. DATE: 20.6.2012		REVISION: 0

Attachment C

Field Work Results

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Former Coal Bunker Assessment
LOCATION: Myall Street, Dubbo

SURFACE LEVEL: 274.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 101
PROJECT No: 72811.01
DATE: 22/5/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
274		CONCRETE							
	0.17	FILLING - river gravel filling		E	0.2		PID=1		
	0.25	CLAYEY SAND - light yellow and brown, fine grained clayey sand							
	0.5	Bore discontinued at 0.5m - practical refusal		E	0.5		PID=1		
	1								1
273									

RIG: Hand auger **DRILLER:** CF **LOGGED:** CF **CASING:** Uncased
TYPE OF BORING: Diatube to 0.17m; Hand auger to 0.5m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Former Coal Bunker Assessment
LOCATION: Myall Street, Dubbo

SURFACE LEVEL: 274.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 102
PROJECT No: 72811.01
DATE: 22/5/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		CONCRETE							
	0.14	FILLING - river gravel/boulder filling							
	0.2	Bore discontinued at 0.2m - refusal on boulder							
274									
	1								1
273									

RIG: Hand auger **DRILLER:** CF **LOGGED:** CF **CASING:** Uncased
TYPE OF BORING: Diatube to 0.14m; Hand auger to 0.2m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Former Coal Bunker Assessment
LOCATION: Myall Street, Dubbo

SURFACE LEVEL: 274.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 72811.01
DATE: 22/5/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
274	0.15	CONCRETE							
		FILLING - river gravel filling		E	0.2		PID=1		
	0.3	CLAYEY SAND - light yellow brown, fine grained clayey sand							
	0.5	Bore discontinued at 0.5m - practical refusal		E	0.5		PID=1		
	1								1
273									

RIG: Hand auger **DRILLER:** CF **LOGGED:** CF **CASING:** Uncased
TYPE OF BORING: Diatube to 0.15m; Hand auger to 0.5m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Former Coal Bunker Assessment
LOCATION: Myall Street, Dubbo

SURFACE LEVEL: 274.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 104
PROJECT No: 72811.01
DATE: 22/5/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
274		CONCRETE							
	0.17	FILLING - river gravel filling		E*	0.2		PID=1		
	0.35	CLAYEY SAND - light yellow-brown, fine grained clayey sand							
	0.5	Bore discontinued at 0.5m - practical refusal		E	0.5		PID=1		
	1								1
273									

RIG: Hand auger **DRILLER:** CF **LOGGED:** CF **CASING:** Uncased
TYPE OF BORING: Diatube to 0.17m; Hand auger to 0.5m
WATER OBSERVATIONS: No free groundwater observed
REMARKS: *Field replicate sample BD1/220512 collected

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

Attachment D

Laboratory Test Results

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 73806

Client:
Douglas Partners
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Peter Oitmaa

Sample log in details:

Your Reference:	**72811, Dubbo**		
No. of samples:	4 soils, 3 paints		
Date samples received / completed instructions received	23/05/12	/	23/05/12

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:	30/05/12	/	28/05/12
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:

Rhian Morgan
Reporting Supervisor

Hinoko Miyazaki
Chemist

Alex MacLean
Chemist

ACCREDITED FOR TECHNICAL COMPETENCE

Lead in Paint				
Our Reference:	UNITS	73806-1	73806-2	73806-3
Your Reference	----------	P1	P2	P3
Depth	----------	-	-	-
Date Sampled		21/05/2012	21/05/2012	21/05/2012
Type of sample		Paint	Paint	Paint
Lead in paint	%w/w	<0.05	<0.05	2.3

PAHs in Soil					
Our Reference:	UNITS	73806-4	73806-5	73806-6	73806-7
Your Reference	----------	BH101	BH103	BH104	BH104
Depth	----------	0.2	0.2	0.2	0.5
Date Sampled		22/05/2012	22/05/2013	22/05/2014	22/05/2015
Type of sample		soil	soil	soil	soil
Date extracted	-	24/05/2012	24/05/2012	24/05/2012	24/05/2012
Date analysed	-	26/05/2012	26/05/2012	26/05/2012	26/05/2012
Naphthalene	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+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)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(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate p-Terphenyl-d_{14}	%	70	101	99	101

Acid Extractable metals in soil					
Our Reference:	UNITS	73806-4	73806-5	73806-6	73806-7
Your Reference	----------	BH101	BH103	BH104	BH104
Depth	----------	0.2	0.2	0.2	0.5
Date Sampled		22/05/2012	22/05/2013	22/05/2014	22/05/2015
Type of sample		soil	soil	soil	soil
Date digested	-	24/05/2012	24/05/2012	24/05/2012	24/05/2012
Date analysed	-	24/05/2012	24/05/2012	24/05/2012	24/05/2012
Arsenic	mg/kg	<4	<4	<4	<4
Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5
Chromium	mg/kg	8	7	11	10
Copper	mg/kg	4	6	6	5
Lead	mg/kg	5	5	6	4
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	5	7	8	5
Zinc	mg/kg	12	24	15	7

Moisture					
Our Reference:	UNITS	73806-4	73806-5	73806-6	73806-7
Your Reference	----------	BH101	BH103	BH104	BH104
Depth	----------	0.2	0.2	0.2	0.5
Date Sampled		22/05/2012	22/05/2013	22/05/2014	22/05/2015
Type of sample		soil	soil	soil	soil
Date prepared	-	24/05/2012	24/05/2012	24/05/2012	24/05/2012
Date analysed	-	25/05/2012	25/05/2012	25/05/2012	25/05/2012
Moisture	%	4.1	4.8	4.2	13

Method ID	Methodology Summary
Metals-004	Digestion of Paint chips/scrapings/liquids for Metals determination by ICP-AES/MS and or CV/AAS.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
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 deg C for a minimum of 4 hours.

QUALITY CONTROL Lead in Paint	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Lead in paint	%w/w	0.05	Metals-004	<0.05	[NT]	[NT]	LCS-1	99%
QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			24/05/2012	[NT]	[NT]	LCS-1	24/05/2012
Date analysed	-			26/05/2012	[NT]	[NT]	LCS-1	26/05/2012
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	104%
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-1	105%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	102%
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-1	106%
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	107%
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-1	103%
Benzo(b+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-1	110%
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-d_{14}	%		Org-012 subset	103	[NT]	[NT]	LCS-1	98%

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	-			24/05/2012	[NT]	[NT]	LCS-1	24/05/2012
Date analysed	-			24/05/2012	[NT]	[NT]	LCS-1	24/05/2012
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	[NT]	[NT]	LCS-1	99%
Cadmium	mg/kg	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-1	94%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	98%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	98%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	98%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	LCS-1	99%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	98%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	96%

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank
Date prepared	-			[NT]
Date analysed	-			[NT]
Moisture	%	0.1	Inorg-008	[NT]

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	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 batched of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

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:

Douglas Partners
96 Hermitage Rd
West Ryde NSW 2114

ph: 02 9809 0666
Fax: 02 9809 4095

Attention: Peter Oitmaa

Sample log in details:

Your reference:	**72811, Dubbo**
Envirolab Reference:	**73806**
Date received:	23/05/12
Date results expected to be reported:	**30/05/12**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	4 soils, 3 paints
Turnaround time requested:	Standard
Temperature on receipt	Cool
Cooling Method:	Ice
Sampling Date Provided:	YES

Comments:

Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples.

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

Douglas Partners
Geotechnics · Environment · Groundwater

CHAIN OF CUSTODY

Project Name: DUBBO .....
Project No: 72811..... Sampler: ...CF .....
Project Mgr: PMO...Mob. Phone: 0409 242 497.....
Email: Peter.oitmaa@douglaspartners.com.au .....
Date Required: Standard..... Lab Quote No. .....

To:Envirolab Services
12 Ashley Street, Chatswood NSW 2068
Attn: Tania Notaras
Phone: 02 9910 6200 Fax: 02 9910 6201
Email: tnotaras@envirolabservices.com.au

Sample ID	Sample Depth	Lab ID	Sampling Date	Sample Type S - soil W – water	Container type	Analytes: Heavy Metals	lead	PAH								Notes
P1		1	21/5	–	P		X									} Paint samples.
P2		2		–	P		X									
P3		3	↓	–	P		X									
BH 101	0.2	4	22/5	S	G	X		X								
BH 103	0.2	5		S	G	X		X								
BH 104	0.2	6		S	G	X		X								
BH 104	0.5	7	↓	S	G	X		X								

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 73806
Date Received: 23.05.12
Time Received: 10.00
Received by: Jia Liu
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Lab Report No. .....
Send Results to: Douglas Partners Address: 96 Hermitage Road, West Ryde 2114
Phone: (02) 9809 0666
Fax: (02) 9809 4095

Relinquished by:	Signed:	Date & Time:	Received By:	Date & Time:
C Falla		23.5.12 1pm		
Relinquished by:	Signed:	Date & Time:	Received By:	Date & Time: