Remedial Action Plan

Honeysuckle Development Corporation

Lee 4
Part Lot 230 DP 1094812
Honeysuckle Dr
Newcastle NSW 2300

October 2007
JBS 40184-11574 (Rev 0)
JBS Environmental Pty Ltd

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List of Abbreviations

A list of the common abbreviations used throughout this report is provided below.

AHD	Australian Height Datum
As	Arsenic
bgs	below ground surface
Cd	Cadmium
CSM	Conceptual site model
Cr	Chromium
Cu	Copper
BTEX	Benzene, toluene, ethylbenzene and xylenes
B(a)P	Benzo(a)pyrene
DECC	NSW Department of Environment and Climate Change
DQOs	Data Quality Objectives
EMP	Environmental Management Plan
EPA	NSW Environment Protection Authority (now the DECC)
GILs	Groundwater investigation levels
Ha	Hectare
HDC	Honeysuckle Development Corporation
Hg	Mercury
HIL	Health based investigation level
JBS	JBS Environmental
LOR	Limit of Reporting
Mn	Manganese
Ni	Nickel
PAHs	Polycyclic aromatic hydrocarbons
Pb	Lead
PBIL	Phytotoxicity based investigation level
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RAP	Remedial Action Plan
RPD	Relative Percentage Difference
SAQP	Sampling, Analysis and Quality Plan
SPLP	Synthetic Precipitation Leaching Procedure
TCLP	Toxic Characteristic Leaching Potential
TPH	Total Petroleum Hydrocarbons
WQOs	Water Quality Objectives
Zn	Zinc

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1 Introduction

1.1 Introduction

JBS Environmental Pty Ltd (JBS) was engaged by Honeysuckle Development Corporation (HDC) to undertake supplementary contamination investigations and preparation of a remediation strategy at the Lee 4 site, located on Honeysuckle Drive, Newcastle, NSW. The site is identified as Part Lot 230 DP 1094812.

The site is proposed to be redeveloped for mixed residential/ commercial use. Contamination was identified in soil and groundwater during previous environmental assessment and more recently JBS Environmental (May 2007) 'Supplementary Contamination Assessment Honeysuckle Development Corporation Lee 4 Honeysuckle Drive Newcastle NSW' (JBS 2007). A Remedial Action Plan (RAP) is required to be prepared to document the procedures that will be undertaken to remediate the site to a condition suitable for the proposed use.

This RAP has been prepared in general accordance with relevant guidelines (**Section 7**) made or endorsed by the NSW Department of Environment and Climate Change (DECC).

1.2 Objectives

The purpose of the RAP is to document the procedures and standards to be followed in order to remove the risks posed by any environmental impact which may be present underlying the 'Lee 4' site and to make the site suitable for the proposed redevelopment, while ensuring the protection of human health and the surrounding environment.

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2 Site Condition & Surrounding Environment

2.1 Site Identification

The Lee 4 site is described as Part Lot 230 DP 1094812 and is located along Honeysuckle Drive, Newcastle, NSW. The site is part of a 50Ha redevelopment strategy of derelict land and buildings along Newcastle Harbour adjacent to the central business district.[1]

The site details are summarised in **Table 2.1** and discussed in the following sections:

Table 2.1 Summary Site details

Street address:	Lee 4, Honeysuckle Drive, Newcastle, NSW
Property description:	Part Lot 230 DP 1094812
Property size:	Approximately 7,650 m²
Zoning	3(c) City Centre
Local Government Area	Newcastle
Parish	Newcastle
County	Northumberland
Site locality	**Figure 1**
Site boundary	**Figure 2**

2.2 Site Condition

The following details are summarised from the previous investigation conducted by Parsons Brinckerhoff (PB, 2002[2]).

The Lee 4 site is located along the northern side of Honeysuckle Drive, to the east of Lee 5 and to the west of Park Residential. The site is bound to the north by Newcastle Harbour. The site has an approximate area of 7,650m². The southern portion of the site is partially covered in bitumen/concrete with a small grassed area. The wharf/concrete dock area adjacent to Newcastle Harbour was formerly used as a tugboat docking facility. A floodway exists along the western boundary of the site. Remnants of the former Wharf Road and former tram line pass through the site. A light tower is located at the centre of the site and a shed is located on the north-eastern side of the site.

Remnants of a former shed are located in the north-eastern portion of the site. Evidence of a former sump/septic system is present within this vicinity. Stockpiled soils are located on the surface in south-eastern portion of the site, and the western portion of the site linking with the neighbouring Lee 5 site.

2.3 Surrounding Landuse

The surrounding land uses have been identified as follows:

- North – Newcastle Harbour;
- West – Lee 5, currently vacant;
- East – Vacant land; and
- South – Commercial buildings are located to the south across Honeysuckle Drive.

[1] Honeysuckle Development Corporation (http://www.honeysuckle.net/pages/hdc/index.php)

[2] Full reference provided in **Section 4**

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2.4 Topography

The general area slopes to the north towards Newcastle Harbour. The Lee 4 site has been extensively filled and the finished surface is relatively flat. Previous investigations (PB, 2002) indicate that ground elevations across the site are less than 10m Australian Height Datum (AHD). Recent JBS investigations are in agreement with the findings of PB. Alluvial soils at the site have the potential to contain acid sulphate soils.

2.5 Geology

The Newcastle 1:100,000 Geological Series Sheet (9231) shows that the geology in the area of the site is predominantly comprised of quaternary alluvial deposits of the Cainozoic era comprising gravel, fine sandy clay and silt. The alluvium is further underlain by Permian aged bedrock of the Newcastle Coal Measures including sandstone, siltstone, claystone, coal and tuff.

Previous investigations (PB, 2002) indicate fill material is present across the site and varies in depth between 0.1m – 4.0m below ground surface (bgs). JBS (2007) investigations have confirmed the widespread occurrence of fill materials across the site.

The NSW Natural Resource Atlas[3] designates the area around and including the Lee 4 site as having a high risk of acid sulphate soils between 1m and 3m of the surface.

2.6 Hydrology

The nearest surface water receptor for the site is Newcastle Harbour located immediately north of the site. Surface water from the site is likely to either exit directly north towards Newcastle Harbour, or northwest to the floodway before being directed into the harbour.

Newcastle has an annual average rainfall of approximately 1200mm[4], with the majority of the rainfall occurring during the summer and autumn months (January – May). The area has annual evapotranspiration of approximately 800mm[5].

Given the general bitumen surface, infiltration at the site is expected to be limited. Recharge of the shallow sand water bearing layer beneath the site is expected to be from rainfall infiltration in hydraulically upgradient areas, as well as some tidal influences.

2.7 Hydrogeology

A groundwater bore search conducted in a previous investigation (PB, 2002) and indicates that there are 9 registered bores within 1km of the Lee 4 site. These bores are located either hydraulically up or cross gradient to the west, southwest, south and southeast of the site. The registered bores are used for either domestic, recreation, irrigation or industrial purposes. All nine registered bores are shallow (less than 10.1m depth). Limited data indicates that all bores are likely to be screened within the shallow sand water bearing layer.

Given the proximity of the site to Newcastle Harbour, groundwater may be potentially saline and subject to tidal influence.

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[3] NSW Natural Resource Atlas. (www.nratlas.nsw.gov.au)

[4] Bureau of Meteorology (www.bom.gov.au/cgi-bin/climate/rainmaps.cg)

[5] Bureau of Meteorology (www.bom.gov.au/cgi-bin/climate/cgi_bin_scripts/evapotrans/et_map_script.cgi)

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3 Site History

3.1 Information Sources

The site history is summarised from the previous investigation (PB, 2002). The previous investigation indicates that given the readily available historical information existing for the Honeysuckle foreshore, including its past use as rail and ship loading facilities, further historical review is unlikely to add further value or alter the planned intrusive investigation.

The limited site history available in previous reports is summarised in **Table 3.1** below.

Table 3.1 - Summary Site History

Dates	Details
Between 1915 and 1950	Site reclamation / filling by dredging
Mid 1950s to present	Site was raised for use as a wharf facility. Wharf Road and railway lines are present in the southern portion of the site.
Mid 1970s	Wharf Road was realigned further south of the site. Railway lines were removed from the site.
2002	Site partially used as a tugboat docking facility.

Significant amounts of site reclamation and filling have been conducted on the Lee 4 site (IEA, 1983)[6]. Dredging of the harbour in the vicinity of the Lee 4 site continued from 1915 to 1950, increasing the harbour depth by approximately 1.2m. The materials dredged included silt, clay, broken and weathered rock.

3.2 Integrity Assessment

There are a number of gaps in the site history provided, including specific site uses prior to the mid 1950s. However, the historical data for the multiple sources is in general agreement and the main potentially contaminating activities appear to have been broadly identified for the purposes of this investigation.

[6] *Shaping the Hunter.* Institution of Engineers, Australia. 1983. (IEA, 1983)

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4 Previous Investigations

Previous investigations summarised from the PB (2002) assessment are presented below.

4.1 Monteath and Powys (Date unknown)[7]

The investigation was conducted to determine the ownership of various parcels of land which comprise the greater Honeysuckle Project site. Specific details regarding the Lee 4 site could not be determined. Major proprietors of the land were Urban Transport Authority, State Railway Authority, Maritime Service Board and Newcastle City Council. The site uses were identified as mainly parking spaces, parkland, railway and port facilities, but also included use by Shortland Electricity for a substation and the Electrolytic Zinc Company.

4.2 Robert Carr and Associates (1995)[8]

Robert Carr and Associates (RCA) were commissioned to determine the total and leachable concentrations of heavy metals and PAHs reported in 400m^3 of soil which had been stockpiled along the boundary of the Trackfast site (which encompassed areas of Lee 4, Lee 5, Lee 5 South, Park Residential, Worth Place and South Park).

Two stockpiles consisted of fine grained silty sand mixed with building rubble thought to have been sourced from excavations in the adjacent Civic precinct. The third stockpile consisted of imported clean fine medium grained sand and was to be used to backfill service trenches.

Previous investigations on the material had reported elevated metals and PAHs present. Analytical results from the RCA 1995 investigation indicated that soils from the two stockpiles with building rubble contained concentrations of analytes generally less than the commercial/industrial guidelines.

4.3 Golder Associates (1995a)[9]

Golder Associates were commissioned to conduct a site remediation investigation for the Trackfast site. The study followed a hazardous waste investigation conducted at the site by Golder in 1993. The aim was to sample previously untested areas of the site.

The previous investigation (Golder 1993) indicated that the site was generally free of major contamination, with only TPH and PAH soil impact at a few locations. Heavy metal contamination was restricted to the upper levels of the fill amterial and was not considered to be highly leachable.

Test pits were excavated in 29 locations to a maximum depth of 2.6m bgs. Fill material was identified to depths of 0.9m bgs. Lead concentrations were detected above residential guidelines (accessible soil) for 2 samples analysed. Benzo(a)pyrene was noted above the

[7] *Honeysuckle Project Land Title Investigation.* Monteath and Powys. Date unknown. (Monteath and Powys, unknown)

[8] *Contamination Assessment Stockpiles Spoil Trackfast Precinct.* Robert Carr and Associates. 1 August 1995 (RCA, 1995)

[9] *Site Remediation Investigation Volume 1 – Trackfast Site – Additional Site Sampling and Analysis. Honeysuckle Redevelopment Newcastle.* Golder and Associates. 1995. (Golder, 1995a)

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NEPM A residential guidelines for 5 samples analysed, and total PAHs above the guidelines for 7 samples analysed.

4.4 Golder Associates (1995b)[10]

Golder Associates were commissioned to conduct additional site investigation at the Trackfast Lee Wharves site and of stockpiles at the Civic Precinct. Trackfast Lee Wharves site contained the current Lee 4 site.

Part of the Lee Wharves storage shed was being demolished at the time of sampling. Exposed soils consisted of medium to course grained sands.

Concentrations of copper, benzo(a)pyrene and total PAHs were reported above the NEPM A residential guidelines in a number of samples.

4.5 Bilbie Dan Hickie Solicitors (1997)[11]

The report details the findings of a land title seach for Lot 1 DP 831753. The investigation contains information on the Throsby site as well as Lee 4 and Lee 5, along with a number of other sites included in the Honeysuckle development. There is no indication which information specifically relates to the Throsby site.

The investigation details a number of deeds between the Maritime Service Board and Newcastle Dumping Company, Challenge Transport and Elder Smit. A number of lease agreements were referenced between the Maritime Service Board and Hunter Oil Laboratories and the Newcastle District Fisherman's Co-op.

The area under investigation was divided into three types of land uses; Central Business (3a), Special Uses – port related (5a) and arterial and local road reserve (5e). Some portions of the land were unzoned, and some land was included in the Newcastle CBD Heritage Conservation Area.

4.6 Honeysuckle Development Corporation (1997)[12]

A land title search was conducted for Lot 3 DP 839050, which includes part of Lee 5, Lee 5 South, Lee 4, Park Residential, South Park and Wright Lane. The report detailed the notification of the proposed easement (DP265403), the zoning of the site for Central Business (3a) and the land is ssown to be within the Newcastle CBD Conservation Area.

[10] *Site Remediation Investigation Volume 1 – Civic Precinct Spoil Pile and Trackfast Lee Wharves – Additional Site Sampling and Analysis. Honeysuckle Redevelopment Newcastle.* Golder and Associates. 1995. (Golder, 1995b)

[11] *Honeysuckle Development Corporation Property Report, Lot 1, DP 851753.* Bilbie Dan Hickie Solicitors. 1997. (BDH, 1997)

[12] *Honeysuckle Development Corporation Property Report, Lot 3, DP 8390503.* Unknown author. 1997. (Unknown, 1997)

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4.7 Dames and Moore (1999)[13]

Dames and Moore were commissioned to undertake an investigation to delineate previously identified hydrocarbon impact within the boundary of Lot 4, DP883474. It should be noted that this property is not located in the current study area for the Honeysuckle investigation. The report presented a previous site history layout of the Honeysuckle area indicating the presence of the former Wharf Rd and railway lines through the Lee 4 site.

4.8 Parsons Brinckerhoff (2002)[14]

Fill was encountered across the majority of the site to a maximum depth of 4m bgs. Fill generally consisted of grey to dark brown sandy gravel and gravel. Underlying the fill was light brown alluvial sand.

Concentrations of TPH C_{10}-C_{36} were noted above the threshold criterion. Concentrations of manganese, benzo(a)pyrene, and total PAHs were also noted in exceedance of the investigation criteria. Cadmium and zinc concentrations were also detected above the phytotoxicity-based guidelines.

Two monitoring wells were installed during the investigation. The groundwater flow direction inferred from gauging data was noted to be in a northerly direction towards Newcastle Harbour. Concentrations of dissolved phase copper, lead, zinc and total PAHs were detected above the nominated criteria.

The QA/QC for the previous investigation (PB, 2002) was noted by PB to demonstrate an adequate level of precision and accuracy, and can be considered representative of the site conditions within Throsby.

4.9 JBS Environmental (2007)

JBS completed supplementary contamination investigations in May 2007. This included the placement of an additional 17 locations to further characterise fill materials, sampling of underlying natural soils to determine the potential for leaching of impact, installation of an additional two groundwater monitoring wells and sampling of groundwater from existing and new monitoring wells.

Some areas of soils have been found to be subject to levels of manganese, PAHs (including benzo(a)pyrene) and TPH C_{10}-C_{36} exceeding the adopted assessment criteria. Groundwater has been found to be subject to levels of manganese and PAH constituents exceeding the adopted assessment criteria.

4.10 Site Characterisation

All available environmental data is provided in **Appendix A**. **Figure 3** shows all known sampling locations. This includes PB (2002) and JBS (2007) sampling data and locations only. Borelogs for the PB and JBS investigations are provided as **Appendix B**. Based on this data, the following conclusions are made about the site status.

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[13] *Remediation Investigation Lot 4 DP 883474, Newcastle.* Dames and Moore Group. 1999. (DMG, 1999)

[14] *Environmental Site Assessment, Lee 4 (Part Lot 1111 DP 1027135), Honeysuckle, NSW.* Parsons Brinckerhoff. August 2002. (PB, 2002).

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4.10.1 Site Geology

- From observation of both JBS and PB Borelogs and correlation to the site history, fill on the site can be described as following:
    - Fill consisting of slag and crushed basalt (also described as ballast and blue metal) with some sand described as being grey / black in colour present from the surface to a variable depth of 0.3 to 1.1m. The greatest depth of the material appears to pass through the central portion of the site. It is considered most likely that this material was imported off-site and placed to stabilise the site surface / raise the site surface for use as a wharf facility, as described in the Site History. It is noted that this material has been reworked with the underlying fill at PB sample location BH10. This is noted to be adjoining JBS sample location SB6. The borelog at SB6 indicates that the reworking extends to a depth of approximately 1.5m. No other evidence of the reworking of the material is apparent in the Borelogs. The absence of reworking of material at SB4 in close proximity indicates that this area is localised. It is considered that a definite and distinguishable interface exists between the surface placement of this material and the underlying fill described following. Based on the average of the encountered depths of the slag/basalt fill material, it is estimated that a total quantity of 4500m^3 of this material is present across the site;
    - Fill consisting of gravels and sand described as a brown to yellow colour underlying the basalt / slag based fill. This material is most likely sourced from historical dredging of the adjoining Newcastle Harbour. This is confirmed by the description in PB borelogs of this material as alluvial material, and the numerous observations across the JBS and PB borelogs of the presence of shell fragments. It is noted that JBS have made several observations of slag in this material. This does not correlate with PB observations. There is a likelihood that slag identified and reported by JBS consisted of fine black shell grit. Noting that this material was used to reclaim the site, it is observed to extend to significant depths at some locations. Based on the assumption that the underlying natural clay is present at a typical depth of 3m it is estimated that a total quantity of approximately 20,000m^3 is present on the site; and
    - Natural material occurs generally below the depth of the water table and the adjoining Newcastle Harbour. This has been found to consist of a dark clay with coal seams present.

4.10.2 Environmental Status of Soil Types

Substantial sampling and analysis has been undertaken of the slag/basalt fill and the fill sourced from dredged material. Heavy metals, PAHs, TPH/BTEX and leachability results tables in **Appendix A** show the division of the analysed samples into these groupings. A single sample has been analysed of the underlying natural clay. Statistical analysis has been undertaken for each of these material types. Statistical analysis has been undertaken using the ProUCL package, with the recommended ProUCL results reported. The results of statistical analysis are summarised in **Table 4.1** following.

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It is noted in undertaking statistical analysis that the PB sample L4/TP5/4M analysed for PAHs has been mislabelled and should be present at a depth of 0.4m. Noting the observation of reworking of material, the deeper sample at sample location SB6 has been classified as 'slag/basalt fill'. The 'slag/basalt fill' has been mixed with the fill sourced from the dredged material here.

No statistical analysis has been undertaken for TPH. TPH impact has been found to generally correlate with PAH impact. Samples where duplicate results are available have been corrected to ensure that the maximum reported concentration for each analyte across the duplicate pairs is included in the statistical analysis. Samples with non-detections have been entered at half detection limits.

Table 4.1: Characterisation of Levels of Environmental Impact in Soil Types (mg/kg)

Constituent	Slag / Basalt Fill			Dredged Material			Clay
	Maximum	95%UCL$_{avg}$	Mean	Maximum	95%UCL$_{avg}$	Mean	Maximum
Arsenic	16	7.4	5.8	6	3.1	2.8	4
Cadmium	13	8.3	1.8	1	0.54	0.52	<1
Chromium	256	112	67.6	27	15.6	4.0	48
Copper	55	29.3	23.0	230	82.7	11.0	12
Lead	450	147	53.9	105	59.5	12.1	15
Manganese	23,000	14,575	8,645	1400	911	220	1400
Nickel	31	11.2	8.3	16	10.0	2.8	7.2
Zinc	1500	1204	291	368	187	43.4	37
PAHs	7,377	3,153	1415	82	25.5	11.8	8.7
Naphthalene	730	164	82.0	1.8	1.3	0.3	<0.1
B(a)P	414	163	77.8	3.6	2.2	0.8	0.83

Based on the statistical analysis provided in **Table 4.1**, the slag/basalt fill is able to be environmentally differentiated by levels of manganese and PAHs. The slag/basalt fill is observed to have slightly elevated (comparative) levels of chromium and zinc. Levels of manganese and PAHs (including benzo(a)pyrene) in the slag / basalt fill was found in JBS (2007) to exceed the adopted site assessment criteria.

4.10.3 Leachability of Soil Types

Leachability testing has also been undertaken in JBS (2007). Two samples of the slag/basalt fill, four samples of the dredged material based fill and one sample of the natural clay have been assessed for potential leachability under distilled water conditions for the principal constituents of concern. It has been found that the fill materials and natural clays are generally non-leachable under distilled water conditions. One sample of slag/basalt fill has recorded low levels of potentially leachable PAHs and low levels of potentially leachable manganese.

A greater indication of the potential leachability can be undertaken by comparison of TCLP results. These are undertaken using a more aggressive acetic acid leach. It is noted, by comparison to total concentrations for the specific samples, that no particular fill type is

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more leachable than the other. The 'slag/basalt fill' has recorded substantially higher leachate levels consequent of the higher total levels present.

The dredged material samples selected for leachability analysis are noted to have relatively low total concentrations of manganese and PAHs. This does not allow a definitive assessment of the potential contribution of the dredged material as source material.

The natural clay material has been found to have significant potentially leachable levels of manganese by the TCLP results. This indicates that the underlying clays may be a natural source of manganese in groundwater.

4.10.4 Groundwater

Limited groundwater sampling and analysis has been undertaken by JBS (2007) and PB (2002). Elevated levels of manganese, as much as an order of magnitude above the adopted assessment criteria, have been detected in groundwater. The highest levels of manganese have been recorded hydrogeologically downgradient of reworked 'slag/basalt fill' and 'dredged material' based fill. The groundwater data indicates that at least over the western portion of the site levels of manganese in groundwater are increasing.

Detectable levels of PAHs have been recorded in groundwater in the majority of groundwater monitoring wells. No apparent trend for the distribution of PAHs was identified.

The principal constituents of impact in groundwater and observed to correlate with the principal constituents in the 'slag / basalt fill' materials. This indicates that the 'slag / basalt fill' material may be acting as a source of groundwater contamination. This is partially confirmed by distilled water leachability results.

4.10.5 Estimation of Relative Contribution of Source Materials

The 'slag/basalt fill' material is found to most likely be acting as source material for groundwater impact. Noting that both fill types have been found to have relatively the same potential of leachability for the principal constituents, a comparison of the relative total mass of source material of manganese and PAHs has been undertaken. This has been estimated by the volume of the fill, multiplied by an approximate density factor of 1.5 (tonnes/m^3) multiplied by the mean concentration of the particular constituent. This is summarised in **Table 4.2** following.

Table 4.2: Comparison of Relative Source Contributions

Constituent	Slag / Basalt Fill		Dredged Material Fill	
	Total	Relative %	Total	Relative %
Manganese	58.4 tonnes	90%	6.6 tonnes	10%
PAHs	9.6 tonnes	97%	0.3 tonnes	3%

The 'slag/basalt fill' can be observed to be the most significant potential source of manganese and PAHs on the site. It is noted that the estimation of 10% of the total manganese being present within the 'dredged material fill' is also significant. However, as demonstrated by the analysis of the underlying natural clays, manganese is a naturally occurring element. Naturally occurring levels of manganese would be anticipated to amount to a significant quantity, as indicated for the 'dredged material fill'.

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5 Remedial Action Plan

5.1 Remediation Goal

The goal of the remediation works is to reduce the exposure of all potential human and ecological populations to the environmental impact associated with the filling historically placed on the Lee 4 site to an acceptable level.

5.2 Extent of Remediation Required

Remediation is required to ensure that potential exposure of future human users of the site do not exceed acceptable levels. Remediation works also require to be sufficient to protect potential ecological receptors who may be exposed by impact on the site. Potential ecological receptors include flora and fauna species on the site, and receptors present within Newcastle Harbour who may be exposed by groundwater discharge from the site.

It is considered, based on the environmental characterisation of the site that this will be achieved by the control of the 'slag/basalt fill'.

In addition, the stockpiled material currently in the southeastern and western portions of the site require removal from the site.

5.3 Remediation Options

The *Guidelines for the NSW Auditor Scheme* (DEC, 2006) lists the following order of preference for remedial actions:

1. On site treatment;
2. Off site treatment;
3. Off site disposal to licensed disposal facility; and
4. Consolidation and isolation on site by engineered barrier containment.

By review of the site and the proposed development a number of specific remediation options have been developed by JBS. These include:

- Excavation and on-site treatment of impact associated with 'slag/basalt fill' material;
- Immobilisation of environmental impact associated with 'slag/basalt fill' material;
- Off-site disposal of 'slag/basalt fill'; and
- Containment of 'slag/basalt fill' within an engineered containment system.

Each of the options is considered further with regard to the DEC (2006) order of preference for remedial actions.

5.3.1 Treatment

The option of on-site treatment is the most preferred option of the NSW DEC for remediation of contaminated sites. PAH impact in soils may be remediated on-site by the use of a thermal desorber, or similar high temperature process, to completely combust and destroy all PAH constituents. Manganese impact in soils may be remediated by an acid extraction process.

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Neither of the remediation technologies is currently commercially available in Australia. Based on this, the remediation approach has not been considered any further.

It is noted that off-site treatment is the DEC's 2nd most preferred option. As with on-site treatment, there are no off-site commercial facilities readily available to treat both PAH and manganese impact in soils.

5.3.2 Immobilisation

The option of immobilisation of the manganese and PAH impact in the slag/basalt fill materials corresponds to option 4 in the preferred DEC (2006) hierarchy. This the least preferred option of the DEC. This option has not been considered any further.

5.3.3 Off-Site Disposal

The option of off-site disposal of the 'slag/basalt fill' material corresponds to the DEC's 3rd most preferred option. Historical advice of Newcastle City Council instructs that impacted slag material must be disposed of to the 'Summerhill Waste Facility'. This option simply involves the excavation of the 'slag/basalt fill' and transport to the off-site waste facility. This option is commercially feasible and is suitable for the proposed site redevelopment which has already identified the requirement for significant excavation of soils.

As the contamination at the site is associated with the 'slag/basalt' fill material at the site, appropriate methods should be undertaken to ensure minimal disturbance of the underlying 'alluvial fill'. This would ensure that 'alluvial fill' material is not removed from the site unnecessarily, and that representative validation samples can be collected from the base and walls of the excavation.

5.3.4 Containment

The option of containment of 'slag/basalt fill' material corresponds to the DEC's least preferred remediation option. Guidelines for containment are provided in ANZECC (1999) 'Guidelines for the Assessment of On-Site Containment of Contaminated Soil'. Manganese is a Group 1 contaminant and the PAHs are classified as Group 9 and 10 contaminants in ANZECC (1999). A containment strategy including physical separation by covering, water exclusion and isolation using vertical barriers would be required to appropriately contain these soils. Leachate monitoring would also be required for this containment system.

This containment system would occupy a significant area of the site and would require the installation of significant infrastructure. Based on this, and the status as least preferred option, this option has not been considered any further.

5.3.5 Groundwater

It has been noted in **Section 4** that the 'slag / basalt fill' is the source of groundwater impact on the site. Where this fill is removed / controlled it is anticipated that levels of groundwater impact will rapidly improve. Based on this, and the site requirement with redevelopment of no beneficial use of groundwater, there is not considered to be any requirement for invasive groundwater remediation.

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5.4 Remediation Scope of Works

5.4.1 Site Establishment

The boundary of the contaminated areas (ie the site boundaries) will be defined and the areas contained to ensure that all safety and environmental controls are implemented. These controls will include site security fencing and stormwater runoff controls.

5.4.2 Removal of Stockpiled Materials

Materials stockpiled in the southern and northeastern portion of the site will be removed from the site.

5.4.3 Demolition and Removal of Overlying Pavement

The site management provisions contained in this RAP should equally apply to the demolition of buildings and removal of the existing slabs where required to facilitate remediation works in addition to the proposed demolition works. This is because demolition workers may be exposed to contaminated soils during the removal of any surface infrastructure.

5.4.4 Waste Classification

Waste classification has been able to be completed on the basis of existing in-situ data collected by JBS (2007) and PB (2002). This is appropriate where the visual observations confirm that the various materials for offsite disposal are consistent with previous observations.

By reference to DEC (2004) 'Environmental Guidelines: Assessment, Classification & Management of Liquid & Non-Liquid Wastes' and NSW EPA (1999) 'General Approval of the Immobilisation of Contaminants in Waste Approval No. 1999/07 metallurgical furnace slag or metallurgical furnace slag contaminated natural excavated materials' the fill is classified as inert waste.

5.4.5 Contaminated Soil Excavation and Off-Site Removal

It is likely that the site will require some dewatering prior to excavation of the 'slag/basalt fill'.

The 'slag/basalt fill' is characterised by brown/ grey/black sand with gravels of slag, basalt (also described as ballast and blue metal) and concrete present from the surface to a variable depth of 0.3 to 1.1m.

The underlying 'dredged material' is characterised by gravels and brown to yellow sand underlying the basalt / slag based fill.

It is noted that a deeper area of the 'slag/basalt fill' (to 1.5m) requires removal in the central portion of the site. It is possible that other deeper pockets of the 'slag/basalt fill' are present across the site, and adequate removal of the material will require the recognisance of the interface between the 'slag/basalt fill' and the 'dredged material'.

The excavation of the 'slag/basalt fill' will require strict control and management to ensure that only 'slag/basalt fill' is removed with the minimal removal of the underlying 'dredged material'. Care should be taken during the excavation works to prevent mixing of the fill types, as this may lead to the removal of insufficient 'slag/basalt fill' and the

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subsequent failure of validation samples, or the removal of too much 'dredged material' and subsequent increased tipping fees.

Based on observations during environmental sampling works, it is the opinion of JBS that such controlled excavation of the 'slag/basalt fill' is readily achievable.

Contaminated soils will be excavated and loaded directly onto tippers for transport to a licensed landfill. Contaminated soil removal works will require to be directed by an appropriately qualified environmental scientist. The environmental scientist will require to be cognisant of the interface between the 'slag/basalt fill' and 'dredged material' based fill.

5.4.6 Validation

Validation sampling and analyses of remediation areas will be conducted based in visual observation and analytical testing, to verify the excavations have extended to the necessary extent (both laterally and vertically).

Data quality objectives established for the assessment of soils will be used in the development of validation sampling requirements for remediation. This is detailed in **Section 6**. The validation strategy is detailed in **Section 8**. Assessment criteria to be used to assess the effectiveness of the remediation works and suitability of soils are provided in **Section 7**.

5.4.7 Preparation of a Construction Management Plan

There is potential for residual impact to remain at the site after remedial works have been completed and the site has been validated as suitable for the proposed use. To detail the protocol for unexpected finds during the construction phase of the site development, on completion of the remedial activities at the site and prior to construction works commencing, a Construction Management Plan (CMP) must be prepared.

The CMP must include the following information:

- Background of the site and contaminated materials previously identified;
- A summary of the remedial works conducted;
- Remaining potential risks at the site, including residual impact and the presence of potential contamination which has not been previously identified;
- Requirements for offsite disposal of surplus soils;
- Recommended personal protective equipment (PPE) for construction workers at the site; and
- At which stage it is required to contact an environmental consultant to obtain advice regarding any unexpected finds at the site.

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6 Data Quality Objectives

Data Quality Objectives (DQOs) have been developed for the validation of the remediation works as discussed in the following sections.

6.1.1 State the Problem

The site is proposed to be redeveloped for mixed residential/ commercial use and contamination has been identified in soil and groundwater during previous investigations at the site.

Remediation works are proposed to remove near surface fill based soils (described as 'slag/basalt fill') which have been found to pose an unacceptable level of human health risk to future site users and pose a potential source of groundwater contamination. Stockpiles located in the southern and northeastern portion of the site will also be removed.

Soil validation works are required to demonstrate the effective removal of the 'slag/basalt fill' and remaining soils as environmentally suitable for the site. Soils which may be imported to backfill the excavation or for use in yard / landscaped areas require to be environmentally suitable.

6.1.2 Identify the Decision

The following decisions require to be made at the completion of the remediation works:

- Has the manganese and PAH impacted 'slag/basalt fill' material been sufficiently removed from the site to cause levels of human health and environmental risk to be acceptable?
- Are soils imported to backfill the excavation or for use in landscaping / yard areas environmentally suitable?

6.1.3 Identify Inputs to the Decision

Inputs to the decisions are:

- Soil analytical data collected from the base (and walls where applicable) of the excavation formed by the removal of the 'slag/basalt fill'; and
- Soil analytical data collected from any soils imported for use as top soils / growing medium on the site.

6.1.4 Define the Study Boundaries

The Lee 4 study area boundary is shown in **Figure 2** (Part Lot 230 DP 1094812). The horizontal extent of remediation is considered to be the lateral site boundaries. The vertical extent of the remediation is the depth of excavation. This is anticipated to typically be 0.5m below current ground levels and potentially as deep as 1.5m in proximity of sample locations L4BH10 and SB6 as shown on **Figure 3**.

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6.1.5 Develop a Decision Rule

Soil analytical data will be assessed against DEC endorsed criteria, including:

- *National Environment Protection (Assessment of Site Contamination) Measure,* National Environment Protection Council, 1999 (NEPC 1999)
- *Contaminated Sites: Guidelines for Assessing Service Station Sites,* NSW EPA, 1994 (EPA 1994)

Soils at the base of the excavation formed by the removal of the 'slag / basalt fill' material, and imported fill used to reinstate the excavation will be assessed against criteria provided for 'residential with minimal opportunities for soil access' in NEPC (1999) and threshold criteria in NSW EPA (1994). Compliance with these criteria may be additionally assessed by statistical analysis of the soil data set using methods described in NSW EPA (1995) 'Sampling Design Guidelines' and comparison to guidelines in accordance with the criteria established in the notes to Table 1 of enHealth (2001) Health-based Soil Investigation Levels'.

Soils which are imported for use as top soils / growing medium and soils which are proposed to be present at accessible locations of the site surface will be assessed against criteria provided for 'standard residential' and 'ecological investigation levels' provided to NEPC (1999) and threshold concentrations provided to NSW EPA (1994). Statistical analysis may be used for comparison to 'standard residential' criteria and threshold concentrations.

6.1.6 Specify Limits on Decision Errors

This step is to establish the decision maker's tolerable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data.

Specific limits for this project are in accordance with the appropriate guidance from the NSW DEC, NEPC (1999), ANZECC/ARMCANZ (2000), DEC (2007), appropriate indicators of data quality (DQIs used to assess quality assurance / quality control **Section 6.4**) and standard JBS Environmental procedures for field sampling and handling.

Data generated during the project requires to be appropriate to allow decisions to be made with confidence. Thus it will be required that all data generated for the site has 100% compliance with the relevant DQIs.

Minimum sampling densities are provided in Table A on NSW EPA (1995). A total of 18 sample locations are recommended for a site area of 7650m^2. A hotspot of minimum diameter 24.3m will be detected on the site where 18 sample locations are undertaken. Noting the proposed land-use, this is considered an acceptable limit on decision errors.

6.1.7 Optimise the Design for Obtaining Data

It is proposed to place the sample locations on a grid basis across the base of the excavation. Eighteen sampling locations are proposed. Indicative locations of sampling points are shown on **Figure 4**.

It is noted that some localised deeper excavations may be required (for example in proximity of JBS location SB6 where material has been reworked). Additional samples shall be collected from the deeper excavations to ensure the appropriate lateral extent of the additional excavation. It is proposed to collect samples:

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- One sample per each 5m of excavation wall, on each wall; and
- One sample per each 25m^2 of base area of the excavation.

Imported fill material will also require to be sampled and analysed. The following sampling frequencies are proposed:

- One sample per 100m^3 where fill materials are non-homogeneous; and
- One sample per 500m^3 where fill materials are homogeneous and can be tracked to a single source site (by validation paperwork or otherwise).

Imported fill material should also be accompanied by relevant documentation.

A summary of the proposed sampling and analysis is provided in **Table 6.1**.

Table 6.1 – Proposed Sampling & Analytical Program

Media	No. of sampling locations	Analyses
Soil – Validation	18 (grid based across site area) Additional Deeper Excavations 1 per wall per 5m 1 per 25m^2 base area	Heavy metals (As, Cd, Cr, Cu, Pb, Mn Hg, Ni and Zn) PAHs TPH
Soil – Imported Fill for Backfilling Excavations or for Top Soil / Growing Medium	1 per 500m^3 (homogeneous fill materials from ingle source site) 1 per 100m^3 (otherwise)	Heavy metals TPH BTEX PAHs OCPs PCBs pH

6.2 Soil Sampling Methodology

Samples will be collected from near surface depths by the use of a hand trowel. The hand trowel will be thoroughly decontaminated using phosphate free detergent and distilled water between each sampling location. Where deeper samples are required within large stockpiles or additional deeper excavation, samples shall be collected by testpits placed using an excavator. Samples shall be collected from the centre of the excavator bucket ensuring that no part of the sample has contacted the sides of the excavator bucket.

During the collection of soil samples, features such as seepage, discolouration, staining, odours and other indications of contamination will be noted. This information will be recorded on the field borehole logs, completed for each of the sampling locations.

Collected soil samples will be immediately transferred to sample containers of appropriate composition (glass jars). Sample labels will record JBS job number; sample identification number; and date and time of sampling.

Sample containers will be transferred to a chilled ice box for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form will be completed and forwarded with the samples to the testing laboratory. The following information will be included on the chain–of-custody form:

- Sample identification;

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- Signature of sampler;
- Date and time of collection;
- Place of collection;
- Type of sample;
- Number and type of container;
- Inclusive dates of possession; and
- Signature of receiver.

6.3 Laboratory and Field Analyses

NATA accredited laboratories will be used for all laboratory analysis of soil and water samples. Field equipment used to analyse waters will be calibrated prior to use. All calibration certificates will be retained for reporting.

6.4 Quality Assurance / Quality Control

The pre-determined Data Quality Indicators (DQIs) established for the project are discussed below in relation to precision, accuracy, representativeness, comparability and completeness (PARCC parameters), and are shown in **Table 6.2**.

- **Precision** - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD)[15] of duplicate samples.
- **Accuracy** - measures the bias in a measurement system. The accuracy of the laboratory data that is generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness** –expresses the degree which sample data accurately and precisely represents a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy.
- **Comparability** - expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; ensuring analysing laboratories use consistent analysis techniques and reporting methods.

[15] $$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where C_0 is the analyte concentration of the original sample
C_d is the analyte concentration of the duplicate sample

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- **Completeness** – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study.

Table 6.2 Summary of Quality Assurance / Quality Control Program

Data Quality Objective	Frequency	Data Quality Indicator
Precision		
Blind duplicates (soil intra laboratory)	1 / 20 samples	<50% RPD[1]
Split duplicates (soil inter laboratory)	1 / 20 samples	<50% RPD[1]
Trip blank	1 / media	<LOR
Rinsate blank	1 / media	<LOR
Trip spike	1 / media[2]	>70%
Accuracy		
Surrogate spikes	All organic samples	70-130%
Matrix spikes	1 per lab batch	50-150%
Representativeness		
Sampling appropriate for media and analytes	All media / analytes	-
Laboratory blanks	1 per lab batch	<LOR
Samples extracted and analysed within holding times.	All samples	14 days for COPC's
Comparability		
Standard operating procedures for sample collection & handling	All Samples	All samples
Standard analytical methods used for all analyses	All Samples	All samples
Consistent field conditions, sampling staff and laboratory analysis	All Samples	All samples
Limits of reporting appropriate and consistent	All Samples	All samples
Completeness		
Soil description and COCs completed and appropriate	All Samples	All samples
Appropriate documentation	All Samples	All samples
Satisfactory frequency and result for QC samples	All QA/QC samples	100%
Data from critical samples is considered valid	All samples	Critical samples valid

(1) If the RPD between duplicates is greater than the pre-determined data quality indicator, a judgement will be made as to whether the excess is critical in relation to the validation of the data set or unacceptable sampling error is occurring in the field.

(2) Only required where volatile substances (TPH C_6-C_9 and BTEX) analysed.

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7 Assessment Criteria

7.1 Regulatory Guidelines

Section 105 of the Contaminated Land Management Act 1997 allows the EPA to "make or approve" guidelines for any purpose related to the objects of the Act. The assessment will be based on the following such guidelines, as relevant:

- Contaminated Sites: Guidelines for Assessing Service Station Sites, NSW EPA, 1994 (EPA 1994)
- Contaminated Sites: Sampling Design Guidelines, NSW EPA, 1995 (EPA 1995)
- Contaminated Sites: Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land, NSW EPA, 1995 (EPA 1995b)
- Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites, NSW EPA, 1997 (EPA 1997)
- Contaminated Sites: Guidelines for Assessing Banana Plantation Sites, NSW EPA, 1997 (EPA 1997b)
- Contaminated Sites: Guidelines for the NSW Site Auditor Scheme, 2nd Edition, NSW EPA, 2006 (DEC 2006)
- Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination, NSW DEC, March 2007 (DEC, 2007)
- Contaminated Sites: Guidelines on Significant Risk of Harm from Contaminated Land and the Duty to Report, NSW EPA, 1999 (EPA 1999)
- National Environment Protection (Assessment of Site Contamination) Measure, National Environment Protection Council, 1999 (NEPC 1999)
- Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australian and New Zealand Environment and Conservation Council and the National Health and Medical Research Council, 1992 (ANZECC/NHMRC 1992)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Paper No 4, 2000 (ANZECC/ARMCANZ 2000)
- Australian Drinking Water Guidelines, National Health and Medical Research Council and Agriculture and Resource Management Council of Australia and New Zealand, 2004 (NHMRC/NRMMC 2004)
- Composite Sampling, Lock, W. H., National Environmental Health Forum Monographs, Soil Series No.3, 1996, SA Health Commission, (NEHF 1996)
- Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards, Department of Health and Ageing and EnHealth Council, Commonwealth of Australia, June 2002 (EnHealth 2002)

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7.2 Soil Criteria

To validate the site, concentrations of contaminants in the soil will be compared against:

- Health-based soil investigation levels for residential (minimal soil access) land use (NEHF – D as provided in NEPC, 1999); and
- Threshold concentrations for sensitive land use (as provided in EPA 1994) for TPH and BTEX.

With consideration to the design and density of the surrounding recent development, consideration has not been given to the provisional phytotoxicity based criteria, since any landscaped portions would be minor and involve imported topsoil in constructed garden areas.

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8 Validation Plan

8.1 Validation Sampling and Analyses

Validation sampling is required to be undertaken to demonstrate that remediation works (where undertaken) have been taken to a sufficient extent to remove contaminated materials to the level stipulated in the Data Quality Objectives. Validation sample results will be initially compared to the adopted validation criteria for the remediation stage (see **Section 7**)

Generally, if an excavation validation sample fails the clean-up criteria, further remediation (by excavation for soils) and subsequent validation of the affected area will be required.

If an elevated sample only slightly exceeds clean-up criteria, and is an isolated occurrence, and there are no visual indications to suggest extensive contamination, statistical methods (such as the 95% UCL of the arithmetic mean) may be used to determine if the excavation has been adequately validated. Existing site data will be used to supplement validation data collected.

In general to allow the DQO's and associated limits on decision errors to be met, validation sampling locations for additional excavation of soils (where required for specific remediation works in addition to the bulk excavation works to remove the 'slag/basalt fill') shall be as follows:

- Validation samples will be taken from the floor and walls of the excavation. The total number of sampling locations will be 1 sample of the excavation wall per 5 linear metres and 1 sample of the excavation floor per 25 m^2 of excavation floor.

Soil samples shall be collected by the same methods as described in **Section 6**. It is noted that where a large excavation area is required for remediation works, then the guidance provide to NSW EPA (1995) will be more appropriately employed to determine appropriate sampling densities.

8.2 Validation Reporting

At the completion of the remedial works a Validation Report will be prepared in general accordance with the NSW EPA (1997) 'Guidelines for Consultants Reporting on Contaminated Site', documenting the works as completed. This report will contain information including:

- Details of the remediation works conducted;
- Information demonstrating that the objectives of the RAP have been achieved, in particular the validation sample results and assessment of the data against both the pre-defined data quality objectives and the remediation acceptance (validation) criteria;
- Information demonstrating compliance with appropriate regulations and guidelines;
- Any variations to the strategy undertaken during the implementation of the remedial works;
- Results of all environmental monitoring undertaken during the course of the remedial works;

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- Details of any environmental incidents occurring during the course of the remedial works and the actions undertaken in response to these incidents; and
- Other information as appropriate, including requirements (if any) for ongoing monitoring / management.

The report will serve to document the remediation works for future reference.

8.3 Contingency Plan

In the unforeseen event that the proposed remediation works do not meet the validation criteria, or if the selected remedial strategy is not able to proceed (such as closure of landfill or the waste material not being within the waste classification for landfill) the following actions will be considered to ensure firstly the safety and health of people and the environment and secondly that the overall project objectives are achieved.

1. Continued controlled excavation until validation is achieved
2. Reassessment of remedial options for excavated materials, including:
    - Onsite treatment
    - Onsite containment

Due to the uncomplicated remedial process that has been selected and the nature of the potential contaminants of concern, further excavation and disposal is likely to continue to be the preferred option.

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9 Site Management Plan

9.1 Hours of Operation

Remediation works shall only be permitted during the following hours:

Monday to Friday: 7:00 am to 5:00 pm

Saturdays: 8:00 am to 1:00 pm

Sundays and Public Holidays: No work permitted.

Emergency work is permitted to be completed outside of these hours.

9.2 Soil and Water Management

To prevent the migration of impacted soil off site, silt fences shall be constructed at the site boundaries. Any material which is collected behind the sediment control structures shall be removed off site with the contaminated soil.

In a storm event, the structures located on site for sediment control will need to be monitored and replaced or altered if necessary. Collected material will need to managed in accordance with remediation works.

Where there is a potential for excavated materials to migrate into the adjoining Newcastle Harbour, a coffer dam shall be constructed within the Harbour adjoining the site. The coffer dam shall utilise silt cloth with a floating boom. Sediment which migrates from the site shall be collected within the coffer dam. At the cessation of the works, collected sediment will require to be extracted from the coffer dam, and the coffer dam removed.

9.2.1 Site Access

During remediation works, perimeter fencing will be installed which will restrict access to the site. Only authorised persons will be able to enter the site.

Vehicle access to the site shall be stabilised to prevent the tracking of materials from the site and the adjoining driveway/access point to the road will be swept or cleaned on an as-needed basis.

9.2.2 Stockpiles

In accordance with Council's Contaminated Land DCP 2004:

- No stockpiles or other materials shall be placed on footpaths or nature strips and will be away from all stormwater infrastructure (including drainage lines, stormwater pits, gutters, etc).
- All stockpiles likely to generate dusts or odours shall be covered and, if left for more than 24 hours, be stored in a secure area.
- All stockpiles will be placed on a level area as a low elongated mound.

9.2.3 Excavation Pump-out

All excavation pump out water (if any) shall be analysed for total suspended solids, pH and the identified contaminants of concern prior to release to stormwater, sewer (only if trade waste permit obtained) or licensed liquid waste contractor.

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Dewatering works, for the purpose of groundwater treatment shall only be undertaken with DNR approval.

9.2.4 Bunding

Any landfarming areas for hydrocarbon contaminated soils (where required, not anticipated based on reported extent and nature of impact) shall be bunded to contain surface water runoff and prevent infiltration of contaminants into the subsurface. Any discharges of bunded areas to the site drainage system shall not have detectable levels of TPH or BTEX compounds.

9.3 Noise

The remediation works shall comply with the conditions o consent provided to the development.

9.4 Vibration

The use of plant and machinery shall not cause vibrations to be felt or capable to be measured at the neighbouring premises.

9.5 Air Quality

9.5.1 Dust Control

During the excavation and removal of the impacted soils the excavation area will be wetted down using a water spray to minimise the potential for dust to be generated. Where required, plastic sheeting will be provided to the hoardings at the site boundaries, to further control dust emissions. No visible dust emissions shall be permitted to leave the boundaries of the Hill area.

Dust shall also be controlled by ensuring vehicles leave via the designated (stabilised) site access and all equipment has dust suppressors fitted.

9.5.2 Odour

Given the nature and extent of the COPCs identified for the site, there are unlikely to be any odour issues. However, should odour be detectable at the site boundary, then appropriate actions will be taken to reduce the odours, which may include: increasing the amount of covering of excavations / stockpiles; mist sprays; odour suppressants; or maintenance of equipment.

Records of volatile emissions and odours shall be kept by the Remediation Manager.

9.6 Groundwater

Where groundwater remediation / dewatering is required approval will be required under the *Water Act 1912*, as discussed further in **Section 11**.

9.7 Material Transporting

Trucks will be loaded in a designated area away from the contaminated material excavations. The transporting contractor shall ensure that there is no material tracked out onto the street and that the load is securely covered. In addition, all site vehicles must leave the site in a forward direction.

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All appropriate road rules shall be observed and state roads will be selected as far as practicable over local roads when deciding on the transport route to the off-site material disposal location.

9.8 Hazardous Materials

All hazardous and/or intractable wastes (if any) shall be removed and disposed of in accordance with the relevant regulatory requirements. In particular, any hazardous wastes will be transported by a DECC licensed transporter.

9.9 Disposal of Contaminated Soil

All soil will be classified, managed and disposed in accordance with the DEC (2004) 'Environmental Guidelines: Assessment, Classification and Management of Liquid & Non Liquid Wastes'.

9.10 Imported Fill

If any materials are required to be imported on site to re-establish existing ground levels, then clean validated material (Virgin Excavated Natural Material) shall be used where available. All material will require to be sampled and analysed in accordance with the imported fill requirements established in the validation strategy.

9.11 Containment / Capping of Contaminated Soil

There is no containment/capping of any contaminated material proposed as part of the remedial works.

9.12 Site Signage and Contact Numbers

A sign shall be displayed throughout the duration of the works with the contact details of the remediation contractor and project manager. The consent authority shall also be notified of these details at least 30 days prior to commencing works.

9.13 Complaint Reporting and Resolution

Complaints from adjoining residents or workers on site will be directed initially to the civil contractor on site. Following that, discussion with the environmental consultant and the complainant will investigate the issue and remedy it as required or applicable.

9.14 Community Consultation

Owners and occupiers of neighbouring premises shall be notified at least 7 days prior to commencing remediation.

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10 Health and Safety

This health and safety plan contains procedures and requirements that are to be implemented as a minimum during the remediation works.

The objectives of the health and safety plan are:

- To apply standard procedures that reduce risks resulting from the above works;
- To ensure all employees are provided with appropriate training, equipment and support to consistently perform their duties in a safe manner; and
- To have procedures to protect other site workers and the general public.

These objectives will be achieved by:

- Assignment of responsibilities;
- An evaluation of hazards;
- Establishment of personal protection standards and mandatory safety practices and procedures; and
- Provision for contingencies that may arise while operations are being conducted at the site.

The health and safety does not provide safety information specific to construction and other demolition or excavation activities carried out by contractors, such as the safe operation, maintenance and inspection of plant, etc. Contractors will be required to prepare their own Safe Work Method Statements for their work activities. All parties working on the site shall comply with all applicable Health and Safety legislation, regulations, codes and guidelines.

10.1 Responsibilities

Remediation Supervisor

The remediation supervisor is responsible for ensuring that the work is carried out in accordance with the health and safety plan. This will include:

- Ensuring a copy of the health and safety plan is available at the site during the remediation/validation activities;
- Confirming individuals are competent in performing allotted tasks;
- Liaison with the contractor representatives, as appropriate, regarding safety matters; and
- Investigation and reporting of incidents and accidents.

Other Members of the Site Workforce

Every individual worker is responsible for conducting their allocated tasks in a safe manner and in accordance with their training and experience. They must give due consideration to the safety of all others in their proximity and cooperate in matters of health and safety. All workers must leave their work areas in such a condition that the location will not be hazardous to others at any time.

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10.2 Hazards

The known or potential hazards associated with the work activities described in Section 4 are listed below:

- Chemical hazards associated with the presence of contaminated soil.
- Physical hazards, including:
  - work in or near excavations;
  - operating machinery;
  - heat stress and UV exposure;
  - underground or overhead services;
  - manual handling; and
  - noise.

In the event of the discovery of any condition that would suggest the existence of a situation more hazardous than anticipated, or of any new hazard that could potentially cause serious harm to personnel or the environment, work will be suspended until the Project Manager has been notified and appropriate instructions have been provided to field personnel.

10.2.1 Chemical Hazards

When working with contaminated materials in general, care needs to be taken to ensure that the contamination is not introduced to the worker via ingestion, inhalation or absorption. The PPE and decontamination requirements outlined in **Sections 10.3** shall be followed to control the risks posed by chemical hazards at the site.

10.2.2 Physical Hazards

Operating Machinery

Heavy plant and equipment operating in the vicinity of field personnel presents a risk of physical injury. Personnel should be cognisant of their position in relation to operating machinery at all times.

Never walk behind or to the side of any operating equipment without the operator's knowledge. Do not assume that the operator knows your position. Personnel should stay at least 1 m from the operational area of heavy equipment and should not stand directly below any load or piece of equipment (eg. backhoes).

Work In or Near Excavations

All excavations shall be shored, sloped or otherwise constructed so as to minimise the potential for collapse. Excavations greater than 1.5m will be provided with battered edges to prevent potential cave in.

Cuts and Abrasions

The manual work associated with the remediation works gives rise to the risk of cuts and abrasions to personnel working in the area. As well as the direct consequences of any cut or abrasion, such injuries can lead to the possibility of exposure to contaminants through

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the wound as well as diseases such as tetanus. To minimise the risk of direct or indirect injury, personnel will wear the personal protective equipment described.

Heat Stress and UV Exposure

Site personnel may experience heat stress due to a combination of elevated ambient temperatures and the concurrent use of personal protection equipment; this depends in part on the type of work and the time of year.

In addition to heat stress, overexposure to UV radiation in sunlight can result in sunburn to exposed skin. The use of a high protection sunscreen (SPF15 or greater) on all exposed skin is recommended. Hats (including hard hats in specified areas) will also provide additional sun protection during the peak (i.e. 10:00 am to 3:00 PM) sun period. Sunglasses should be worn (where appropriate) to protect eyes from effects of UV exposure.

Underground Services

There is the potential for underground services (electricity, natural gas lines, water, telephone, sewer, and stormwater) to be present beneath the work area. The remediation contractor shall ensure that appropriate procedures will be taken to minimise the risk associated with excavation near services.

Aboveground Electrical Hazards

All electrical plant and equipment must comply with the requirements of Australian Standard AS 3000. Hand held portable tools shall comply with AS/NZS 3160 "hand-held portable electric tools" and shall be double insulated. Cord connected portable hand lamps shall comply with AS/NZS 3118. A Residual Current Device (RCD) shall protect plug-in portable equipment, which is connected to a supply above Extra Low Voltage - 12-24volts (including equipment supplied from a generator or welding set). RCD protection shall be provided during maintenance of portable electrical equipment at all times while the equipment is connected to a power supply above Extra Low Voltage, irrespective of whether power is switched ON or OFF. RCD's shall comply with AS 3190 and shall be type II units, rated to trip at or below 30 milliamps within 40 milliseconds.

No excavator, drill rig or crane may work within 2 m of overhead distribution power lines.

Manual Handling

When lifting or handling heavy objects, use correct lifting techniques, bending the knees not the back. If the item to be lifted is too heavy or awkward for one person to lift, seek assistance from other company employees or use mechanical help.

Noise

Long-term exposure to high levels of noise is unlikely. However, operating machinery may cause significant noise exposures for short periods. Earplugs or earmuffs should be worn in any situation where noise levels make normal conversation difficult.

10.3 Personal Protective Equipment

All workers who may come into direct contact with contaminated soil will wear the following personal protective equipment:

- overalls or long sleeved collared shirt;

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- heavy duty outer gloves (eg. leather) where there is a risk of cuts or abrasions, otherwise PVC outer gloves if in direct contact with contaminated soil;
- steel capped boots;
- safety glasses;
- high visibility vest or jacket; and
- hard hat.

10.4 Decontamination Procedures

The decontamination procedures specified below will be followed whenever personnel, plant or equipment leave the site.

Personnel

The following steps should be taken to ensure personnel do not leave the site with potentially contaminated clothing:

1. wash boots in clean water
2. remove outer gloves and store for reuse
3. remove overalls and store for reuse (during the day) or place in the waste bind provided on site for disposal.
4. thoroughly wash hands and face.

If any part of a worker's body comes into direct contact with any potentially contaminated material, the affected part(s) should be immediately washed with clean water.

Vehicle, Plant and Equipment

All equipment, including personal protective equipment, will be washed or otherwise cleaned to ensure that contaminated soil, water or dust is removed before it leaves the Site. All plant and equipment will have their outer bodies thoroughly cleaned of soil and sediment before moving off the site.

10.5 Emergency response

The remediation contractor will be responsible for preparing an emergency response plan, which will provide details on appropriate action and evacuation procedures in the event of an emergency.

In the event of an emergency arising on the site, appropriate action should be taken. Site evacuation procedures should be followed, as necessary.

In the event of an accident: evaluate the seriousness of the injury, and contact emergency services, if necessary; provide first aid, as appropriate, and if safe to do so evacuate the injured person via the Decontamination Zone; make the area as safe as possible without jeopardising safety.

If a serious accident occurs, do not disturb the scene, except to make safe and prevent further injury or damage, and keep all unauthorised people out, and report all accidents to the Project Manager.

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11 Regulatory Approvals/Licensing

11.1 State Environment Planning Policy Number 55 (SEPP55) Remediation of Land

The proposed remediation works are considered to be classified as "Category 2" Remediation Works – i.e., not requiring consent. However, the notification requirements of SEPP 55 requires the consent authority to be notified 30 days before category 2 remediation works commence. The notification will provide the Consent Authority with the information needed to verify the work is not category 1 by reference to the following criteria;

- The work is not designated development under schedule 3 of the EPA&A Regulation or under a planning instrument;
- The work proposed is not on land identified as critical habitat under the *Threatened Species Conservation Act 1995;*
- Consideration of s.5A of the EP&A Act indicates the remediation work is not likely to have a significant effect on threatened species, populations, ecological communities or their habitats;
- The work is not proposed in an area or zone identified in a planning instrument as being an area of environmental significance such as scenic areas or wetlands;
- The work does not require consent under SEPP or another regional environmental plan; and
- The work will not be carried out in a manner inconsistent with the Sydney Council policy on contaminated land.

In addition, the notification will also include relevant contact details and a proposed remediation schedule.

Notice is also required to be given to the Consent Authority within 30 days of remediation works completion.

11.2 Protection of the Environment Operations Act 1997

The proposed remediation/validation activities are not required to be licensed under the *Protection of the Environment Operation Act 1997*.

11.3 Rivers and Foreshores Improvement Act 1948

The *Rivers and Foreshores Improvement Act 1948* (R&FI Act) designates protected land as being within 40m of a natural waterbody. The excavation or removal of material from protected land that is likely to interfere with the flow of protected waters requires a permit under this Act.

Excavation works are required for the implementation of the remediation strategy. Though the scope of these works will not have an impact upon flow of waters, the proximity of the works to the existing waterway will require approval by Department of Natural Resources under the R&FI Act. This can be obtained simultaneously with the notice period of the remediation works.

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11.4 Mine Subsidence Compensation Act 1961

The *Mine Subsidence Compensation Act 1967* (MSC Act) is provided to control development on land areas potentially impacted by mine subsidence and to provide a framework for compensation where mine subsidence has impacted improvements or amenity of land. Where the Governor has declared an area to be a mine subsidence district under s15(1) of the MSC Act 1967, a special project control system works. The approval of the Mine Subsidence Board is required for the erection and alteration of improvements of land. The site is located within an identified mine subsidence district. The proposed remediation works will require approval from the Mine Subsidence Board. This can be obtained simultaneously with the notice period for the remediation works.

11.5 Protection Of The Environment Operations (Waste) Regulation 2005

The regulations make requirements relating to non-licensed waste activities and waste transporting. The proposed works on the site will not require to be licensed. Section 48 of the Reg. requires that wastes are stored in an environmentally safe manner. Its is also stipulated that vehicles used to transport waste must be covered when loaded.

The Regulation exempts certain waste streams from the full waste tracking and record keeping requirements. Waste tracking is required only for industrial and hazardous wastes. However these are not anticipated to be present on the site base don the use of the immobilisation approval. Provision is provided in the Regulation for the DECC to approve the immobilisation of contaminants in waste.

11.6 Water Act 1912

Where dewatering of groundwater is required to achieve groundwater validation, a dewatering and re-injection approval will be required from the Department of Natural Resources (DNR as per the requirements of the *Water Act 1912*). The approval will be obtained prior to the undertaking of any groundwater remediation dewatering and treatment.

11.7 State Environmental Planning Policy 14 – Coastal Wetlands

State Environmental planning Policy (SEPP) 14 aims to ensure that coastal wetlands are preserved and protected in the environmental and economic interests of the state. No part of the land required for the proposal is identified within SEPP 14.

11.8 State Environmental Planning Policy 74 – Newcastle Port and Employment Lands

State Environmental Planning Policy (SEPP) 74 has been provided to control the development of areas of Newcastle Port. The subject areas of the SEPP are observed to be located well north of the area of the proposed development. No part of the site is identified within SEPP 74.

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11.9 Hunter Regional Environmental Plan 1989

The Hunter Regional Environmental Plan 1989 (Hunter REP) applies to the area of the site. The Hunter REP describes a number of policies that must be taken into account when assessing development proposals. The aims of the Hunter REP are to:

- Promote the balanced development of the region;
- Co-ordinate activities related to development in the region; and
- Continue a regional planning process that will serve as a framework for identifying priorities for further investigations.

The remediation of contamination is appropriate for the subject site and will facilitate the balanced development of the Newcastle region.

11.10 Environmental Guidelines: Assessment, Classification & Management Of Liquid & Non-Liquid Wastes (DEC 2004).

All wastes generated shall be assessed, classified and managed in accordance with this guideline.

11.10.1 Newcastle City Council DCP Contaminated Land

The requirements of the Council's DCP have been included in throughout the Site Management provisions of this RAP.

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12 Long Term Management

On the basis of the proposed remedial strategy, there is not considered to be a requirement for any ongoing monitoring or management of any soil or groundwater contamination that may be identified on the site.

However, it is noted that abstraction of groundwater underlying the area of the site will be prohibited, apart from monitoring purposes.

It is also noted that a Construction Management Plan (CMP) must be developed after remedial works are completed but prior to the commencement of development works (as described in **Section 5.4.7**). The CMP will detail the risks identified by impact potentially remaining on the site and the unexpected finds protocol.

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Figures

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North

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Not to scale

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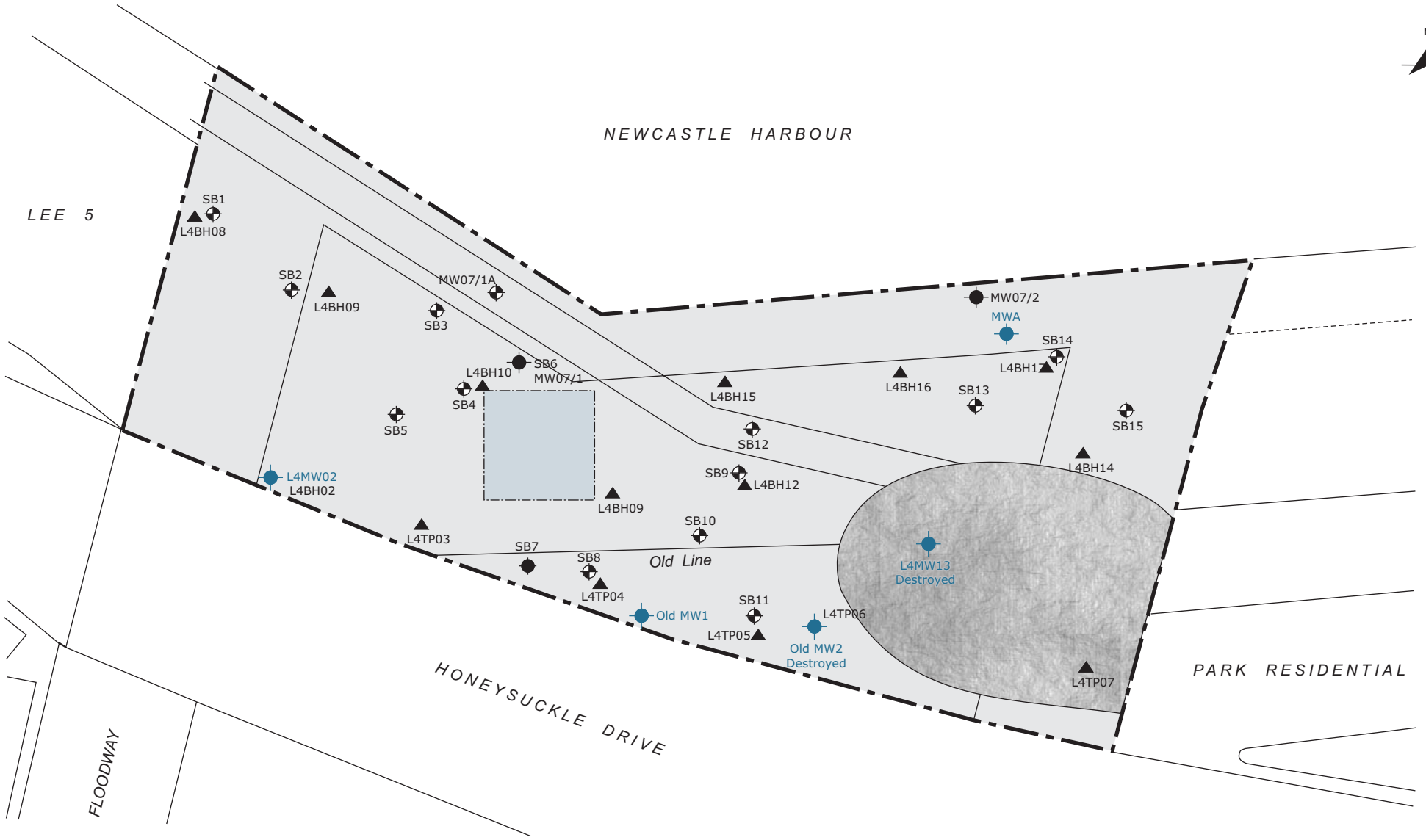
Figure 1
Lee 4 Site Location

Client: Honeysuckle Development Corporation
Job Number.: 40184

Site Address: Part Lot 1111 DP 1027135
Honeysuckle Drive, Newcastle West, NSW

File Name: Figure 1 (Rev 0)



Source: PPK (2002)

Legend

- Identified Area of Impact (PB, 2005)
- Existing Monitoring Well
- Soil Bore
- Monitoring Well

0 20 40m

Approximate Scale

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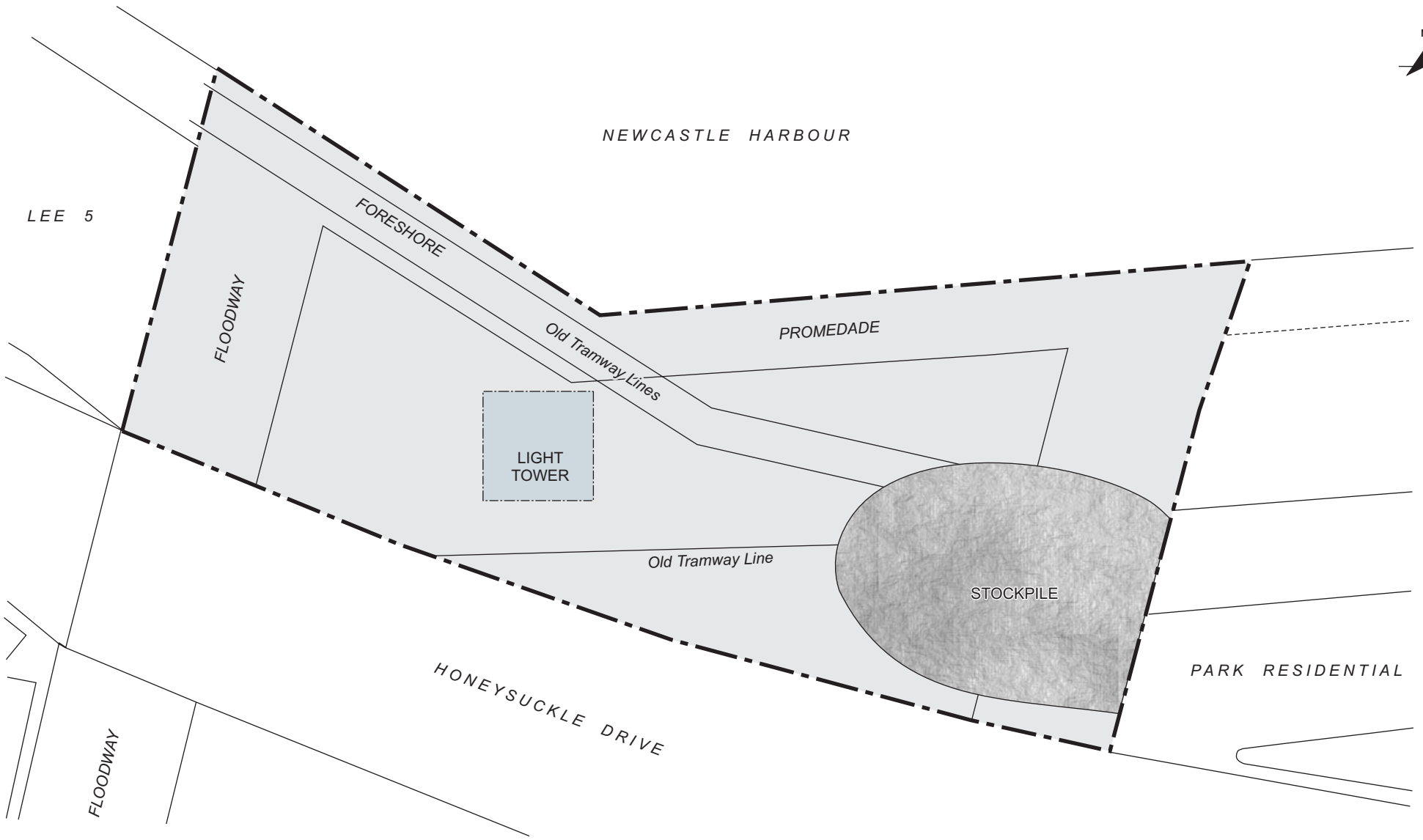
Figure 3
Lee 4 Investigation Sampling Locations

Client: Honeysuckle Development Corporation **Job Number:** 40184

Site Address: Lee 4, Honeysuckle Drive, Newcastle, NSW

File Name: 40184_05.cdr



Source: PPK (2002)

0 20 40m

Approximate Scale

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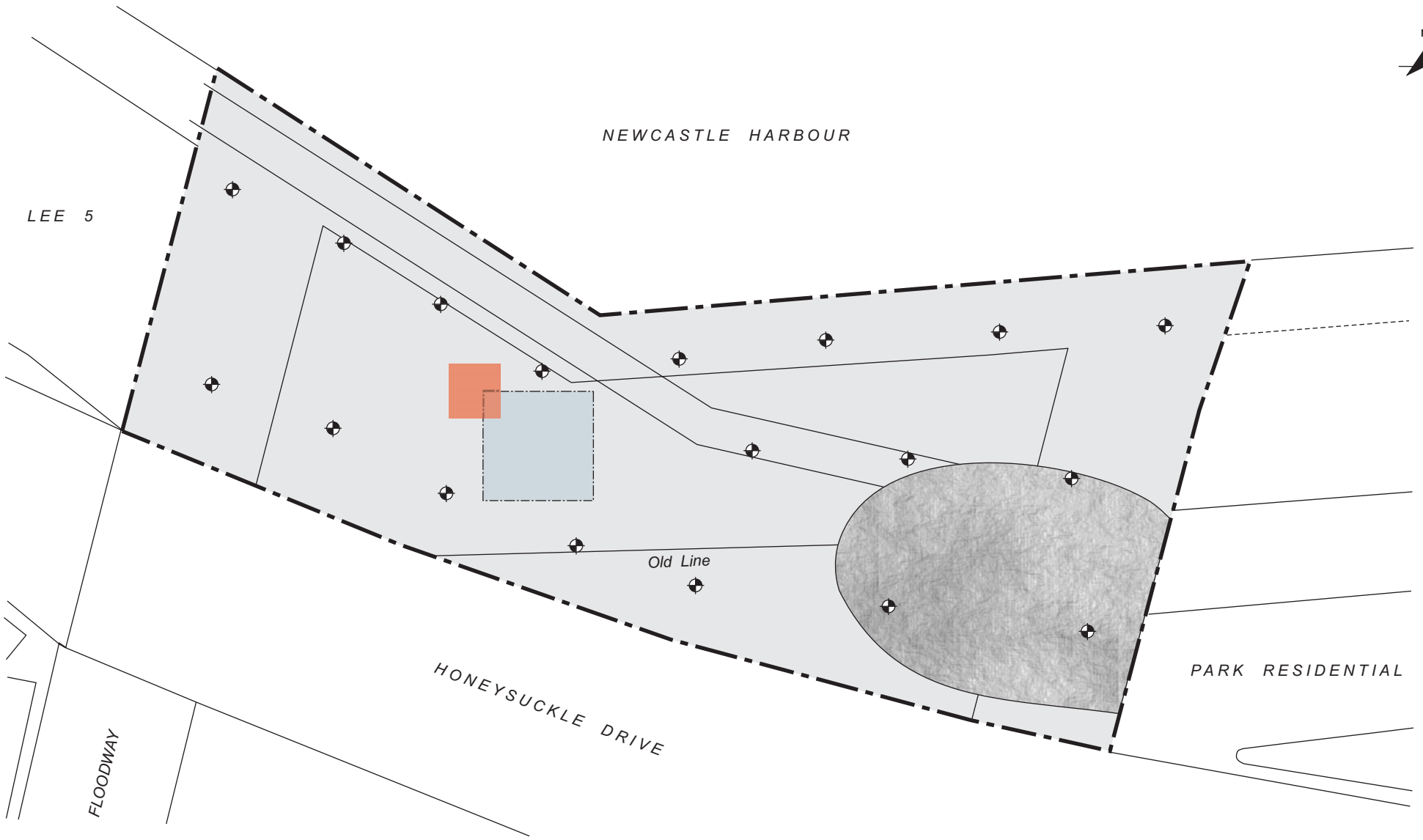
JBS ENVIRONMENTAL

Figure 2
Lee 4 Site Layout

Client: Honeysuckle Development Corporation **Job Number:** 40184

Site Address: Lee 4, Honeysuckle Drive, Newcastle, NSW

File Name: 40184_04.cdr



Source: PPK (2002)

Legend

Proposed Validation Sample Location

Area of likely deeper excavation

0 20 40m

Approximate Scale

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JBS ENVIRONMENTAL

Figure 4
Proposed Validation Sampling Locations

Client: Honeysuckle Development Corporation **Job Number:** 40184

Site Address: Lee 4, Honeysuckle Drive, Newcastle, NSW

File Name: 40184_05.cdr

Appendix A – Summary Results Tables

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Table A Sample Register (JBS Environmental Samples)
Environmental Site Assessment
Lee 4, Cottage Creek Development

Sample id	Depth	Date	Sample Type	Location	pH	Metals	TPH	BTEX	PAHs	TCLP/SPLP	Asbestos
Soil											
SB1-0.1	0.1	29/03/2007	Soil								
SB1-0.3	0.3	29/03/2007	Soil								
SB1-0.5	0.5	29/03/2007	Soil								
SB1-1	1.0	29/03/2007	Soil		x				x	x	
SB1-1.5	1.5	29/03/2007	Soil								
SB1-2	2.0	29/03/2007	Soil	Targeting impact detected at L4BH08							
SB1-2.5	2.5	29/03/2007	Soil								
SB1-3	3.0	29/03/2007	Soil								
SB1-3.5	3.5	29/03/2007	Soil								
SB1-4	4.0	29/03/2007	Soil								
SB1-4.5	4.5	29/03/2007	Soil								
SB1-5	5.0	29/03/2007	Soil			x			x	x	
SB2-0.1	0.1	28/03/2007	Soil			x			x		
SB2-0.3	0.3	28/03/2007	Soil								
SB2-0.5	0.5	28/03/2007	Soil								
SB2-1	1.0	28/03/2007	Soil								
SB2-1.5	1.5	28/03/2007	Soil			x			x		
SB2-2	2.0	28/03/2007	Soil	Delineation of impact detected at L4BH08							
SB2-2.5	2.5	28/03/2007	Soil								
SB2-3	3.0	28/03/2007	Soil								
SB2-3.5	3.5	28/03/2007	Soil								
SB2-4	4.0	28/03/2007	Soil								
SB2-4.5	4.5	28/03/2007	Soil								
SB2-5	5.0	28/03/2007	Soil								
SB3-0.1	0.1	28/03/2007	Soil								
SB3-0.3	0.3	28/03/2007	Soil								
SB3-0.5	0.5	28/03/2007	Soil			x			x		
SB3-1	1.0	28/03/2007	Soil								
SB3-1.5	1.5	28/03/2007	Soil			x			x		
SB3-2	2.0	28/03/2007	Soil	Delineation of impact detected at L4BH10							
SB3-2.5	2.5	28/03/2007	Soil								
SB3-3	3.0	28/03/2007	Soil								
SB3-3.5	3.5	28/03/2007	Soil								
SB3-4	4.0	28/03/2007	Soil								
SB3-4.5	4.5	28/03/2007	Soil								
SB4-0.1	0.1	28/03/2007	Soil								
SB4-0.3	0.3	28/03/2007	Soil								
SB4-0.5	0.5	28/03/2007	Soil								
SB4-1	1.0	28/03/2007	Soil								
SB4-1.5	1.5	28/03/2007	Soil	Delineation of impact detected at L4BH10	x	x			x	x	
SB4-2	2.0	28/03/2007	Soil								
SB4-2.5	2.5	28/03/2007	Soil								
SB4-3	3.0	28/03/2007	Soil								
SB5-0.1	0.1	29/03/2007	Soil								
SB5-0.3	0.3	29/03/2007	Soil			x			x		
SB5-0.5	0.5	29/03/2007	Soil								
SB5-1	1.0	29/03/2007	Soil	Delineation of impact detected at L4BH10							
SB5-1.5	1.5	29/03/2007	Soil								
SB5-2	2.0	29/03/2007	Soil								
SB5-2.5	2.5	29/03/2007	Soil								
SB5-3	3.0	29/03/2007	Soil								
SB6-0.1	0.1	22/03/2007	Soil			x			x		
SB6-0.3	0.3	22/03/2007	Soil								
SB6-0.5	0.5	22/03/2007	Soil								
SB6-1	1.0	22/03/2007	Soil	Delineation of impact detected at L4BH10							
SB6-1.5	1.5	22/03/2007	Soil			x			x		
SB6-2	2.0	22/03/2007	Soil								
SB6-3	3.0	22/03/2007	Soil								
SB6-4	4.0	22/03/2007	Soil								

Table A Sample Register (JBS Environmental Samples)
Environmental Site Assessment
Lee 4, Cottage Creek Development

Sample id	Depth	Date	Sample Type	Location	pH	Metals	TPH	BTEX	PAHs	TCLP/SPLP	Asbestos
SB7-0.1	0.1	23/03/2007	Soil	Delineation of impact detected at L4TP04							x
SB7-0.3	0.3	23/03/2007	Soil			x	x	x	x		
SB7-0.5	0.5	23/03/2007	Soil								
SB7-1	1.0	23/03/2007	Soil		x	x	x	x	x		
SB7-1.5	1.5	23/03/2007	Soil								
SB7-2	2.0	23/03/2007	Soil								
SB7-2.5	2.5	23/03/2007									
SB7-3	3.0	23/03/2007	Soil								
SB8-0.1	0.1	23/03/2007	Soil	Delineation of impact detected at L4TP04							
SB8-0.3	0.3	23/03/2007	Soil								
SB8-0.5	0.5	23/03/2007	Soil								
SB8-1	1.0	23/03/2007	Soil			x	x	x	x		
SB8-1.5	1.5	23/03/2007	Soil								
SB8-2	2.0	23/03/2007	Soil								
SB8-2.5	2.5	23/03/2007									
SB8-3	3.0	23/03/2007	Soil								
SB9-0.1	0.1	28/03/2007	Soil	Delineation of impact detected at L4BH12		x	x	x	x		
SB9-0.3	0.3	28/03/2007	Soil								
SB9-0.5	0.5	28/03/2007	Soil								
SB9-1	1.0	28/03/2007	Soil								
SB9-1.5	1.5	28/03/2007	Soil			x	x	x	x		
SB9-2	2.0	28/03/2007	Soil								
SB9-2.5	2.5	28/03/2007	Soil								
SB9-3	3.0	28/03/2007	Soil								
SB10-0.1	0.1	28/03/2007	Soil	Delineation of impact detected at L4TP04 and L4BH12		x	x	x	x		x
SB10-0.3	0.3	28/03/2007	Soil								
SB10-0.5	0.5	28/03/2007	Soil								
SB10-1	1.0	28/03/2007	Soil								
SB10-1.5	1.5	28/03/2007	Soil			x	x	x	x	x	
SB10-2	2.0	28/03/2007	Soil								
SB10-2.5	2.5	28/03/2007	Soil								
SB10-3	3.0	28/03/2007	Soil								
SB11-0.1	0.1	28/03/2007	Soil	Delineation of impact detected at L4TP05							
SB11-0.5	0.5	28/03/2007	Soil								
SB11-1	1.0	28/03/2007	Soil								
SB11-1.5	1.5	28/03/2007	Soil			x	x	x	x	x	
SB11-2	2.0	28/03/2007	Soil								
SB11-2.5	2.5	28/03/2007	Soil								
SB11-3	3.0	28/03/2007	Soil								
SB12-0.1	0.1	22/03/2007	Soil	Delineation of impact detected at L4BH12		x	x	x	x	x	x
SB12-0.3	0.3	22/03/2007	Soil								
SB12-0.5	0.5	22/03/2007	Soil								
SB12-1	1.0	22/03/2007	Soil			x	x	x	x		
SB12-1.5	1.5	22/03/2007	Soil								
SB12-2	2.0	22/03/2007	Soil								
SB12-3	3.0	22/03/2007	Soil								
SB13-0.2	0.2	22/03/2007	Soil	Delineation of impact detected at L4BH7			x	x	x		
SB13-0.5	0.5	22/03/2007	Soil								
SB13-1	1.0	22/03/2007	Soil				x	x	x		
SB13-2	2.0	22/03/2007	Soil								
SB13-3	3.0	22/03/2007	Soil								
SB14-0.1	0.1	22/03/2007	Soil	Delineation of impact detected at L4BH7			x	x	x	x	
SB14-0.3	0.3	22/03/2007	Soil								
SB14-0.5	0.5	22/03/2007	Soil				x	x	x		
SB14-1	1.0	22/03/2007	Soil								
SB14-1.5	1.5	22/03/2007	Soil								
SB14-2	2.0	22/03/2007	Soil								
SB14-3	3.0	22/03/2007	Soil								
SB15-0.1	0.1	22/03/2007	Soil	Delineation of impact detected at L4BH7			x	x	x		
SB15-0.3	0.3	22/03/2007	Soil								
SB15-0.5	0.5	22/03/2007	Soil								
SB15-1	1.0	22/03/2007	Soil								
SB15-1.5	1.5	22/03/2007	Soil								
SB15-2	2.0	22/03/2007	Soil								
SB15-3	3.0	22/03/2007	Soil								

Table A Sample Register (JBS Environmental Samples)
Environmental Site Assessment
Lee 4, Cottage Creek Development

Sample id	Depth	Date	Sample Type	Location	pH	Metals	TPH	BTEX	PAHs	TCLP/SPLP	Asbestos
MW07/1-0.1	0.1	22/03/2007	Soil	Delineation of impact detected at L4BH10		x	x	x	x		x
MW07/2-0.1	0.1	21/03/2007	Soil	Delineation of impact detected at L4BH7			x	x	x		
MW07/2-0.3	0.3	21/03/2007									
MW07/2-0.5	0.5	21/03/2007	Soil								
MW07/2-1	1.0	21/03/2007	Soil								
MW07/2-1.5	1.5	21/03/2007	Soil								
MW07/2-2	2.0	21/03/2007	Soil								
MW07/2-3	3.0	21/03/2007									
MW07/2-4	4.0	21/03/2007	Soil								
Soil QA/QC											
QA5		21/03/2007	Soil	Duplicate of MW07/2-2							
QA5A		21/03/2007	Soil	Triplicate of MW07/2-2							
QA6		22/03/2007	Soil	Duplicate of SB15-3							
QA6A		22/03/2007	Soil	Triplicate of SB15-3							
QA7		22/03/2007	Soil	Duplicate of SB14-1.5							
QA7A		22/03/2007	Soil	Triplicate of SB14-1.5							
QA8		22/03/2007	Soil	Duplicate of SB13-1			x	x	x		
QA8A		22/03/2007	Soil	Triplicate of SB13-1			x	x	x		
QA9		23/03/2007	Soil	Duplicate of SB12-2.5							
QA9A		23/03/2007	Soil	Triplicate of SB12-2.5							
QA10		23/03/2007	Soil	Duplicate of SB7-2							
QA18		28/03/2007	Soil	Duplicate of SB11-3							
QA18A		28/03/2007	Soil	Triplicate of SB11-3							
QA19		28/03/2007	Soil	Duplicate of SB10-3							
QA20		28/03/2007	Soil	Duplicate of SB9-1.5		x	x	x	x		
QA20A		28/03/2007	Soil	Triplicate of SB9-1.5		x	x	x	x		
QA21		28/03/2007	Soil	Duplicate of SB4-3							
QA21A		28/03/2007	Soil	Triplicate of SB4-3							
QA22		29/03/2007	Soil	Duplicate of SB1-5		x			x		
QA22A		29/03/2007	Soil	Triplicate of SB1-5		x			x		
QA23		29/03/2007	Soil	Duplicate of SB5-2							
QA23A		29/03/2007	Soil	Triplicate of SB5-2							
Trip spike	-	19/03/2007	-	Trip spike submitted with soil samples collected on 21-23/3/07				x			
Trip blank	-	19/03/2007	-	Trip blank submitted with soil samples collected on 21-23/3/07				x			
Trip spike	-	26/03/2007	-	Trip spike submitted with soil samples collected on 28-29/3/07				x			
Trip blank	-	26/03/2007	-	Trip blank submitted with soil samples collected on 28-29/3/07				x			
Groundwater											
MW07/1	-	12/04/2007	Water	Downgradient well on northern site boundary		x	x	x	x		
MW07/2	-	12/04/2007	Water	Downgradient well on northern site boundary		x	x	x	x		
MWA	-	12/04/2007	Water	Existing well northern site boundary		x	x	x	x		
OldMW1	-	12/04/2007	Water	Upgradient well southern site boundary		x	x	x	x		
Groundwater QA/QC											
QC3	-	12/04/2007	Water	Duplicate of L4MW07/1		x	x	x	x		
QC3A	-	12/04/2007	Water	Triplicate of L4MW07/1		x	x	x	x		
Trip blank	-	12/04/2007	Water	Trip blank submitted with groundwater samples collected on 12/4/07				x			
Trip spike	-	12/04/2007	Water	Trip spike submitted with groundwater samples collected on 12/4/07				x			
Lee 4 Rinsate	-	12/04/2007	Water	Rinsate blank submitted with samples collected on 12/4/07		x	x	x	x		
				Total	**3**	**31**	**28**	**34**	**40**	**7**	**4**

Table B Soil Heavy Metals and Asbestos Results
Environmental Site Assessment (JBS Environmental and PB Samples)
Lee 4, Cottage Creek Development

all units in mg/kg

				Heavy Metals										Asbestos	
				As	Cd	Co	Cr	Cu	Pb	Mn	Hg	Ni	Zn		
			PQL	4	1	1	1	1	1	4	0.1	1	1	-	-
			Assessment Criteria[3]	400	80		400 (CrVI)	4000	1200	6000	60	2400	28000	-	-
Sample id	**Depth**	**Description**	**Date**												
L4TP01/1M	1m	Dredged material	12/04/2002	3	<1	<1	1	<1	1	12	<0.1	<1	4		
L4/TP1/1.8M	1.8m	Dredged material	12/04/2002	3	<1	<1	<1	<1	<1	7	<0.1	<1	2		
L4BH2/1.5M	1.5m	Dredged material	12/04/2002	2	<1	<1	1	<1	1	11	<0.1	<1	4		
L4BH2/2.5M	2.5m	Dredged material	12/04/2002	2	<1	<1	<1	<1	2	8	<0.1	<1	4		
L4/TP3/0.2M	0.2m	Slag/basalt fill	12/04/2002	10	<1	2	3	25	52	179	<0.1	3	82		
L4/TP3/2M	2m	Dredged material	12/04/2002	3	<1	<1	<1	<1	<1	16	<0.1	<1	3		
L4/TP4/0.3M	0.3m	Slag/basalt fill	12/04/2002	3	<1	3	13	12	23	6460	<0.1	1	56		
L4/TP4/2M	2m	Dredged material	12/04/2002	2	1	<1	<1	1	2	11	<0.1	11	51		
L4/TP5/0.4M	0.4m	Slag/basalt fill	12/04/2002	6	5	1	21	47	104	412	0.2	6	188		
L4/TP6/0.1M	0.1m	Slag/basalt fill	12/04/2002	6	2	3	3	55	25	730	<0.1	10	780		
L4/TP6/1M	1m	Dredged material	12/04/2002	3	<1	<1	<1	<1	1	23	<0.1	2	133		
L4/TP6/1.8M	1.8m	Dredged material	12/04/2002	5	<1	2	1	1	3	21	<0.1	<1	24		
L4/TP7/0.2M	0.2m	Slag/basalt fill	12/04/2002	16	13	<1	12	55	161	246	0.1	6	833		
L4/TP7/1M	1m	Dredged material	12/04/2002	3	<1	3	<1	<1	<1	7	<0.1	<1	2		
L4/BH8/0.4M	0.4m	Slag/basalt fill	23/04/2002	3	<1	5	30	7	23	2190	<0.1	6	64		
L4/BH8/2.5M	2.5m	Dredged material	23/04/2002	6	<1	3	9	12	89	1380	<0.1	16	368		
L4/BH9/0.1M	0.1m	Slag/basalt fill	12/04/2002	2	<1	4	256	19	11	**21400**	<0.1	6	43		
L4BH9/1M	1m	Dredged material	12/04/2002	3	<1	3	3	<1	4	292	<0.1	2	24		
L4BH9/2M	2m	Dredged material	12/04/2002	4	<1	2	18	230	105	824	0.1	8	197		
L4BH9/3.1M	3.1m	Dredged material	12/04/2002	4	<1	5	27	36	36	930	<0.1	4	73		
L4/BH10/0.1M	0.1m	Slag/basalt fill	23/04/2002	3	<1	6	175	29	35	**20700**	<0.1	12	235		
L4/BH10/1M	1m	Slag/basalt fill	23/04/2002	5	<1	3	66	16	21	**6830**	<0.1	25	66		
L4/BH11 1M	1m	Dredged material	23/04/2002	3	<1	1	4	7	7	121	<0.1	5	21		
L4/BH11/2.5M	2.5m	Dredged material	23/04/2002	2	<1	2	2	3	3	48	<0.1	2	8		
L4/BH12/0.1M	0.1m	Slag/basalt fill	23/04/2002	4	<1	2	9	8	29	**6980**	<0.1	2	74		
L4/BH12/2M	1m	Dredged material	23/04/2002	4	<1	<1	3	4	6	49	<0.1	3	17		
L4/BH14/1M	1m	Dredged material	23/04/2002	2	<1	<1	<1	1	<1	21	<0.1	<1	2		
L4/BH14/2M	2m	Dredged material	23/04/2002	1	<1	<1	<1	<1	<1	9	<0.1	<1	2		
L4/BH15/1M	1m	Dredged material	23/04/2002	3	<1	<1	2	<1	<1	10	<0.1	1	2		
L4/BH15/2M	2m	Dredged material	23/04/2002	2	<1	<1	<1	<1	<1	70	<0.1	<1	8		
L4/BH16/1M	1m	Dredged material	23/04/2002	3	<1	<1	2	1	1	177	<0.1	2	7		
L4/BH16/2M	2m	Dredged material	23/04/2002	2	<1	<1	<1	<1	<1	29	<0.1	<1	3		
L4/BH17/0.1M	0.1m	Slag/basalt fill	23/04/2002	7	1	4	8	20	12	3720	<0.1	4	398		
L4/BH17/2M	2m	Dredged material	23/04/2002	3	<1	1	3	1	2	298	<0.1	3	22		
SB1	1.0	Dredged material	29/3/07												
SB1	5.0	Natural clay	29/3/07	<4	<1		17	12	10	350	<0.1	4	19		
SB2	0.1	Slag/basalt fill	28/3/07	<4	<1		200	17	19	**23000**	<0.1	11	81		
SB2	1.5	Dredged material	28/3/07	<4	<1		20	13	71	1400	<0.1	6.7	90		
SB3	0.5	Slag/basalt fill	28/3/07	7.5	<1		99	30	450	**20000**	<0.1	11	120		
SB3	1.5	Dredged material	28/3/07	5.4	<1		16	28	42	650	0.13	14	230		
SB4	1.5	Dredged material	28/3/07	<4	<1		<1	<1	<1	32	<0.1	1.1	51		
SB5	0.3	Slag/basalt fill	29/3/07	8.3	<1		85	11	7	**9600**	<0.1	5.7	30		
SB6	0.1	Slag/basalt fill	22/03/07	4	**4**		190	13	16	**15000**	0.11	3.7	1200		
SB6	1.5	*Dredged material*	22/03/07	<4	<1		10	12	11	550	<0.1	6.2	44		
SB7	0.1	Slag/basalt fill	23/03/07											No asbestos detected	Respirable fibres not detected
SB7	0.3	Slag/basalt fill	23/03/07	10	**5.3**		19	44	63	1800	0.12	31	1500		
SB7	1.0	Dredged material	23/03/07	<4	<1		1.5	1.6	2.2	36	<0.1	1.2	17		
SB8	1.0	Dredged material	23/03/07	<4	<1		1.6	<1	<1	8.9	<0.1	<1	2.4		
SB9	0.1	Slag/basalt fill	28/3/07	4.2	<1		100	18	19	**22000**	<0.1	7.6	89		
SB9	1.5	Dredged material	28/3/07	<4	<1		<1	<1	<1	15	<0.1	<1	1.6		

Table B Soil Heavy Metals and Asbestos Results
Environmental Site Assessment (JBS Environmental and PB Samples)
Lee 4, Cottage Creek Development

all units in mg/kg

				Heavy Metals										Asbestos	
				As	Cd	Co	Cr	Cu	Pb	Mn	Hg	Ni	Zn		
			PQL	4	1	1	1	1	1	4	0.1	1	1	-	-
			Assessment Criteria[3]	400	80		400 (CrVI)	4000	1200	6000	60	2400	28000	-	-
SB10	0.1	Slag/basalt fill	28/3/07	12	<1		8.8	19	19	440	<0.1	7.5	71	No asbestos detected	Respirable fibres not detected
SB10	1.5	Dredged material	28/3/07	<4	<1		1.4	1.2	1.3	10	<0.1	<1	4.5		
SB11	1.5	Dredged material	28/3/07	<4	<1		1.1	<1	<1	7.5	<0.1	<1	2.3		
SB12	0.1	Slag/basalt fill	22/03/07	<4	<1		100	16	18	**16000**	<0.1	4.1	65	No asbestos detected	Respirable fibres not detected
SB12	1.0	Dredged material	22/03/07	<4	<1		3	2.1	2.6	510	<0.1	<1	10		
SB13	0.2	Slag/basalt fill	22/03/07												
SB13	1.0	Dredged material	22/03/07												
SB14	0.1	Slag/basalt fill	22/03/07												
SB14	1.0	Dredged material	22/03/07												
SB15	0.1	Slag/basalt fill	22/03/07												
MW07/1	0.1	Slag/basalt fill	22/03/07	4	<1		11	9.9	14	3300	<0.1	4.6	98	No asbestos detected	Respirable fibres not detected
MW07/2	0.1	Slag/basalt fill	21/03/07												
MW07/2	0.5	Slag/basalt fill	21/03/07												
QA8	-		22/03/07												
QA8A	-		22/03/07												
QA20	-		28/3/07	<4	<1		<1	<1	<1	10	<0.1	<1	1.5		
QA20A	-		28/3/07	<3	<0.1		0.8	<0.5	<1	7.5	<0.05	<0.5	1.4		
QA22	-		29/3/07	<4	<1		23	11	14	1100	<0.1	5.4	29		
QA22A	-		29/3/07	4	0.2		48	11	15	1400	0.05	7.2	37		

Notes

above HIL (D) /TC

not analysed

Investigation Criteria

(1) Phytotoxicity Based Investigation Levels (Column 5, DEC 2006)
(2) Residential with gardens and accessible soil (Column 1, DEC 2006)
(3) Residential with minimal access to soil including high-rise apartments and flats (Column 2, DEC 2006)
(4) Parks, recreational open space, playing fields including secondary schools (Column 3, DEC 2006)
(5) Commercial or Industrial (Column 4, DEC 2006)
(6) Threshold concentrations for sensitive land use - soils (Table 3. NSW EPA 1994)

Table C Soil TPH and BTEX Results
Environmental Site Assessment (JBS Environmental and PB Samples)
Lee 4, Cottage Creek Development

all units in mg/kg

				BTEX				Total Petroleum Hydrocarbon (TPH)				
				Benzene	Toluene	Ethyl-benzene	Xylenes	C6-C9	C10-C14	C15-C29	C30-C36	ΣC10-C36
			PQL	1	1	1	3	25	50	100	100	250
			Assessment criteria[3]	-	-	-	-	65	-	-	-	1000
Sample id	**Depth**	**Description**	**Date sampled**									
L4BH02	1.5m	Dredged material	12/04/2002	<0.2	<0.2	<0.2	<0.4	<2	<50	<100	<100	<250
L4TP05	0.4m	Slag/basalt fill	12/04/2002	<0.2	<0.2	<0.2	<0.4	<2	<50	<100	109	184
L4TP07	0.2m	Slag/basalt fill	12/04/2002	<0.2	<0.2	<0.2	<0.4	<2	<50	201	181	407
L4BH09	1m	Dredged material	12/04/2002	<0.2	<0.2	<0.2	<0.4	<2	<50	<100	<100	<250
L4BH12	0.1m	Slag/basalt fill	23/04/2007	<0.2	<0.2	<0.2	<0.4	**159**	<50	11800	8370	**20195**
L4BH17	0.1m	Slag/basalt fill	23/04/2007	<0.2	<0.2	<0.2	<0.4	<2	807	9190	3820	**13817**
SB1	1.0	Dredged material	29/3/07									
SB1	5.0	Natural clay	29/3/07									
SB2	0.1	Slag/basalt fill	28/3/07									
SB2	1.5	Dredged material	28/3/07									
SB3	0.5	Slag/basalt fill	28/3/07									
SB3	1.5	Dredged material	28/3/07									
SB4	1.5	Dredged material	28/3/07									
SB5	0.3	Slag/basalt fill	29/3/07									
SB6	0.1	Slag/basalt fill	22/03/07									
SB6	1.5	*Dredged material*	22/03/07									
SB7	0.1	Slag/basalt fill	23/03/07									
SB7	0.3	Slag/basalt fill	23/03/07	<1	<1	<1	<3	<25	<50	120	<100	120
SB7	1.0	Dredged material	23/03/07	<1	<1	<1	<3	<25	<50	<100	<100	<250
SB8	1.0	Dredged material	23/03/07	<1	<1	<1	<3	<25	<50	<100	<100	<250
SB9	0.1	Slag/basalt fill	28/3/07	<1	<1	<1	<3	<25	<50	<100	<100	<250
SB9	1.5	Dredged material	28/3/07	<1	<1	<1	<3	<25	<50	<100	<100	<250
SB10	0.1	Slag/basalt fill	28/3/07	<1	<1	<1	<3	<25	68	740	460	**1268**
SB10	1.5	Dredged material	28/3/07	<1	<1	<1	<3	<25	<50	<100	<100	<250
SB11	1.5	Dredged material	28/3/07	<1	<1	<1	<3	<25	<50	<100	<100	<250
SB12	0.1	Slag/basalt fill	22/03/07	<1	<1	<1	<3	<25	<50	<100	<100	<250
SB12	1.0	Dredged material	22/03/07	<1	<1	<1	<3	<25	<50	<100	<100	<250
SB13	0.2	Slag/basalt fill	22/03/07	<1	<1	<1	<3	<25	<50	150	<100	150
SB13	1.0	Dredged material	22/03/07	<1	<1	<1	<3	<25	<50	<100	<100	<250
SB14	0.1	Slag/basalt fill	22/03/07	<1	<1	<1	<3	<25	<100	4900	2200	**7100**
SB14	1.0	Dredged material	22/03/07	<1	<1	<1	<3	<25	<50	<100	<100	<250
SB15	0.1	Slag/basalt fill	22/03/07	<1	<1	<1	<3	<25	620	5800	2700	**9120**
MW07/1	0.1		22/03/07	<1	<1	<1	<3	<25	<50	160	150	310
MW07/2	0.1		21/03/07	<1	<1	<1	<3	<25	<100	1600	1200	**2800**
MW07/2	0.5		21/03/07						96	4400	2700	**7196**
QA8	-		22/03/07	<1	<1	<1	<3	<25	<50	<100	<100	<250
QA8A	-		22/03/07	<0.5	<0.5	<0.5	<1.5	<20	<20	<50	230	230

Table C Soil TPH and BTEX Results
Environmental Site Assessment (JBS Environmental and PB Samples)
Lee 4, Cottage Creek Development

all units in mg/kg

				BTEX				Total Petroleum Hydrocarbon (TPH)				
				Benzene	**Toluene**	**Ethyl-benzene**	**Xylenes**	**C6-C9**	**C10-C14**	**C15-C29**	**C30-C36**	**ΣC10-C36**
			PQL	**1**	**1**	**1**	**3**	25	50	100	100	250
			Assessment criteria[3]	**-**	**-**	**-**	**-**	65	-	-	-	1000
QA20	-		28/3/07	<1	<1	<1	<3	<25	<50	<100	<100	<250
QA20A	-		28/3/07	<0.5	<0.5	<0.5	<1.5	<20	<20	<50	<50	<120
QA22	-		29/3/07									
QA22A	-		29/3/07									
Trip Blank	-		19/03/07	<1	<1	<1	<3					
Trip Spike	-		19/03/07	84%	103%	118%	118%					
Trip Blank	-		26/03/07	<1	<1	<1	<3					
Trip Spike	-		26/03/07	92%	102%	101%	103%					

Notes

above HIL (D) /TC

not analysed

Investigation Criteria

(1) Phytotoxicity Based Investigation Levels (Column 5, DEC 2006)
(2) Residential with gardens and accessible soil (Column 1, DEC 2006)
(3) Residential with minimal access to soil including high-rise apartments and flats (Column 2, DEC 2006)
(4) Parks, recreational open space, playing fields including secondary schools (Column 3, DEC 2006)
(5) Commercial or Industrial (Column 4, DEC 2006)
(6) Threshold concentrations for sensitive land use - soils (Table 3. NSW EPA 1994)

Table D Soil Polynuclear Aromatic Hydrocarbons Results
Environmental Site Assessment (JBS Environmental and PB Samples)
Lee 4, Cottage Creek Development

all units in mg/kg

				Polynuclear Aromatic Hydrocarbons															
				Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a) anthracene	Chrysene	Benzo(b,k) fluoranthene	Benzo(a) pyrene	Indeno(1,2,3-c,d) pyrene	Dibenzo(a,h) anthracene	Benzo(g,h,i) perylene
PQL					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.05	0.1	0.1	0.1
Assessment criteria[3]				80	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
Sample id	**Depth**	**Description**	**Date sampled**																
L4/TP1/1M	1m	Dredged material	12/04/2002	13.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.7	3.9	1.9	1.1	2.1	1.1	<0.5	<0.5	<0.5
L4BH2/1.5M	1.5m	Dredged material	12/04/2002	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.6	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5
L4/TP3/0.2M	0.2m	Slag/basalt fill	12/04/2002	25.7	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	5.4	5.4	2.8	1.8	4.1	2.2	1.3	<0.5	1.4
L4/TP4/0.3M	0.3m	Slag/basalt fill	12/04/2002	**232.9**	<0.5	2.3	2.2	1.9	42	10.2	39.1	39.8	16.3	13.5	26.8	**14.7**	10.1	2.9	11.1
L4/TP5/0.4M	0.4m	Slag/basalt fill	12/04/2002	52.8	<0.5	<0.5	<0.5	<0.5	2	0.8	9.6	10.8	4.9	3.7	8.7	**4.9**	3.1	0.8	3.5
L4/TP6/0.1M	0.1m	Slag/basalt fill	12/04/2002	21.8	<0.5	<0.5	<0.5	<0.5	1	<0.5	4.3	5	1.8	1.5	3.5	1.9	1.3	<0.5	1.5
L4/TP7/0.2M	0.2m	Slag/basalt fill	12/04/2002	30.3	<0.5	0.7	<0.5	<0.5	2.6	0.9	5.5	5.9	2	1.8	4.2	2.2	2	<0.5	2.5
L4/BH8/0.4M	0.4m	Slag/basalt fill	23/04/2002	46.7	<0.5	0.5	<0.5	<0.5	3.2	0.9	8.1	8.5	4.1	3.5	7.1	**4.2**	2.6	0.7	3.3
L4BH9/1M	1m	Dredged material	12/04/2002		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5
L4BH9/2M	2m	Dredged material	12/04/2002	3.4	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	1.2	1.2	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5
L4/BH11/1M	1m	Dredged material	12/04/2002	27	<0.5	0.5	<0.5	<0.5	1.3	<0.5	5.9	5.4	3	2.2	4	2.3	1.1	<0.5	1.3
L4/BH12/0.1M	0.1m	Slag/basalt fill	23/04/2002	**6696**	120	89.6	29.2	42.9	998	192	1290	1330	384	367	696	**414**	290	62.3	391
L4/BH15/1M	1m	Dredged material	23/04/2002	2.1	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	0.7	0.7	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5
L4/BH16/1M	1m	Dredged material	23/04/2002	82	1.8	1.5	0.7	1	16.7	2.9	17.4	16.6	4.3	4.5	6.4	3.6	2.1	<0.5	2.5
L4/BH17/0.1M	0.1m	Slag/basalt fill	23/04/2002	**5974.6**	333	65.7	56.5	116	1160	236	1000	1040	299	281	503	**351**	205	44.4	284
SB1	1.0	Dredged material	29/3/07	0.8	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.2	0.2	<0.1	0.1	<0.2	0.1	<0.1	<0.1	<0.1
SB1	5.0	Natural clay	29/3/07	5.3	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	1.1	1.2	0.6	0.5	0.8	0.5	0.3	<0.1	0.2
SB2	0.1	Slag/basalt fill	28/3/07	9.4	0.3	<0.1	<0.1	<0.1	0.8	0.1	1.6	1.6	0.7	0.8	1.4	1	0.6	<0.1	0.5
SB2	1.5	Dredged material	28/3/07	3.9	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	0.8	0.7	0.3	0.3	0.6	0.4	0.3	<0.1	0.2
SB3	0.5	Slag/basalt fill	28/3/07	**173.4**	0.1	0.2	2.1	1.2	20	5	36	31	13	12	21	**14**	9.2	0.8	7.8
SB3	1.5	Dredged material	28/3/07	31.8	0.1	0.3	0.2	0.2	1.7	0.7	7.1	6.1	3	2.6	4.4	2.7	1.4	0.2	1.1
SB4	1.5	Dredged material	28/3/07	0.25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.2	0.05	<0.1	<0.1	<0.1
SB5	0.3	Slag/basalt fill	29/3/07	**403.8**	7.1	2.6	4.3	3.7	69	14	75	69	25	24	42	**30**	19	2.1	17
SB6	0.1	Slag/basalt fill	22/03/07	**1118.8**	0.8	1.4	18	9.9	120	40	260	210	83	75	130	**83**	46	5.7	36
SB6	1.5	*Dredged material*	22/03/07	**1012.3**	2.9	8.9	7.9	7.5	92	23	240	200	79	71	120	**78**	42	6.1	34
SB7	0.1	Slag/basalt fill	23/03/07																
SB7	0.3	Slag/basalt fill	23/03/07	**94.4**	2.1	0.6	1.3	1	6.7	2.2	21	18	7.3	6.9	12	**7.3**	4.2	0.7	3.1
SB7	1.0	Dredged material	23/03/07	0.9	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.3	0.2	0.1	0.1	<0.2	0.1	<0.1	<0.1	<0.1
SB8	1.0	Dredged material	23/03/07	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
SB9	0.1	Slag/basalt fill	28/3/07	16.1	<0.1	0.2	<0.1	<0.1	0.6	0.2	3.5	3.1	1.5	1.2	2.4	1.6	0.9	0.1	0.8
SB9	1.5	Dredged material	28/3/07	0.47	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.2	0.07	<0.1	<0.1	<0.1
SB10	0.1	Slag/basalt fill	28/3/07	**584.7**	60	9.6	8	16	70	18	88	83	30	29	61	**47**	32	3.1	30
SB10	1.5	Dredged material	28/3/07	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.2	0.1	<0.1	<0.2	0.1	<0.1	<0.1	<0.1
SB11	1.5	Dredged material	28/3/07	1.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.3	0.3	0.1	0.1	<0.2	0.1	<0.1	<0.1	<0.1
SB12	0.1	Slag/basalt fill	22/03/07	7.3	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	1.4	1.4	0.6	0.7	1.3	0.8	0.4	<0.1	0.4
SB12	1.0	Dredged material	22/03/07	2.0	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.4	0.4	0.2	0.2	0.3	0.2	0.1	<0.1	0.1
SB13	0.2	Slag/basalt fill	22/03/07	29.3	0.1	0.4	<0.1	<0.1	1.6	0.3	6.3	6.2	1.8	2	4.1	2.8	1.8	0.2	1.7
SB13	1.0	Dredged material	22/03/07	8.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	1.8	1.7	0.5	0.6	1.2	0.8	0.5	<0.1	0.5
SB14	0.1	Slag/basalt fill	22/03/07	**6052.0**	480	23	48	140	1400	210	1200	1100	230	220	370	**280**	180	21	150
SB14	1.0	Dredged material	22/03/07	40.1	1.2	0.2	0.3	0.4	8	1.2	8.7	7.8	1.9	2	3.4	2.2	1.4	0.2	1.2
SB15	0.1	Slag/basalt fill	22/03/07	**7377.0**	730	25	46	86	1700	200	1500	1300	290	280	480	**310**	210	30	190
MW07/1	0.1	Slag/basalt fill	22/03/07	**160.9**	0.1	0.3	1.2	0.5	9.9	3.1	35	31	12	12	23	**15**	9	1.2	7.6
MW07/2	0.1	Slag/basalt fill	21/03/07	**1009.3**	66	5	5	3.7	260	26	200	170	37	43	70	**47**	36	4.6	36
MW07/2	0.5	Slag/basalt fill	21/03/07																
QA8	-		22/03/07	11.2	<0.1	0.1	<0.1	<0.1	0.6	0.1	2.4	2.4	0.7	0.8	1.6	1.1	0.7	<0.1	0.7

Table D Soil Polynuclear Aromatic Hydrocarbons Results
Environmental Site Assessment (JBS Environmental and PB Samples)
Lee 4, Cottage Creek Development

all units in mg/kg

				Polynuclear Aromatic Hydrocarbons															
				Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a) anthracene	Chrysene	Benzo(b,k) fluoranthene	Benzo(a) pyrene	Indeno(1,2,3-c,d) pyrene	Dibenzo(a,h) anthracene	Benzo(g,h,i) perylene
PQL					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.05	0.1	0.1	0.1
QA8A	-		22/03/07	8.3	<0.1	<0.1	<0.1	<0.1	0.5	0.1	1.7	1.7	0.5	0.5	1.1	0.79	0.6	<0.1	0.8
QA20	-		28/3/07	1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.3	0.3	0.1	0.1	<0.2	0.1	<0.1	<0.1	<0.1
QA20A	-		28/3/07	4.98	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	1.2	1.2	0.3	0.3	0.6	0.38	0.3	<0.1	0.3
QA22	-		29/3/07	6.3	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	1.3	1.5	0.7	0.6	0.9	0.6	0.3	<0.1	0.2
QA22A	-		29/3/07	8.73	<0.1	0.1	<0.1	<0.1	0.4	0.2	1.8	2	0.9	0.7	1.1	0.83	0.3	<0.1	0.4

Notes

above HIL (D) /TC

not analysed

Investigation Criteria

(1) Phytotoxicity Based Investigation Levels (Column 5, DEC 2006)
(2) Residential with gardens and accessible soil (Column 1, DEC 2006)
(3) Residential with minimal access to soil including high-rise apartments and flats (Column 2, DEC 2006)
(4) Parks, recreational open space, playing fields including secondary schools (Column 3, DEC 2006)
(5) Commercial or Industrial (Column 4, DEC 2006)
(6) Threshold concentrations for sensitive land use - soils (Table 3. NSW EPA 1994)

Table E Soil OCs, OPs and PCBs
Environmental Site Assessment (JBS Environmental and PB Samples)
Lee 4, Cottage Creek Development

all units in mg/kg

			Organochlorine pesticides				Organophosphate pesticides				Polychlorinated biphenyls						
			Aldrin+Dieldrin	Chlrodane	Heptachlor	DDT+DDD+DDE	Chlorpyriphos	Fenitrothion	Bromophos-ethyl	Ethion	Arochlor 1016	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	Total Positive PCBs
		PQL	0.2	0.2	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.6
		Assessment criteria[5]	50	250	50	1000	-	-	-	-	-	-	-	-	-	-	50
Sample id	**Depth**	**Date sampled**															
L4BH2/1.5M	1.5m	12/04/2002	<0.1	<0.05	<0.05	<0.15	-	-	-	-	-	-	-	-	-	-	<0.1
L4/TP4/0.3M	0.3m	12/04/2002	<0.1	<0.05	<0.05	<0.15	-	-	-	-	-	-	-	-	-	-	<0.1
SB1	1.0	29/3/07															
SB1	5.0	29/3/07															
SB2	0.1	28/3/07															
SB2	1.5	28/3/07															
SB3	0.5	28/3/07															
SB3	1.5	28/3/07															
SB4	1.5	28/3/07															
SB5	0.3	29/3/07															
SB6	0.1	22/03/07	<0.2	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0
SB6	1.5	22/03/07															
SB7	0.1	23/03/07															
SB7	0.3	23/03/07															
SB7	1.0	23/03/07															
SB8	1.0	23/03/07															
SB9	0.1	28/3/07	<0.2	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0
SB9	1.5	28/3/07															
SB10	0.1	28/3/07															
SB10	1.5	28/3/07															
SB11	1.5	28/3/07															
SB12	0.1	22/03/07															
SB12	1.0	22/03/07															
SB13	0.2	22/03/07															
SB13	1.0	22/03/07															
SB14	0.1	22/03/07															
SB14	1.0	22/03/07															
SB15	0.1	22/03/07															
MW07/1	0.1	22/03/07															
MW07/2	0.1	21/03/07															
MW07/2	0.5	21/03/07															
QA8	-	22/03/07															
QA20	-	28/3/07															
QA20A	-	28/3/07															
QA22	-	29/3/07															
QA22A	-	29/3/07															

Notes

bold above HIL (E) /TC

not analysed

Investigation Criteria

(1) Phytotoxicity Based Investigation Levels (Column 5, DEC 2006)
(2) Residential with gardens and accessible soil (Column 1, DEC 2006)
(3) Residential with minimal access to soil including high-rise apartments and flats (Column 2, DEC 2006)
(4) Parks, recreational open space, playing fields including secondary schools (Column 3, DEC 2006)
(5) Commercial or Industrial (Column 4, DEC 2006)
(6) Threshold concentrations for sensitive land use - soils (Table 3. NSW EPA 1994)

Table F Soil TCLP and SPLP Results
Environmental Site Assessment
Lee 4, Cottage Creek Development

all units in mg/L

				Polynuclear Aromatic Hydrocarbons																Heavy Metals								
				Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Arsenic	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Zinc
			PQL	0.016	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.05	0.01	0.01	0.01	0.03	0.04	0.005	0.02	0.02
Sample id	**Depth**	**Description**	**Date sampled**																									
TCLP																												
SB1	1.0	Dredged material	29/3/07	0.002	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001									
SB1	5.0	Natural clay	29/3/07	<0.016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.05	<0.01	0.02	0.03	0.15	4.7	<0.0005	0.05	0.43
SB2	0.1	Slag/basalt fill	28/3/07																									
SB2	1.5	Dredged material	28/3/07																									
SB3	0.5	Slag/basalt fill	28/3/07																									
SB3	1.5	Dredged material	28/3/07																									
SB4	1.5	Dredged material	28/3/07	<0.016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.05	<0.01	<0.01	<0.01	0.07	0.14	<0.0005	<0.02	1.1
SB5	0.3	Slag/basalt fill	29/3/07																									
SB6	0.1	Slag/basalt fill	22/03/07																									
SB6	1.5	*Dredged material*	22/03/07																									
SB7	0.1	Slag/basalt fill	23/03/07																									
SB7	0.3	Slag/basalt fill	23/03/07																									
SB7	1.0	Dredged material	23/03/07																									
SB8	1.0	Dredged material	23/03/07																									
SB9	0.1	Slag/basalt fill	28/3/07																									
SB9	1.5	Dredged material	28/3/07																									
SB10	0.1	Slag/basalt fill	28/3/07																									
SB10	1.5	Dredged material	28/3/07	0.004	0.002	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.03	0.14	<0.0005	<0.02	0.17
SB11	1.5	Dredged material	28/3/07	<0.016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.05	<0.01	<0.01	0.04	0.05	0.08	<0.0005	<0.02	0.1
SB12	0.1	Slag/basalt fill	22/03/07	<0.016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.03	68	<0.0005	<0.02	0.13
SB12	1.0	Dredged material	22/03/07																									
SB13	0.2	Slag/basalt fill	22/03/07																									
SB13	1.0	Dredged material	22/03/07																									
SB14	0.1	Slag/basalt fill	22/03/07	1.150	0.95	<0.001	0.013	0.02	0.12	0.003	0.024	0.018	0.001	0.001	<0.002	<0.001	<0.001	<0.001	<0.001									
SB14	1.0	Dredged material	22/03/07																									
SB15	0.1	Slag/basalt fill	22/03/07																									
MW07/1	0.1	Slag/basalt fill	22/03/07																									
MW07/2	0.1	Slag/basalt fill	21/03/07																									
MW07/2	0.5	Slag/basalt fill	21/03/07																									
SPLP																												
SB1	1.0	Dredged material	29/3/07	<0.016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001									
SB1	5.0	Natural clay	29/3/07	<0.016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.03	<0.01	<0.0005	<0.02	<0.02
SB2	0.1	Slag/basalt fill	28/3/07																									
SB2	1.5	Dredged material	28/3/07																									
SB3	0.5	Slag/basalt fill	28/3/07																									
SB3	1.5	Dredged material	28/3/07																									
SB4	1.5	Dredged material	28/3/07	<0.016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.03	0.13	<0.0005	<0.02	0.22
SB5	0.3	Slag/basalt fill	29/3/07																									
SB6	0.1	Slag/basalt fill	22/03/07																									
SB6	1.5	*Dredged material*	22/03/07																									
SB7	0.1	Slag/basalt fill	23/03/07																									
SB7	0.3	Slag/basalt fill	23/03/07																									
SB7	1.0	Dredged material	23/03/07																									
SB8	1.0	Dredged material	23/03/07																									
SB9	0.1	Slag/basalt fill	28/3/07																									
SB9	1.5	Dredged material	28/3/07																									
SB10	0.1	Slag/basalt fill	28/3/07																									
SB10	1.5	Dredged material	28/3/07	<0.016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.03	<0.01	<0.0005	<0.02	<0.02
SB11	1.5	Dredged material	28/3/07	<0.016	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.03	<0.01	<0.0005	<0.02	<0.02

Table F Soil TCLP and SPLP Results
Environmental Site Assessment
Lee 4, Cottage Creek Development

all units in mg/L

				Polynuclear Aromatic Hydrocarbons																Heavy Metals								
				Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Arsenic	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Zinc
		PQL		0.016	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.05	0.01	0.01	0.01	0.03	0.04	0.005	0.02	0.02
SB12	0.1	Slag/basalt fill	22/03/07	<0.016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.03	0.23	<0.0005	<0.02	<0.02
SB12	1.0	Dredged material	22/03/07																									
SB13	0.2	Slag/basalt fill	22/03/07																									
SB13	1.0	Dredged material	22/03/07																									
SB14	0.1	Slag/basalt fill	22/03/07	0.921	0.8	<0.001	0.01	0.013	0.073	0.003	0.013	0.009	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001									
SB14	1.0	Dredged material	22/03/07																									
SB15	0.1	Slag/basalt fill	22/03/07																									
MW07/1	0.1	Slag/basalt fill	22/03/07																									
MW07/2	0.1	Slag/basalt fill	21/03/07																									
MW07/2	0.5	Slag/basalt fill	21/03/07																									

Notes

not analysed

Table G Groundwater Gauging Results
Environmental Site Assessment (JBS Environmental and PB Samples)
Lee 4, Cottage Creek Development

Sample id	Date gauged	DTW	Comments	Physical Parameters				
		Depth to water (m)	Sheen or odour	Electrical Conductivity (uS/cm)	Redox Potential (mV)	Dissolved Oxygen (mg/l)	pH	Temperature (C)
L4MW2	22/04/02	2.07	-	2104	185	1.64	7.86	23.8
L4MW13	22/04/02	1.97	-	931	162	2.22	8.1	23.5
MW07/1	30/03/07	1.928	-	-	-	-	-	-
MW07/1	12/04/07	2.051	None	10870	-121	0.18	7.46	25.4
MW07/2	30/03/07	1.871	-	-	-	-	-	-
MW07/2	12/04/07	2.141	None	1742	-15	0.19	7.22	26.2
MWA	30/03/07	1.802	-	-	-	-	-	-
MWA	12/04/07	2.160	None	1445	-25	0.25	7.04	26.6
OldMW1	30/03/07	2.576	-	-	-	-	-	-
OldMW1	12/04/07	2.678	None	1382	-143	0.16	7.38	24.8
Old MW2	Destroyed							
L4MW13	Destroyed							

Table H Groundwater Heavy Metals Results
Environmental Site Assessment (JBS Environmental and PB Samples)
Lee 4, Cottage Creek Development

all units in μg/l

		Heavy Metals									
		As	**Cd**	**Co**	**Cr**	**Cu**	**Pb**	**Mn**	**Hg**	**Ni**	**Zn**
PQL		1	0.1	1	1	1	1	1	0.1	1	1
Adopted Assessment Criteria		4.5	0.7	1	10	1.3	4.4	80	0.1	7	15
Sample id	**Date sampled**										
L4/MW2	22/04/2002	**9**	<1	1	<1	**6**	**8**	**99**	<0.1	2	**23**
L4/MW13	22/04/2002	**11**	<1	<1	<1	**3**	<1	**113**	<0.1	2	**12**
OldMW1	12/04/07	<1	<0.1		<1	<1	<1	**110**	<0.1	1.6	7.9
MW07/1	12/04/07	4	<0.1		<5*	<5*	<1	**890**	<0.1	<5	9.2
MW07/2	12/04/07	1.9	0.4		<1	<1	<1	33	<0.1	1.3	7.3
MWA	12/04/07	1.6	<0.1		<1	<1	<1	21	<0.1	1.1	13
QC3	12/04/07	3.9	<0.1		<5*	<5*	<1	900	<0.1	<5	<5
QC3A	12/04/07	5	<0.1		<1	<1	1.8	750	<0.05	1.3	5.9
Trip Blank	10/04/07										
Trip Spike	10/04/07										
Lee 4 Rinsate	12/04/07	<1	<0.1		<1	<1	<1	<1	<0.1	<1	2.1

Notes

bold above adopted groundwater assessment criteria (see Section 6.3)

* PQLs raised due to ion interference attributed to saline water

Table I Groundwater TPH and BTEX Results
Environmental Site Assessment (JBS Environmental and PB Samples)
Lee 4, Cottage Creek Development

all units in μg/l

		BTEX					Total Petroleum Hydrocarbon (TPH)				
		Benzene	Toluene	Ethylbenzene	m&p-xylene	o-xylene	C6-C9	C10-C14	C15-C29	C30-C36	ΣC10-C36
PQL		1	1	1	2	1	10	50	100	100	250
Adopted Assessment Criteria		10	180	5	275	350	-	-	-	-	600
Sample id	**Date sampled**										
L4/MW2	22/04/2002	<1	<1	<1	<2	<2	<20	<50	<100	<50	<200
L4/MW13	22/04/2002	<1	<1	<1	<2	<2	<20	<50	<100	<50	<200
OldMW1	12/04/07	<1	<1	<1	<2	<1	<10	<50	370	<100	370
MW07/1	12/04/07	<1	<1	<1	<2	<1	<10	<50	<100	<100	<250
MW07/2	12/04/07	<1	<1	<1	<2	<1	<10	<50	<100	<100	<250
MWA	12/04/07	<1	<1	<1	<2	<1	<10	<50	<100	<100	<250
QC3	12/04/07	<1	<1	<1	<2	<1	<10	<50	<100	<100	<250
QC3A	12/04/07	<1	<1	<1	<3		<40	<100	<200	<200	<500
Trip Blank	10/04/07	<1	<1	<1	<2	<1					
Trip Spike	10/04/07	122%	110%	107%	105%	102%					
Lee 4 Rinsate	12/04/07	<1	<1	<1	<2	<1	<10	<50	<100	<100	<250

Notes

bold above adopted groundwater assessment criteria (see Section 6.3)

Table J Groundwater Polynuclear Aromatic Hydrocarbons Results
Environmental Site Assessment (JBS Environmental and PB Samples)
Lee 4, Cottage Creek Development

all units in μg/l

		Polynuclear Aromatic Hydrocarbons														
		Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a) anthracene	Chrysene	Benzo(b,k) fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d) pyrene	Dibenzo(a,h) anthracene	Benzo(g,h,i) perylene
PQL		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
Adopted Assessment Criteria		50	-	-	-	0.6	0.1	0.1	-	-	-	-	0.1	-	-	-
Sample id	**Date sampled**															
L4/MW2	22/04/2002	<2	3	6	<2	<2	<2	**3**	2	<2	<2	<2	<2	<2	<2	<2
L4/MW13	22/04/2002	<2	<2	<2	<2	**2**	<2	**3**	2	<2	<2	<2	<2	<2	<2	<2
OldMW1	12/04/07	<0.1	7.1	8.4	<0.1	0.5	**0.4**	**1.9**	13	8.7	0.4	0.3	<0.1	<0.1	<0.1	<0.1
MW07/1	12/04/07	0.1	<0.1	0.4	0.3	**1.1**	**0.1**	**1.1**	1.2	0.2	0.2	0.3	**0.2**	0.1	<0.1	0.1
MW07/2	12/04/07	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	**2.6**	1.6	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
MWA	12/04/07	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
QC3	12/04/07	0.1	<0.1	0.5	0.3	1.3	0.1	1.3	1.4	0.2	0.3	0.3	0.2	0.1	<0.1	0.2
QC3A	12/04/07	<0.1	<0.1	0.5	0.3	0.7	0.1	0.7	0.9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trip Blank	10/04/07															
Trip Spike	10/04/07															
Lee 4 Rinsate	12/04/07	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1

Notes

bold above adopted groundwater assessment crite

Table K Soil RPDs
Environmental Site Assessment
Lee 4, Cottage Creek Development

all units in mg/kg

				Heavy Metals									BTEX				TPH					Polynuclear Aromatic Hydrocarbons																
				As	Cd	Cr	Cu	Pb	Mn	Hg	Ni	Zn	Benzene	Toluene	Ethyl-benzene	Xylenes	C6-C9	C10-C14	C15-C29	C30-C36	ΣC10-C36	Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a) anthracene	Chrysene	Benzo(b,k) fluoranthene	Benzo(a) pyrene	Indeno(1,2,3-c,d) pyrene	Dibenzo(a,h) anthracene	Benzo(g,h,i) perylene
			PQL	4	1	1	1	1	4	0.1	1	1	**1**	**1**	**1**	**3**	25	50	100	100	250		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.05	0.1	0.1	0.1
Sample id	**Depth**	**Lab**	**Date sampled**																																			
L4SB1	5.0	Envirolab	29/3/07	<4	<1	17	12	10	350	<0.1	4	19										5.3	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	1.1	1.2	0.6	0.5	0.8	0.5	0.3	<0.1	0.2
QA22	-	Envirolab	29/3/07	<4	<1	23	11	14	1100	<0.1	5.4	29										6.3	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	1.3	1.5	0.7	0.6	0.9	0.6	0.3	<0.1	0.2
			RPD %	NA	NA	30%	9%	33%	**103%**	NA	30%	**42%**										17%	NA	NA	NA	NA	**67%**	NA	8%	22%	15%	18%	12%	18%	0%	NA	0%
QA22A	-	SGS	29/3/07	4	0.2	48	11	15	1400	0.05	7.2	37										8.73	<0.1	0.1	<0.1	<0.1	0.4	0.2	1.8	2	0.9	0.7	1.1	0.83	0.3	<0.1	0.4
			RPD %	NA	NA	**95%**	9%	40%	**120%**	NA	**57%**	**64%**										49%	NA	NA	NA	NA	**120%**	NA	48%	50%	40%	33%	32%	50%	0%	NA	**67%**
L4SB9	1.5	Envirolab	28/3/07	<4	<1	<1	<1	<1	15	<0.1	<1	1.6	<1	<1	<1	<3	<25	<50	<100	<100	<250	0.47	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.2	0.07	<0.1	<0.1	<0.1
QA20	-	Envirolab	28/3/07	<4	<1	<1	<1	<1	10	<0.1	<1	1.5	<1	<1	<1	<3	<25	<50	<100	<100	<250	1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.3	0.3	0.1	0.1	<0.2	0.1	<0.1	<0.1	<0.1
			RPD %	NA	NA	NA	NA	NA	40%	NA	NA	6%	NA	NA	NA	NA	NA	NA	NA	NA	NA	**72%**	NA	NA	NA	NA	NA	NA	40%	40%	NA	NA	NA	35%	NA	NA	NA
QA20A	-	SGS	28/3/07	<3	<0.1	0.8	<0.5	<1	7.5	<0.05	<0.5	1.4	<0.5	<0.5	<0.5	<1.5	<20	<20	<50	<50	<120	4.98	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	1.2	1.2	0.3	0.3	0.6	0.38	0.3	<0.1	0.3
			RPD %	NA	NA	NA	NA	NA	**67%**	NA	NA	13%	NA	NA	NA	NA	NA	NA	NA	NA	NA	**166%**	NA	NA	NA	NA	NA	NA	**143%**	**143%**	NA	NA	NA	**138%**	NA	NA	NA
L4SB13	1.0	Envirolab	22/03/07										<1	<1	<1	<3	<25	<50	<100	<100	<250	8.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	1.8	1.7	0.5	0.6	1.2	0.8	0.5	<0.1	0.5
QA8	-	Envirolab	22/03/07										<1	<1	<1	<3	<25	<50	<100	<100	<250	11.2	<0.1	0.1	<0.1	<0.1	0.6	0.1	2.4	2.4	0.7	0.8	1.6	1.1	0.7	<0.1	0.7
			RPD %										NA	NA	NA	NA	NA	NA	NA	NA	NA	30%	NA	NA	NA	NA	18%	NA	29%	45%	33%	29%	29%	32%	33%	NA	33%
QA8A	-	SGS	22/03/07										<0.5	<0.5	<0.5	<1.5	<20	<20	<50	230	230	8.3	<0.1	<0.1	<0.1	<0.1	0.5	0.1	1.7	1.7	0.5	0.5	1.1	0.79	0.6	<0.1	0.8
			RPD %										NA	NA	NA	NA	NA	NA	NA	NA	NA	2%	NA	NA	NA	NA	0%	NA	6%	0%	0%	18%	9%	1%	18%	NA	46%

Notes

bold Above 30-50%

not analysed

Table L Groundwater RPDs
Environmental Site Assessment
Lee 4, Cottage Creek Development

all units in µg/l

			Heavy Metals									BTEX					TPH					Polynuclear Aromatic Hydrocarbons														
			As	Cd	Cr	Cu	Pb	Mn	Hg	Ni	Zn	Benzene	Toluene	Ethylbenzene	m&p-xylene	o-xylene	C6-C9	C10-C14	C15-C29	C30-C36	ΣC10-C36	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a) anthracene	Chrysene	Benzo(b,k) fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d) pyrene	Dibenzo(a,h) anthracene	Benzo(g,h,i) perylene
		PQL	1	0.1	1	1	1	1	0.1	1	1	1	1	1	2	1	10	50	100	100	250	1	1	1	1	1	1	1	1	1	2	1	1	1	1
Sample id	**Lab**	**Date sampled**																																		
L4MW07/1	Envirolab	12/04/07	4	<0.1	<5*	<5*	<1	890	<0.1	<5	9.2	<1	<1	<1	<2	<1	<10	<50	<100	<100	<250	0.1	<0.1	0.4	0.3	1.1	0.1	1.1	1.2	0.2	0.2	0.3	0.2	0.1	<0.1	0.1
QC3	Envirolab	12/04/07	3.9	<0.1	<5*	<5*	<1	900	<0.1	<5	<5	<1	<1	<1	<2	<1	<10	<50	<100	<100	<250	0.1	<0.1	0.5	0.3	1.3	0.1	1.3	1.4	0.2	0.3	0.3	0.2	0.1	<0.1	0.2
		RPD	1%	NA	NA	NA	NA	1%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0%	NA	22%	0%	17%	0%	17%	15%	0%	40%	0%	0%	0%	NA	**67%**
QC3A	SGS	12/04/07	5	<0.1	<1	<1	1.8	750	<0.05	1.3	5.9	<1	<1	<1	<3		<40	<100	<200	<200	<500	<0.1	<0.1	0.5	0.3	0.7	0.1	0.7	0.9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
		RPD	22%	NA	NA	NA	NA	17%	NA	42%	44%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	22%	0%	44%	0%	44%	29%	NA	NA	NA	NA	NA	NA	NA

Notes

bold	Above 30-50%
	not analysed

* PQLs raised due to ion interference attributed to saline water

Appendix B – Borelogs

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Borehole Log

Borehole No: **L4MW07/1A**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 0.2m Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 22/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4MW07/1A-0.1			Bitumen Fill - gravelly sand, brown, heterogenous, damp, very loose, fine gravels of slag. Refusal at 0.25m on slag boulders. Relocated three times each with refusal. Abandoned hole.	4.2ppmv	

1
2
3
4
5

Notes:

GW Encountered: NA Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB1**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 5 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 23/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB1/0.1			Bitumen	110ppmv	
	D	L4SB1/0.3			Fill - Gravelly clayey sand, brown, heterogenous, damp, moderately loose, coarse to fine gravels of slag, poorly sorted, fine to medium grained sand. No odour noted.	80.2ppmv	
	D	L4SB1/0.5				30.3ppmv	
						interface at 0.70m	
	D	L4SB1/1	1		Fill - grey to brown, gravelly fine grained sands, light grey, heterogenous, dry, very soft, non plastic, ash, fine gravels of slag	22.5ppmv	
						interface at 1.10m	
	D	L4SB1/1.5			Fill: gravelly sand, grey to brown, heterogenous, damp, moderately loose, poorly sorted, coarse to fine gravels of slag, shell fragments, little clay and silt	6.2ppmv	
	D	L4SB1/2	2			Water at 1.9m 18.4ppmv	
					Fill as above - wet, increased clay content		
	D	L4SB1/2.5			Fill as above - saturated, increase in gravel size, organic matter and wood fragments	19.8ppmv	
	D	L4SB1/3	3			10.4ppmv	
	D	L4SB1/3.5			Fill as above - increase in shell fragments	11.4ppmv	
	D	L4SB1/4.0	4			6.2ppmv	
					Clayey sand - brown, homogenous, saturated moderately dense, well sorted, fine to medium grained sands, organic material	interface at 4.20m	
	D	L4SB1/4.5				4.2ppmv	
	D	L4SB1/5.0	5		End of hole at 5.0m	3.1ppmv	

Notes:

GW Encountered: 1.9 Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB2**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 5 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 23/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB2/0.1			Bitumen Fill - Gravelly clayey sand, brown, heterogenous, damp, moderately loose, fine gravels of slag, poorly sorted, little silt and clay	3.9ppmv	
	D	L4SB2/0.3				3.4ppmv	
	D	L4SB2/0.5				2.7ppmv	
						interface at 0.70m	
	D	L4SB2/1	1		Fill - grey to brown, gravelly fine grained sands, light grey, heterogenous, dry, very soft, non plastic, shell fragments, fine gravels of slag	2.1ppmv	
	D	L4SB2/1.5				11.1ppmv	
	D	L4SB2/2	2			8.8ppmv	
					Fill as above - moist, decrease in slag		
	D	L4SB2/2.5			Fill as above - large slag gravels and boulders present	4.2ppmv	
						Water at 2.8m	
	D	L4SB2/3	3		Fill as above, wet, increased clay, little slag	3.0ppmv	
					Fill as above - increase in clay, saturated		
	D	L4SB2/3.5				6.0ppmv	
			4		Clayey sand - brown, homogenous, saturated moderately dense, well sorted, fine to medium grained sands, organic material	interface at 4.2m	
	D	L4SB2/4.5				4.0ppmv	
	D	L4SB2/5.0	5		End of hole at 5.0m	3.7ppmv	

Notes:

GW Encountered: 2.8m Meters

GW Static Level: Meters

GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon

G - Grab

HA - Hand Auger

D - Disturbed Sample

Borehole Log

Borehole No: **L4SB3**

Client: HDC Project: Cottage Creek Remediation Project No.: 40184 Location: Lee 4	Drilled By: Port Stephens Drilling Logged By: Mike Parker Datum: Date: 23/3/07	Diameter: 20cm Total Depth: 4.5m Meters Drilling Method: Solids & hollows Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB3/0.1			Bitumen	3.1ppmv	
	D	L4SB3/0.3			Fill - Cobbles of slag and ballast	-	
	D	L4SB3/0.5				4.8ppmv	
					Fill - Gravelly, clayey sand, brown, heterogenous, damp, loose, fine to coarse gravels of slag, poorly sorted, fine to medium grained sand, little silt and clay	interface at 0.5m	
	D	L4SB3/1	1			5.1ppmv	
	D	L4SB3/1.5				2.5ppmv	
					Fill as above - moist, finer gravels of slag, shell fragments, crushed sandstone		
	D	L4SB3/2	2			1.2ppmv	
					Fill - Gravelly, clayey sands, grey, wet, heterogenous, moderately loose, poorly sorted, shell fragments, poorly sorted	Water at 1.9m interface at 2.0m Water at 2.1m	
	D	L4SB3/2.5				1.4ppmv	
					Fill as above - saturated, increased plasticity, increased shell concentration, some fine sandstone and river gravels		
	D	L4SB3/3	3			1.9ppmv	
					Sandy Clay - dark brown, homogenous, saturated, very soft, low plasticity, fine to medium grained sands		
	D	L4SB3/3.5				1.9ppmv	
	D	L4SB3/4	4			1.3ppmv	
	D	L4SB3/4.5				2.0ppmv	
					End of hole at 4.5m		
			5				

Notes:

GW Encountered: 2.1m Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB4**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 4.5m Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 23/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB4/0.1			Bitumen	3.3ppmv	
	D	L4SB4/0.3			Fill - Ballast and slag boulders and cobbles, some clayey sand, brown, heterogenous, damp, loose, fine to medium grained sand, poorly sorted	-	
	D	L4SB4/0.5				-	
						interface at 0.6m	
	D	L4SB4/1	1		Fill - sand, yellow to grey, homogenous, damp, loose, fine gravels of seashells, fine to medium grained sands, well sorted	0.5ppmv	
	SP	L4SB4/1.5			Fill as above - grey, moist, increased clay	1.2ppmv	
					Fill as above - saturated, ironstone gravels	Water at 1.7m	
	SP	L4SB4/2	2			0.8ppmv	
	SP	L4SB4/2.5			Clayey Sand - black, homogenous, saturated, soft, low plasticity, fine to medium grained sands, moderately loose, well sorted, organic material including wood fragments and seashells, shale and ironstone gravels present	0.8ppmv	
	SP	L4SB4/3	3			1.9ppmv	
			4				
			5				

Notes:

GW Encountered: 2.1m Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB5**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 3.0 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 23/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB5/0.1			Bitumen	8.6ppmv	
	D	L4SB5/0.3			Fill - Gravelly, clayey sand, brown, heterogenous, moderately loose, poorly sorted, fine to coarse gravels of slag, fine to medium grained sand, little silt and clay.	6.3ppmv	
	D	L4SB5/0.5				5.8ppmv	
						interface at 0.5m	
	D	L4SB5/1	1		Fill - Sand, yellow, alluvial, homogenous, dry loose, well sorted, fine to medium grained sand, shell fragments	1.7ppmv	
	SP	L4SB5/1.5			Fill as above - increase in shell fragments	5.9ppmv	
	SP	L4SB5/2	2		Fill as above - wet	Water at 1.9m 5.6ppmv	
					Fill as above - saturated		
	SP	L4SB5/2.5				5.6ppmv	
	SP	L4SB5/3	3		Fill as above - increase in size of shell fragments	5.6ppmv	
					End of hole at 3.0m		
			4				
			5				

Notes:

GW Encountered: 1.9 Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB6/ L4MW07/1**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 4 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 22/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB6-0.1			Bitumen	2.6ppmv	
	D	L4SB6-0.3			Fill - gravelly clayey sand, dark brown/black, heterogenous, damp, loose, fine gravels of slag, concrete, medium grained sand	interface at 0.20m 3.1ppmv	
	D	L4SB6-0.5				2.5ppmv	
	D	L4SB6-1	1		Fill - slag gravels and boulders	interface at 0.90m 5.3ppmv	
	SP	L4SB6-1.5			Fill - gravelly, clayey sand, heterogenous, damp, non-plastic, loose, poorly sorted, fine to course gravels of slag	7.1ppmv	
	SP	L4SB6-2	2		Fill - white to yellow sands, heterogenous, damp, very loose, fine gravels of slag, poorly sorted	interface at 1.50m 7.2ppmv	
	SP	L4SB6-3	3		Fill - yellow to brown, homogenous, moist, loose, well sorted, alluvial, fine to medium grained sand with shell fragments	Water at 2.2m -	
	SP	L4SB6-4	4		Fill as above - increased moisture Fill as above - saturated Clay - brown/black clay with coal seams, moist, firm End of hole at 4.0m	interface at 4.0m	
			5				

Notes:

GW Encountered: 2.2m Meters

GW Static Level: Meters

GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB7**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 3 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 23/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB7/0.1			Bitumen	10.4ppmv	
	D	L4SB7/0.3			Fill - Gravelly clayey sand, black, heterogenous, damp, loose, fine gravels of slag, concrete, poorly sorted, medium grained	8.0ppmv	
	SP	L4SB7/0.5				interface at 0.40m 8.5ppmv	
	SP	L4SB7/1	1		Fill - yellow, homogenous, damp, alluvial, very loose, fine shell fragments	9.0ppmv	
	SP	L4SB7/1.5				9.1ppmv	
	SP	L4SB7/2	2		Fill as above - wet	8.7ppmv Water at 2.0m	
	SP	L4SB7/2.5			Fill as above - saturated, gravels including coal and shell fragments	6.6ppmv	
	SP	L4SB7/3	3		End of hole at 3.0m	4.1ppmv	
			4				
			5				

Notes:

GW Encountered: 2.0 Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB8**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 3 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 23/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB8/0.1			Bitumen	1.6ppmv	
	D	L4SB8/0.3			Fill - Slag and ballast cobbles, with minor clayey sand, brown, heterogenous, loose, damp, poorly sorted, little silt and clay	interface at 0.20m 2.2ppmv	
	D	L4SB8/0.5				4.1ppmv	
	SP	L4SB8/1	1		Fill - Sand, yellow, homogenous, damp, very loose, medium grained, fine shell fragments, alluvial	44ppmv	
	SP	L4SB8/1.5			Fill as above - increased moisture and sea shells	5.1ppmv	
	SP	L4SB8/2	2		Fill as above - saturated, some black organic mud	Water at 1.80m 6.7ppmv	
	SP	L4SB8/2.5				5.7ppmv	
	SP	L4SB8/3	3		Fill as above - increased black organic content End of hole at 3.0m	7.0ppmv	
			4				
			5				

Notes:

GW Encountered: 1.8 Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB9**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 3.0 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 28/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB9/0.1			Bitumen	3.1ppmv	
	D	L4SB9/0.3			Fill - slag and ballast cobbles with clayey sand, brown, heterogenous, loose, damp, poorly sorted, little silt and clay	-	
	D	L4SB9/0.5				-	
					Fill - Sand, yellow, homogenous, dry, very loose, fine to medium grained, well sorted, fine gravels of shell fragments	interface at 0.6m	
	D	L4SB9/1.0	1			0.9ppmv	
	SP	L4SB9/1.5			Fill as above - increased moisture, coal present	0.9ppmv	
						Water at 1.7m	
	SP	L4SB9/2.0	2		Fill as above - saturated	0.8ppmv	
	SP	L4SB9/2.5			Sandy Clay - olive to grey, homogenous, saturated, low plasticity, coal seams, sandstone fragments	0.7ppmv Interface at 2.5m	
	SP	L4SB9/3.0	3		Sandy clay as above - increased organic matter, wood, coal, river pebbles and sandstone fragments	1.7ppmv	
					End of hole at 3.0m		
			4				
			5				

Notes:

GW Encountered: 1.7 Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB10**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 3.0 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 28/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB10/0.1			Bitumen	3.6ppmv	
	D	L4SB10/0.3			Fill - Gravelly, clayey sand with slag and ballast boulders and cobbles, brown, heterogenous,	2.7ppmv	
	D	L4SB10/0.5			damp, poorly sortedm little clay and silt	1.7ppmv	
						interface at 0.60m	
	D	L4SB10/1.0	1		Fill - Sand, yellow, dry, alluvial, very loose, homogenous, well sorted, fine to medium grained sands, fine gravels of shell fragments	0.9ppmv	
	SP	L4SB10/1.5			Fill as above - increased moisture and shell framents	0.9ppmv	
					Sandy clay - grey, homogenous, wet, soft,	interface at 1.70m Water at 1.8m	
	SP	L4SB10/2.0	2		moderate plasticity, organic material, organic odour	1.0ppmv	
					Sandy clay as above - saturated		
	SP	L4SB10/2.5			Sandy clay as above - coal inclusions, increased clay	0.7ppmv	
					Sandy clay as above - increased inclusions of organic matter, wood,		
	SP	L4SB10/3.0	3		sandstone fragments	0.6ppmv	
					End of hole at 3.0m		
			4				
			5				

Notes:

GW Encountered: 1.8 Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB11**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 3.0 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 28/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB11/0.1			Bitumen	39.6ppmv	
					Fill - Gravelly, clayey sand with fine gravels of slag and ballast, brown, heterogenous, damp, poorly sortedm little clay and silt	interface at 0.20m	
	D	L4SB11/0.5				17.0ppmv	
					Fill - Slag and ballast gravels with some clayey sand		
	D	L4SB11/1	1			0.9ppmv	
					Fill - Sand, yellow, dry, alluvial, very loose, homogenous, well sorted,	interface at 1.10m	
	SP	L4SB11/1.5			fine to medium grained sands, fine gravels of shell fragments	0.9ppmv	
					Fill as above - increased moisture and shell framents	Water at 1.8m	
	SP	L4SB11/2	2		Fill as above - saturated, increased grain size	2.1ppmv	
	SP	L4SB11/2.5			Fill as above - increase in clay and organic matter	2.4ppmv	
	SP	L4SB11/3	3		End of hole at 3.0m	1.9ppmv	
			4				
			5				

Notes:

GW Encountered: 1.8 Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB12**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 3 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 22/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
					Bitumen		
	D	L4SB12/0.1			Fill - Gravelly sand, brown, heterogenous, damp, loose, poorly sorted, slag gravels	0.5ppmv interface at 0.15	
	D	L4SB12/0.3				-	
	D	L4SB12/0.5			Fill - Railway ballast, large basalt and slag cobbles, angular	-	
						interface at 0.80m	
	SP	L4SB12/1	1		Fill - Sand, yellow to brown, homogenous, damp, very loose, some sea shells, well sorted	0.1ppmv	
	SP	L4SB12/1.5				0.2ppmv	
					Fill as above - wet, increasing shell content	Water at 1.70m	
	SP	L4SB12/2	2			0.2ppmv	
	SP	L4SB12/3	3		Fill as above - saturated	0.1ppmv	
					End of hole at 3.0m		
			4				
			5				

Notes:

GW Encountered: 1.7 Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB13**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 3 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 22/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
					Bitumen		
	D	L4SB13/0.1			Fill - gravelly sand, yellow to light brown, heterogenous, damp, very loose, fine gravels of slag and concrete	1.8ppmv	
	D	L4SB13/0.3				-	
	D	L4SB13/0.5				2.6ppmv	
						interface at 0.450m	
					Fill - yellow sand, heterogenous, samp, very loose, medium grained, well sorted	interface at 0.70m	
	SP	L4SB13/1	1		Fill - Sand, yellow/grey, homogenous, damp, very loose, well sorted with some shell fragments.	3.4ppmv	
					Fill as above - wet	Water at 1.80m	
	SP	L4SB13/2	2			3.3ppmv	
	SP	L4SB13/3	3		End of hole at 3.0m	2.9ppmv	
			4				
			5				

Notes:

GW Encountered: 1.8 Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB14**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 3 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 22/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
					Bitumen		
	D	L4SB14/0.1			Fill - gravelly sand, dark brown/black, heterogenous, damp, loose, fine gravels of slag, roadbase, medium grained sand	3.9ppmv	
	D	L4SB14/0.3				6.1ppmv	
	D	L4SB14/0.5				7.1ppmv	
						interface at 0.40m	
						interface at 0.50m	
					Concrete	interface at 0.60m	
					Fill - sand, light grey, heterogenous, dry		
	SP	L4SB14/1	1		Fill - Sand, yellow/grey, homogenous, damp, very loose, well sorted	4.5ppmv	
					Fill as above - fewer gravels		
					Fill as above - crushed sea shells	Water at 1.60m	
					Fill as above - wet		
	SP	L4SB14/2	2			2.6ppmv	
	SP	L4SB14/3	3		End of hole at 3.0m	4.6ppmv	
			4				
			5				

Notes:

GW Encountered: 1.6m Meters

GW Static Level: Meters

GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon

G - Grab

HA - Hand Auger

D - Disturbed Sample

Borehole Log

Borehole No: **L4SB15**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 3 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 22/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB15/0.1			Bitumen	41.1ppmv	
	D	L4SB15/0.3			Fill - gravelly sand, dark brown, heterogenous, damp, loose, fine gravels of slag, concrete, poorly sorted	21.0ppmv	
	D	L4SB15/0.5				interface at 0.30m 18.0ppmv	
					Fill - light grey, very fine grained sand, ash, dry, heterogenous, very loose, poorly sorted, gravels of concrete and slag	interface at 0.80m	
	D	L4SB15/1	1			2.5ppmv	
					Fill - yellow/grey sand, homogenous, damp, very loose, well sorted, medium grained		
	SP	L4SB15/2	2		Fill as above - saturated	Water at 1.95m	
	D	L4SB15/3	3		Fill as above - increased sea shells, some slag, sandstone gravels	6.2ppmv	
					Refusal at 3.0m on pipe (possibly to abandoned septic tank)		
			4				
			5				

Notes:

GW Encountered: 1.95m Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4SB16**

Client: HDC Project: Cottage Creek Remediation Project No.: 40184 Location: Lee 4	Drilled By: Port Stephens Drilling Logged By: Mike Parker Datum: Date: 22/3/07	Diameter: 20cm Total Depth: 0.2m Meters Drilling Method: Solids & hollows Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4SB16/0.1			Bitumen Fill - gravelly sand, brown, heterogenous, damp, very loose, fine gravels of slag. Refusal at 0.2m on sleeper. Relocated 1m, hit sleeper again at 0.2m. Abandoned hole.	0.8ppmv	
			1				
			2				
			3				
			4				
			5				

Notes:

GW Encountered: NA Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Borehole Log

Borehole No: **L4MW07/2**

Client: HDC	Drilled By: Port Stephens Drilling	Diameter: 20cm
Project: Cottage Creek Remediation	Logged By: Mike Parker	Total Depth: 4 Meters
Project No.: 40184	Datum:	Drilling Method: Solids & hollows
Location: Lee 4	Date: 21/3/07	Screen & Pack:

Sample	Sample Type	Sample Number	Depth	Graphic Log	Description (Type, Particle Size, Moisture)	Comments (Odour, Visual, Other)	Construction
	D	L4MW07/2-0.1			Bitumen	9.8ppmv	
	D	L4MW07/2-0.3			Fill - gravelly sand, grey, heterogenous, loose, fine gravels of basalt, slag, concrete, medium grained sand, poorly sorted, trace fines	4.7ppmv	
	D	L4MW07/2-0.5				4.6ppmv interface at 0.60m	
	D	L4MW07/2-1	1		Fill as above - black, increased clay, finer gravels Fill - sand mixed with fill gravels. Sand appears natural, yellow and grey, heterogenous (gravels), damp and very loose, medium grained, fine gravels well sorted	7.2ppmv interface at 1.20m	
	SP	L4MW07/2-1.5				8.8ppmv	
					Fill - sand, yellow to grey, homogenous, damp, very loose, medium grained, well sorted	Water at 1.90m	
	SP	L4MW07/2-2	2		Clayey sand - dark grey, homogenous, wet, organic, moderately loose, medium grained, well sorted	6.3ppmv	
	D	L4MW07/2-3	3			-	
	D	L4MW07/2-4	4		End of hole at 4.0m	-	
			5				

Notes:

GW Encountered: 1.9m Meters
GW Static Level: Meters
GW Potentmetric Level: Meters

Consistency:

VS - Very Soft
S - Soft
F - Firm
ST - Stiff
VST - Very Stiff
H - Hard

Sample Type:

SP - Split Spoon
G - Grab
HA - Hand Auger
D - Disturbed Sample

Appendix E

Borelogs

TEST PIT NO.

TEST PIT ENVIRONMENTAL LOG

L4 TP01

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**12/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**12/4/02**
Test Pit Location:	**Lee 4**	Recorded By:	**LS**
Project Number:	**2122128A**	Log Checked By:	**SD**

Excavation Method:

Surface RL: **2.11 m AHD**

Co-ords: **E 371376.81 N 1355303.22**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
N F G W E	2 / 0.10					ASPHALT: black	D			
						FILL: sandy gravel to gravel, grey				L4 TP1 0.1m
	0.40				SP	ALLUVIAL: sand, pale brown, medium grained sand, shell fragments	M			
	1 / 1									L4 TP1 1m
										L4 TP1 1.8m
	0 / 2					END OF TEST PIT AT 1.90 m				TP collapse
	-1 / 3									
	-2 / 4									
	-3 / 5									

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

L4 BH02

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**12/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**12/4/02**
Borehole Location:	**Lee 4**	Recorded By:	**AC**
Project Number:	**2122128A**	Log Checked By:	**SD**

Drill Model/Mounting:		Hole Angle:	**90°**	Surface RL:	**2.25 m AHD**
Borehole Diameter:		Bearing:	**---**	Co-ords:	**E 371401.56 N 1355290.26**

Borehole Information						Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
TC			0.05					ASPHALT: black	D			
			2					FILL: sandy gravel, dark brown, coarse angular gravel, coarse grained sand, some cobbles and boulders				
			0.40				SP	ALLUVIAL: sand, light brown, medium grained sand, some fine to medium rounded gravel, some shell fragments	M			
			1									L4 BH2 1.5m
			1									
			2									
			0						W			
			3									L4 BH2 2.5m L4 BH2 2.5mA L4 BH2 2.5mAA
			-1									
			4.00 4					END OF BOREHOLE AT 4.00 m				
			-2									
			5									
			-3									

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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TEST PIT NO.

TEST PIT ENVIRONMENTAL LOG

L4 TP03

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**12/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**12/4/02**
Test Pit Location:	**Lee 4**	Recorded By:	**LS**
Project Number:	**2122128A**	Log Checked By:	**SD**

Excavation Method:

Surface RL: **2.31 m AHD**

Co-ords: **E 371417.96 N 1355281.79**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
	2 (0.10)					ASPHALT: black	D			
						FILL: sand to gravelly sand, dark brown, medium grained, trace to some fine slag/gravel				L4 TP3 0.2m
	1 (0.50)				SP	ALLUVIAL: sand, pale brown, medium grained, shell fragments				
	1						M			L4 TP3 1m
▽							W			L4 TP3 2m
	0					END OF TEST PIT AT 2.00 m				
	-1									
	-2									
	-3									

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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TEST PIT NO.

TEST PIT ENVIRONMENTAL LOG

L4 TP04

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**12/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**12/4/02**
Test Pit Location:	**Lee 4**	Recorded By:	**LS**
Project Number:	**2122128A**	Log Checked By:	**SD**

Excavation Method:

Surface RL: **2.31 m AHD**

Co-ords: **E 371445.1 N 1355275.63**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
	0.10					ASPHALT: black	D			
	0.20					FILL: sandy gravel, dark grey, medium angular concrete and basalt gravel, road base				
	2					FILL: gravelly sand, dark brown, medium grained, medium angular gravel, trace slag gravel				L4 TP4 0.3m L4 TP4 0.3mA
	0.40				SP	ALLUVIAL: sand, pale brown, medium grained, shell fragments	M			
	1									L4 TP4 1m
	1									
							W			L4 TP4 2m
	2					END OF TEST PIT AT 2.00 m				
	0									
	3									
	-1									
	4									
	-2									
	5									
	-3									

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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TEST PIT NO.

TEST PIT ENVIRONMENTAL LOG

L4 TP05

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**12/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**12/4/02**
Test Pit Location:	**Lee 4**	Recorded By:	**LS**
Project Number:	**2122128A**	Log Checked By:	**SD**

Excavation Method:

Surface RL: **2.25 m AHD**

Co-ords: **E 371467.6 N 1355268.88**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST H / FB VL L MD VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
N F G W E	2 / 0.10 / 0.30				OH	TOPSOIL: silty sand, dark brown, fine to medium grained, low plasticity fines ASPHALT: black FILL: sand to sandy gravel, dark brown, medium to coarse grained sand Coarse angular rock gravel to cobbles @ 0.6m	D			L4 TP5 0.2m L4 TP5 0.4m
	1 / 1 / 2 / 0 / 3 / -1 / 4 / -2 / 5 / -3					END OF TEST PIT AT 0.60 m				TP collapse

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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TEST PIT NO.

TEST PIT ENVIRONMENTAL LOG

L4 TP06

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**12/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**12/4/02**
Test Pit Location:	**Lee 4**	Recorded By:	**LS**
Project Number:	**2122128A**	Log Checked By:	**SD**

Excavation Method:

Surface RL: **2.47 m AHD**

Co-ords: **E 371498.3 N 1355264.95**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST H / FB VL L MD VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
	0.10				OH	TOPSOIL: silty sand, dark brown, medium grained	D			L4 TP6 0.1M
	0.30					FILL: sand, dark brown with orange mottling, medium grained sand				
	2				SP	ALLUVIAL: sand, light/pale brown, white flecks, medium grained, shell fragments	M			
	1									L4 TP6 1m L4 TP6 1mA
	1						W			L4 TP6 1.8m
	2					END OF TEST PIT AT 1.90 m				
	0									
	3									
	-1									
	4									
	-2									
	5									
	-3									

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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TEST PIT NO.

TEST PIT ENVIRONMENTAL LOG

L4 TP07

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**12/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**12/4/02**
Test Pit Location:	**Lee 4**	Recorded By:	**LS**
Project Number:	**2122128A**	Log Checked By:	**SD**

Excavation Method:

Surface RL: **2.40 m AHD**

Co-ords: **E 371516.09 N 1355269.65**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
	2.40 / 0.10				OH	TOPSOIL: silty sand, dark brown, medium grained	D			
						FILL: sand, dark brown, medium grained, trace of gravel sized metal rubble				L4 TP7 0.2m
	2 / 0.40				SP	ALLUVIAL: sand, light brown, medium grained, shell fragments	M			
	1									L4 TP7 1m
	1									
▽							W			L4 TP7 1.8m
	2					END OF TEST PIT AT 1.90 m				
	0									
	3									
	-1									
	4									
	-2									
	5									
	-3									

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

L4 BH08

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**23/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**23/4/02**
Borehole Location:	**Lee 4**	Recorded By:	**AC**
Project Number:	**2122128A**	Log Checked By:	**SD**

Drill Model/Mounting:		Hole Angle:	**90°**	Surface RL:	**2.17 m AHD**
Borehole Diameter:		Bearing:	**---**	Co-ords:	**E 371391.23 N 1355324.83**

Borehole Information						Field Material Description						
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
TC			0.05					ASPHALT: black	D			
			2					FILL: sandy gravel, dark brown, fine to medium sand, medium angular gravel	M			
			0.40					FILL: sand, dark brown, some fine angular gravel, shell fragments				L4 BH8 0.4m
												Reworked alluvium
			1									L4 BH8 1m
			1									
			1.40					FILL: gravel, grey, coarse angular concrete gravel				
			1.60					FILL: sand, dark brown, medium grained sand, shell fragments, brick fragments, trace coarse rock gravel				
			2									Reworked alluvium
			0									
									W			L4 BH8 2.5m
			3									
			-1									
			4.00				SP	ALLUVIAL: sand, grey/brown, medium to coarse grained sand, shell fragments, trace fine subrounded gravel				
			4									
			-2									
			5									L4 BH8 5m
			-3									
			5.45					END OF BOREHOLE AT 5.45 m				

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

L4 BH09

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**12/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**12/4/02**
Borehole Location:	**Lee 4**	Recorded By:	**AC**
Project Number:	**2122128A**	Log Checked By:	**SD**

Drill Model/Mounting:		Hole Angle:	**90°**	Surface RL:	**2.22 m AHD**
Borehole Diameter:		Bearing:	**---**	Co-ords:	**E 371408 N 1355312.74**

Borehole Information						Field Material Description						
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
TC			0.05					ASPHALT: black	D			
			2					FILL: sandy gravel, brown, medium to coarse angular gravel, coarse grained sand	M			L4 BH9 0.1m
			0.70					FILL: gravelly sand, light brown, medium to coarse grained sand, fine to medium rounded gravel, some shell fragments				
			1									L4 BH9 1m
			1									
			1.50					FILL: gravelly sand, grey/black, medium to coarse grained sand, fine subangular gravel, some shell fragments, fine to coarse angular gravel below 2m	W			Reworked alluvium
			2									L4 BH9 2m
			0									
			3.00				SP	ALLUVIAL: sand, light grey/brown, medium to coarse grained sand, trace fine subrounded gravel, some shell fragments				L4 BH9 3.1m
			3									
			-1									
			3.50					END OF BOREHOLE AT 3.50 m				
			4									
			-2									
			5									
			-3									

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

L4 BH10

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**23/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**23/4/02**
Borehole Location:	**Lee 4**	Recorded By:	**AC**
Project Number:	**2122128A**	Log Checked By:	**SD**

Drill Model/Mounting:		Hole Angle:	**90°**	Surface RL:	**2.13 m AHD**
Borehole Diameter:		Bearing:	**---**	Co-ords:	**E 371428.05 N 1355303.48**

Borehole Information						Field Material Description						
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VS S F L ST MD VST D H VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
TC		NGWE	2 / 0.05					ASPHALT: black	D			
								FILL: sandy gravel, dark brown/black, coarse grained sand, fine to medium gravel	M			L4 BH10 0.1m
			0.40					FILL: sand, brown, some fine subangular to subround gravel, shell fragments				
			1.00 1					FILL: sandy gravel, dark brown, coarse angular slag gravel to cobbles, shell fragments				L4 BH10 1m
			1									Reworked alluvium
								Brick and slag cobbles @ 1.6m				
			1.60					END OF BOREHOLE AT 1.60 m				Refusal on slag cobbles
			2									
			0									
			3									
			-1									
			4									
			-2									
			5									
			-3									

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

L4 BH11

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**23/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**23/4/02**
Borehole Location:	**Lee 4**	Recorded By:	**AC**
Project Number:	**2122128A**	Log Checked By:	**SD**

Drill Model/Mounting:		Hole Angle:	**90°**	Surface RL:	**2.29 m AHD**
Borehole Diameter:		Bearing:	**---**	Co-ords:	**E 371446.04 N 1355289.71**

Borehole Information						Field Material Description						
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
TC			0.05					ASPHALT: black	D			
			2					FILL: sandy gravel, black, fine angular gravel, coarse grained sand,	M			L4 BH11 0.1m
			0.40					FILL: sand, light brown, medium grained sand, some coal fines				
			1									L4 BH11 1M
			1									
			1.50				SP	ALLUVIAL: sand, light brown, coarse grained sand, some fine rounded gravel, shell fragments				
			2						W			
			0					Gravel and cobbles below 2.8m				L4 BH11 2.5m
			2.80									
			2.90				SP	ALLUVIAL: gravelly sand, light brown, coarse grained sand				
			3					END OF BOREHOLE AT 2.90 m				
			-1									
			4									
			-2									
			5									
			-3									

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

L4 BH12

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**23/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**23/4/02**
Borehole Location:	**Lee 4**	Recorded By:	**AC**
Project Number:	**2122128A**	Log Checked By:	**SD**

Drill Model/Mounting:		Hole Angle:	**90°**	Surface RL:	**2.15 m AHD**
Borehole Diameter:		Bearing:	**---**	Co-ords:	**E 371465.26 N 1355289.95**

Borehole Information						Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VS, VL S, L F, MD ST, D VST, VD H)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
TC			0.05					ASPHALT: black	D			
			2					FILL: sandy gravel, black, fine to medium angular gravel, coarse grained sand,	M			L4 BH12 0.1m L4 BH12 0.1mA
			0.40					FILL: gravel to sandy gravel, grey, medium angular gravel				
			0.70					FILL: sand, light brown, medium grained sand				
			1									L4 BH12 1m
			1									
			2.00 2					FILL: sand to gravelly sand, brown, medium grained sand, medium angular brick gravel	W			L4 BH12 2m
			0									
			2.50					END OF BOREHOLE AT 2.50 m				
			3									
			-1									
			4									
			-2									
			5									
			-3									

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

L4 BH13

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**15/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**15/4/02**
Borehole Location:	**Lee 4**	Recorded By:	**AC**
Project Number:	**2122128A**	Log Checked By:	**SD**

Drill Model/Mounting:		Hole Angle:	**90°**	Surface RL:	**2.2 m AHD**
Borehole Diameter:		Bearing:	**---**	Co-ords:	**E 371494.29 N 1355280.74**

Borehole Information						Field Material Description						
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F FB VL L MD ST D VST VD H)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
RAD			2 / 0.05					ASPHALT: black	D			
								FILL: sandy gravel, black, fine to coarse angular gravel, medium sand	M			
			1 / 1.00					FILL: gravelly sand, brown, fine to medium sand, fine to medium angular gravel				
			1 / 1.50					FILL: sand, light brown, medium grained				Reworked alluvium
			0 / 2.00						W			
			2.50					FILL: gravelly sand to sandy gravel, light brown, medium sand, concrete gravel				
			-1 / 3.30					FILL: sand to gravelly sand, light brown, medium grained sand, angular gravel				
			3.80					END OF BOREHOLE AT 3.80 m				

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

L4 BH14

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**23/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**23/4/02**
Borehole Location:	**Lee 4**	Recorded By:	**AC**
Project Number:	**2122128A**	Log Checked By:	**SD**

Drill Model/Mounting:		Hole Angle:	**90°**	Surface RL:	**2.16 m AHD**
Borehole Diameter:		Bearing:	**---**	Co-ords:	**E 371510.43 N 1355292.11**

Borehole Information						Field Material Description						
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VS VL S L F MD ST D VST H VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
TC			2 (0.05)					ASPHALT: black	D			L4 BH14 0.1m
								FILL: gravelly sand, brown, medium grained sand, fine to medium angular gravel	M			
			1									L4 BH14 1m
			1 (1.20)				SP	ALLUVIAL: sand, light brown, medium to coarse grained sand, trace fine subrounded gravel below 2m				
									W			L4 BH14 2m
			2									
			0									
			(2.50)					END OF BOREHOLE AT 2.50 m				
			3									
			-1									
			4									
			-2									
			5									
			-3									

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

L4 BH15

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**23/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**23/4/02**
Borehole Location:	**Lee 4**	Recorded By:	**AC**
Project Number:	**2122128A**	Log Checked By:	**SD**

Drill Model/Mounting:		Hole Angle:	**90°**	Surface RL:	**2.18 m AHD**
Borehole Diameter:		Bearing:	**---**	Co-ords:	**E 371466.29 N 1355302.26**

Borehole Information						Field Material Description						
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VS S VL F L ST MD VST D H VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
TC			0.05					ASPHALT: black	D			
			2					FILL: sandy gravel, black, medium to coarse slag gravel, coarse grained sand	M			L4 BH15 0.1m
			0.80									
			1					FILL: silty sand, dark brown, fine to medium grained sand				L4 BH15 1m
			1 1.20				SP	ALLUVIAL: sand, brown, medium to coarse grained sand, some fine rounded gravel				
			2						W			L4 BH15 2m L4 BH15 2mA L4 BH15 2mAA
			0									
			2.45					END OF BOREHOLE AT 2.45 m				
			3									
			-1									
			4									
			-2									
			5									
			-3									

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

L4 BH16

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**23/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**23/4/02**
Borehole Location:	**Lee 4**	Recorded By:	**AC**
Project Number:	**2122128A**	Log Checked By:	**SD**

Drill Model/Mounting:		Hole Angle:	**90°**	Surface RL:	**2.18 m AHD**
Borehole Diameter:		Bearing:	**---**	Co-ords:	**E 371489.34 N 1355304.57**

Borehole Information						Field Material Description						
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VS VL S F L ST MD VST D H VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
TC			0.05					ASPHALT: black	D			
			2					FILL: sandy gravel, dark brown/black, medium to coarse angularslag gravel, coarse grained sand, some coal fines	M			L4 BH16 0.1m
			0.90				SP	ALLUVIAL: sand, light brown, medium grained sand, some fine subrounded gravel				L4 BH16 1m
			1						W			L4 BH16 2m
			0									
			2.45					END OF BOREHOLE AT 2.45 m				
			3									
			-1									
			4									
			-2									
			5									
			-3									

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE ENVIRONMENTAL LOG

BOREHOLE NO. **L4 BH17**

SHEET 1 OF 1

Client:	**Honeysuckle Development Corporation**	Date Commenced:	**23/4/02**
Project:	**Honeysuckle ESA**	Date Completed:	**23/4/02**
Borehole Location:	**Lee 4**	Recorded By:	**AC**
Project Number:	**2122128A**	Log Checked By:	**SD**

Drill Model/Mounting: Hole Angle: **90°** Surface RL: **2.16 m AHD**

Borehole Diameter: Bearing: **---** Co-ords: **E 371509.48 N 1355305.95**

Borehole Information						Field Material Description						
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	RL(m) AHD / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents, moisture, relative density/consistency) (ROCK NAME; grain size, colour, weathering, strength, minor constituents)	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS (Defects - depth, type, orientation, spacing, planarity, roughness, thickness, coating)
TC			0.05					ASPHALT: black	D			
			2					FILL: gravelly sand, dark brown/black, coarse grained sand, fine to medium angular gravel	M			L4 BH17 0.1m
			0.80					FILL: sand, dark brown/grey, fine grained sand, some angular gravel				
			1									L4 BH17 1m L4 BH17 1mA
			1									
			1.40				SP	ALLUVIAL: sand, light brown, medium grained, trace fine subrounded gravel				
			2						W			L4 BH17 2m
			0									
			2.45					END OF BOREHOLE AT 2.45 m				
			3									
			-1									
			4									
			-2									
			5									
			-3									

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

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Document Status

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		Name	Name	Signature	Date
A	Matt Parkinson	Cathy Roberts	Draft for Auditor Review		4 June 2007
0	Cathy Roberts	Andrew Lau	Andrew Lau		30 October 2007