Remedial Options Report

City of Sydney

12 Maxwell Road
Glebe, NSW

October 2010
JBS 41105-15450 Revision 1
JBS Environmental Pty Ltd

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List of Abbreviations

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

ACM	Asbestos Containing Material (e.g. fibre cement sheet)
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
DECCW	NSW Department of Environment, Climate Change and Water
DQOs	Data Quality Objectives
EMP	Environmental Management Plan
EPA	NSW Environment Protection Authority
GILs	Groundwater investigation levels
Ha	Hectare
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
UCL	Upper Confidence Limit
WQOs	Water Quality Objectives
Zn	Zinc

1 Introduction

1.1 Background

JBS Environmental Pty Ltd was engaged by City of Sydney (CoS) to develop a Remedial Options Report for the site located at 12 Maxwell Road, Glebe, herein referred to as the site. The site comprises an irregular shaped parcel of land occupying an area of approximately 0.55 Ha, which is currently vacant.

Contamination investigations have been previously completed to assess soil and groundwater conditions at the site. These investigations have generally identified that fill materials present from the ground surface to depths of approximately 9.5m are unsuitable for open space use. This Remedial Options Report has been prepared to provide an assessment of strategies that may be applicable to the site.

1.2 Previous Assessments

The following contamination assessments have been previously prepared for the site:

- AGC Woodward-Clyde Pty Limited (1999) '*Bush Regeneration Area Located Off Maxwell Road, Glebe, Environmental Site Investigation*' Letter Report dated 25 June 1999, Reference A8602316/0001;
- Gutteridge Haskins & Davey Pty Ltd (2000) '*Contamination Assessment Report on Sydney Light Rail Western Extension Project – Jubilee Park Embankment'*, Reference 60318, 211/182266/00;
- Coffey Geosciences Pty Ltd (2000) '*Stage 2 Environmental Site Investigation and Remedial Action Plan, Sydney Light Rail, Western Extension Jubilee Site'* Reference E12401/1-AE;
- Coffey Geosciences Pty Ltd (2001) *'Assessment of Groundwater Quality, Jubilee Park Embankment Site'* Letter report dated 20 April 200, Reference E12401/1-AM;
- JBS (2010) '*Stage 2 Environmental Site Assessment, 12 Maxwell Road, Glebe, NSW*', Reference 41105-15304;

JBS was provided with copies of these documents for preparation of this document however it is noted that:

- Sections 4 to 7 were missing from the copy of the Gutteridge, Haskins & Davey Pty Ltd (GHD) Report; and
- The copy of the Coffey Geosciences Pty Ltd (Coffey) report provided was a draft version only, in which the results tables (i.e. Tables 2 to 4) were missing, along with laboratory certificates containing the results of asbestos identification testing.

Environmental data from the previous investigations have been provided in **Appendix A**.

1.3 Purpose of Report

The objectives of the Remedial Options document are to:

- Provide a summary of contamination issues at the site and the site setting;
- Identify the remediation objectives; and
- To guide future decisions about the potential uses for the land and identify the options for remediation which would make those uses possible;

2 Site Condition & Surrounding Environment

2.1 Site Identification and Condition

Detailed information of the site condition, physical characteristics, history and surrounding land uses are provided in the previous investigation (JBS 2010). The following is a summary of relevant information.

The site is located at Glebe, NSW approximately 2.5 km south of the Sydney CBD, lying between Parramatta Road to the south and Blackwattle Bay and Rozelle Bay to the north. The site location is shown in **Figure 1**. The site details are summarised in **Table 2.1** and described in more detail in the following sections.

Table 2.1 Summary Site Details

Lot/DP	Lot 387 in Deposited Plan 752049
Coordinates of Site Centre	331462.87 E, 6250130.18 N (approximately)
Address	12 Maxwell Road, Glebe
Local Government Authority	City of Sydney Council
Proposed Land-use	Open Space
Current Land-use	Vacant land, used for intermittent soil stockpiling
Site Area	5576 m^2

It is understood that the site is owned by the Crown but is currently under the 'care and control' of City of Sydney. A site layout plan is presented on **Figure 2**.

2.2 Surrounding Landuse

The site is located in an area used for a mixture of residential, commercial and recreational purposes. Land uses surrounding the site are identified as follows:

- North – the Jubilee Park Light Rail station, and light rail train line. The Jubilee Park Sports Ground is located further north;
- East – Victoria and Maxwell Roads, with small residential property lots further east and Saint Scholastica Girls High School;
- South – a disused tramshed building and car parking areas. Harold Park Paceway is located further south; and
- West – Johnstons Creek, parkland and Chapman Road.

Detailed inspection of the surrounding properties was not conducted as part of the Stage 2 ESA scope of works.

2.3 Topography

Review of the Sydney Topographic Map (sheet 9130-2N second edition) indicates that the site is located in an area sloping west towards Johnstons Creek and associated stormwater channel, and north-west towards Jubilee Oval and Blackwattle Bay further to the north. Ground elevation in the surrounding area ranges between 0 and 15 m above Australian Height Datum (AHD).

Observations made during the site inspection indicated that the area of the site has been built up against the natural west and northwestern slopes. The site level at the eastern boundary, level with the Maxwell and Victoria Road frontages, is approximately 10m AHD.

The majority of the site was built up to this level, while the southern, western and northern boundaries of the site were steep fill embankments sloping away from the centre of the site, falling steeply to the level of the former tramshed building, Johnstons Creek stormwater channel and Jubilee Oval respectively.

2.4 Geology

Review of the Sydney 1:1 000 000 Geology Map (Sheet 9130) indicates that the site is underlain by manmade fill material which is in turn underlain by Hawkesbury Sandstone. It is noted that alluvial sandy clays were observed underlying fill material at the site during the Stage 2 ESA (JBS, 2010). While the presence of alluvial materials was not included on the Geological Map in this area, the occurrence was not unexpected given the proximity of the site to Johnston's Creek.

2.5 Hydrology

At the time of the JBS site inspection the majority of the site was unsealed and no stormwater drainage network was observed. Much of the precipitation falling onto the site is expected to infiltrate the subsurface material. Following periods of heavy rainfall, precipitation is expected to runoff the site down the boundary embankments and discharge into the concrete lined channel of Johnstons Creek at the western end of the site. Following periods of heavy rainfall, the stormwater runoff from the site entering Johnstons Creek is expected to drain into Rozelle and Blackwattle Bays, located less than 500 metres (m) north of the site.

2.6 Hydrogeology

A review of the Coffey (2000) report stated that ''…*groundwater beneath the site is expected to occur in bedrock. However it is possible that groundwater may be present perched on fill material on bedrock. The regional groundwater flow direction at the site is expected to be north towards Rozelle Bay"*.

3 Site History

A review of historical information for the site indentified the following potentially contaminating activities:

- The presence of widespread fill across the site, several metres in depth, that has been demonstrated to be impacted by ash, slag and ACM;
- The presence of material stockpiles across the site; and
- Use of the site as an informal works depot for a number of years, which may have included fuel / oil and waste liquid storage.

Further details are provided in JBS (2010).

4 Previous Investigations

The following sections provide a summary of the previous investigations, as listed in **Section 1.2**, positions of former test locations are presented on **Figure 3**.

4.1 Woodward-Clyde (1999)

Woodward Clyde conducted an environmental investigation of surface soils present along the southern embankment of the site in 1999. The objective of the investigation was to assess the potential risks for the Leichhardt Council bush regeneration team working in this area. The investigation included the collection and laboratory analysis of surface soil samples collected at "… *four random locations …*". No figures were attached to the letter report identifying the position of the sampling locations along the embankment, however the report notes that soil samples were collected over an interval of between 0 and 0.2 m deep. The sampled material was described as "… *loose, moist, dark brown, sandy silt and fill material with some gravel and metallic content*".

Concentrations of lead in all four samples were reported in the range of 1030 and 3420 $mg.kg^{-1}$, and concentrations of benzo(a)pyrene (BaP), in all four samples were reported in the range of 2.9 and 9.3 $mg.kg^{-1}$. For both analytes the reported concentrations in all samples were above the National Environmental Health Forum (NEHF) Monographs health based Level E guidelines. The NEHF Level E guidelines are applicable to open space land use such as parks and playing fields, and are consistent with criteria provided for the open space land use in the current NEPC (1999) '*National Environment Protection (Assessment of Site Contamination) Measure*'.

On the basis of the results it was concluded that the surface fill material located in the study area was contaminated with lead and polycyclic aromatic hydrocarbons. The report stated that "*Based on the work completed for the assessment and the conclusions expressed herein, the following is recommended prior to the commencement /recommencement of bush regeneration works in the vicinity of the Maxwell Road site:*

- *Council prepare a of* [sic] *health and safety plan for workers involved in the bush regeneration; and*
- *Undertake a risk assessment to establish long term suitability of proposed land use."*

4.2 GHD (2000)

GHD conducted a contamination assessment of the southern embankment section of the site in 2000. The objectives of the investigation were to provide a "… *broad assessment*" of site contamination to assess potential impact to human health and the environment posed by any identified contamination and to discuss requirements for further work. The investigation included the collection of soil samples from four locations, comprising two boreholes and two testpits.

Sampling locations were extended to a depth of 2.5 m below ground level (m bgl)

The field and laboratory results indicated that fill material at the site contained lead, nickel, arsenic and PAHs at concentrations exceeding the provisional phytotoxicity based threshold concentrations. Petroleum hydrocarbons in the C_{10} – C_{40} range were detected at concentrations exceeding the threshold concentrations applicable to sensitive sites. Chrysotile asbestos was identified at two of the four locations tested, within samples of fill material collected from BH1/0.3-0.4m and BH2/0- 0.1m depth. The asbestos detected was reported to be present as fibres, i.e. friable. The borehole log for BH2 was not included in the GHD report copy provided for JBS to review, however, it is noted that the borehole log from BH1 does not include observation of asbestos containing materials (ACM) at any depth. Given that BH1 and BH2 were drilled using solid flight augers, it is possible that the asbestos present in fill may generally be present in the bonded form, and was broken during progression of the boreholes.

The report concluded that the observed levels of contaminants "…*are considered to have potential to pose a risk of harm to both the environment and human health… In the event that no development action is taken at the site there remains a statutory requirement to consider consequences to the environment and to human health under the Guidelines on Significant Risk of Harm from Contaminated Land and the Duty to Report (NSW EPA 1999)*".

GHD recommended that additional investigations be undertaken to further assess potential risks from asbestos in the fill, including air monitoring at the site, and the leaching of contaminants from the fill.

4.3 Coffey (2000)

Coffey conducted a contamination assessment of the southern embankment section of the site in 2000, and produced a Remedial Action Plan (RAP) for the area. The objective of the assessment was to obtain information that would allow preparation of a RAP for public open space use of the site.

The site investigation component of the assessment comprised the drilling of six boreholes to a maximum depth of 1.5m. It was reported that the boreholes encountered heterogeneous fill material to the termination depth. The fill material typically comprised sandy, gravel and clay with slag, charcoal, glass, wire and tile inclusions. A piece of grey fibre cement containing asbestos was encountered near the surface at one location.

Statistical analysis of the data indicated that the 95% upper confidence limit (UCL) of the mean concentration of B(a)P, total PAHs and lead exceeded the human health criteria for open space land use. It was also noted that B(a)P concentrations in 12 samples of fill were more than 2.5 times the human health criteria for open space land use.

Leachability testing, using a water of neutral pH as the leaching media, was undertaken in four samples of fill. All four samples were analysed for heavy metals, and concentrations of arsenic, copper, cadmium and nickel were below the laboratory detection limit in all samples. The 95% UCL of the leachable concentrations reported for lead was 115 µg/L, for zinc was 150 µg/L and for B(a)P was 0.9 µg/L.

Based on the reported total and leachable concentrations of heavy metals and PAHs in fill it was stated that "…*without further supporting information …it is not possible to conclude that leaching of contaminants from fill will not impact offsite receptors at unacceptable levels*". Additionally, based on the available results, it was assessed that fill at the site was classed as 'Industrial Waste' for off-site disposal in accordance with '*Environmental Guidelines: Assessment Classification and Management of Liquid and Non-Liquid Waste*' (NSW EPA, 1999).

Based on the results of the Coffey, GHD and WC results a brief RAP was prepared for the site that provided two remediation options to render the site suitable for public open space land use, specifically:

- Cap and contain, *i.e.* providing a barrier, preventing or reducing contact between site users and contaminated material. Multiple scenarios within the capping option were discussed including reducing the overall embankment slope through capping and constructing a series of berms, or benches. It was noted that that the capping option required geotechnical investigation to confirm stability prior to finalisation of the design; or

- Management through administrative controls. This option essentially described restricting access to contaminated soil in the embankment through fence, signs and maintaining vegetation cover.

For implementation of either option it was considered that a program of routine inspection would be required, along with a long term Environmental Management Plan (EMP) for the site. Additionally, it was noted that as both strategies would result in the retention of contaminated soil on the site, then both options would result in notification on title of the presence of this material, and this information would be included on any Section 149 Planning Certificate for the site.

4.4 Coffey (2001)

Coffey produced a letter report dated 20 April 2001, documenting the installation of two monitoring wells along the eastern and western boundaries of the southern embankment, and results of the subsequent groundwater sampling.

Borehole MW1, located within the current study site, at the top of the southern embankment, was drilled to depth of 4.7 m and was terminated upon refusal in sandstone at this depth. Groundwater was not encountered in the well installed at this location.

Borehole MW2, located outside the boundaries of the site, adjacent to the Johnstons Creek stormwater channel, was drilled to a depth of 5.5 m. At this location fill was encountered to a depth of 1.0 m, comprising a brown gravelly sand. Natural clay soils were encountered below the top fill layer.

Lead, total PAH, and zinc concentrations in the groundwater sample collected from this location were reported to be less than the laboratory detection limit. Of the analytes tested, only the concentration reported for copper, of 15 µg/L, was above the adopted assessment criterion of 5 µg/L. The report noted that the detected concentration was consistent with heavy metal concentrations "…*in the surface water and groundwater under tidal influences in the Sydney Harbour"*. It was also noted that matrix interference prevented assessment of arsenic concentrations, however the report concluded that "*Leachability tests undertaken during the Stage 2 ESI revealed that the leachable concentration of arsenic in fill material was very low and therefore the likelihood of arsenic leaching from the fill embankment is considered to be low"*.

The conclusions and recommendations of the report state that:

- "*…it is considered that a developed groundwater table is not present above the bedrock at the site and therefore groundwater is not in contact with the majority of the fill;*
- *Therefore, leaching of contaminants from the fill material can only occur during or following rainfall events;*
- *As the fill embankment is vegetated and is steep, the majority of water falling on the site will not be available for infiltration and leaching of contaminants…;*
- *Water coming from upgradient running over the bedrock is likely to dilute whatever leachate that occurs;*

- *There is likely to be significant attenuation of the contaminants in leachate before reaching groundwater"*

The report ultimately concludes that "*…it is considered that leaching of contaminants from fill material at the site is not significantly impacting offsite receptors at unacceptable levels and therefore the application of administrative controls is a feasible remediation option for the site"*.

4.5 JBS (2010)

JBS conducted a Stage 2 ESA on the site comprising the following scope of works:

- soil sample collection from fifteen grid based borehole locations across the site;
- installation of monitoring wells within two of the soil sampling locations to enable groundwater sample collection. A groundwater sample from a third well, installed in 2001 and located off site, was also included in the site assessment dataset.

Fill material was encountered underlying the site in all boreholes, to a depth of up to 9.75 metres below ground level (m bgl), and was underlain by natural sandy clay soils to the maximum drilling depth of 13 m bgl.

The results of intrusive investigations indicated that at least one soil sample analysed from each of the 15 boreholes contained either lead, TPH C_{10}-C_{36} and/or BaP concentrations above the health based assessment criteria. Furthermore 17 of the thirty samples analysed from the site contained either a lead, TPH C_{10}-C_{36} and/or BaP concentration greater than 2.5 times the assessment criteria, and were considered to be soil contamination hotspots. These hotspots were reported in soils collected from the surface zone, i.e. 0 to 0.15 m, to depths of 12.5 m bgl.

The results of the Stage 2 ESA were also consistent with lead, TPH C_{10}-C_{36} or BaP hotspots identified in soils underlying the southern embankment, as assessed in previous investigations by Woodward Clyde (1999), GHD (2000) and Coffey (2000 and 2001).

Results of the groundwater assessment indicated that groundwater is likely to flow north and north-west, subject to tidal influences, in the vicinity the adjacent Johnston's Creek. While fill materials underlying the site were reported to contain elevated lead, TPH C_{10}-C_{36} and/or BaP concentrations, groundwater samples collected from the site were reported to contain generally low concentrations of these contaminants.

It was concluded that the site requires remediation or management controls to render it suitable for open space land use. Several remediation options may be adopted at the site depending on budget, timing and access constraints, and may include:

- excavation and off site disposal of contaminated soils;
- Excavation of contaminated soil, stabilization and reinstatement of treated material; or
- capping of the site.

It was recommended that a Remedial Action Plan be developed in accordance with the relevant regulatory requirements and implemented to render the site suitable for the proposed open space use.

It was also recommended that the NSW Department of Environment, Climate Change and Water (DECCW) is notified of the presence of contamination on site. If this has not already been undertaken, then JBS recommends that this notification is completed by the site owner, or other relevant stakeholder, as soon as practical.

5 Site Characterisation

5.1 Soil

Results for all investigations conducted on the site are provided in Appendix 1. In total analytical results are available for 51 primary samples collected from 29 soil sampling locations across the site. Of these only 2 soil samples were collected from natural soils underlying the site, the remaining 49 samples were of fill material.

Locations where the concentrations of contaminants exceed the assessment criteria are shown on **Figure 4.** Samples collected from only 2 of the 29 locations complied with assessment criteria for open space land use. Review of the exceedances shown on Figure 4 indicates that lead, copper, BaP and Total PAHs are the main contaminants of concern on the site.

To aid review and interpretation of soil analytical results the site data have been segregated into four distinct horizons:

- Surface soils, i.e. collected from between 0 and 0.5m depth;
- Material present between 0.5 and 2 m depth;
- Material present 2 and 9.5 m depth; and
- Natural soils present underlying fill between 9.5 and 13 m depth.

A statistical summary of the data available for each horizon is provided in **Table 5.1**.

Table 5.1 Statistical Summary of Soil Concentrations with Depth

Horizon	Analyte	Copper	Lead	Nickel	TPH C_{10}-C_{36}	BaP	Total PAHs
Surface material (0 to 0.5m depth)	count	21	20	21	17	21	21
	min	27	31	5	320	1	5
	Mean (mg/kg)	217	729	30	**1,542**	**26**	**247**
	95% UCL (mg/kg)	87.87	366.7	8.972	852.75	**24.6**	**235.7**
	standard deviation	205.4	836.71	20.98	1793.9	57.4	551
Soils between 0.5 and 2.0m depth	count	13	13	12	10	11	13
	min	4	38	5	210	0	1
	Mean (mg/kg)	910	**1998**	86	**6945**	**19**	**208**
	95% UCL (mg/kg)	690.8	**1163.2**	34.19	**11 324**	**19.5**	**240**
	standard deviation	1271	2139.9	60.44	18 270	32.99	441.5
Soils between 2.0 m and 9.5m depth	count	8	8	8	6	7	7
	min	67	303	8	650	1	6
	Mean(mg/kg)	1095	**4,717**	323	**2874**	**24**	**219**
	95 % UCL (mg/kg)	751.7	**7143.7**	512.3	**2443.7**	**16.27**	**146.4**
	standard deviation	1085	10 309	739.4	3054.1	21.96	197.6
Natural Soil (2 samples)	BH6/11.8 – 12.0m	160	270	16	480	**6.4**	**60.6**
	BH7/12-12.5m	72	**1700**	92	450	**6.5**	**70.5**
Ecological (EIL)		100	600	60	-	-	-
Open Space [(1)] / TC [(2)]		2,000	600	600	1000	2	40

Review of the average results provided in **Table 5.1** indicated that copper, lead and nickel concentrations increase with depth. TPH C_{10}-C_{36} concentrations were highest in the 0.5-2.0 m depth horizon, while BaP and Total PAH concentrations were highest in the surface soils. In the natural soil samples it is noted the concentrations of lead, BaP and total PAHs were also above the assessment criteria. The criteria exceedances detected in the two natural samples were generally less than those detected in fill samples from across the site, and it is possible that the natural soils directly underlying fill material has become impacted over time.

The results of intrusive investigations also indicated that the concentrations of lead, BaP and TPH C_{10}-C_{36} in the majority of soil samples analysed from the site, were generally greater than the health based assessment criteria for open space land use. Furthermore, the presence of a number of samples containing lead, BaP and TPH C_{10}-C_{36} concentrations more than 2.5 times the assessment criteria precludes the use of UCL statistics to justify open space land use at the site without remediation. Elevated concentrations of copper were also detected at two isolated locations.

The concentration of all other chemical contaminants analysed were below the adopted health based assessment criteria in all samples analysed.

Additionally the results of intrusive investigations indicated that the concentrations of all heavy metals in soil analysed from the site exceeded the ecological assessment criteria for open space land use at one or more locations. These results suggest that plant growth on the site could be adversely affected by the elevated heavy metals concentrations in soil underlying the site.

Fragments of material possibly containing asbestos were observed on the site surface at isolated locations, consistent with observations made during assessment of the southern boundary of the site. However, it is noted that respirable asbestos fibres were not detected in any samples analysed from the site.

If the site is to be used as public open space, in order to satisfy the NEPM land use requirements for parks, recreational open space and playing fields, the identified contamination in soil must be remediated to reduce the potential risks to future site users.

5.2 Aesthetics

Fill containing ash, slag and coke fragments was observed across the site at the ground surface down to depths of 9.75 m bgl. A slight TPH odour was noted at one location, BH1 in the top 0.5 m of fill material, while at BH3 a strong coal odour was noted in the fill material between 1.8 and 2.0 m.

While some of this material will require remediation for elevated contaminant concentrations, it is noted that any locations outside the required remediation areas, where ash, slag, coke or odourous material is present at the surface, will also require remediation to meet the aesthetic standards of urban redevelopment sites.

There were no other aesthetic issues identified that may pose an issue at the site.

5.3 Potential Groundwater Contamination Underlying the site

Groundwater underlying the site is considered not to pose a potential risk to the surrounding environment.

While fill materials underlying the site were reported to contain significantly elevated lead, TPH C_{10}-C_{36} and/or BaP concentrations, groundwater samples collected from the site were reported to contain generally low concentrations of heavy metals, TPH and PAHs.

It is noted that nickel concentrations in MW2 and MW3, 19 and 10 µg/L, respectively, exceeded the aquatic ecosystems assessment criteria of 7 µg/L, along with lead and zinc concentrations in MW3, 10 and 26 µg/L respectively. However these exceedances are considered to be not significant and not evidence of contaminated soil underlying the site impacting groundwater, given that the detected concentrations only marginally exceed the stringent criteria despite the age of the fill on the site.

5.4 Potential for Soil Contamination to Impact Groundwater

Soil at the site in its current state is considered to pose a potential risk to underlying groundwater resources and the surrounding environment.

The soils samples analysed from the site contained not only high total concentrations of lead, TPH and BaP, but selected samples also contained leachable concentrations of heavy metals and PAHs above the assessment criteria. It is noted that the leachable concentrations reported are likely to overestimate the potential for contamination underlying the site to be leached out of fill and enter groundwater given that:

- The leachability test involves tumbling of the sample in the leaching media for an 18 hour period, and is considered to be more aggressive than any mechanisms for leaching that would occur *in-situ*;
- The samples selected for leachability testing were of fill present above the surface of the water table, and again it is unlikely that any material on the site, not permanently saturated, would be regularly exposed to conditions conducive to leaching and sufficient to reach the water table at depth;
- Actual groundwater results collected from the site contained low concentrations of heavy metals and PAHs, despite the presence of contaminated soils on the site for several decades.

However, in its current condition no controls exist on the site to prevent contamination potentially being leached out of the soil. Therefore this material must be considered as a potential risk to groundwater and the surrounding environment, until such time as it is remediated or managed.

6 Remediation Options

6.1 Remediation Goals

The site is currently zoned for open space land use. It is understood that in the long term the site is being considered for use as potential public domain / open space land use, with improved linkages to facilities in the area including the Jubilee Park Light Rail Station and Jubilee Oval to the north.

6.2 Extent of Remediation

Previous assessments have identified that all fill material present on the site is generally unsuitable for open space use. Fill material has been observed underlying the site to depths of approximately 9.5 m bgl.

7 Consideration of Long Term Remediation Options

7.1 Soil 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.

In addition, it is also a requirement that remediation should not proceed in the event that it is likely to cause a greater adverse effect than leaving the site undisturbed. And, where there are large quantities of soil with low levels of contamination, alternative strategies are required to be considered or developed (DEC 2006).

The following sections provide a discussion of remedial methods that may be applicable to the site including a preferred remediation method for the site. It is however noted that the remediation method best suited to a site is generally a function of the redevelopment proposed including:

- The proposed landuse – e.g. open space, residential, commercial, mixed use;
- The type of development – i.e. whether buildings/basements are proposed, what percentage of the site is to be sealed; and
- Whether a responsible party will exist following remediation, which is capable of enforcing administrative controls on the site.

Until a redevelopment plan is determined for the site, it is difficult to assess what would be the best remediation option. The following sections therefore provide a general description of possible methods, along with a list of advantages and disadvantages, that may be important considerations in planning for the site.

7.2 Treatment On-Site and Re-Use On-Site

On site treatment of soil could involve either in-situ or ex-situ treatment. The perceived advantage of on-site treatment methods is the potential for much of the treated material to be reused on site, thus reducing costs associated with disposing soil to a suitable off-site location and importing clean material for reinstatement.

However on site treatment methods generally have high capital and operational costs and would therefore only be considered for such a small site if removal of all material exceeding the allowable criteria was a requirement of the development, or if residential land use with accessible soils were being considered for the site.

Further details on ex-situ and in-situ treatment methods are discussed in the following sections for completeness and in the event that the requirements of any remediation program on the site change.

7.2.1 Ex-situ treatment

Excavation of contaminated soil and fill materials for ex-situ treatment on site may be a viable remediation option. Much of the excavated material could be beneficially reused on the site following appropriate treatment and validation, thus reducing the requirement for importing material to reinstate existing site levels.

The establishment of any ex-situ soil treatment facility on the site (such as a thermal desorption plant) for the treatment of contaminated soil in the proximity of residences would be likely to give rise to significant community, environmental health and aesthetic concerns. Implementation of ex-situ treatment methods generally also requires a detailed assessment, bench-scale testing and a pilot trial program prior to implementation. The treatment process may also require licensing by DECCW.

7.2.2 In-situ Treatment

In situ treatment methods for the reduction of heavy metals and PAHs generally involve the introduction of chemical reagents into the subsurface to remove the contamination or transform it into a less toxic form.

All in-situ treatment methods have the potential for causing adverse impacts to the surrounding environment, and therefore any proposal to use in-situ treatment methods would need to be considered in detail with appropriate monitoring and contingency strategies developed as part of the planning stage.

Implementation of in-situ treatment methods generally also requires a detailed assessment, bench-scale testing and a pilot trial program prior to implementation. Successful completion of these planning works are likely to be an important milestone for use of in-situ methods on the current site, given its proximity to Rozelle Bay, and it is likely that such a remediation method would only be approved once the trials have demonstrated that the method is capable of destroying or transforming the contaminants without unacceptable impact to the environment.

7.3 Treatment Off-Site For Re-Use On-Site

Another remedial approach adopting soil treatment technologies, is off site treatment of contaminated soil. This option would involve excavating the contaminated material (i.e. all fill material) on the site, transporting it to an off-site facility for treatment followed by returning the treated material to site for reinstatement.

While such an option would be likely to overcome community opposition to the operation of a soil treatment plant on the site, the increased transport costs associated with carting material between the site and treatment location would significantly add to the project costs and completion time for the works.

Other considerations of this method would be increased traffic movements required to remove and return material to the site given the need to use the local road network for access. The likely advantages of treatment off site are likely to be reduced community opposition and the potential for much of the contaminated material to be reused on site following treatment.

7.4 Excavation and Off Site Disposal of Soil

Excavation and off-site disposal of contaminated material would involve excavating any material on the site that exceeds the assessment criteria for open space land use (essentially all fill material on the site) and disposing of it directly to an appropriately licenced landfill. The concentrations of contaminants in some localised sections of the site would be classed as Hazardous Waste, and therefore would require some treatment prior to disposal to landfill. Some licenced landfill contractors are capable of conducting the treatment works on their sites on material that will ultimately be disposed to landfill.

The disadvantages of this option are the high costs associated with landfill disposal and importing clean material for reinstatement of the former site levels. The primary advantage of this method is that it would greatly increase the confidence that the source of impact is removed and minimises the need for ongoing management or maintenance.

Other considerations of this method would be increased traffic movements required to remove and import material to the site given the need to use the local road network for access.

7.5 On Site Management

On site management methods are considered applicable based on the results of groundwater sampling conducted as part of the Stage 2 ESA. Should site conditions change or additional information become available, perhaps in the future, that fill material present on the site is adversely impacting the groundwater migrating off site then the applicability of any onsite management method should be reconsidered.

On site management methods may be applied at the site in a number of ways:

- ‘do nothing’ i.e. continued restricted access to the site without use as public domain;
- Encapsulation of the material (i.e. construction of a base, walls and cap to contain the contaminated material);
- Surface capping all exposed surfaces on the site; and
- Capping of the top of the site with management of exposed surfaces along the sloped batters.

Further details regarding each of the above management option are provided in the following sections. It should be noted that adoption of any of the above mentioned methods will require completion of both:

- a risk assessment to ensure the proposed management method does not result in health risks to future site users that are unacceptable; and

- an Environmental Management Plan (EMP) to document the process by which required management controls will be maintained.

7.5.1 Do Nothing Approach

No remedial action is taken adopting this approach, which results in major advantage of not incurring in any remedial costs.

The disadvantage of this option is that is does not render the site suitable for any sensitive land use, including public open space or commercial use, and would be considered an unacceptable approach for some stakeholders including the DECCW.

Generally this option would be considered unsuitable for the site as the previous ESAs completed have demonstrated that the concentrations of some contaminants in fill, including lead, copper, BaP and Total PAHs, exceed the health based levels for common urban land uses.

7.5.2 Encapsulation of Material

This approach involves the placement of contaminated material on the site within a purpose built containment cell. The engineered base, walls and cap of the cell act to isolate contamination from the surrounding environment. It is noted that while this method sequesters the contamination, it does not remove it from the environment.

Generally this method is adopted where:

- the contamination identified is present in extremely high concentration;
- the contamination has been shown as impacting on groundwater or very likely to do so: and/or:
- relative to the entire area of the site, the contamination identified occupies only a small area.

Under these circumstances the main advantages of this option are that contaminated material does not have to be removed off site and that by consolidating all the contaminated material into one smaller area, it reduces the portion of the site that remain subject to on-going liability and implementation of an EMP.

While this option may be applied to the current site, it is considered to be one of the less preferable of the on-site management methods as:

- High costs will be incurred constructing the ‘cell’;
- Construction of the cell is likely to require the excavation of all fill material underlying the entire site and will therefore cause major disturbance to the site;
- The visual impact to the surrounding community is likely to be high during the excavation and cell construction phases;
- Unless a portion of the contaminated material is disposed to landfill during the excavation process, this remediation approach will increase the finished level of the site by more than a metre, given that the floor, walls and cap of the newly construction cell will occupy additional space; and
- Available groundwater data indicate that the contaminated material on the site is not impacting the surrounding environment and therefore full encapsulation of this material is not necessary to safeguard the down gradient receptors.

7.5.3 Surface Capping of the Entire Site

As described in Section 2, the majority of the site is a flat parcel of land with batter slopes forming the northern, western and southern boundaries. Surface capping involves the installation of a purpose built cap over the entire site, including batter slopes, to isolate future users from the contamination underneath. Capping layers are generally installed with a thickness between 0.5 and 1.0m. As with encapsulation, discussed in **Section 7.5.2**, it is noted that while this method sequesters the contamination, it does not remove it from the site.

Generally this method is adopted where:

- the contamination identified is present in extremely high concentration;
- the contamination has been demonstrated as not adversely impacting on groundwater or the surrounding environment, and potentially only posing a risk to future above ground users of the site: and/or:
- relative to the entire area of the site, the contamination identified occupies a large area.

Under these circumstances the main advantages of this option are that contaminated material does not have to be removed off site and that major expenses or disruption do not occur through the construction of an engineered containment cell.

While this option may be applied to the current site, it is considered to be one of the less preferable of the on-site management methods as:

- Capping of the existing batter slopes in their current condition is likely to cause major slope instability. Additional costs are likely to be incurred for the earthworks required to regrade these slopes, such that their stability can be guaranteed during installation of the capping and for the foreseeable future;
- Capping of the existing batter slopes will require complete removal of all vegetation on the existing batter slopes. While it is noted that some of the existing vegetation is noxious weed requiring removal, installation of the capping will also require removal of the existing treeline that adds to the visual amenity of the site and surrounding area. This process may destabilise the existing slopes and therefore increase the scale and cost of the preparatory earthworks required.
- The visual impact to the surrounding community is likely to be high during the excavation and cap construction phases; and
- Unless a portion of the contaminated material is disposed to landfill during the excavation process, this remediation approach will increase the finished level of the site, given that the newly constructed capping will occupy additional space.

7.5.4 Surface Capping of Part of the Site

This option is essentially a variation of the full site capping remedial option discussed in **Section 7.5.3**. This option involves a combination of surface capping and administrative controls on the site as follows:

- The installation of a purpose built cap over the flat portion of land level with Maxwell Road and comprising the majority of the site; and;
- Administrative controls with increased ground cover/revegetation along the existing batter slopes forming the northern, western and southern boundaries. The intention

being that maintenance of well established vegetation along the batter slopes will act as a deterrent to future users entering those areas.

Of all the on-site management methods, this is considered to be the most appropriate method. Both measures, i.e. capping and revegetation, in combination will act to isolate future users from the contamination present underneath, and enable future open space use of the site. This approach has all the advantages of the entire surface capping approach discussed in **Section 7.5.3**, without the need for major slope regrading works or removal of existing vegetation.

As with the encapsulation approach, discussed in **Section 7.5.2**, it is noted that while this method sequesters the contamination, it does not remove it from the site. Adoption of this approach will also require:

- A well designed landscaping plan for the batter slopes, that provides continuous and thick ground cover;
- Some minor slope re-grading works along the toe of each of the batter to prevent erosion of the existing slopes; and
- increased maintenance checks, at least in the initial stages, to ensure the new vegetation cover is sufficient and is not being breached, either by acts of vandalism or by inadequate growing conditions.

JBS would also recommend completion of a surface clearance for ACM along each of the batter slopes prior to implementation of the revegetation program.

Considering that this remedial option will render the site suitable for open space land use for the lowest cost of all option considered, and with minimal disruption to the existing vegetation, ground levels and visual amenity, it is considered the most appropriate for the site.

7.6 Comparison of Applicable Remediation Options

A summary of the characteristics of each remedial strategy discussed above is provided in **Table 7.1.**

Capping of part of the site has been identified as the most appropriate for the site where only one remediation technology is to be adopted. However, dependent on the requirements of the site following remediation, it more likely that a combination of several of the methods considered will provide the optimal solution. For example:

- while it is noted that off-site disposal of soil to landfill will increase the costs or remediation, it may be possible to reduce the magnitude of capping works and management control required if some of the most contaminated material within the top metre of the site is excavated, validated and disposed off-site; or
- should the level across sections of the site require lowering, then on site or off-site treatment of the excavated material prior to disposal or reuse elsewhere may reduce the overall project costs.

It is also noted that a risk assessment undertaken as part of the remedial strategy design may further reduce the scale of remediation required by demonstrating that contaminant concentrations above default land use criteria will not pose unacceptable risks to future site users.

Ultimately the optimal remedial method for the site will be a function of the future land use requirements.

A formal Remedial Action Plan (RAP) will be required for the selected method. Regardless of the method adopted, any RAP developed for the site should include consideration of the following issues:

- Any existing services on the site that will need to remain operational before, during and after remediation;
- Geotechnical and slope stability constraints relating to works along the slopes;
- Impact of any proposed strategy on the vegetation established along the batter slopes; and
- The need for air monitoring during any works requiring disturbance to the existing soil profile.

Table 7.1: Summary of Remediation / Management Methods for the Site

Remediation Methodology	On-going Liability	Advantages	Disadvantages	Relative Cost	Suitability
Treatment Off-site and Dispose to Licensed Landfill Facility	Long term – none Short term – licencing of off-site location likely during treatment works	Fast – impacted material removed immediately, significantly reduced potential for future impact to groundwater. No storage or treatment problems. Disposal to landfill costs lower as material can be treated to reduced waste classification/off-site re-use.	Treatments costs at the remediation facility. Commercial availability of an appropriate remediation facility. High costs associated with importation of clean fill	High capital costs High overall costs	Unlikely, due to cost considerations, the impacted material is unsuited to remediation by off-site treatment and disposal.
Treatment Off-Site and Re-Use On-Site	Long term – none Short term – licencing of off-site location likely during treatment works	Minimise quantities of waste materials generated by site development and disposed to landfill. No on-site storage or treatment problems.	High treatments costs at the remediation facility. Commercial availability of an appropriate remediation facility. Time implications of waiting for material to be treated off-site. Differing treatment methods will be required for lead, asbestos and PAHs further complicating process. Treatment methods for PAHs diminish the 'growing potential' of the soils by destruction of organic carbon. Where treated soils (returned to site) are surplus to site requirements NSW legislation will require classification as 'wastes' negating advantage of waste minimisation.	High capital costs Moderate overall costs	Unlikely, due to cost considerations, the impacted material is unsuited to remediation by off-site treatment and returned to the site.
Treatment On-Site and Re-Use On-Site	None	Minimise quantities of waste materials generated by site development and disposed to landfill. Most preferred option in NSW DECC remediation hierarchy. Clean material available to be used with the site development.	High treatment costs. Treatment methods for PAH constituents present in site soils are energy intensive and have slow production rates (50T/day maximum based on commercially available equipment in NSW). Treatment methods for PAHs diminish the 'growing potential' of the soils by destruction of organic carbon. Treatment methods for removal of lead not readily available. Differing treatment methods will be required for asbestos, lead and PAHs further complicating process. Potential hazardous emissions from treatment plant in heavy populated urban area.	High capital costs Moderate overall costs	Unlikely, due to cost considerations, the impacted material is unsuited to remediation by excavation and treatment on-site.
Treatment On-Site and Re-Use Off-Site	None	Minimise quantities of waste materials generated by site development and disposed to landfill. A preferred option in NSW DECC remediation hierarchy. Potential clean fill material generated which can be used as a resource off-site. Potential more tolerant off-site uses available for treated soils allowing a lower standard of treatment to be undertaken.	High treatment costs. Treatment methods for PAH constituents present in site soils are energy intensive and have slow production rates (50T/day maximum based on commercially available equipment in NSW). Treatment methods for PAHs diminish the 'growing potential' of the soils by destruction of organic carbon. Treatment methods for removal of lead not readily available. Differing treatment methods will be required for asbestos, lead and PAHs further complicating process. Potential hazardous emissions from treatment plant in heavy populated urban area. Where treated soils are surplus to site requirements NSW legislation will require classification as 'wastes' negating advantage of waste minimisation.	High capital costs Moderate overall costs	Unlikely, due to cost considerations, the impacted material is unsuited to remediation by treatment on-site for future use off-site.
Off-Site Disposal	None	Fast – impacted material removed immediately, removed potential for potential future impact to groundwater. No storage or treatment problems. Minimal design and management costs.	Transfer of waste to another location. High costs associated with the disposal and importation of clean fill. Sustainability / waste generation issues related to disposal to landfill. Major disruption to site, major impact on surrounding community and visual amenity for the duration of remediation works	Low capital costs High cost overall	Yes, fill materials can be readily remediated by off-site disposal.
Management of Impacted Soils On-Site	Requires on-going management, may limit future use of the site and responsibility if breaches occur	Cost effective approach. Reduce quantities of waste being disposed to landfill. Least disruption to surrounding community and visual amenity of the area	Requirement to maintain areas where soil containment, capping or revegetation has occurred. Restrictions on potential future site uses associated with area of management	Low capital and overall costs	Yes, fill materials can be readily managed in-situ.

8 Regulatory Approvals/Licensing

8.1 Environment Planning and Assessment Act 1979 / SEPP55

Should remedial works be conducted as part of redevelopment of the site, consideration should be made at the time of project planning as to whether the physical works for remediation are included within the development approval. If assessed not to be the case then a separate approval may be required for the remediation program.

8.2 Protection of the Environment Operations Act 1997

Should the proposed remedial works involve any form of soil or groundwater treatment, then consideration should be given to whether the nature or scale of the activity requires licensing under the *Protection of the Environment Operation Act 1997*.

In general remediation works that do not involve soil or groundwater treatment do not require licencing under the *Protection of the Environment Operation Act 1997*, however, given the proximity of the site to Johnston's Creek, consideration should be given to whether remediation of the site would be 'Category 1' works under *State Environmental Planning Policy (SEPP) 55: Remediation of Land*, which would require development consent.

8.3 Water Management Act 2000

Provided that remediation works proposed for the site do not require dewatering of the site, approval under the Water Management Act is not required. However where the works methodology is required to be varied (by unexpected finds or otherwise) and dewatering occurs, an approval under the Act will be obtained prior to the undertaking of any groundwater dewatering.

8.4 Protection of the Environment Operations (Waste) Regulation 2005

The regulations make requirements relating to non-licensed waste activities and waste transporting. The general requirements stipulated by the Regulation include that:

- wastes are stored in an environmentally safe manner; and
- vehicles used to transport waste must be covered when loaded.

Any remedial program adopted at the site should be compliant with the requirements of the Regulation and ensure that all wastes generated and proposed to be disposed off-site are assessed, classified and managed in accordance with the relevant DECCW guidelines.

Provision is also provided in the Regulation and recent DECC (2008) guidelines for the DECC to approve the immobilisation of contaminants in waste. Specifically that where wastes require immobilisation prior to off-site disposal (to reduce waste classifications) an immobilisation approval shall be sought in accordance with Part 2 of the DECC 2008 guideline, or by the existing general immobilisation approvals also noted in this guideline.

At the time of project planning, consideration should be made as to whether the proposed works require more specific licencing or approvals, such as an immobilisation order, under the relevant DECCW guidelines.

8.5 City of Sydney (2004) 'Contaminated Land Development Control Plan'

The Council DCP provides a number of environmental and site management provisions required to be employed during any remediation program. Any remediation environmental management plan prepared for the site should ensure these provisions are included in the site procedures.

9 Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties. The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose. JBS Environmental Pty Ltd accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS Environmental Pty Ltd, and should not be relied upon by other parties, who should make their own enquires.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements and site history, not on sampling and analysis of all media at all locations for all potential contaminants.

Limited sampling and laboratory analyses was undertaken as part of the investigations, as described herein. Ground conditions between sampling locations may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS Environmental Pty Ltd reserves the right to review the report in the context of the additional information

Figures

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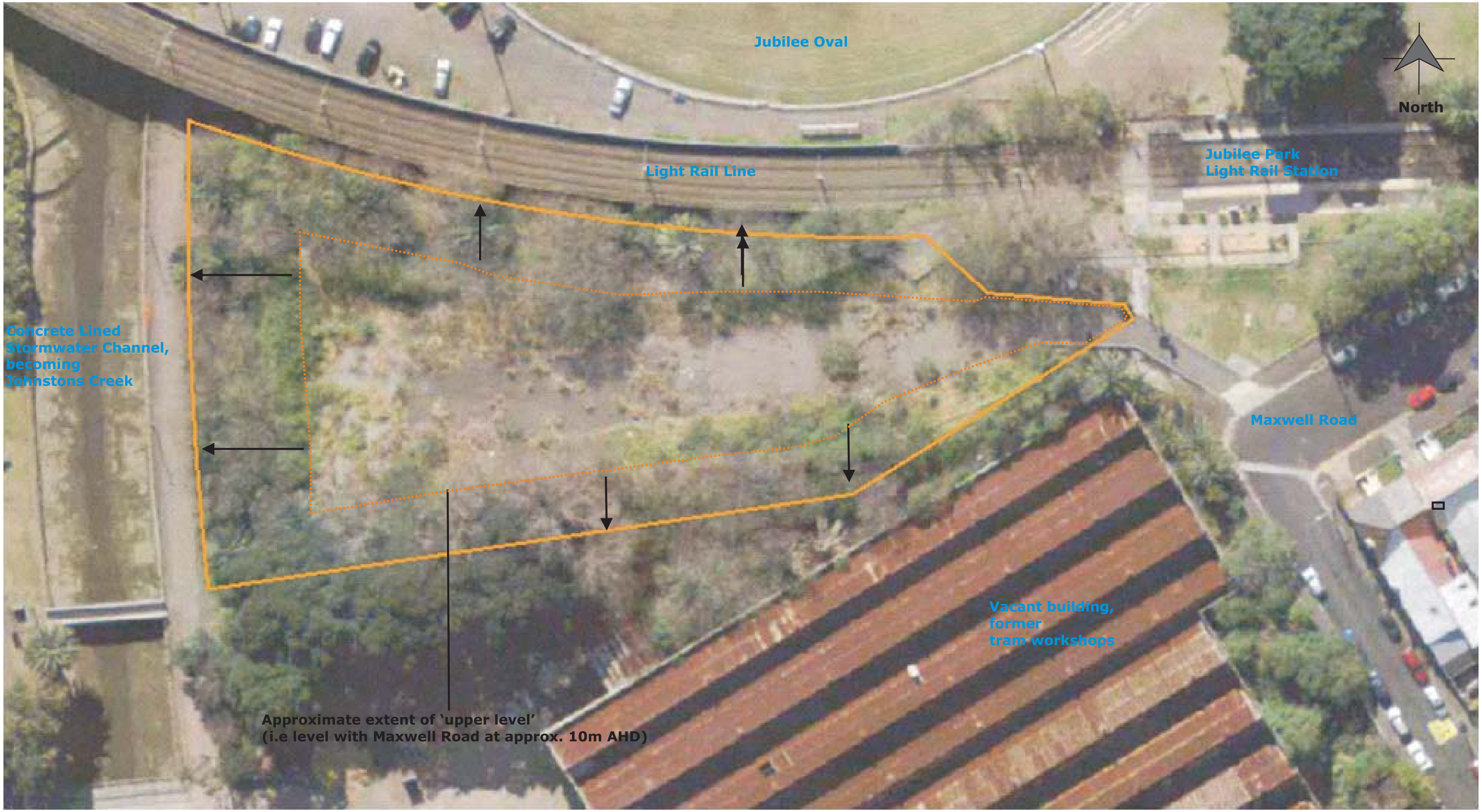
0 — 1km

Approximate scale

Figure 1 **Site Location**

UBD 2007

Note- All locations shown are approximate only



0 — 40m

Approximate scale

Figure Not to Scale

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Figure 2: Site Layout

Client: City of Sydney

Site Address: 12 Maxwell Road, Glebe

File Name: 41105 Figure 1 **Job Number.: 41105**

Legend

Site Boundary

Direction of slope

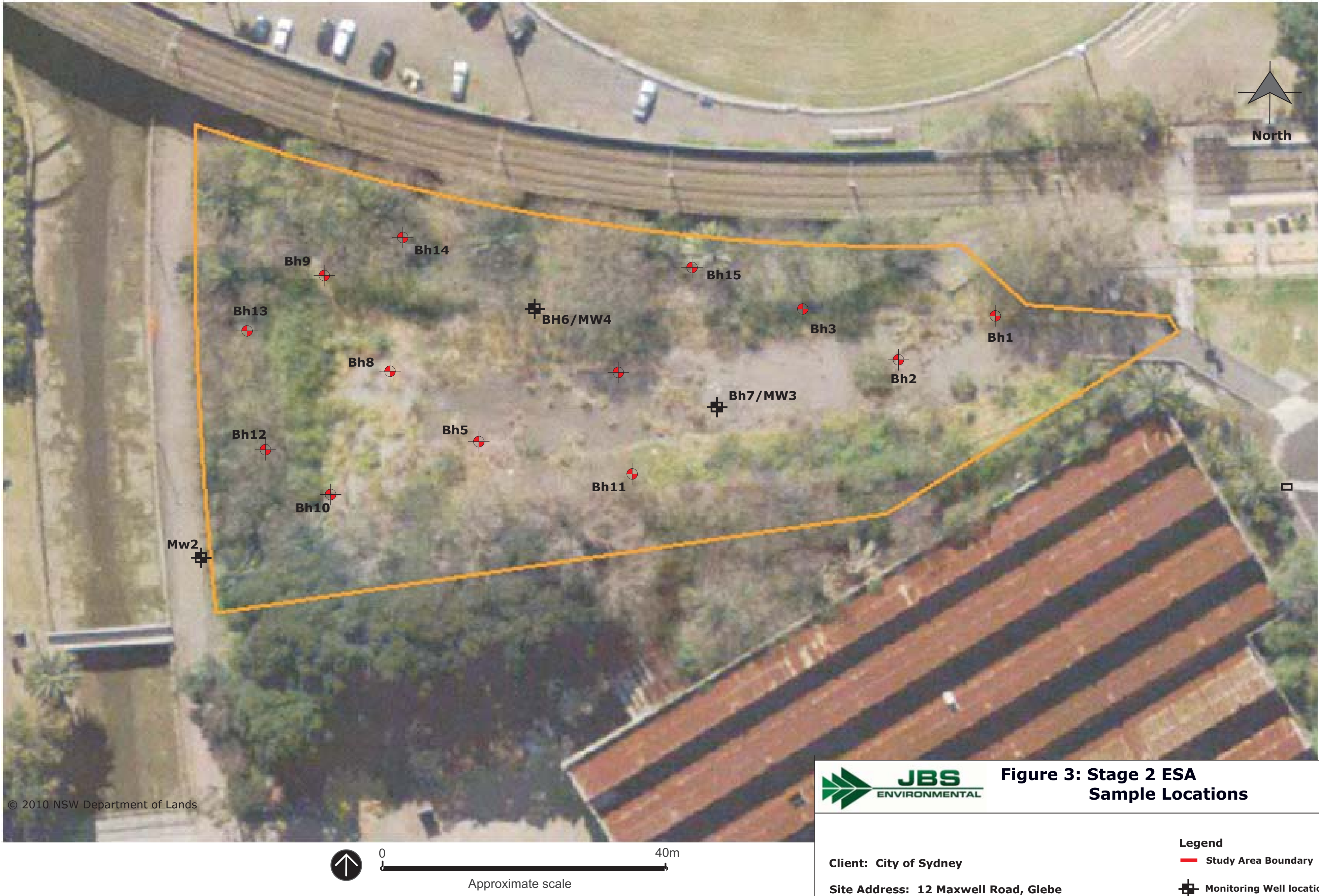

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Figure 3: Stage 2 ESA Sample Locations

Client: City of Sydney

Site Address: 12 Maxwell Road, Glebe

File Name: 41105 Figure 3 **Job Number: 41105**

Legend

- Study Area Boundary
- Monitoring Well locations
- Soil sampling locations

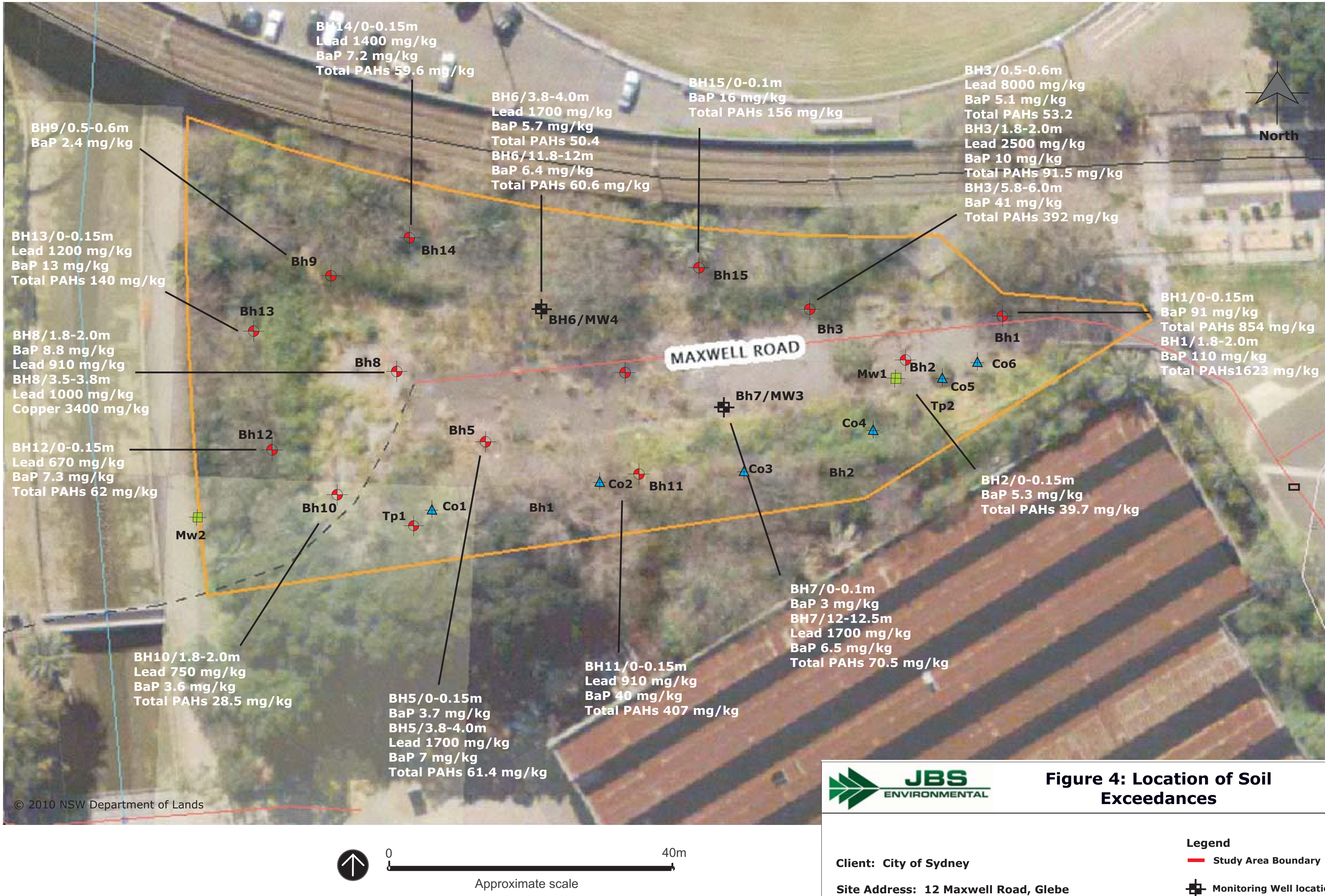

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Figure 4: Location of Soil Exceedances

Client: City of Sydney

Site Address: 12 Maxwell Road, Glebe

Job Number: 41105

Legend
- Study Area Boundary
- Monitoring Well locations
- Soil sampling locations

Appendix A

Results of Previous Assessments

41105
City of Sydney
Table E - Summary Groundwater Results

Notes:

(1) 95% Protection Level used, as recommended by ANZECC/ARMCANZ 2000

(2) Recreational Trigger Values for Primary and Secondary Contact Recreation (ANZECC/ARMCANZ 2000)

bold above Aquatic Ecosystems Criteria Concentrations
All units in μg/L unless indicated.

FILE REF: G:\JBS Environmental\Projects\City of Sydney\41105-Glebe Maxwell Rd\Reports\R02 Attach\[R02 Tables A to E.xlsx]Sheet1

				Groundwater Sample ID			Soil Leachability Sample ID						QA / QC			
Analyte	**Limit of Reporting**	**Aquatic Ecosystem Criteria[1]**	**Recreational Criteria – primary and secondary contact[2]**	**MW2**	**MW3**	**MW4**	**BH1 / 0-0.15m ASLP**	**BH1 / 0-0.15m TCLP**	**BH11 / 0-0.15m ASLP**	**BH3 / 0.5-0.6m ASLP**	**BH3 / 1.8-2.0m ASLP**	**BH4 / 5.8-6.0m ASLP**	**QA1 (Envirolab)**	**QC1 (SGS)**	**Trip Spike**	**Trip Blank**
METALS																
Arsenic	1	-	50	<1	5	5	1	<50	3	4	2	<1	5	4	-	-
Cadmium	0.1	0.74	5	<0.1	<0.1	<0.1	0.1	<10	0.2	0.2	0.4	0.3	<0.1	<0.1	-	-
Chromium	1	27.4	50	<1	2	<1	1	<10	3	65	72	1	<1	2	-	-
Copper	1	1.3	1000	<1	2	1	7	30	13	4	20	12	<1	1	-	-
Nickel	1	7	100	19	10	6	4	<20	<1	<1	<1	<1	7	7	-	-
Lead	1	4.4	50	<1	10	<1	<1	<30	29	5	42	<1	2	<1	-	-
Zinc	1	15	5000	3	26	4	43	300	110	85	230	320	6	3	-	-
Mercury	0.5	0.14	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	-	-
BTEX COMPOUNDS																
Benzene	1	50010	10	<1	<1	<1	-	-	-	-	-	-	<1	<1	95%	<1
Toluene	1	1805	-	<1	<1	1.2	-	-	-	-	-	-	<1	<1	81%	<1
Ethylbenzene	1	55	-	<1	<1	<1	-	-	-	-	-	-	<1	<1	80%	<1
o-Xylene	1	3505	-	<2	<2	<2	-	-	-	-	-	-	<2	<2		<2
m-Xylene	1	755	-	<1	<1	<1	-	-	-	-	-	-	<1	<1	76%	<1
p-Xylene	1	2005	-	<3	<3	<3	-	-	-	-	-	-	<3	<3		<3
PETROLEUM HYDROCARBONS																
$C_6 – C_9$ Fraction	10	-	-	<LOR	<LOR	<LOR	-	-	-	-	-	-	<LOR	<LOR	-	-
$C_{10} – C_{36}$ Fraction	250	6009	No odour or sheen	<LOR	<LOR	<LOR	-	-	-	-	-	-	<LOR	<LOR	-	-
POLYCYCLIC AROMATIC HYDROCARBONS																
Naphthalene	0.1	504	-	<0.1	<0.1	<0.1	2	3	<1	<1	2	<1	<1	<0.1	-	-
Anthracene	0.1	0.1[4,5,6,7]	-	<0.1	<0.1	0.1	2	<1	<1	<1	<1	1	0.1	0.4	-	-
Phenanthrene	0.1	0.6[4,5,6]	-	<0.1	0.2	0.5	13	<1	<1	1	2	5	0.5	1.1	-	-
Fluoranthene	0.1	1[4,5,6]	-	<0.1	0.2	0.4	4	5	<1	1	1	1	0.4	1.6	-	-
Benzo(a)pyrene	0.1	0.1[4,5,6]	0.17	<0.1	<0.1	<0.1	<1	<1	<1	<1	<1	<1	<0.1	0.6	-	-
VOLATILE ORGANIC COMPOUNDS																
PCE	1	70	10	<1	<1	<1	-	-	-	-	-	-	<1	<1	-	-
TCE	1	3306	30	<1	<1	<1	-	-	-	-	-	-	<1	<1	-	-
Cis 1,2 DCE	1	-	-	<1	<1	<1	-	-	-	-	-	-	<1	<1	-	-
Trans 1,2 DCE	1	-	-	<1	<1	<1	-	-	-	-	-	-	<1	<1	-	-
VC	1	1006	-	<1	<1	<1	-	-	-	-	-	-	<1	<1	-	-

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City of Sydney
Table D - Summary Soil Results

Notes:

(1) Open Space Lacd Use Health based Investigation Levels (HIL-F) (Column 4, DEC 2006)
(2) Threshold concentrations for sensitive land use - soils (Table 3. EPA 1994)

FILE REF: G:\JBS Environmental\Projects\City of Sydney\41105-Glebe Maxwell Rd\Reports\R02 Attach\[R02 Tables A to E.xlsx]Table D

Sample number	Summary of Matrix Description	Asbestos
LOR		-
Landuse criteria (mg/kg)		
Recreational [(1)] / TC [(2)]		NIL
BH1/0 - 0.15	FILL Silty sand, brown, with inclusions of slag, roadbase gravels and glass.	NIL
BH2/0 - 0.15	FILL Sandy silt, brown, with inclusions of glass, slag, roadbase gravels and bitumen.	NIL
BH1/1.8-2	FILL Sandy clay, brown, with inclusions of glass, terracotta pipe fragments, shale, roadbase gravels and fragment of potentially ACM.	NIL
BH10/0 - 0.15	FILL Silty sand, dark brown, with inclusions of sandstone.	NIL
BH10/1.8-2	FILL Silty sand, dark brown, with inclusions of brick, glass, slag and ash.	NIL
BH11/0 - 0.15	FILL Gravelly sand, dark grey, black, with inclusions of brick, slag, igneous and sedimentary gravels.	NIL
BH12/0 - 0.15	FILL Gravelly sand, dark grey, black, with inclusions of brick, slag, glass, concrete, igneous and sedimentary gravels.	NIL
BH13/0 - 0.15	FILL Sandy silty clay, dark brown with inclusions of glass, brick, slag and sandstone.	NIL
BH14/0 - 0.15	FILL Silty sand, brown, with inclusions of roadbase gravels, glass and brick fragments.	NIL
BH15/0 - 0.15	FILL Silty sand, dark brown, with inclusions of roadbase gravels, glass and brick fragments.	NIL
BH2/2.8-3	FILL Silty sand, brown, with inclusions of glass, roadbase gravels, slag and sandstone.	NIL
BH3/0.5-0.6	FILL Silty sand, dark grey, black, with inclusions of sandstone gravels, railway ballast and glass.	NIL
BH3/1.8-2	FILL Silty sand, dark grey, brown, with inclusions of glass and tile fragments.	NIL
BH3/5.8-6	FILL: silty sandy clay, pale white to brown	NIL
BH4/0.5-0.6	FILL Silty sand, dark brown, grey, with inclusions of tile, brick, grey basalt gravels and glass.	NIL
BH4/5.8-6	FILL Silty sand, dark brown with orange and red lens, with inclusions of slag and coal.	NIL
BH5/0 - 0.15	FILL Silty sand, brown to grey brown, with inclusions of brick fragments and slag.	NIL
BH5/3.8-4	FILL Silty sand, dark brown, black, with inclusions of brick fragments and slag.	NIL
BH6/11.8-12	NATURAL Sandy clay, grey black, heterogeneous, saturated, high plasticity.	NIL
BH6/3.8-4	FILL Silty sand, dark brown, with inclusions of trace clay, roadbase gravels, railway ballast, glass, tile and matal.	NIL
BH7/0 - 0.1	FILL Gravelly sand, grey brown, with inclusions of asphalt, brick, roadbase gravels, ash, slag, tile, roadbase gravels and metal.	NIL
BH7/12-12.5	NATURAL Sandy clay, brown, heterogeneous, saturated, stiff, high plasticity.	NIL
BH8/1.8-2	FILL Silty sand, black brown, with inclusions of ash and slag.	NIL
BH8/3.5-3.8	FILL Silty sand, black brown, with inclusions of ash, slag and crushed glass.	NIL
BH9/0 - 0.15	FILL Clayey sand, brown, with inclusions of slag, glass, metal, tile, roadbase gravels, brick and sandstone.	NIL
BH9/0.5-0.6	FILL Clayey sand, brown, with inclusions of slag, glass, metal, tile, roadbase gravels, brick and sandstone.	NIL

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Table C - Summary Soil Results

Notes:

(1) Open Space Land Use Health based Investigation Levels (HIL-F) (Column 4, DEC 2006)
(2) Threshold concentrations for sensitive land use - soils (Table 3. EPA 1994)

BOLD above HIL (F) / Threshold Concentr

FILE REF: G:\JBS Environmental\Projects\City of Sydney\41105-Glebe Maxwell Rd\Reports\R02 Attach\[R02 Tables A to E.xlsx]Table C

Sample number	Matrix Description	BTEX			
		Benzene	Toluene	Ethyl-benzene	Xylenes
LOR		0.5	0.5	1.0	3.0
Landuse criteria (mg/kg)					
Recreational (1) / TC (2)		1	130	50	25
BH1/0 - 0.15	FILL Silty sand, brown, with inclusions of slag, roadbase gravels and glass.	<0.5	<0.5	<1	<3
BH2/0 - 0.15	FILL Sandy silt, brown, with inclusions of glass, slag, roadbase gravels and bitumen.	<0.5	<0.5	<1	<3
BH1/1.8-2	FILL Sandy clay, brown, with inclusions of glass, terracotta pipe fragments, shale, roadbase gravels and fragment of potentially ACM.	<0.5	<0.5	<1	<3
BH10/0 - 0.15	FILL Silty sand, dark brown, with inclusions of sandstone.	<0.5	<0.5	<1	<3
BH10/1.8-2	FILL Silty sand, dark brown, with inclusions of brick, glass, slag and ash.	<0.5	<0.5	<1	<3
BH11/0 - 0.15	FILL Gravelly sand, dark grey, black, with inclusions of brick, slag, igneous and sedimentary gravels.	<0.5	<0.5	<1	<3
BH12/0 - 0.15	FILL Gravelly sand, dark grey, black, with inclusions of brick, slag, glass, concrete, igneous and sedimentary gravels.	<0.5	<0.5	<1	<3
BH13/0 - 0.15	FILL Sandy silty clay, dark brown with inclusions of glass, brick, slag and sandstone.	<0.5	<0.5	<1	<3
BH14/0 - 0.15	FILL Silty sand, brown, with inclusions of roadbase gravels, glass and brick fragments.	<0.5	<0.5	<1	<3
BH15/0 - 0.15	FILL Silty sand, dark brown, with inclusions of roadbase gravels, glass and brick fragments.	<0.5	<0.5	<1	<3
BH2/2.8-3	FILL Silty sand, brown, with inclusions of glass, roadbase gravels, slag and sandstone.	<0.5	<0.5	<1	<3
BH3/0.5-0.6	FILL Silty sand, dark grey, black, with inclusions of sandstone gravels, railway ballast and glass.	<0.5	<0.5	<1	<3
BH3/1.8-2	FILL Silty sand, dark grey, brown, with inclusions of glass and tile fragments.	<0.5	<0.5	<1	<3
BH3/5.8-6	FILL: silty sandy clay, pale white to brown	<0.5	<0.5	<1	<3
BH4/0.5-0.6	FILL Silty sand, dark brown, grey, with inclusions of tile, brick, grey basalt gravels and glass.	<0.5	<0.5	<1	<3
BH4/5.8-6	FILL Silty sand, dark brown with orange and red lens, with inclusions of slag and coal.	<0.5	<0.5	<1	<3
BH5/0 - 0.15	FILL Silty sand, brown to grey brown, with inclusions of brick fragments and slag.	<0.5	<0.5	<1	<3
BH5/3.8-4	FILL Silty sand, dark brown, black, with inclusions of brick fragments and slag.	<0.5	<0.5	<1	<3
BH6/11.8-12	NATURAL Sandy clay, grey black, heterogeneous, saturated, high plasticity.	<0.5	<0.5	<1	<3
BH6/3.8-4	FILL Silty sand, dark brown, with inclusions of trace clay, roadbase gravels, railway ballast, glass, tile and metal.	<0.5	<0.5	<1	<3
BH7/0 - 0.1	FILL Gravelly sand, grey brown, with inclusions of asphalt, brick, roadbase gravels, ash, slag, tile, roadbase gravels and metal.	<0.5	<0.5	<1	<3
BH7/12-12.5	NATURAL Sandy clay, brown, heterogeneous, saturated, stiff, high plasticity.	<0.5	<0.5	<1	<3
BH8/1.8-2	FILL Silty sand, black brown, with inclusions of ash and slag.	<0.5	<0.5	<1	<3
BH8/3.5-3.8	FILL Silty sand, black brown, with inclusions of ash, slag and crushed glass.	<0.5	<0.5	<1	<3
BH9/0 - 0.15	FILL Clayey sand, brown, with inclusions of slag, glass, metal, tile, roadbase gravels, brick and sandstone.	<0.5	<0.5	<1	<3
BH9/0.5-0.6	FILL Clayey sand, brown, with inclusions of slag, glass, metal, tile, roadbase gravels, brick and sandstone.	<0.5	<0.5	<1	<3
QA/QC					
QA1 (duplicate of BH6/3.8-4.0)	FILL: silty clay, pale brown	<0.5	<0.5	<1	<3
QC2 (duplicate of BH6/11.8-12)	FILL: silty sand, dark brown black	<0.5	<0.5	<1	<3
QA7 (duplicate of BH12/0-0.15m)	FILL: sandy clay, orange, brown, yellow and grey	<0.5	<0.5	<1	<3
QC1 (triplicate of BH6/3.8-4.0)	FILL: gravelly sandy clay, grey, moist	<0.5	<0.5	<1	<3
QC7 (triplicate of BH12/0-0.15m)	FILL: silty sand, dark black, brown	<0.5	<0.5	<1	<3
Trip Spike 22/06/10	FILL: silty sand, dark brown, medium grained	-	-	-	-
Trip Blank 22/06/10	FILL: silty clay pale brown possible ACM fragment	<0.5	<0.5	<1	<3

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City of Sydney

Table B - Summary Soil Results

Notes:

(1) Open Space Land Use Health based Investigation Levels (HIL-F) (Column 4, DEC 2006)

(2) Threshold concentrations for sensitive land use - soils (Table 3. EPA 1994)

bold above HIL (F) / Threshold Concentrations

All units in mg/kg unless indicated.

FILE REF: G:\JBS Environmental\Projects\City of Sydney\41105-Glebe Maxwell Rd\Reports\R02 Attach\[R02 Tables A to E.xlsx]TAble B

Sample number	Matrix Description	TPH		PAHs		Organochlorine Pesticides				PCBs
		C6 - C9	C10 - C36	Benzo (a) pyrene	Total PAHs	Aldrin + Dieldrin	Chlordane	Heptachlor	DDT + DDD + DDE	Total PCBs
LOR		25	250	0.05	1.55	0.2	0.2	0.1	0.3	0.6
Landuse criteria (mg/kg)										
Recreational [(1)] / TC [(2)]		65	1000	2	40	20	100	20	400	20
BH1/0 - 0.15	FILL Silty sand, brown, with inclusions of slag, roadbase gravels and glass.	<25	6900	91	854	<2	<2	<1	<3	<6
BH2/0 - 0.15	FILL Sandy silt, brown, with inclusions of glass, slag, roadbase gravels and bitumen.	<25	1340	5.3	39.7	<0.2	<0.2	<0.1	<0.3	<0.6
BH1/1.8-2	FILL Sandy clay, brown, with inclusions of glass, terracotta pipe fragments, shale, roadbase gravels and fragment of potentially ACM	<25	58890	110	1623	<2	<2	<1	<3	<6
BH10/0 - 0.15	FILL Silty sand, dark brown, with inclusions of sandstone.	<25	580	1.4	11.7	<0.2	<0.2	<0.1	<0.3	<0.6
BH10/1.8-2	FILL Silty sand, dark brown, with inclusions of brick, glass, slag and ash.	<25	2500	3.6	28.5	<0.2	<0.2	<0.1	<0.3	<0.6
BH11/0 - 0.15	FILL Gravelly sand, dark grey, black, with inclusions of brick, slag, igneous and sedimentary gravels.	<25	780	40	407	<0.2	<0.2	<0.1	<0.3	<0.6
BH12/0 - 0.15	FILL Gravelly sand, dark grey, black, with inclusions of brick, slag, glass, concrete, igneous and sedimentary gravels.	<25	630	7.3	62	<0.2	<0.2	<0.1	<0.3	<0.6
BH13/0 - 0.15	FILL Sandy silty clay, dark brown with inclusions of glass, brick, slag and sandstone.	<25	970	13	140	<0.2	<0.2	<0.1	<0.3	<0.6
BH14/0 - 0.15	FILL Silty sand, brown, with inclusions of roadbase gravels, glass and brick fragments.	<25	740	7.2	59.6	<0.2	<0.2	<0.1	<0.3	<0.6
BH15/0 - 0.15	FILL Silty sand, dark brown, with inclusions of roadbase gravels, glass and brick fragments.	<25	1010	12	94.6	<0.2	<0.2	<0.1	<0.3	<0.6
BH2/2.8-3	FILL Silty sand, brown, with inclusions of glass, roadbase gravels, slag and sandstone.	<25	880	16	156	<0.2	<0.2	<0.1	<0.3	<0.6
BH3/0.5-0.6	FILL Silty sand, dark grey, black, with inclusions of sandstone gravels, railway ballast and glass.	<25	<250	5.1	53.2	<0.2	<0.2	<0.1	<0.3	<0.6
BH3/1.8-2	FILL Silty sand, dark grey, brown, with inclusions of glass and tile fragments.	<25	760	10	91.5	<0.2	<0.2	<0.1	<0.3	<0.6
BH3/5.8-6	FILL: silty sandy clay, pale white to brown	<25	2900	41	392	<0.2	<0.2	<0.1	<0.3	<6
BH4/0.5-0.6	FILL Silty sand, dark brown, grey, with inclusions of tile, brick, grey basalt gravels and glass.	<25	<250	0.4	4	<0.2	<0.2	<0.1	<0.3	<0.6
BH4/5.8-6	FILL Silty sand, dark brown with orange and red lens, with inclusions of slag and coal.	<25	3600	45	502	<0.2	<0.2	<0.1	<0.3	<6
BH5/0 - 0.15	FILL Silty sand, brown to grey brown, with inclusions of brick fragments and slag.	<25	550	3.7	28.5	<0.2	<0.2	<0.1	<0.3	<0.6
BH5/3.8-4	FILL Silty sand, dark brown, black, with inclusions of brick fragments and slag.	<25	650	7	61.4	<0.2	<0.2	<0.1	<0.3	<0.6
BH6/11.8-12	NATURAL Sandy clay, grey black, heterogeneous, saturated, high plasticity.	<25	480	6.4	60.6	<0.2	<0.2	<0.1	<0.3	<0.6
BH6/3.8-4	FILL Silty sand, dark brown, with inclusions of trace clay, roadbase gravels, railway ballast, glass, tile and matal.	<25	660	5.7	50.4	<0.2	<0.2	<0.1	<0.3	<0.6
BH7/0 - 0.1	FILL Gravelly sand, grey brown, with inclusions of asphalt, brick, roadbase gravels, ash, slag, tile, roadbase gravels and metal.	<25	1470	3	22	<0.2	<0.2	<0.1	<0.3	<0.6
BH7/12-12.5	NATURAL Sandy clay, brown, heterogeneous, saturated, stiff, high plasticity.	<25	450	6.5	70.5	<0.2	<0.2	<0.1	<0.3	<0.6
BH8/1.8-2	FILL Silty sand, black brown, with inclusions of ash and slag.	<25	1050	8.8	76.4	<0.2	<0.2	<0.1	<0.3	<0.6
BH8/3.5-3.8	FILL Silty sand, black brown, with inclusions of ash, slag and crushed glass.	<25	<250	0.5	5.5	<0.2	<0.2	<0.1	<0.3	<0.6
BH9/0 - 0.15	FILL Clayey sand, brown, with inclusions of slag, glass, metal, tile, roadbase gravels, brick and sandstone.	<25	830	0.6	4.7	<0.2	<0.2	<0.1	<0.3	<0.6
BH9/0.5-0.6	FILL Clayey sand, brown, with inclusions of slag, glass, metal, tile, roadbase gravels, brick and sandstone.	<25	220	2.4	20.5	<0.2	<0.2	<0.1	<0.3	<0.6
QA/QC										
QA1 (duplicate of BH6/3.8-4.0)		-	-	<0.05	<1.55	<0.2	<0.2	<0.1	<0.3	-
QC2 (duplicate of BH6/11.8-12)		-	-	<0.05	<1.55	<0.2	<0.2	<0.1	<0.6	-
QA7 (duplicate of BH12/0-0.15m)		-	-	<0.05	<1.55	<0.2	<0.2	<0.1	<0.3	-
QC1 (triplicate of BH6/3.8-4.0)		<20	380	4	<1.55	<0.2	<0.2	<0.1	<0.3	<0.6
QC7 (triplicate of BH12/0-0.15m)		<20	380	5.2	<1.55	<0.2	<0.2	<0.1	<0.3	<0.6
Trip Spike 22/06/10										
Trip Blank 22/06/10		<25	<250							

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City of Sydney
Table A - Summary Soil Results

Notes:

(1) Open Space Lacd Use Health based Investigation Levels (HIL-F) (Column 4, DEC 2006)
(2) Threshold concentrations for sensitive land use - soils (Table 3. EPA 1994)

BOLD above EIL criteria
bold above HIL (E) / Threshold Concentrations
All units in mg/kg unless indicated.

FILE REF: G:\JBS Environmental\Projects\City of Sydney\41105-Glebe Maxwell Rd\Reports\R02 Attach\[R02 Tables A to E.xlsx]Table A

Sample number	Matrix Description	Metals							
		Arsenic	Cadmium	Chromium (Total)	Copper	Lead	Mercury	Nickel	Zinc
LOR		4.0	1.0	1.0	1.0	1.0	0.1	1.0	1.0
Landuse criteria (mg/kg)									
Ecological (EIL)		20	3	400	100	600	1	60	200
Recreational [(1)] / TC [(2)]		200	40	240000	2,000	600	30	600	14000
BH1/0 - 0.15	FILL Silty sand, brown, with inclusions of slag, roadbase gravels and glass.	<4	<0.5	4	67	63	0.1	5	82
BH2/0 - 0.15	FILL Sandy silt, brown, with inclusions of glass, slag, roadbase gravels and bitumen.	6	<0.5	10	**100**	76	<0.1	19	110
BH1/1.8-2	FILL Sandy clay, brown, with inclusions of glass, terracotta pipe fragments, shale, roadbase gravels and fragment of potentially ACM	7	<0.5	17	51	240	0.1	5	150
BH10/0 - 0.15	FILL Silty sand, dark brown, with inclusions of sandstone.	5	<0.5	16	**140**	31	0.2	16	38
BH10/1.8-2	FILL Silty sand, dark brown, with inclusions of brick, glass, slag and ash.	18	**10**	44	**410**	**750**	0.4	**79**	**740**
BH11/0 - 0.15	FILL Gravelly sand, dark grey, black, with inclusions of brick, slag, igneous and sedimentary gravels.	17	1.3	36	**280**	**910**	0.6	38	**1100**
BH12/0 - 0.15	FILL Gravelly sand, dark grey, black, with inclusions of brick, slag, glass, concrete, igneous and sedimentary gravels.	**22**	1.4	53	**180**	**670**	0.6	55	**710**
BH13/0 - 0.15	FILL Sandy silty clay, dark brown with inclusions of glass, brick, slag and sandstone.	11	2.3	52	**380**	**1200**	0.4	32	**860**
BH14/0 - 0.15	FILL Silty sand, brown, with inclusions of roadbase gravels, glass and brick fragments.	11	2.5	40	**230**	**1400**	0.4	27	**1000**
BH15/0 - 0.15	FILL Silty sand, dark brown, with inclusions of roadbase gravels, glass and brick fragments.	11	<0.5	21	44	160	0.2	12	150
BH2/2.8-3	FILL Silty sand, brown, with inclusions of glass, roadbase gravels, slag and sandstone.	27	2.7	53	**570**	**1400**	0.4	57	**1400**
BH3/0.5-0.6	FILL Silty sand, dark grey, black, with inclusions of sandstone gravels, railway ballast and glass.	81	**3.9**	**750**	**830**	**8000**	0.1	**220**	**4700**
BH3/1.8-2	FILL Silty sand, dark grey, brown, with inclusions of glass and tile fragments.	**58**	**6.4**	140	**1600**	**2500**	0.2	120	**4500**
BH3/5.8-6	FILL: silty sandy clay, pale white to brown	17	1	65	**260**	**620**	0.5	28	**590**
BH4/0.5-0.6	FILL Silty sand, dark brown, grey, with inclusions of tile, brick, grey basalt gravels and glass.	**41**	0.8	120	**4700**	**3800**	<0.1	96	**580**
BH4/5.8-6	FILL Silty sand, dark brown with orange and red lens, with inclusions of slag and coal.	14	1	33	**1800**	**810**	0.6	38	**700**
BH5/0 - 0.15	FILL Silty sand, brown to grey brown, with inclusions of brick fragments and slag.	<4	<0.5	12	39	75	<0.1	11	74
BH5/3.8-4	FILL Silty sand, dark brown, black, with inclusions of brick fragments and slag.	**44**	**5.6**	**950**	**1100**	**1700**	0.3	**150**	**1400**
BH6/11.8-12	NATURAL Sandy clay, grey black, heterogeneous, saturated, high plasticity.	13	1.1	30	**160**	270	1.6	16	**410**
BH6/3.8-4	FILL Silty sand, dark brown, with inclusions of trace clay, roadbase gravels, railway ballast, glass, tile and matal.	**37**	**12**	74	**1100**	**1700**	0.6	**92**	**2000**
BH7/0 - 0.1	FILL Gravelly sand, grey brown, with inclusions of asphalt, brick, roadbase gravels, ash, slag, tile, roadbase gravels and metal.	<4	<0.5	16	40	42	<0.1	8	61
BH7/12-12.5	NATURAL Sandy clay, brown, heterogeneous, saturated, stiff, high plasticity.	14	1.4	30	72	**1700**	0.8	10	**820**
BH8/1.8-2	FILL Silty sand, black brown, with inclusions of ash and slag.	**29**	**5.9**	150	**260**	**910**	0.9	54	**5100**
BH8/3.5-3.8	FILL Silty sand, black brown, with inclusions of ash, slag and crushed glass.	**37**	1.2	29	**3400**	**1000**	0.5	**64**	**1200**
BH9/0 - 0.15	FILL Clayey sand, brown, with inclusions of slag, glass, metal, tile, roadbase gravels, brick and sandstone.	<4	<0.5	10	30	32	<0.1	7	62
BH9/0.5-0.6	FILL Clayey sand, brown, with inclusions of slag, glass, metal, tile, roadbase gravels, brick and sandstone.	12	0.6	15	74	150	0.5	23	190
QA/QC									
QA1 (duplicate of BH6/3.8-4.0)		**42.0**	9.6	90.0	**2400**	**1400**	0.7	**100.0**	**3500.0**
QC2 (duplicate of BH6/11.8-12)		13.0	1.2	23.0	**200.0**	380	1.2	18.0	**720.0**
QC7 (duplicate of BH12/0-0.15m)		**21.0**	1.3	37.0	**230.0**	**620**	0.4	**57.0**	**650.0**
QC1 (triplicate of BH6/3.8-4.0)		**48**	10	92	**930**	**1000**	0.48	**110**	**2700**
QC7 (triplicate of BH12/0-0.15m)		**26**	2.1	51	**360**	**880**	0.43	64	**920**
Trip Spike 22/06/10		-	-	-	-	-	-	-	-
Trip Blank 22/06/10		-	-	-	-	-	-	-	-

Document Status

Rev No.	Author	Reviewer	Approved for Issue		
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0	Sumi Dorairaj	Charlie Furr	Draft for Client Review		11/08/10
1	Sumi Dorairaj	Charlie Furr	Charlie Furr		12/10/10

128 O'Riordan Street
Mascot NSW 2020
Tel: +61 2 8338 1011
Fax: +61 2 8338 1700

www.jbsgroup.com.au