REMEDIAL ACTION PLAN

677 - 687 CANTERBURY ROAD, BELMORE NSW

PREPARED FOR WM RITCHIE PROPERTIES PTY LTD
& BELMORE 677 PTY LTD
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1 PROJECT INFORMATION

1.1 INTRODUCTION

Geo-Environmental Engineering Pty Ltd (GEE) was commissioned by City Alliance Property Pty Ltd, on behalf of WM Ritchie Properties Pty Ltd & Belmore 677 Pty Ltd, to prepare this Remedial Action Plan (RAP) for the site located at 677 - 687 Canterbury Road, Belmore, New South Wales (NSW) (herein referred to as 'the site').

The RAP was required to support a Development Application with Canterbury Municipal Council (Council) which relates to the proposed demolition of existing structures and the construction of a multi-storey, mixed-use, development with basement carparking. The exact details of the proposed development, including the number of levels above and below ground, have not been finalised. However, it is expected that the ground floor will comprise commercial land-use with residential apartments above. Additionally, the basement level(s) are expected to cover the majority of the site.

The RAP is based on information contained within a Stage 1 and 2 Environmental Site Assessment (Stage 1 and 2 ESA) completed by GEE in 2014 (reference 1) and relates to the following localised presence of soil contamination, and potential soil contamination:

- ◊ Lead within the near surface fill material located in the eastern portion of the site,
- ◊ Benzo(a)pyrene within near surface fill material in the south-western corner of the site, and
- ◊ Potential soil contamination which may be present immediately surrounding Underground fuel Storage Tanks (USTs) and associated infrastructure (*eg.* pipework) which could not be adequately assessed as part of the Stage 1 and 2 ESA.

The above contamination, and potential contamination, requires remediation in order for the site to be suitable the proposed land-use (residential with minimal access to soil). The RAP outlines the remediation methodology proposed, including the process for the removal of existing USTs and associated infrastructure and the remediation and validation of surrounding soils. The remediation strategy adopted in this RAP is the removal of the contamination followed by validation of the remaining soils. GEE understands that the remediation works will be undertaken as part of proposed redevelopment of the site following vacation of the site by the existing tenant.

The RAP has been prepared in accordance with relevant guidelines endorsed by the NSW Office of Environment and Heritage (OEH)[1].

1.2 BACKGROUND INFORMATION

The site occupies a combined area of approximately 6,900m^2, including the following legal allotments:

- Lots 1 & 2 in DP 533919
- Lots A & B in DP952115, and
- Lot 91 in DP3862.

A site location map is provided as **Figure 1,** while the allotment boundaries which make up the site are shown on **Figure 2**. A detailed site survey is provided for reference in **Appendix A.**

The southern corner of the site was formerly a motor vehicle workshop and service station between approximately 1929 and 1979 and it is understood that four USTs remain. The USTs vary from 5,400 litre to 20,140 litre in capacity and considering the age of the former service station facility, the contents of the USTs is likely to have been leaded petrol, diesel and/or waste oil.

Additionally, there is a 2,200L UST beneath the loading dock in the north-eastern corner of the site. This latter UST was abandoned *in-situ* in September 1996 by filling it with a concrete slurry. The suction line was removed and the vent line, fill pipe, dip pipe and bowser line sealed. Considering the age of the tank and the fact that there was once a bowser associated with the tank, it is likely that the UST contained diesel or leaded petrol prior to being decommissioned.

1.3 OBJECTIVES

The objectives of this RAP are to:

1. Define the remedial goals that will ensure that the remediated site will be suitable for the most sensitive of the proposed land-use following redevelopment (i.e. residential with minimal access to soil),

[1] Note that NSW Environment Protection Authority (EPA) is part of the OEH, which replaces the NSW Department of Environment and Climate Change and Water (DECCW), NSW Department of Environment and Climate Change (DECC), and NSW Department of Environment (DEC).

2. Document the remediation strategy and describe the remediation procedures to be implemented to reduce the contamination risk to an acceptable level for the land-use, including requirements for validating the remedial works,
3. Establish the necessary environmental management procedures to be implemented during the proposed remedial works, and
4. Identify any regulatory approvals or licences required by the proposed works.

1.4 SCOPE OF WORKS

The scope of this RAP is as follows:

1. Identify the extent and type of contamination requiring remediation,
2. Definition of remediation goals and Remediation Acceptance Criteria (RAC),
3. Evaluate the feasible remediation strategies and options,
4. Detail the preferred remediation option for the site,
5. Preparation of a validation plan to ensure that the RAC are achieved,
6. Preparation of an OH&S plan to minimise the risk of human exposure to contaminants, and
7. Preparation of an environmental management plan to minimise the impact of remediation works on the surrounding environment.

Following the execution of the remediation process, a validation report will be prepared. The objective of the validation report is to describe the completed remedial works and determine whether the site has been remediated to a standard that is suitable for the proposed residential land-use with minimal opportunities for access to soil.

2 SITE IDENTIFICATION

A summary of the site location details is provided below, while a site location map is provided as **Figure 1**:

Street Address:	677 - 687 Canterbury Road, Belmore NSW
Legal Description:	Lots 1 & 2 in DP 533919, Lots A & B in DP952115 and Lot 91 in DP3862 (refer to **Figure 2** and **Appendix A**)
Coordinates (MGA 56):	323700 mE, 6244780 mN
Local Government Area:	Canterbury Municipal Council
Site Area:	Approximately 6,900m^2
Current Owner:	WM Ritchie Properties Pty Ltd
Current Zoning:	B6 – Enterprise Corridor & R3 Medium density residential[2]
Current Use:	J. Robins & Sons Pty Ltd – Manufacture of shoes
Proposed Zoning:	GEE understands that the proposed development will be within the requirements of the current zoning[2]
Proposed Use:	Mixed Commercial and Residential

[2] Canterbury Local Environment Plan 2012 – Land Zoning Map – Sheet LZN_004

3 PREVIOUS INVESTIGATIONS

In early 2014, GEE completed a Stage 1 and 2 Environmental Site Assessment (ESA) of the site (reference 1) which included:

- ◊ A review of the environmental and physical setting in which the site lies,
- ◊ A review of the history of the site,
- ◊ A detailed site inspection for potential sources of contamination,
- ◊ A detailed soil and groundwater sampling and analysis program to characterise potential contamination across the site.

A review of the historical information indicates that the site has been operating as a shoe factory since approximately 1979. Before 1979 the majority of the site (*i,e*. lots 91, 1 and 2) was occupied by a clothing factory which commenced circa 1937. Of the other allotments, Lot A (located along the western boundary fronting Drummond Street) appears to have been used as a residential property since at least 1916 and this land-use has continued up until the time of this investigation. The final allotment which makes up the site (Lot B - in the south-western corner of the site) appeared to be a motor vehicle workshop and service station prior to being purchased by J. Robins & Sons Pty Ltd in circa 1980. The garage and/or service station was likely operated from approximately 1929 when Motor & Engineering Works Ltd purchased the allotment. The allotment was then owned by various individuals listed as being a '*garage proprietor'* before Caltex Oil (Australia) Pty Ltd owned the allotment between 1953 and 1979.

Soil conditions across the site were assessed at twenty eight borehole locations (BH1 to BH28) positioned across the site and targeting areas of potential contamination (in particular the service station in the south-western corner). The number of boreholes exceeded the minimum number of sampling points required for adequate site characterisation as defined by the EPA NSW and Australian Standards.

The subsurface conditions encountered during the field investigations comprised a layer of fill material which was underlain by a natural clay soil which graded into shale bedrock. The depth of filling was typically between 0.15m and 1.3m bgs, although deeper sand fill was present in the vicinity of the USTs in the south-western corner of the site. The depth to shale bedrock ranged from 0.75m to 2.2m bgs.

During the drilling of boreholes, there were no unusual odours (that could be potentially associated with contamination) noted. Additionally, no potentially Asbestos Containing Materials (ACM) was observed below ground during sampling and logging. Permanent groundwater was not encountered during the drilling of each borehole, however, groundwater seepage did eventually occur in the monitoring wells installed within bores BH2, BH3, BH4, BH10, BH14 and BH20.

As part of the investigation, GEE submitted a total of 69 soil samples from the 28 boreholes to Envirolab for NATA accredited laboratory analysis of metals (arsenic, cadmium, chromium, copper, nickel, lead, mercury and zinc), TRH, BTEX, PAHs, OCPs, PCBs and asbestos and the analytical results were compared against relevant set of Site Assessment Criteria (SAC) appropriate for the proposed residential land-use with minimal access to soil.

In summary, the only analytes to exceed the health and/or ecological SAC was:

- Lead within the fill layer at BH26 (sample SM060114-93 – 6000mg/kg) which exceeded the ecological and health based SAC. BH26 was 17m from the eastern boundary and 15m from the northern boundary of the factory, and
- B(a)P within the fill at BH4 (sample SM161213-22 – 1.3mg/kg) which exceeded the ecological SAC of 0.7mg/kg. BH4 was 2m from the western boundary and 4m from the southern boundary.

The lead concentration in sample SM060114-93 was re-analysed three times using new sub-samples from the same sample jar and the results were 1700mg/kg, 2400mg/kg and 3900mg/kg which equates to an average lead concentration of 3500mg/kg. The average concentration of lead was more than 2.5 times the health and ecological SAC and therefore is considered to be a 'hot-spot' of contamination which will need to be remediated and/or managed *in-situ* as part of the proposed redevelopment works.

The concentration of B(a)P in sample SM161213-22 only marginally exceeded the ecological SAC which is a screening level, above which will require further evaluation and consideration. Considering the urban environment in which the site lies, the existing land-use and the extent and type of the proposed development (particularly the fact that the site will be excavated to form a basement level), GEE considers that the elevated B(a)P concentration does not require specific remediation and can be managed appropriately as part of the proposed redevelopment work, including

provision of a waste classification for the fill layer and disposal to an appropriately licenced landfill facility.

An estimate of the most likely waste classifications for the fill and natural soil profile is as follows:

- ◊ Fill layer in the vicinity of BH26 which is impacted with lead up to 6000mg/kg. This portion of fill is expected to have a waste classification of 'Restricted Solid Waste'.
- ◊ The remaining portion of the fill layer is likely to be classified as General solid waste (non-putrescible).
- ◊ The natural soil profile (including shale bedrock) is free of any contamination and therefore has a classification of virgin excavated natural material (VENM) which is a sub-class of general solid waste (non-putrescible) which and can be re-used, rather than be disposed at a landfill. To ensure VENM classification the natural soil / bedrock must not be mixed with any fill material or other deleterious material. GEE recommends that all remediation work including removal of any USTs, the lead impacted soil at BH26 and remaining fill layer be removed from site before excavation and disposal of VENM.

GEE notes that these waste classifications are only estimates and further testing of the fill layer will be necessary including leachate analysis using the Toxicity Characteristic Leaching Procedure (TCLP).

Groundwater conditions beneath the site were assessed using six monitoring wells installed within boreholes BH2, BH3, BH4, BH10, BH14 and BH20. Water within the wells was generally neutral in pH and high in conductivity indicating brackish / saline water. The standing (or stabilised) water level was recorded in each well prior to purging and sampling and when compared to the surface elevations it was determined that groundwater is flowing in a north-westerly direction which is commensurate with the topography.

To assess the presence of contamination within the groundwater beneath the site, water from each well was submitted to Envirolab for NATA accredited analysis of dissolved metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc and mercury), TRH, BTEX, PAHs and VOCs. The analytical results were then compared against a set of groundwater investigation Levels (GILs) considered appropriate for the environmental setting of the site.

The concentrations of arsenic, cadmium, chromium, copper, lead, mercury, TRH, BTEX and PAHs conformed to the adopted GILs, while the concentrations of nickel and zinc in some wells exceeded the SAC. The metal exceedances are not considered to be significant because:

- ◊ The groundwater from the site was collected from a stratigraphy comprising shale and according Hem (1989 – reference 2), the concentrations of nickel and zinc are commensurate with naturally occurring background concentrations.
- ◊ The concentrations are consistent across the site (including the up-hydraulic gradient wells).
- ◊ No source of metal contamination was identified in the fill and natural soils across the site.
- ◊ The concentrations detected are commensurate with metal concentrations within the groundwater across the Sydney region.

Figure 3 shows the location of the boreholes drilled as part of the Stage 1 and 2 ESA and includes a recent aerial photograph of the site. **Figure 4** is similar but includes the site survey as a background. The approximate location of the USTs is provided on **Figure 4** and **5**, while the borehole logs are provided in **Appendix B.**

4 SITE CONDITION AND SURROUNDING ENVIRONMENT

This section provides a summary of the site features and surrounding environment and has been extracted from the Stage 1 and 2 ESA report (reference 1).

4.1 SITE DESCRIPTION

The site is bounded by Canterbury Road to the south, Drummond Street to the west and Anderson Street to the east. To the north are low density residential properties.

At the time of the investigation the site was owned by WM Ritchie Properties Pty Ltd and leased to J. Robins & Sons Pty Ltd, a shoe manufacturing company which has occupied the site since approximately 1979. Shoe manufacturing predominately took place within a factory (plate 1) which occupies the central and eastern portion of the site (lots 1 and 2 of DP 533919). The factory was predominately set over one level with a mezzanine level along the western side and a basement in the northern portion. The eastern portion of the factory was where the polyurethane shoe soles were moulded and the cutting of shoe materials and final construction of the shoes was undertaken in the western portion of the factory. Based on information from J. Robins & Sons Pty Ltd, the main use of chemicals (apart from polyurethane for the soles) included glue (adhesives) for final construction of the shoes. Leather and other shoe materials were imported to site and not coloured or dyed on site.

An inspection of the factory revealed that the entire ground floor and basement level had a concrete floor slab which appeared to be in good condition with little evidence of cracking or staining from past use of chemicals. Chemicals were stored either in drums in the main manufacturing area or in raised cabinets. A vehicle loading dock was located in the north-western and north-eastern corners of the factory. Beneath the floor of the dock was a 2,200 litres underground storage tank which had been decommissioned using concrete slurry in 1996. The factory appeared to be steel framed with brick walls and a compressed fibro roof which was likely to contain asbestos.

Lot 91 in the north-western corner of the site, was undeveloped land which was being used as a carpark and truck access to the shoe factory (plate 2). A concrete paved driveway linked the loading dock within the north-western corner of the factory with Drummond Street to the west. The remainder of this allotment was predominately paved with asphalt with the exception of a grass strip along the northern boundary.

Lot A (along Drummond Street) was occupied by a three level residential apartment building with grass lawns to the west and a concrete pavement on all remaining sides (plate 3). The building was constructed of brick and had a tiled roof.

Lot B, which is located in the south-western corner, was occupied by a single storey brick and metal building and detached single storey brick 'garage' building. The smaller, 'garage' building contained a backup generator for the adjoining factory which was understood to have not been required. This building was brick clad and had a steel roof.

The larger building on Lot B was in a state of disrepair and was being used for storage of old equipment from the main shoe factory. This building was steel framed with brick walls and a corrugated steel roof. GEE understands that this was once an operating part of the shoe factory, however, a downturn in the shoe business meant that this space was no longer required. There was a fibro and tile clad awning attached to the southern side of the larger building which covered a concrete paved area (adjacent to Canterbury Road). It is beneath this concrete where the former Underground storage Tanks (USTs) listed on the 'contract of sale document' in **Appendix D**.

Existing site features are shown on the site survey provided in **Appendix A** and also **Figure 2**. Photographs of the site, which were taken at the time of the site inspection on the 23rd October 2013, are provided for reference in Plates 1 to 6 below.

Plate 1 – View towards the east along the southern boundary showing the external factory wall

Plate 2 – View towards the north across Lot 91 showing the asphalt car parking area and concrete driveway in the background.

Plate 3 – View towards the east along the northern side of the residential apartment building.

Plate 4 – View towards the east where the former garage / service station was located.

Plate 5 – View towards the west where the former garage / service station was located.

Plate 6 – View towards the south across Lot B with the factory building to the left.

4.2 TOPOGRAPHY

According to the site survey plan (**Appendix A**), the site has an elevation of between 41m and 46m above Australian Height Datum (AHD). The highest ground is located at the southern end of the site (adjacent to Canterbury Road) and the ground slopes down towards the opposite boundary at a gentle grade of approximately 5%.

4.3 PROPOSED LAND-USE

GEE understands that the proposed development will be consistent with the existing land-use zoning of '*B6 – Enterprise Corridor & R3 Medium density residential*'.

4.4 SUBSURFACE SITE CONDITIONS

4.4.1 Regional Geology and Soils

A review of the Sydney 1:100 000 Geological Map (Reference 3) A review of the Sydney 1:100 000 Geological Map indicates that the site is underlain by the Ashfield Shale formation which typically comprises "...*black to dark-grey shale and laminate*" of the Wianamatta Group.

A review of the regional soils map (reference 4) indicates that the site is located within the Blacktown Soil Landscape Group which typically comprise heavy, highly reactive clays derived from the weathering process of shale bedrock, and have low fertility and are often strongly acidic.

4.4.2 Local Geology and Soil

The subsurface conditions, as observed in the boreholes drilled as part of the Stage 1 and 2 ESA, typically comprised some fill material over natural clay soil which graded into weathered shale bedrock. The depth of filling was typically between 0.15m and 1.3m bgs, although deeper sand fill was present in the vicinity of the USTs in the south-western corner of the site. The depth to shale bedrock ranged from 0.75m to 2.2m bgs. Adverse aesthetics, specifically odours associated with potential contamination, were not noted during the fieldwork. Additionally, no potentially Asbestos Containing Materials (ACM) was observed in the bores during the drilling.

A summary of the soil profile beneath the surface pavements was as follows:

Fill Material:	Mix of sand, gravel and clay across the majority of the site and sand only in the vicinity of the UST tankpits.
Natural Soil	Dark-brown, red-brown, orange-brown and pale grey, moist, medium to high plasticity with some ironstone gravel content.
Bedrock:	Grey and brown weathered shale.

4.4.3 Groundwater

The regional groundwater in the vicinity of the site is likely to be confined or partly confined, discrete, water-bearing zones within the Ashfield shale formation. Therefore, considering the relatively low permeable soils present across the site, groundwater is unlikely to be influence by near surface soil contamination. This is supported by the fact that the permeability of the shale matrix is also very low (between 10^{-13} and 10^{-9} m/sec – reference 5) and groundwater flow is dominated by

water movement through fractures (or joints), where stress has caused partial loss of cohesion in the rock.

Groundwater was not encountered in the boreholes during the short time they remained open (< 10 minutes). However, water did eventually seep into the three groundwater monitoring wells (BH2, BH3, BH4, BH10, BH14 and BH20). Based on the standing (or stabilised) water levels in each well and the surface elevation at each well location it was determined that the direction of groundwater flow is to the north-west which is commensurate with the topography.

A search of registered groundwater bores within the vicinity of the site identified four monitoring bores installed on a property approximately 1.2km to the north-northwest of the site. The bores were installed for Caltex Oil (Australia) Pty Ltd and no other relevant information was recorded. Although down-gradient of the site, the distance and regional geology / soils suggest that these registered bores are unlikely to be impacted by any contamination originating from the subject site.

4.5 AREAS AND TYPE OF CONTAMINATION

As detailed in the Stage 1 and 2 ESA report (reference 1), there was some localised soil contamination identified which require remediation and/or in-situ management to ensure the site is suitable for the proposed land use. The contamination comprised:

- Lead within the fill layer at BH26 (sample SM060114-93 – 6000mg/kg) which exceeded the ecological and health based SAC. BH26 was 17m from the eastern boundary and 15m from the northern boundary of the factory. The total depth of fill at BH26 was 0.6m below the concrete surface slab, and
- B(a)P within the fill at BH4 (sample SM161213-22 – 1.3mg/kg) which exceeded the ecological SAC of 0.7mg/kg. BH4 was 2m from the western boundary and 4m from the southern boundary and the fill extended 0.3m below the concrete surface.

Additionally, adequate assessment of the soil immediately surrounding the USTs and any associated infrastructure could not be undertaken during the Stage 1 and 2 ESA and therefore will further assessment (and potentially remediation and validation) will be carried out following the removal of the USTs and associated infrastructure. The type of contamination (if present) is expected to be related to the contents of the former USTs (i.e. leaded petrol, diesel and/or waste oil). The approximate location of the USTs is shown on **Figure 5** along with boreholes drilled as part of the Stage 1 and 2 ESA.

5 REMEDIATION STRATEGY

This section provides the remediation goal, the extent of remediation required and discusses the remedial options to determine the preferred remedial option.

5.1 REMEDIATION GOAL

The goal of the remediation activities is to render the site suitable for the proposed land-use which is residential with minimal opportunities for soil access as defined by NEPM 2013 – Schedule B7 Section3 (reference 6).

5.2 EXTENT OF REMEDIATION

As detailed in the Sections 4.5, there was lead contamination identified in fill material at BH26 and minor B(a)P contamination identified within fill material at BH4. Based on the laboratory analytical results from other samples collected from BH26 and BH4, the extent of contamination is expected to be restricted to the fill layer. Additionally, the analytical results from adjoining boreholes suggest that the elevated lead and B(a)P are isolated incidents.

The extent of contamination (if any) surrounding the USTs and any associated infrastructure is also expected to be somewhat isolated because testing of samples collected from the surrounding boreholes did not identify any obvious contamination relating to the former contents of the USTs (i.e. petrol, diesel and/or waste oil). To assess soil contamination surrounding the USTs (i.e. tankpit) and any associated infrastructure (e.g. fuel feed lines), GEE will carry out an assessment and validation in accordance with Section 4.2 of the NSW EPA (1994) *Guidelines for Assessing Service Station Sites* (reference 7).

5.3 REMEDIATION OPTIONS

The current policy of the Australian and New Zealand Environment Conservation Council (ANZECC) and National Health and Medical Research Council (NHMRC) is provided within the Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (reference 9) and is endorsed in NSW OEH as detailed in NSW DEC *Guidelines for the NSW Site Auditor Scheme* (reference 8). The policy requires that soil remediation and management in NSW should be is implemented in the following preferred order:

1. On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level.
2. Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site.
3. Removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill.
4. Consolidation and isolation of the soil on-site by containment within a properly designed barrier.

Additionally, NSW DEC (reference 8) states that remediation should not proceed in the event that it is likely to cause a greater adverse effect than leaving the site undisturbed. Additionally, in cases where it is not viable to remediate large quantities of soil with low levels of contamination, alternative remediation strategies should be considered or developed.

Given the limited type and extent of contamination expected to be associated with the former USTs, remediation is not expected to cause a greater adverse effect compared to leaving the contamination undisturbed. Although any contamination is likely to be contained within the tankpit(s), the site is expected to be re-developed which will involve excavation for a basement level, resulting in a potential exposure pathway to construction workers. Also, the quantity of contamination requiring remediation, although not accurately defined, is not considered to be significant.

A summary of the soil remediation options and assessment of the suitability of each is provided in **Table 1**.

Table 1: Summary of the Soil Remedial Options

Remediation Option	Assessment	Conclusion
1. On-site treatment of the soil	Due to the relatively stubborn nature of Lead and B(a)P there are no proven, cost effective or reliable treatment processes which are able to destroy the contaminants or reliably reduce the hazards to acceptable levels, particularly for the quantities involved. On-site treatment of the petroleum hydrocarbon contaminants is feasible and can be achieved through 'landfarming' or 'biopiles'. The advantage of this option is that it minimises off-site disposal of material, however, is not a viable option given that both of these technologies require a relatively large land area and time for the completion of natural biodegradation processes. Bioremediation also has the potential to generate odours associated with the presence of volatile hydrocarbon fractions and due to the presence of nearby residences is not considered a viable option.	Unfeasible for Lead and B(a)P and feasible for some hydrocarbons but not preferred
2. Off-site treatment of excavated soil.	As above, however, there are reductions in noise and dust emissions on site in comparison to on-site treatment, which are offset by increased truck movements. This strategy is expected to incur additional costs, such as transport (to and from site), possible costs associated with lease of land fees and approval would be required from consent authorities.	Unfeasible for Lead and B(a)P and feasible for some hydrocarbons but not preferred
3. Removal of contaminated soil to an approved site or facility.	There are currently suitably licensed waste facilities in the Sydney Metropolitan region capable of accepting petroleum hydrocarbon impacted soil, although waste classification is required in accordance with NSW DECC (2009) *Waste Classification Guidelines (reference 10).* Although this option generates additional truck movements and associated fuel/emissions over option 1 and option 4, it is less than option 2, since materials are not returned to site. This option also generates the highest quantity of waste, since the materials are disposed to landfill rather than treated and reused or retained on Site. Finally it is also an uncomplicated strategy that is time effective.	Feasible and the preferred option.
4. Consolidation and isolation of the soil on-site.	B(a)P and lead is considered suitable for consolidation and isolation within an on-site containment structure because they are relatively immobile and not volatile. However, it is also not considered cost effective or appropriate given the relatively small volumes of soil that requires remediation and the fact that proposed development includes a basement level and therefore soil will need to be excavated regardless. Additionally, petroleum hydrocarbons (if present) are not considered to be suitable for consolidation and isolation within an on-site containment structure, given that they are relatively mobile and possibly volatile.	Not feasible

5.4 PREFERRED REMEDIATION OPTION

In consideration of the hierarchy for soil remediation options outlined above, the contaminants (i.e. lead, B(a)P and potentially petroleum hydrocarbons), the minimal quantities involved, the proposed redevelopment works (including basement excavation) and the environmental setting of the site (including proximity to adjoining residential dwellings), the preferred remediation option is excavation of the contaminated soil and off-site disposal to a facility licensed to receive the waste.

GEE notes that the prior to disposal off-site the contaminated soil will require classification in accordance the NSW DECC *Waste Classification Guidelines* (reference 10).

6 REMEDIATION METHODOLOGY

This section outlines the scope of the remediation works and provides detail of the proposed methodology of each of the required remediation tasks.

6.1 REMEDIATION SCOPE OF WORK

The remediation work should be carried out following demolition of existing structures including the removal of any surface pavements. The initial step of remediation will be to obtain the necessary approval from the Canterbury City Council in accordance with planning guidelines (references 11 and 12). The subsequent steps of remediation will depend on the type of contamination or potential contamination as described below:

6.1.1 Lead Contaminated Fill

It is understood that the entire fill layer across the site and the underlying natural soil and part of the shale formation will be excavated and disposed off-site to facilitate construction of the basement. The lead concentration in the fill layer at BH26 is considered to be very high and when compared to the NSW EPA waste classification guidelines (reference 10) indicates that a 'restricted solid waste' classification for off-site disposal would apply, while the remaining fill material will likely be general solid waste. In this regard, the lead impacted soil will be segregated and disposed off-site separately.

The broad steps of remediating the lead contaminated soil are as follows:

1. Inspection of the fill material for physical indicators of the elevated lead concentrations.
2. Waste classification sampling and analysis of the fill at the location of BH26.
3. Excavation and disposal of the fill layer at a suitably licenced landfill facility,
4. Validation sampling and analysis of the resulting excavation to ensure that the lead contaminated soil has been removed. If validation fails then further excavation and further sampling and analysis as required,
5. Preparation of a validation report.

6.1.2 B(a)P Contaminated Fill

The B(a)P concentration in the fill at BH4 (1.3mg/kg) was only marginally over the ecological based SAC and was below the health based SAC. As previously mentioned (Section 3) the waste classification for the fill layer (including elevated B(a) at BH4) is likely to be general solid waste, although further testing of the fill layer will be necessary including leachate analysis using the Toxicity Characteristic Leaching Procedure (TCLP).

The broad steps of remediating / managing the B(a)P impacted soil are as follows:

1. Waste classification sampling and analysis of the entire fill layer including leachate analysis using the Toxicity Characteristic Leaching Procedure (TCLP).
2. Excavation and disposal of the fill layer at a suitably licenced landfill facility,
3. Validation sampling and analysis from the underlying natural clay soil profile to ensure that the fill material has been removed. If validation fails then further excavation and further sampling and analysis as required,
4. Preparation of a validation report.

6.1.3 Potential Soil Contamination Relating to the USTs

The proposed steps for the assessment and remediation of any contamination surrounding the USTs are as follows:

1. Removal of the USTs and any associated infrastructure.
2. Assessment of any perched water within the UST tankpits.
3. Extraction / pumping out of any perched water within the UST tankpits.
4. Field screening of the soil in the tankpits and immediately surrounding any associated infrastructure.
5. Controlled excavation and stockpiling of any contaminated soil.
6. Waste classification of the stockpiled soil followed by off-site disposal at a suitably licensed landfill facility.
7. Validation sampling and analysis of the resulting UST excavations and surrounding any associated infrastructure
8. Preparation of a validation report.

6.2 METHODOLOGY

The methodologies to be undertaken on the site for the various components of the remediation works are presented in detail in the sections below.

6.2.1 Lead Contaminated Fill

The lead contaminated soil was encountered at BH26 which was 17m from the eastern boundary and 15m from the northern boundary of the factory.

- *Task 1: Inspection of Fill*

Following demolition of existing structures and the surface slab of concrete, an inspection of the fill material will be carried out for physical indicators (e.g. such as stained soil or presence of metal fragments) of the elevated lead concentrations. Such physical indicators would assist with determining the extent of contamination and the extent of required remediation.

- *Task 2: Waste classification sampling and analysis of the fill material.*

The lead contaminated fill material at BH26 will be classified in accordance with NSW DECC (2009) *Waste Classification Guidelines* (reference 10) prior to off-site disposal at a suitably licensed facility. Sampling and analysis will be undertaken as described in Section 8.2. GEE anticipates that a restricted solid waste classification will apply, although there is a chance that the stockpile may be classified as general solid waste if the former elevated lead result was an isolated anomaly.

If there are no physical indicators of the lead contamination then GEE will assume a 10m x 10m section of fill material around BH26 is contaminated and will be excavated (**Figures 3** and **4**).

- *Task 3: Controlled excavation and disposal of the contaminated soil*

Once the fill layer has been classified, it will be excavated and disposed at a suitably licensed facility. Dockets from tip weighbridges and liquid waste disposal contractors are to be provided as a record of the disposal of the material.

- *Task 4: Validation sampling and analysis.*

Following removal of the lead contaminated fill material, a programme of soil validation will be implemented as described in Section 0. The validation programme will include the sampling and analysis of soil from the four walls and base of the excavation.

- *Task 5: Preparation of a validation report.*

At the completion of the remediation works, a validation report will need to be prepared in accordance with NSW EPA (reference 18) which outlines the results of the remediation works undertaken at the site and an assessment of the suitability of the site for the proposed use.

6.2.2 B(a)P Contaminated Fill

- *Task 1: Waste classification sampling and analysis.*

Following removal of the lead contaminated soil at BH26, the remaining fill layer will be classified in accordance with NSW DECC (2009) *Waste Classification Guidelines* (reference 10) prior to off-site disposal at a suitably licensed facility. Sampling and analysis will be undertaken as described in Section 8.2.

- *Task 2: Disposal at a suitably licenced landfill facility.*

Once the fill layer has been classified, it will be excavated and disposed at a suitably licensed facility. Dockets from tip weighbridges and liquid waste disposal contractors are to be provided as a record of the disposal of the material. GEE anticipates that the fill layer will be classified as 'general solid waste' and if there is an exception then further testing and analysis may be carried out to delineate and anomalies.

- *Task 3: Validation sampling and analysis.*

Following removal of the fill layer, a programme of soil validation will be implemented as described in Section 0. The validation programme will include the sampling and analysis of the exposed natural soil profile below the fill layer.

- *Task 4: Preparation of a validation report.*

At the completion of the remediation works, a validation report will need to be prepared in accordance with NSW EPA (reference 18) which outlines the results of the remediation works undertaken at the site and an assessment of the suitability of the site for the proposed use.

6.2.3 Potential Soil Contamination Relating to the USTs

- *Task 1: Removal of the USTs and any associated infrastructure.*

This will be undertaken by a specialised contractor and include removal of all existing tanks and associated infrastructure such as bowsers and fuel lines, in accordance with:

◊ Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008, and

◊ AS 4976 (2008): The Removal and Disposal of Underground Petroleum Storage Tanks.

◊ Residual liquids (if any) within the tanks will be removed by a licensed liquid waste contractor (e.g. Worths Recycling or similar).

- *Task 2: Assessment of any perched water within the UST tankpits.*

Following removal of the tanks and if there is water present within the tankpits then GEE will collect a sample for assessment prior to off-site disposal. The sample will be analysed for contaminants of concern related to fuel and waste oil USTs and include metals, TRH, BTEX and PAHs.

- *Task 3: Extraction / pumping out of any perched water within the UST tankpits.*

Any water that is perched within the tankpit excavations will be extracted and subjected to off-site treatment by a NSW EPA licensed contractor licensed to remove, transport and treat groundwater impacted by petroleum hydrocarbons.

- *Task 4: Field screening of soil in the tankpits and immediately surrounding any associated infrastructure.*

The soil in the tankpits and immediately surrounding any associated infrastructure will be assessed in accordance with the NSW EPA *Guidelines for Assessing Service Station Sites* (reference 7). In this regard, field screening will be required in order to delineate the lateral and vertical extent of any TPH-impacted soil around the USTs.

Field screening reduces delays of several days associated with laboratory testing, and helps to ensure that residual contamination is detected during the excavation.

Field screening will be conducted using a Flame Ionisation Detector (FID), Photo-Ionisation Detector (PID) or similar instrument capable of measuring Volatile Organic Compounds (VOCs) in air. An appropriately trained person will operate the instrument in accordance with the documented GEE procedure using the controlled headspace method. Full documentation relating to the calibration of the instrument, the samples analysed in relation to gas screening results and site observations, will be provided. These results will be compiled and presented in the validation report. NOTE: Field screening data from FIDs/PIDs must be verified by laboratory data.

Following removal of fuel lines, the appointed environmental scientist must conduct regular field screening and visual inspection of the fuel line excavations to demonstrate impact has been adequately chased out. Visual inspection will be conducted on the entire length of the fuel line excavation while field screening samples will be collected every 5 m for head-space VOC monitoring using a calibrated PID meter. If the PID result exceeds 20 ppm, additional material will be removed. Results below 20 ppm will be considered acceptable. Validation samples for chemical analysis will be collected every 10 m along fuel lines.

If PID screening levels within the tank pit excavation and under the removed associated infrastructure are above 20 ppm, additional material will be removed in 100 mm increments across the area between the screening point and the adjacent field screening points and will then be re-screened.

Task 5: Controlled excavation and stockpiling of contaminated soil.

Once any soil contamination has been delineated, the impacted soil will be excavated under the direction of an experienced environmental scientist or engineer. The material will be stockpiled on a nearby concrete sealed surface and sampled for waste classification purposes.

- *Task 6: Waste classification of the Excess Soil and Disposal.*

Excavated and stockpiled material will be classified in accordance with NSW Waste Guidelines (reference 10) prior to off-site disposal at a suitably licensed facility. Sampling and analysis will be undertaken as described in Section 8.2. Once the soil is classified, it will be removed by an appropriately licensed waste transporter. Dockets

from tip weighbridges and liquid waste disposal contractors are to be provided as a record of the disposal of the material.

- *Task 7: Validation sampling and analysis.*

Following removal of any contaminated soil, a programme of soil validation will be implemented as described in Section 7. The validation programme will include the sampling and analysis of soil from the walls and base of the UST tankpits and any extended excavations required when chasing and delineating contamination.

- *Task 8: Preparation of a validation report.*

At the completion of the remediation works, a validation report will need to be prepared in accordance with NSW EPA (reference 18) which outlines the results of the remediation works undertaken at the site and an assessment of the suitability of the site for the proposed use. According to Division 4 – Clause 15 of the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008 (reference 12), the validation report will be issued within 60 days of the completion of site works.

7 REMEDIATION WORKS CONTINGENCY PLAN

GEE anticipates that remediation methodology described in Section 6 above will ensure that the site is suitable for the proposed land-use. However, the following potential issues and proposed actions will be taken:

Issue	Action
1. Failure of the validation testing, indicating a greater amount of contamination than anticipated.	Additional excavation and validation sampling
2. Waste classification sampling and analysis of the fill layer identifies additional contamination.	If the waste classification is general solid waste then the fill will be disposed off-site at an appropriately licensed landfill facility as originally proposed. If the additional contamination results in a waste classification of restricted solid waste, then the elevated contaminant concentrations will be targeted for further assessment and separate off-site disposal in the same manner of the lead contaminated fill at BH26. The remaining fill will then be re-classified until general solid waste classification applies. GEE will also include any newly identified contaminants in the validation plan and the RAC will be adopted from the same EPA endorsed guidelines outlined in Section 9.
4. Generation of unacceptable odours from the excavation works.	Refer to section 11.2
5. The generation of unacceptable levels of dust during excavation and reinstatement works.	Refer to section 11.2
6. Generation of unacceptable noise during site works.	Refer to section 11.3

8 VALIDATION PLAN

A validation plan will be implemented on the site to ensure that RAP has been followed and that the remediation goal has been achieved. The purpose of the validation plan is to develop a framework for the validation of the site to verify the suitability of the site for the proposed use.

Requirements for the sampling and analytical plan, sampling methodology and quality control/quality assurance procedures to be adopted for the validation works are presented below.

8.1 SCOPE OF THE VALIDATION WORKS

The scope of work that is required to be undertaken during the validation on the site comprises the following:

1. The sampling and analysis of the excavated materials for waste classification purposes,
2. The sampling and analysis of the excavation(s) resulting from the remediation works, and
3. Preparation of a validation report.

8.2 SOIL SAMPLING PLAN

Validation soil samples will be collected from the various remediation excavations to confirm whether adequate remediation has been accomplished. Additionally, Quality Control (QC) samples will be collected as appropriate (refer to Section 8.5) in accordance with AS4482 - Part 2 (reference 14).

8.2.1 Sampling Locations and Frequency

8.2.1.1 Lead Contaminated Fill

Grab samples will be collected from the lead contaminated fill material at a frequency of 1 sample per $20m^3$. Assuming an initial 10m x 10m x 0.5m excavation then this equates to 5 samples

Validation soil samples will be collected from the walls and base of the lead contaminated soil excavation either from the centre of the excavator bucket by hand protected by a disposable nitrile glove or directly from the surfaces of the excavations by hand protected by a disposable nitrile glove. The number and/or frequency of sampling will be as follows:

- ◊ The excavation walls will be sampled at 5 m lateral intervals. The depth of fill at this location (following removal of the surface slab of concrete) is expected to be approximately 0.5m depth and therefore only 1 sample from each of the walls is proposed.
- ◊ One sample per 25m^2 from the base of the excavation.

8.2.1.2 B(a)P Contaminated Fill

Following the removal of the lead contaminated fill, grab samples will be collected from the remaining fill layer for waste classification purposes. Samples will be collected at random and at a rate of approximately 1 sample per 500m^3 of fill which equates to approximately 10 samples. The validation samples from the four walls of the lead contaminated soil excavation may also be included for assessment of the waste classification.

Following removal of the fill layer, GEE will collect validation soil samples from the near surface (0 – 200mm) of the underlying natural silty clay soil profile. The samples will be collected by hand protected by a disposable nitrile glove at a frequency of 24.3 sampling points per hectare which is equivalent to the minimum number of sampling points for site characterisation as defined by the NSW EPA (1995) *Sample Design Guidelines* (reference). Considering that the site area is 6,900m^2, this equates to 17 validation samples.

8.2.1.3 USTs and associated infrastructure

Validation sampling requirements for the UST tankpit excavations and removal of associated infrastructure are summarised in **Table 2** and is in accordance with the NSW EPA guidelines for assessing service station sites (reference 7). It should be noted that additional material will need to be removed if the initial round of validation sampling yields results that do not conform to the RAC (refer to Section 9). In addition, if particular evidence of potential contaminants other than TRH and BTEX are identified during the remediation works, samples of this material will be collected and analysed for an expanded suite of analytes.

Table 2: Validation Sampling Program – UST tankpits and Associated Infrastructure

Location	Number	Depth	Parameters			
			TRH, BTEX and Lead	TRH, BTEX, PAHs, phenol and Lead	TRH, BTEX and VOCs	Heavy metals, TRH, BTEX, PAHs, OCPs, PCBs and asbestos
UST pit backfill sands (unleaded / diesel / former leaded fuels)	2 per tank and below tank	0–200mm	✓		-	-
UST pits natural soil (unleaded / diesel / former leaded fuels)	5 per tank (1 on base, 4 on wall)[1]	0-200 mm	✓	-	-	-
UST pit backfill sands (unleaded / diesel / former leaded fuels)	2 per tank and below tank	0-200 mm	-	✓	-	-
UST pits natural soil (waste oil)	5 per tank (1 on base, 4 on wall)[1]	0-200 mm	-	✓	-	-
UST pit backfill sands (Kerosene)	2 per tank and below tank	0-200 mm	-	-	✓	-
UST pits natural soil (Kerosene)	5 per tank (1 on base, 4 on wall)[1]	0-200 mm	-	-	✓	-
Bowser (pump) location	1 beneath each former pump location	0-200 mm	✓	-	-	-
Fuel feed lines to pumps	1 per line or every 10 linear metres in addition to visual inspection/field screening	0-200 mm	✓	-	-	-
Groundwater in tank pit excavation	Representative sample	-	✓	-	-	-
Excavated material [2]	Waste classification at 1 per 100 m^3	-	-	-	-	✓
Imported fill [3]	1 per 100 m^3	-	-	-	-	✓
Note 1: Validation for single tank pits requires one sample from the floor and each wall of the excavation (i.e. 5 per tank). For extended tankpits or connected pits additional samples to be collected as appropriate or every 5 linear metres around wall or on base.						
Note 3: Analysis may also include leachable concentrations of PAHs and Metals						
Note 3: Sampling of imported fill only required if a validation report with analytical results and QA/QC assessment not provided by supplier of fill.						

8.2.2 Sampling Methodology

Samples will be collected in accordance with the documented GEE procedure by appropriately trained staff to ensure that they are collected in a consistent manner and in accordance with internal GEE QA/QC requirements.

General soil sampling procedures are summarised below:

i.) Label sample containers with unique sample identification, project details, date and sampling personnel,

ii.) Decontaminate sampling equipment using phosphate-free detergent solution (Decon 90) followed by a distilled water rinse,

iii.) Collect samples in laboratory-prepared glass jars with Teflon-lined lids in accordance with USEPA methods SW846, using a decontaminated stainless steel trowel,

iv.) Complete record of samples collected and Chain of Custody form,

v.) Place samples in coolers containing ice,

vi.) Seal coolers with security seal at the conclusion of sampling,

vii.) Transport samples to the analytical laboratory under GEE chain of custody, and

viii.) Sample holding times, container and preservation requirements are to be in accordance with laboratory specifications.

8.2.3 Decontamination of Sampling Equipment

Considering that samples will be collected by hand using a new set of disposable nitrile gloves, decontamination will not be necessary as no re-useable equipment will be used. Additionally, when sampling from an excavator bucket, care will be taken to ensure that the soil sampled did not come into contact with the excavator bucket.

However, if the assistance of a trowel is required to collect samples, in situations of hard or well compacted ground) then the trowel will be decontaminated by washing with a laboratory grade, biodegradable and phosphate-free detergent followed by rinsing with potable water.

8.2.4 Field Logging / Documentation

While on site, the supervising engineer/scientist will be required to fill out, and sign a copy of the GEE 'Field Log Sheet' each day, which documents significant events,

sampling locations and numbers, number and type of samples collected and weather conditions.

8.3 ANALYTICAL PLAN

8.3.1 Lead Contaminated Fill

Each validation sample collected from the lead remediation excavation will be analysed for the contaminant of concern which is lead.

Samples collected from the stockpiles for waste classification purposes will be analysed for:

- ◊ Total and leachable[3] metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc and mercury);
- ◊ Total and leachable PAHs;
- ◊ Total Petroleum Hydrocarbons (TPH);
- ◊ Benzene, Toluene Ethylbenzene and Xylenes (BTEX);
- ◊ Organochlorine Pesticides (OCPs);
- ◊ Total Chlorinated Biphenyls (PCBs).

8.3.2 B(a)P Contaminated Fill

Each validation sample collected from the near surface of the natural soil profile will be analysed for the contaminant of concern which is lead and B(a)P.

Samples collected from the fill layer for waste classification purposes will be analysed for:

- ◊ Total and leachable[4] metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc and mercury),
- ◊ Total and leachable PAHs,
- ◊ Total Petroleum Hydrocarbons (TPH),
- ◊ Benzene, Toluene Ethylbenzene and Xylenes (BTEX),
- ◊ Organochlorine Pesticides (OCPs),
- ◊ Total Chlorinated Biphenyls (PCBs).

[3] Leachable testing will be conducted using the Toxicity, Characteristic Leaching Procedure (TCLP).

8.3.3 USTs and associated infrastructure

The validation samples collected following the removal of the USTs and associated infrastructure will be analysed in accordance with the NSW EPA guidelines for assessing service station sites (reference 7). A summary of the analytical plan is provided in **Table 2**.

8.4 QUALITY ASSURANCE

Quality Assurance (QA) involves all of the actions, procedures, checks and decisions undertaken to ensure the representativeness and integrity of samples and accuracy and reliability of analysis results (reference 19).

In accordance with AS4482.1 (reference 16), a series of QA procedures will be integrated within the sampling and analysis plan and include:

- ◊ The collection of Quality Control (QC) samples (i.e. blind replicates, split duplicates, rinsate samples, trip blanks and trip spikes).
- ◊ The use of standardised field sampling forms developed by GEE.
- ◊ Documentation of calibration and use of field instruments.

To ensure QA in the field, samples will be collected by experienced and trained personnel using appropriate methods detailed herein, including appropriate sample handling, containment and transport, and calibrated equipment.

To ensure QA in the laboratory, GEE intend to use laboratories that are NATA accredited for the analytical tests carried out, therefore it is reasonable for GEE to rely on the laboratories to be proficient in all tests conducted. This encompasses all actions, procedures, checks and decisions undertaken, to ensure the accuracy and reliability of the analysis results.

To measure the effectiveness of the QA procedures Quality Control (QC) samples will be collected and analysed as described in Section 0.

8.5 QUALITY CONTROL

QC involves those parts of QA which serve to monitor and measure the effectiveness of QA procedures. In accordance with AS4482 (Part 2), Quality Control (QC) samples will be collected as appropriate including blind replicate and split samples at a frequency of 5%, and the collection of trip blanks and trip spikes. When collecting duplicates, samples to be analysed for volatiles will not be mixed, rather they will be placed directly into sample jars.

Table 3 provides a description and objective of each of the field and laboratory QC samples to be used during the remediation program.

Table 3: QC Sample Types, Descriptions and Frequency of Analysis

Type	Description	Purpose	Recommended Frequency
FIELD QC SAMPLES			
Blind Replicate	A sample collected at the same time and from the same sampling point as the corresponding primary sample[4], and analysed at the same laboratory. Blind replicates are collected, preserved, stored, transported and analysed in the same manner as the primary sample, with the laboratory having no knowledge of the source of the replicate sample. The assessment of blind replicates samples is undertaken by calculating the Relative Percent Difference (RPD) which is defined as: RPD (%) = 100 x (Result No. 1 – Result No. 2) / Mean Result	Used to evaluate total sampling and analysis precision and, in the case of soil samples, sample variability.	In accordance with AS4482.1 (reference 16) and NEPM (reference 19) it is recommended that 1 blind replicate sample is collected for every 20 primary samples.
Split Duplicate	A sample collected at the same time and from the same sampling point as the corresponding primary sample, and analysed at a separate laboratory. Split duplicates are collected, preserved, stored, transported and analysed in the same manner as the primary sample, with the laboratories having no knowledge of the purpose of the sample. The assessment of split duplicates samples is undertaken by calculating the Relative Percent Difference (RPD) which is defined as: RPD (%) = 100 x (Result No. 1 – Result No. 2) / Mean Result	Used to provide a check on the analytical proficiency of the laboratories and hence precision and comparability.	In accordance with AS4482.1 (reference 16) and NEPM (reference 19) it is recommended that 1 split duplicate sample is collected for every 20 primary samples.
Rinsate	This is a sample of distilled or de-ionised water poured over the surface of a decontaminated piece of sampling equipment and collected in appropriate laboratory supplied sample containers. The sample is then analysed for contaminants of concern analysed as part of the investigation.	Provides an assessment of potential cross contamination of chemicals from sampling equipment caused by inadequate decontamination procedures.	In accordance with AS4482.1 – (reference 16) one rinsate sample should be collected each day per piece of sampling equipment.

[4] Primary samples are the original representative samples of soil or groundwater collected for analysis to determine aspects of their chemical composition. Primary samples are the original sample taken from a particular location and other samples from the same location are duplicates, replicates or splits.

Table 3: QC Sample Types, Descriptions and Recommended Frequency of Analysis (Continued)

Type	Description	Purpose	Recommended Frequency
Trip Blank	Trip blanks are laboratory supplied test samples of analyte-free media (either washed sand or de-ionised water) which remain in the sample storage eskies during sampling activities and returned to the laboratory unopened. For soil sampling programs, the trip blank consists of acid-washed quartz sand that has been heated to 400ºC. For water sampling programs trip blanks comprise pre-washed glass vials containing distilled or de-ionised water with appropriate preservatives. The USEPA has shown that cross-contamination only occurs with volatile organics (reference 21), therefore, trip blanks are only analysed for volatile organics.	Used to measure cross-contamination during sampling, transport, sample preparation and analysis.	Industry standard is 1 trip blank per batch of primary samples.
Trip Spike	Trip spikes, like trip blanks, are supplied by the primary laboratory using analyte-free media (either washed sand or de-ionised water) and remain in the sample storage eskies during sampling activities and returned to the laboratory unopened. The sample media, however, is spiked with BTEX. For water sampling programs the BTEX concentration is known and standardised by each laboratory, while for soil sampling programs the exact spike concentration is not known, rather two identical jars of sand are spiked the same concentration with one sample becoming the trip-spike and the other becoming a control sample, which remains in a refrigerator at the laboratory. The trip spike is analysed after returning from the field and the % recovery of the known spike (for water sampling programs), or of the control sample (for soil sampling programs), is calculated.	Used to monitor VOC losses during transit.	Industry standard is 1 trip spike per batch of primary samples where volatile concentrations are being measured.
LABORATORY QC SAMPLES			
Laboratory Duplicate	Laboratory duplicates are field samples which are prepared and analysed in the same manner twice. The assessment of laboratory duplicates is undertaken by calculating the (RPD) which is defined as: $RPD\ (\%) = 100 \times \frac{\text{Result No. 1 – Result No. 2}}{\text{Mean Result}}$	Determines analytical precision for a sample batch	NATA specifies 1 per 10 samples for trace element and inorganic analysis
Laboratory Control Sample (LCS)	Laboratory Control Samples (LCS) are analyte-free matrices (de-ionised water or clean sand) spiked with a known concentration of target analytes and carried through the entire preparation and analysis. Assessment of LCS is undertaken by calculating the percent recovery (%R) of the spike which is defined as: $\text{Percent Recovery (\%R)} = 100 \times \frac{\text{Spikes Sample Result (SSR) – Sample Result (SR)}}{\text{Concentration of Spike Added (SA)}}$	Determines analytical accuracy and precision for a batch of samples	NATA specifies 1 per batch of up to 20 samples

Table 3: QC Sample Types, Descriptions and Recommended Frequency of Analysis (Continued)

Type	Description	Purpose	Recommended Frequency
Surrogates	Surrogates are organic compounds added to field samples and laboratory QC samples prior to preparation. They are similar in chemical behavior to the target analytes and are not expected to be present in samples. They form part of the laboratory QC for organic analyses, and are used to indicate the presence of sample specific interferences. The surrogate is added at the extraction stage then analysed with the batch of samples. Like LCSs, surrogates are assessed by calculating the percent recovery (%R), although the definition is slightly different as shown below: $\text{Percent Recovery (\%R)} = 100 \times \frac{\text{Spiked Sample Result (SSR)}}{\text{Concentration of Spike Added (SA)}}$	Used to demonstrate that the surrogate does not interfere with the target analytes, therefore determines analytical accuracy for each sample	Added to every blank, field and laboratory QC sample
Matrix Spikes	Field samples spiked with a known concentration of a target analytes and carried through the entire preparation and analysis. Matrix spike samples are assessed by calculating the percent recovery (%R) of the spike which is defined as: $\text{Percent Recovery (\%R)} = 100 \times \frac{\text{Spikes Sample Result (SSR)} - \text{Sample Result (SR)}}{\text{Concentration of Spike Added (SA)}}$	Determine the effects of matrix interferences on analytical accuracy of a sample.	Performed at least 1 per batch of up to 20 samples.
Method Blank	Method blanks are an analyte-free matrices (reagent water or clean sand) that is carried through the entire preparation and analysis.	Establishes that laboratory contamination does not cause false positives.	Prepared with every batch of up to 20 samples for all organic and inorganic analyses.

8.5.1 Evaluation of QC Sample Results

The QC Acceptance Criteria adopted for this investigation is provided in **Table 4** and is in general accordance with the Table 4 of AS4482.1 (reference 16) and NEPC (reference 19).

Table 4: QC Sample Acceptance Criteria

QC Sample	Criteria / Acceptable Range
FIELD QC SAMPLES	
Blind Replicate & Split Duplicate	RPD < 50 % When average concentration is > 10 x LOR/PQL[5] RPD < 75 % When average concentration is 5 to 10 x LOR/PQL RPD < 100 % When average concentration is< 5 x LOR/PQL
Rinsate	Analytical Result < LOR/PQL
Trip Blank	Analytical Result < LOR/PQL
Trip Spike	± 30%
LABORATORY QC SAMPLES	
Laboratory Duplicates	RPD < 30 % When average concentration is > 10 x LOR/PQL RPD < 50 % When average concentration is 4 to 10 x LOR/PQL RPD < 100 % When average concentration is< 4 x LOR/PQL
Laboratory Control Samples	%R of 70 – 130% (General analytes) %R of 50 – 130% (Phenols) %R of 60 – 130% (OCP/OPPs) %R of 62 – 130% (Chromium)
Surrogates	%R of 70 – 130% (General analytes) %R of 50 – 130% (Phenols) %R of 60 – 130% (OCP/OPPs)
Matrix Spikes	%R of 70 – 130% (General analytes) %R of 50 – 130% (Phenols) %R of 60 – 130% (OCP/OPPs) %R of 62 – 130% (Chromium)
Method Blanks	Analytical Results < LOR/PQL

If data do not meet the QC Acceptance Criteria then a judgement is made as to whether the exceedance is critical in relation to the suitability of the data set. Otherwise the following steps will be taken:

◊ Request that the laboratory re-check or even re-analyse the sample.

◊ Inspect the sample for anomalies which may be causing the failure.

◊ If necessary, undertake additional sampling and analyses.

[5] Both the LOR and PQL are interchangeable terms used by laboratories and is defined as the lowest concentration that can be reliably achieved within specific limits of precision and accuracy during routine laboratory operating conditions.

8.6 VALIDATION REPORT

Consistent with NSW OEH requirements, a validation report will be prepared at the conclusion of remediation works. The validation report, prepared in accordance with the requirements of EPA guidelines (reference 18), will outline the results of the remediation works undertaken at the site and an assessment of the suitability of the site for the proposed use.

According to Division 4 – Clause 15 of the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008 (reference 12) the validation report will be issued within 60 days of completion of the work.

9 REMEDIATION ASSESSMENT CRITERIA

To determine the success of the proposed remediation plan it is necessary to define appropriate Remediation Assessment Criteria (RAC).

9.1 SOIL REMAINING ON-SITE

For any environmental assessment, it is necessary to assess the human health and ecological risks associated with the presence of site contamination. In this regard, appropriate human health and ecological investigation and/or screening levels need to be defined and are referred herein as the RAC.

Also, in accordance with Appendix I of DEC, 2006 guidelines (reference 8), residential sites need to address aesthetics such as highly malodorous soils. In this regard, aesthetics will be continually assessed in the field during borehole drilling and logging.

9.1.1 Ecological Investigation / Screening Levels

To address potential ecological risks, GEE will compare the soil analytical results against the Ecological Investigation Levels (EILs) and Ecological Screening Levels (ESLs) appropriate for the residential land-use with minimal opportunities for soil access as detailed in NEPM (2013), *Schedule B(1) – Guidelines on Investigation Levels for Soil and Groundwater* (reference 19).

9.1.1.1 EILs

EILs were derived for common contaminants in soil (specifically Arsenic, Copper, Chromium (III), DDT, naphthalene, Nickel, Lead and Zinc) and are based on a species sensitivity distribution (SSD) model developed for Australian conditions. They consider the physicochemical properties of soil (e.g. Cation Exchange Capacity, pH and clay content), contaminants and the capacity of the local ecosystem to accommodate increases in contaminant levels (referred to as the 'added contaminant limit' or ACL) above ambient background. Also, EILs consider various land use scenarios and generally only apply to the top 2m of soil which corresponds to the root zone and habitation zone of many species. Finally, different EILs apply for 'fresh' contamination and 'aged' contamination. 'Fresh' contamination is usually associated with current activity and chemical spills, while a contaminant that has been incorporated into a soil for more than 2 years is considered to be 'aged'. For the purpose of this RAP, 'aged' EILs will be adopted because any contaminants that are likely to be present is expected to be from activities occurring over a long time period.

To assist with determining appropriate EILs to screen the soil analytical results at the site, the CEC and pH of the soil will be analysed for relevant soils samples and the average values adopted.

When determining the EILs for Copper, Nickel, Chromium and Zinc, ambient background concentrations can be used to increase the final EIL, however, for the purpose of this RAP, zero ambient background concentrations will be adopted.

A summary of the EILs appropriate for the site is provided in **Table 5**.

9.1.1.2 ESLs

ESLs have been developed for selected petroleum hydrocarbon compounds (specifically TRH[6], BTEX and Benzo(a)pyrene) and are applicable for assessing risk to terrestrial ecosystems. ESLs broadly apply to coarse- and fine-grained soils and like EILs the ESLs consider various land use scenarios, only apply to the top 2m of soil and differ for 'fresh' contamination and 'aged' contamination.

A summary of the ESLs appropriate for the site is provided in **Table 5.**

9.1.2 Health Investigation Levels

To address potential health impacts at the site, GEE will compare the analytical results against Health Investigation Levels (HILs) provided NEPM (2013), *Schedule B(1) – Guidelines on Investigation Levels for Soil and Groundwater* (reference 19) which are appropriate for the proposed land-use (*i.*e. residential with minimal opportunities for soil access) and the exposure scenario on which they are based (Exposure setting B).

For selected petroleum hydrocarbons, Health Screening Levels (HSLs), which were developed by the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE), will be adopted and are referenced in Schedule B(1) of NEPM (2013 – reference 19) and Friebel & Nadebaum (2011 – reference 20). Typically, the assessment of petroleum hydrocarbon contamination is driven by human health concerns relating to volatile components (e.g. TRH $C_6 – C_{10}$, TRH $>C_{10} – C_{16}$ and Benzene) which have the potential to cause health issues via vapour intrusion. For these components, different HSLs apply for different land use scenarios, for different soil types (i.e. sand silt and clay) and different depths. For the purpose of

[6] ESLs for the various carbon fractions are based on TRH analysis with F1 (C6-C9) being obtained after subtraction of BTEX.

this investigation, criteria relevant for sand soil at a shallow depth (0m to 1m) have been adopted to screen the soil analytical results because they are most conservative (except for Xylene where fine soil criteria is the most conservative). If a sample exceedance occurs then the criteria will be adjusted to suit actual soil type and depth.

For TPH fractions where there are no vapour intrusions HSLs available, management limits have been adopted (Table A4 – reference 19). The management limits are designed to avoid or minimise potential effects of petroleum hydrocarbons including:

- ◊ The formation of observable light non-aqueous phase liquids (LNAPL),
- ◊ Fire and explosive hazards, and
- ◊ The effects on buried infrastructure e.g. penetration of, or damage to, in-ground services by hydrocarbons.

Again, there is different management limits for the various land use scenarios and GEE has adopted the management limits appropriate for commercial / industrial sites.

A summary of the HILs/HSLs appropriate for the site is provided in **Table 5**.

Table 5: Soil Remediation Assessment Criteria (RAC)

Analyte	Health Investigation/Screening Levels (HILs/HSLs) (mg/kg)		Ecological Investigation/Screening Levels (EILs/ESLs) (mg/kg)	
	Exposure Setting B – Apartment Buildings	Reference	**Residential**	Reference
Total Metals				
Lead	1,200	Table 1A – Reference 19	1,100	Table 1B(4) – Reference 19
Polycyclic Aromatic Hydrocarbons (PAHs)				
Naphthalene	3	Table 1A(3) – Reference 19	170	Table 1B(5) – Reference 19
Benzo(a)pyrene	--	--	0.7	Table 1B(6) – Reference 19
Benzo(a)pyrene TEQ	4	Table 1A – Reference 19	--	--
TOTAL PAHs	400	Table 1A – Reference 19	--	--
BTEX				
Benzene	0.5	Table 1A(3) – Reference 19	50	Table 1B(6) – Reference 19
Toluene	160	Table 1A(3) – Reference 19	85	Table 1B(6) – Reference 19
Ethylbenzene	55	Table 1A(3) – Reference 19	70	Table 1B(6) – Reference 19
Xylenes	40	Table 1A(3) – Reference 19	45	Table 1B(6) – Reference 19
Total Recoverable Hydrocarbons (TRH)				
(F1) C6 – C10	45	Table 1A(3) – Reference 19	180	Table 1B(6) – Reference 19
(F2) >C10 - C16	110	Table 1A(3) – Reference 19	120	Table 1B(6) – Reference 19
(F3) >C16 – C34	2,500	Table 1B(7) – Reference 19	300	Table 1B(6) – Reference 19
(F4) >C34 – C40	10,000	Table 1B(7) – Reference 19	2,800	Table 1B(6) – Reference 19

9.2 ASSESSMENT OF EXCAVATED MATERIAL FOR OFF-SITE DISPOSAL

Waste classification criteria have been adopted from the DECC NSW (2009) *Waste Classification Guidelines Part 1: Classifying Waste*. Under the DECC NSW (2009) guidelines, non-liquid waste may be classified in the following groups:

- ◊ General Solid Waste (Putrescibles);
- ◊ General Solid Waste (Non-putrescibles);
- ◊ Restricted Solid waste;
- ◊ Hazardous Waste; and
- ◊ Special Waste.

The guidelines contain a classification process for liquid and non-liquid waste. The process includes the comparison of total or Specific Contaminant Concentrations (SCC) with Contaminant Threshold (CT) values. The CT values are highly conservative and are based on the assumption that all the contaminants present in a sample are leachable and would leach completely. CT values are used largely in the early stages of waste-classification activities.

The waste classification process can also involve the determination of leachable contaminant concentrations using the TCLP. In this stage of the process, both SCC and leachable concentrations are used to classify waste. The waste classification can be determined jointly by SCC and leachable concentrations. It should be noted that in the instance that either SCC or leachable concentration criteria for one contaminant are exceeded, then the higher waste category must be adopted. SCC values for waste classification refer to total contaminant concentrations measured as part of the investigation.

Waste criteria for contaminants measured as part of the remediation works are presented in **Table 6**.

Table 6: Waste Classification Criteria

Parameter	Maximum Values of Specific Contaminant concentrations for classification without TCLP		Maximum Values for Leachable (TCLP) Concentration and Specific Contaminant Concentration (SCC)			
	General Solid Waste[1]	Restricted Solid Waste[1]	General Solid Waste[1]		Restricted Solid Waste[1]	
	CT1 mg/kg	CT1 mg/kg	SCC1 mg/kg	TCLP1 mg/L	SCC2 mg/kg	TCLP2 mg/L
Metals						
Arsenic	100	400	500	5	2000	20
Cadmium	20	80	100	1	400	4
Chromium (VI)	100	400	1900	5	7600	20
Lead	100	400	1500	5	6000	20
Mercury	4	16	50	0.2	200	0.8
Nickel	40	160	1050	2	4200	8
TRH						
TPH C_6-C_9	---[4]	---[4]	650	N/A [2]	N/A [2]	N/A [2]
TPH C_{10}-C_{36}	---[4]	---[4]	10,000	N/A [2]	N/A [2]	N/A [2]
BTEX						
Benzene	10	40	18	0.5	72	0.2
Toluene	288	1152	518	14.4	2073	57.6
Ethylbenzene	600	2400	1,080	3	4320	120
Total Xylenes	1000	4000	1,800	5	7200	200
PAHs						
Benzo(a)pyrene	0.8	3.2	10	40	23	160
Total PAHs	---[4]	---[4]	200	N/A [2]	800	N/A [2]
Other Chemicals						
Scheduled Chemicals [3]	---[4]	---[4]	<50	N/A [2]	<50	N/A [2]

Notes

Note 1: NSW DECC (2009) Waste Classification Guidelines (Part 1 - Tables 1, 2 and 3)

Note 2: TPH, Total PAHs and scheduled chemicals are evaluated on the basis of total concentrations (SCC) only. No TCLP required

Note 3: Scheduled chemicals include some pesticides. The sum of the SCC for all of the scheduled chemicals must not exceed the criteria

Note 4: Assessed using SCC only

10 INTERIM SITE MANAGEMENT PLAN (SITE PREPARATION)

10.1 SERVICES AND UTILITIES

The only underground service on the site is a sewer pipe, the location of which is known and will be avoided.

10.2 SITE SECURITY, RESTRICTED ACCESS AND SIGNAGE

Access to site will be restricted during site redevelopment works as required by Council Development Application conditions.

10.3 STORMWATER CONTROL MEASURES

No stormwater control measures are proposed during the site preparation phase since it is expected that the transportation of contaminated soil will occur immediately after excavation and there will be no need to form stockpiles for any length of time.

10.4 OCCUPATIONAL HEALTH & SAFETY PLAN

A Project Safety Plan (PSP) will be prepared for all personnel and contractors performing on-site works associated with this RAP. Contractors would be required to read and understand the PSP, however, contractors would be responsible for formulating and monitoring their own Health and Safety.

All work associated with the decommissioning and remediation of the site would conform at a minimum, to the requirements of the NSW Occupational Health and Safety Act.

10.5 LICENCES AND APPROVALS

As previously mentioned, the proposed remediation work requires development consent and will be incorporated into the existing development application before Canterbury Council which relates to the proposed site redevelopment works.

10.6 COMMUNITY RELATIONS PLAN

A community relations plan is not considered necessary for the site.

11 SITE MANAGEMENT PLAN (OPERATIONAL PHASE)

Remediation works shall be conducted in a manner that minimises environmental impacts and that meets statutory requirements. Site works should comply with the following legislation:

- ◊ Contaminated Land Management Act (1997);
- ◊ Contaminated Land Management Amendment Act (2008);
- ◊ Protection of the Environment Operations Act (1997);
- ◊ Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation (2008);
- ◊ Environmentally Hazardous Chemicals Act (1985);
- ◊ Dangerous Goods Act (1975);
- ◊ Waste Avoidance and Resource Recovery Act (2001);
- ◊ Clean Air (Plant and Equipment) Regulation (1997);
- ◊ Occupational Health and Safety Act (2001); and
- ◊ Local Government Act (1993).

The contractor shall endeavour to:

- ◊ Minimise fugitive dust emissions;
- ◊ Minimise the volume of water containing suspended sediment leaving the site;
- ◊ Prevent vehicles from tracking mud on local roads; and
- ◊ Ensure that noise and vibration levels conform to legislative requirements.

A preliminary site management plan is provided below.

11.1 STORMWATER MANAGEMENT

Stormwater will be diverted away from excavations by a series of bunds to be retained until excavations are backfilled or until permanent stormwater infrastructure is installed on the site. Similarly, low (nominal 0.5 m) earthen bund walls will be constructed around stockpiles (where placed in uncovered areas of the site) to prevent the erosion and off site transport of contaminated soil. Management measures for the site will include:

- ◊ Stormwater diversion bunds and appropriate erosion controls around excavations (as required) and stockpiles;
- ◊ Minimising surface disturbance and maximising the retention of existing surface cover (pavements) during the works;
- ◊ Stockpiles to be located away from concentrated stormwater flow paths including drainage lines, gutters or stormwater pits and inlets;
- ◊ No stockpiles to be placed on footpaths unless prior Council approval has been obtained;
- ◊ Construction of sediment controls downstream of diversion bunds, stockpile and traffic areas to minimise the off-site migration of sediment; and
- ◊ Soil, earth and mud shall be removed from the roadway by sweeping, shovelling or a means other than washing on a daily basis or as required.

If required, stormwater at site discharge points will be inspected on each day of discharge. Where necessary, samples will also be collected during the works where necessary. Samples will be analysed for Total Suspended Solids (TSS) and Total Oil and Grease (TOG). Corrective action will be required if concentrations of these parameters exceed 50 and 10 mg/L respectively.

Hay bales will be installed around excavations, stockpiles and stormwater pits in accordance with Landcom (2004) requirements (reference 22). Visually contaminated seepage water in the excavations will be removed by a licensed liquid waste contractor for disposal. Seepage without visible signs of contamination (*e.g.*, oily sheen) may be pumped onto stockpiles for dust suppression or directly into the stormwater system subject to Council approval. Excavation pump-outs must be sampled and analysed for pH, concentrations of TSS, TOG and priority contaminants. Analytical results must comply with relevant EPA and ANZECC standards for water quality prior to discharge. Limit concentrations for TSS and TOG of 50 and 10 mg/L respectively may be adopted. Council may impose additional discharge criteria for water released into the stormwater system at the site.

11.2 CONTROL OF DUST AND ODOUR

Works will be undertaken in a manner that minimises fugitive dust and odour emissions.

Measures to control dust and odour will include:

- ◊ Careful handling of material in a manner that minimises dust emissions;
- ◊ Placement of screening material (*e.g.*, hessian) on perimeter fences adjacent to excavations;
- ◊ Water spraying across dusty areas of the site;
- ◊ Keeping excavations moist (where practical);
- ◊ The use of tarpaulins or similar to cover loads (incoming and outgoing); and
- ◊ The restriction of stockpile heights to less than 2 m.

Where visual inspection indicates that dust levels may be unacceptable, work will cease until measures are taken to reduce emissions or until weather conditions improve. The site supervisor will be responsible for dust management.

Local Government requirements state that no odours shall be detected at the site boundary during remedial works by an authorised Council officer relying solely on the sense of smell. The following procedures may be engaged in order to minimise odours:

- ◊ Covering of stockpiles (where practical);
- ◊ Use of fine mist sprays and hydrocarbon mitigating agent on impacted areas and materials; and
- ◊ Adequate maintenance of equipment and machinery to minimise exhaust emissions.

11.3 NOISE CONTROL

Minor increased noise levels may result from the use of machines on site during the course of the project, which is expected to take less than 1 week day. To mitigate any noise which may arise as a result of site works, all works would be carried out in accordance the EPA NSW *Interim Construction Noise Guideline* (reference 23).

Working hours will be restricted to those specified in the DA consent conditions for the proposed development.

11.4 VIBRATION CONTROL

Excavation proposed as part of the remediation works is unlikely to cause any significant vibrations to be transmitted through the ground and potentially impact on adjoining structures.

11.5 TRAFFIC AND TRANSPORT

Minor traffic disruptions are expected as a result of site remediation works. Trucks which are required to transport soil on and off-site may temporarily park on the site therefore no traffic control measures are warranted.

All machinery will be transported to the site in accordance with regulatory requirements.

All haulage routes for trucks transporting soil, materials, equipment or machinery to and from the site are to be selected to meet the following requirements:

- ◊ Comply with all road traffic rules;
- ◊ Minimise noise, vibration and odour to adjacent properties; and
- ◊ Utilise State Roads and minimise the use of local roads.

The site supervisor shall ensure that all vehicles:

- ◊ Conduct deliveries of soil, materials, equipment of machinery during the allowed hours of remediation work;
- ◊ Securely cover all loads to prevent/minimise any dust or odour emissions during transport; and
- ◊ Do not track soil, mud or sediment onto the roads and footpaths.

11.6 UNDERGROUND SERVICES

The only underground service on the site is a sewer pipe, the location of which is known and will be avoided.

11.7 RESTRICTED ACCESS

Contractors only will be allowed on site whilst excavation and removal of soil to trucks is in progress. No members of the public will be allowed on site during this time.

During remediation works, the site will be designated as a construction area. Consequently, access will be restricted to authorised staff and contractors equipped with appropriate Personal Protective Equipment (PPE). The site supervisor will control site access. All visitors will report to the site supervisor to be inducted into the site safety programme and environmental protection programme prior to entering the site.

12 OCCUPATIONAL HEALTH AND SAFETY PLAN

The purpose of the OHS plan is to ensure that the RAP is conducted in a controlled and safe manner with due regard for potential hazards and safe work practices. The OHS plan will be implemented and enforced by the appointed site supervisor following a brief induction by GEE. The following preliminary plan contains minimum OHS requirements at the site. Contractors must be required to produce their own project-specific Project Safety Plans prior to the commencement of any works at the site, under which their employees are to operate at all times whilst at the site.

12.1 PERSONNEL AND RESPONSIBILITY

All personnel will be made aware of the person responsible for implementing health and safety procedures. All personnel should read and understand the OHS plan prior to commencing work and have signed a statement to verify this understanding. Contractors shall be responsible for ensuring that their employees are aware of and comply with the Project Safety Plans developed for each task and with all relevant statutes and regulations.

12.2 IDENTIFICATION OF POTENTIAL HAZARDS

12.2.1 Chemical Hazards

Chemicals or compounds that may be present at the site include, but are not limited to:

- Lead,
- PAHs,
- TRH, and
- BTEX.

Potential risks to personnel associated with these compounds, if present at the site, include:

1. Ingestion of soil or liquids;
2. Dermal (skin) contact with contaminated soil or liquids; and
3. Inhalation of dust, vapours or aerosols containing contaminants;

12.2.2 Physical Hazards

The following physical hazards may exist at the site:

- ◊ Heavy equipment (mobile and stationary);
- ◊ Light vehicles with associated traffic and vehicle hazards;
- ◊ Excavations;
- ◊ Heat exposure;
- ◊ Buried Services;
- ◊ Noise;
- ◊ Dust;
- ◊ Electrical equipment.

Personnel should also be aware of the necessary precautions with respect to hoisting of people, smoking, drugs and alcohol, first aid, privacy of information, environmental considerations, health surveillance, working alone, incident reporting, OHS consultation, discrimination and sexual harassment.

12.3 Medical Surveillance

It is expected that all personnel on the site have undergone specific training for working on contaminated sites. A site-specific medical surveillance scheme is not considered necessary for this project.

12.4 Site Work Practices

12.4.1 Personal hygiene

No smoking, eating or drinking will be permitted on site in areas where the possibility of contamination exists. In particular, smoking will be prohibited in areas were volatile hydrocarbons or other inflammable materials have accumulated. In these areas, a designated clean location should be allocated for smoking and the consumption of food or drink. These areas should be equipped with hand washing facilities which must be used prior to engaging in these activities. Personnel should be made aware of the location of these facilities.

12.4.2 Decontamination

Contaminated equipment should not be removed from the work area to avoid contaminating other parts of the site.

12.4.3 Restricted Access

A perimeter fence exists and will remain during the remediation work. Signs should be erected to notify personnel of the presence of excavations on the site. Site visitors must report to the site office prior to entering the site.

12.4.4 Personal protection

Personnel will take measures to avoid coming into direct contact with contaminated material. Workers are to ensure that soil, surface water or groundwater are not ingested or swallowed and that direct contact with skin is avoided. Personnel should wear the following Personal Protective Equipment (PPE):

- ◊ Steel-capped boots meeting AS2210.3 requirements (reference 24);
- ◊ Fluorescent safety vest or other high visibility clothing conforming to AS/NZS 4602:1999 (reference 25);
- ◊ Hard hat meeting AS1801-1981 (reference 26) requirements when working within close proximity to the excavator;
- ◊ Safety glasses or goggles with side shields meeting AS1337.6-2007 (reference 27) requirements as necessary; and
- ◊ Disposable latex gloves for personnel involved in soil or groundwater sampling.

In the unlikely event that personnel are required to work in areas with highly-contaminated soil or other hazardous materials, the following additional protection will be required:

- ◊ Disposable coveralls (if necessary) to prevent contact with splashed soil or materials; and
- ◊ Nitrile gloves meeting AS2161-2000 (reference 28) requirements or heavy-duty gauntlet gloves.

12.5 EMERGENCY RESPONSE PLAN

12.5.1 Resources

The following emergency numbers can be called in the event that medical or other emergency services are required:

Hospital: Canterbury Hospital
Corner of Thorncraft Parade and Canterbury Road, Campsie NSW 2194
(02) 9787 0000

Police, fire ambulance: 000

Electrical: Energy Australia
13 13 18

Council: Canterbury Council
137 Beamish St, Campsie NSW 2194

Water: Sydney Water
132 090

Gas: Jemena Gas
131 909

Utilities: Telstra
1800 653 935

12.5.2 Responsibilities

The site supervisor will be responsible for ensuring that site personnel are aware of emergency services available. A site safety officer must be available during remedial works.

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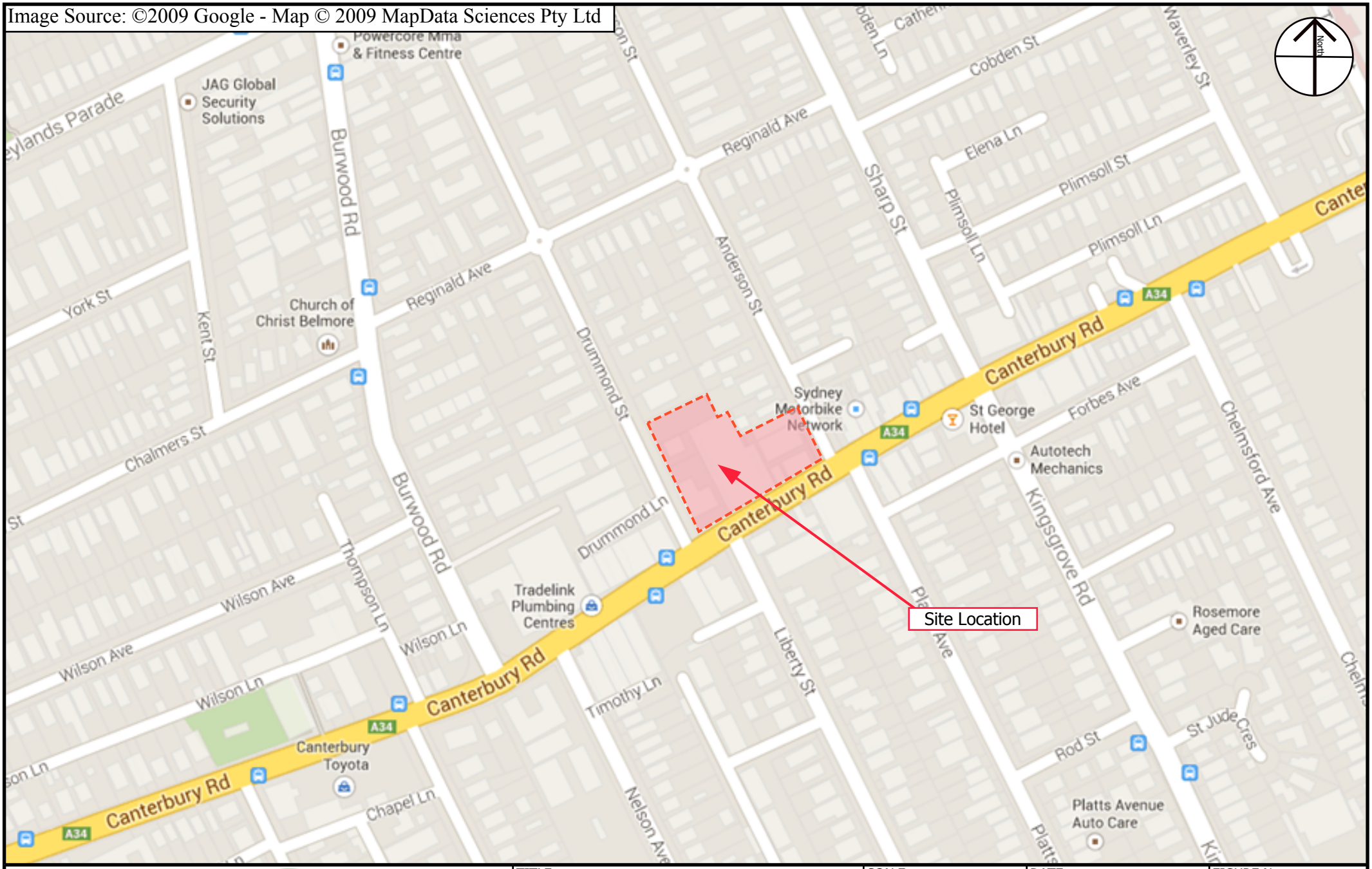
FIGURES



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TITLE:	SCALE:	DATE:	FIGURE No.
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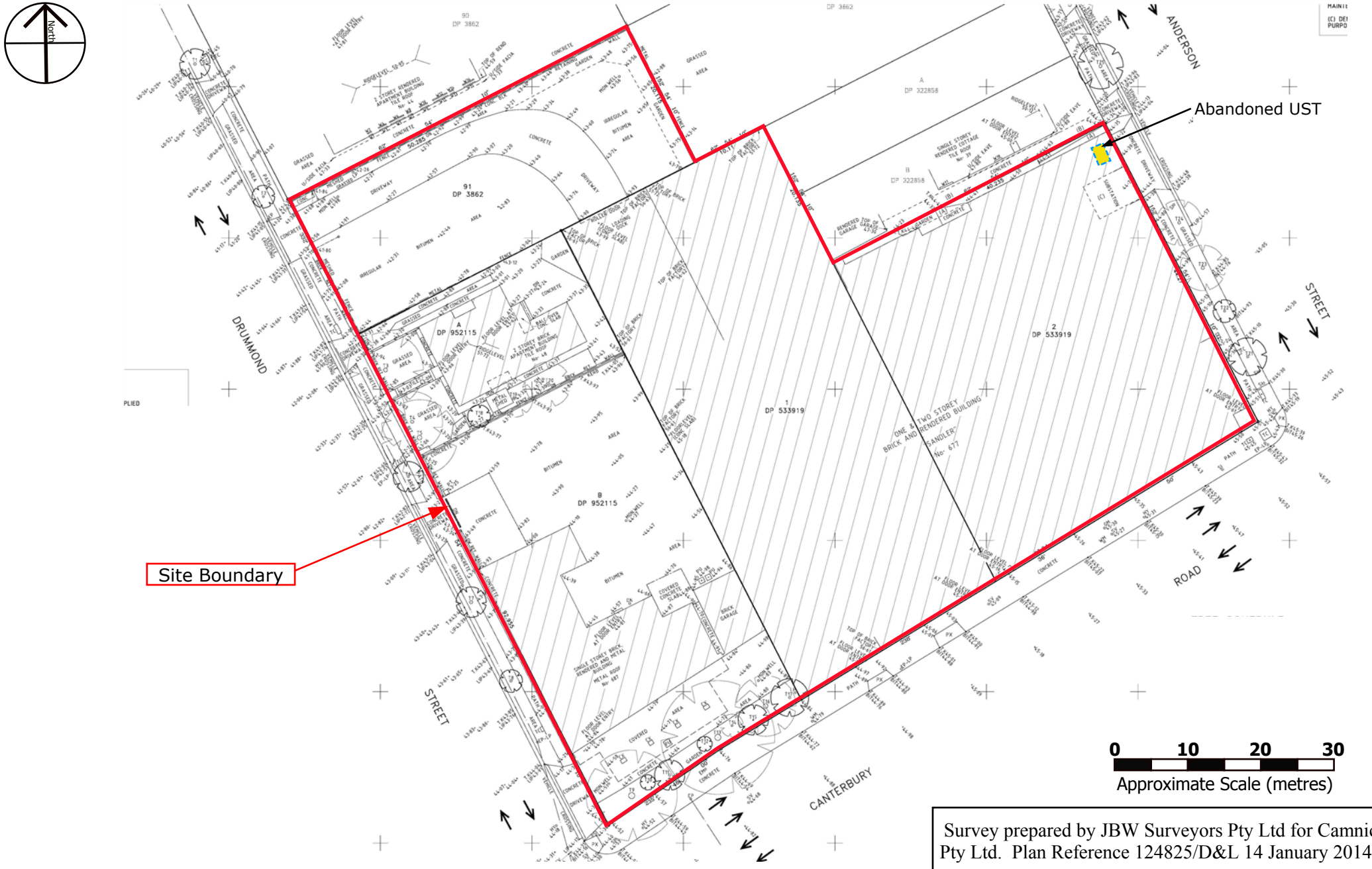
	DRAWN: SMc	JOB No.: E13017BEL	REVISION: A



Survey prepared by JBW Surveyors Pty Ltd for Camnic Pty Ltd. Plan Reference 124825/D&L 14 January 2014.

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TITLE:	SCALE:	DATE:	FIGURE No.
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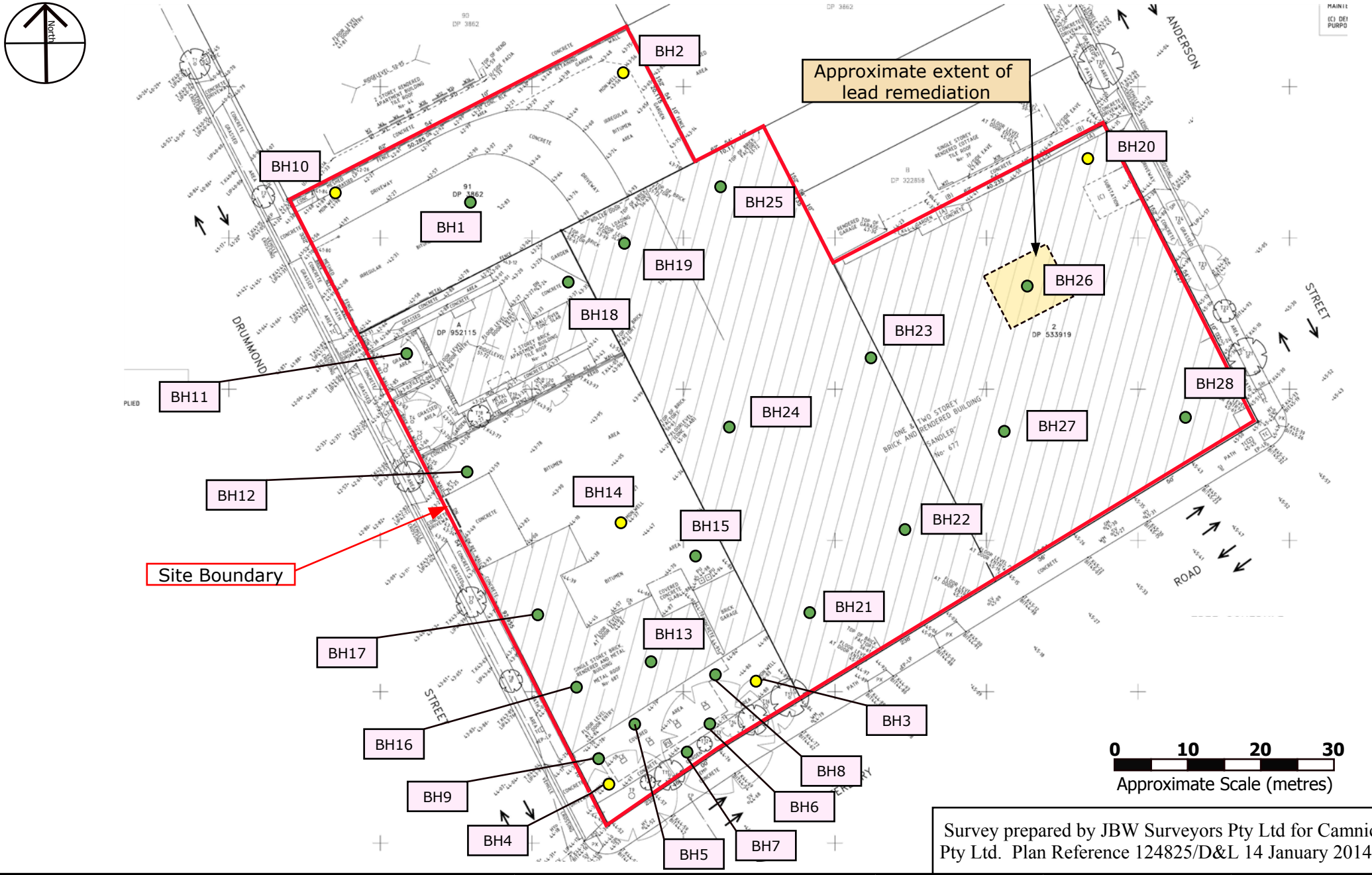
	DRAWN: SMc	JOB No.: E13017BEL	REVISION: A



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TITLE:	SCALE:	DATE:	FIGURE No.
SITE PLAN 677 - 687 Canterbury Road, Belmore NSW	N.T.S	4 Feb 2014	3
	DRAWN: SMc	JOB No.: E13017BEL	REVISION: A

Aerial Image Source: The Spatial Information eXchange ("SIX") provided and administered by the NSW Land and Property Information ("LPI") - Image Date May 2011

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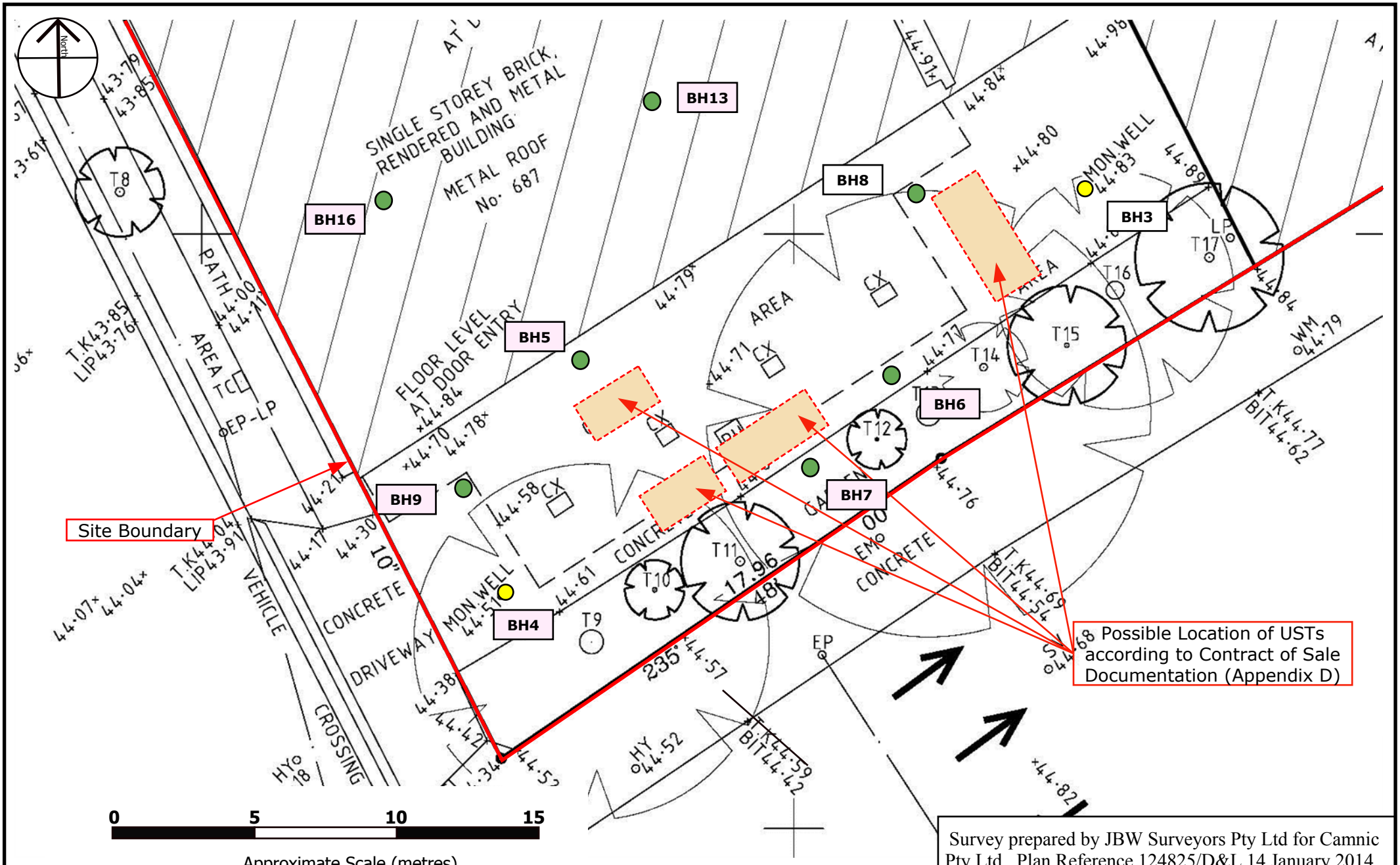
TITLE:	SCALE:	DATE:	FIGURE No.
SITE PLAN (Aerial Photograph) 677 - 687 Canterbury Road, Belmore NSW	N.T.S	4 Feb 2014	4
	DRAWN: SMc	JOB No.: E13017BEL	REVISION: A



Survey prepared by JBW Surveyors Pty Ltd for Camnic Pty Ltd. Plan Reference 124825/D&L 14 January 2014.

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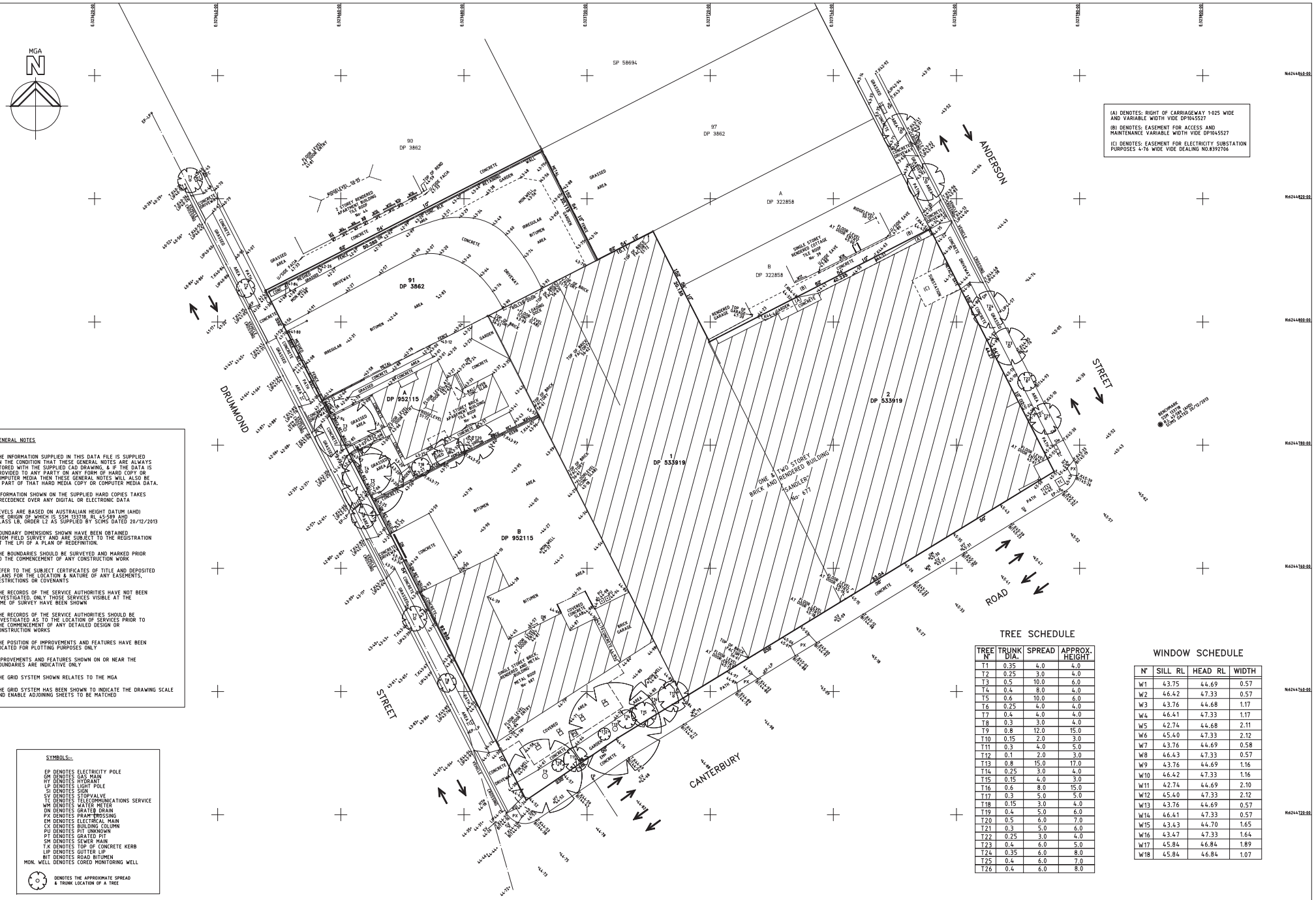
TITLE:	SCALE:	DATE:	FIGURE No.
SITE PLAN SHOWING SERVICE STATION 677 - 687 Canterbury Road, Belmore NSW	N.T.S	4 Feb 2014	5
	DRAWN: SMc	JOB No.: E13017BEL	REVISION: A

Appendix A

Site Survey



GENERAL NOTES

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LEVELS ARE BASED ON AUSTRALIAN HEIGHT DATUM (AHD) THE ORIGIN OF WHICH IS SSM 133718, RL 45·589 AHD CLASS LB, ORDER L2 AS SUPPLIED BY SCIMS DATED 20/12/2013

BOUNDARY DIMENSIONS SHOWN HAVE BEEN OBTAINED FROM FIELD SURVEY AND ARE SUBJECT TO THE REGISTRATION AT THE LPI OF A PLAN OF REDEFINITION.

THE BOUNDARIES SHOULD BE SURVEYED AND MARKED PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION WORK

REFER TO THE SUBJECT CERTIFICATES OF TITLE AND DEPOSITED PLANS FOR THE LOCATION & NATURE OF ANY EASEMENTS, RESTRICTIONS OR COVENANTS

THE RECORDS OF THE SERVICE AUTHORITIES HAVE NOT BEEN INVESTIGATED. ONLY THOSE SERVICES VISIBLE AT THE TIME OF SURVEY HAVE BEEN SHOWN

THE RECORDS OF THE SERVICE AUTHORITIES SHOULD BE INVESTIGATED AS TO THE LOCATION OF SERVICES PRIOR TO THE COMMENCEMENT OF ANY DETAILED DESIGN OR CONSTRUCTION WORKS

THE POSITION OF IMPROVEMENTS AND FEATURES HAVE BEEN LOCATED FOR PLOTTING PURPOSES ONLY

IMPROVEMENTS AND FEATURES SHOWN ON OR NEAR THE BOUNDARIES ARE INDICATIVE ONLY

THE GRID SYSTEM SHOWN RELATES TO THE MGA

THE GRID SYSTEM HAS BEEN SHOWN TO INDICATE THE DRAWING SCALE AND ENABLE ADJOINING SHEETS TO BE MATCHED

SYMBOLS:-

EP DENOTES ELECTRICITY POLE
GM DENOTES GAS MAIN
HY DENOTES HYDRANT
LP DENOTES LIGHT POLE
SI DENOTES SIGN
SV DENOTES STOPVALVE
TC DENOTES TELECOMMUNICATIONS SERVICE
WM DENOTES WATER METER
DN DENOTES GRATED DRAIN
PX DENOTES PRAM CROSSING
EM DENOTES ELECTRICAL MAIN
CX DENOTES BUILDING COLUMN
PU DENOTES PIT UNKNOWN
PT DENOTES GRATED PIT
SM DENOTES SEWER MAIN
TK DENOTES TOP OF CONCRETE KERB
LIP DENOTES GUTTER LIP
BIT DENOTES ROAD BITUMEN
MON. WELL DENOTES CORED MONITORING WELL

DENOTES THE APPROXIMATE SPREAD & TRUNK LOCATION OF A TREE

TREE SCHEDULE

TREE N°	TRUNK DIA.	SPREAD	APPROX. HEIGHT
T1	0.35	4.0	4.0
T2	0.25	3.0	4.0
T3	0.5	10.0	6.0
T4	0.4	8.0	4.0
T5	0.6	10.0	6.0
T6	0.25	4.0	4.0
T7	0.4	4.0	4.0
T8	0.3	3.0	4.0
T9	0.8	12.0	15.0
T10	0.15	2.0	3.0
T11	0.3	4.0	5.0
T12	0.1	2.0	3.0
T13	0.8	15.0	17.0
T14	0.25	3.0	4.0
T15	0.15	4.0	3.0
T16	0.6	8.0	15.0
T17	0.3	5.0	5.0
T18	0.15	3.0	4.0
T19	0.4	5.0	6.0
T20	0.5	6.0	7.0
T21	0.3	5.0	6.0
T22	0.25	3.0	4.0
T23	0.4	6.0	5.0
T24	0.35	6.0	8.0
T25	0.4	6.0	7.0
T26	0.4	6.0	8.0

WINDOW SCHEDULE

N°	SILL RL	HEAD RL	WIDTH
W1	43.75	44.69	0.57
W2	46.42	47.33	0.57
W3	43.76	44.68	1.17
W4	46.41	47.33	1.17
W5	42.74	44.68	2.11
W6	45.40	47.33	2.12
W7	43.76	44.69	0.58
W8	46.43	47.33	0.57
W9	43.76	44.69	1.16
W10	46.42	47.33	1.16
W11	42.74	44.69	2.10
W12	45.40	47.33	2.12
W13	43.76	44.69	0.57
W14	46.41	47.33	0.57
W15	43.43	44.70	1.65
W16	43.47	47.33	1.64
W17	45.84	46.84	1.89
W18	45.84	46.84	1.07

DATE	REVISION	AUTH.

COUNCIL REF:
SURVD. APP.:
ENGNG. APP.:

JBW Surveyors Pty Ltd.
ACN 001149373
Level 7, 376 Bay Street Brighton-Le-Sands NSW 2216
Phone: (02) 9335 9700 Fax: (02) 9556 3100
www.jbwsurveyors.com.au
Liability limited by a scheme approved under Professional Standards Legislation.

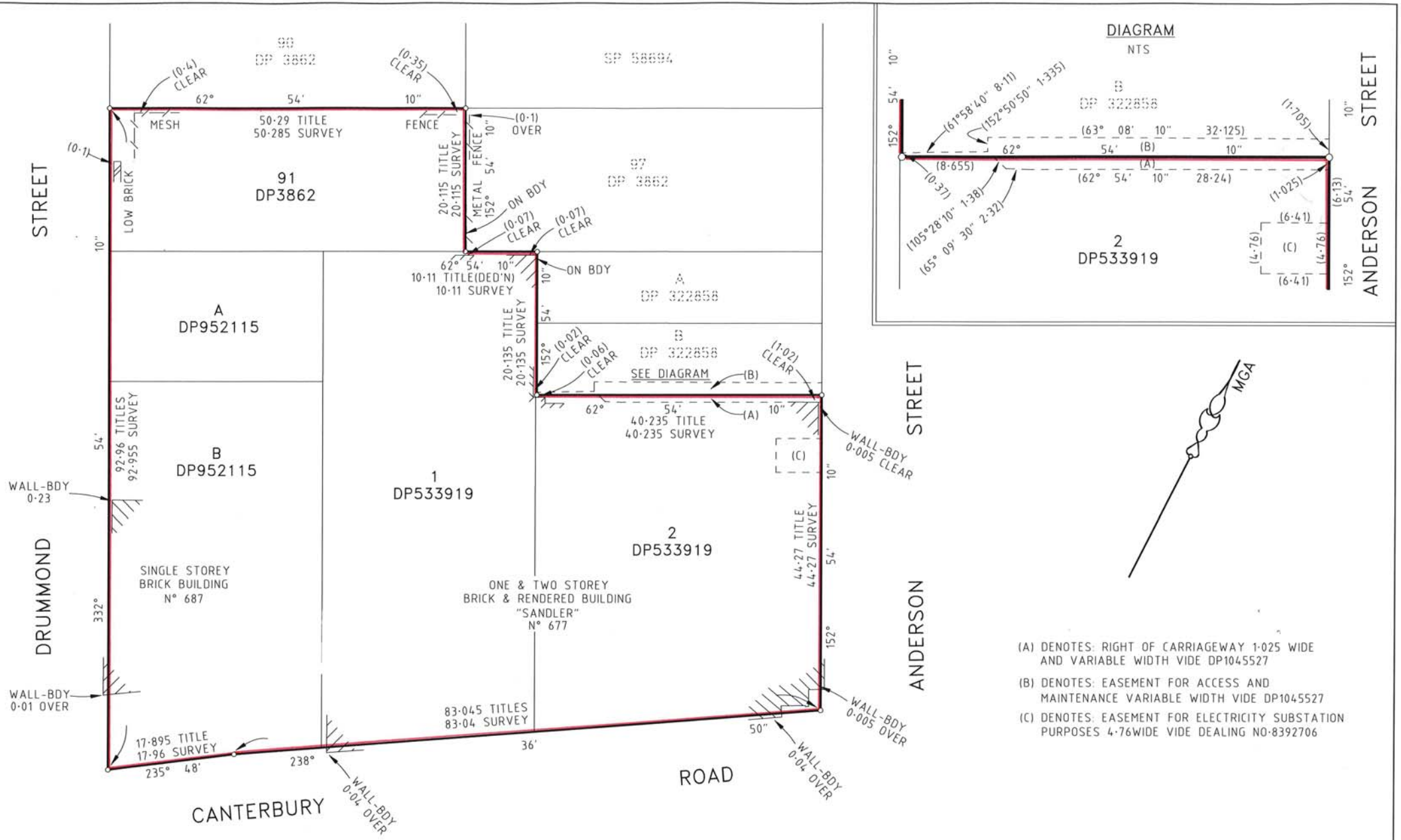
CLIENT
CAMNIC PTY LTD

PLAN SHOWING SELECTED DETAIL AND LEVELS OVER LOT 91 DP3862, LOTS 1&2 DP533919 & LOTS A&B DP952115 KNOWN AS NO'S 677, 687 CANTERBURY ROAD & 48 DRUMMOND ST, BELMORE

LOCALITY: BELMORE
LOCAL GOVERNMENT AREA: CANTERBURY

SCALE: 1:200
DATUM AHD
DATE: 14/01/14
AREA: 7070m² (TOT. BY SURVEY)

PLAN REF. 124825/D&L
DESIGNED: JSS
DRAWN: JSS



(A) DENOTES: RIGHT OF CARRIAGEWAY 1·025 WIDE AND VARIABLE WIDTH VIDE DP1045527

(B) DENOTES: EASEMENT FOR ACCESS AND MAINTENANCE VARIABLE WIDTH VIDE DP1045527

(C) DENOTES: EASEMENT FOR ELECTRICITY SUBSTATION PURPOSES 4·76WIDE VIDE DEALING NO·8392706

DISCRETIONARY NOTE:–

This survey has been made for identification purposes. If it is intended to erect any improvements on or near the boundaries of the subject land, those boundaries should be marked

This is the plan referred to in my report dated
letter

Registered Surveyor

JBW Surveyors Pty Ltd.
ACN 001149373
Level 7, 376 Bay Street Brighton-Le-Sands NSW 2216
Phone: (02) 9335 9700 Fax: (02) 9556 3100
www.jbwsurveyors.com.au

CLIENT CAMNIC PTY LTD

TITLE PLAN SHOWING THE BUILDING/S LOCATION TO THE SURVEYED BOUNDARIES OVER LOT 91 DP3862, LOTS 1&2 DP533919 & LOTS A&B DP952115 KNOWN AS NO'S 677, 687 CANTERBURY ROAD & 48 DRUMMOND ST, BELMORE

LGA:- CANTERBURY

SHEET NO 1	NO SHEETS 1		
SCALES 1:500 (A3)	DRAWN BG		
DATE 14/01/2014	DRAFTED BG		
AREA OF SITE	CHECKED BG		
	QUOTE 124825/IDENT		

Appendix B

Borehole Logs

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

Hole ID. **BH1**
Hole Depth: **1.20 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation**
Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW**
Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd**
Date Started: **16/12/2013**
Ground Level: **RL42.5m** (approx)
Drill Method: **Push Tube**
Date Completed: **16/12/2013**
Easting: **----------**
Equipment: **Geoprobe 7822DT**
Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
Push Tube		0.5	42			Fill	**ASPHALT**. **FILL**- Sandy GRAVEL, dark brown, with some clay.	medium dense	dry to moist	SM161213-01 0.1-0.4	
		1.0			CH	Natural	**Silty CLAY**- orange / brown, grey, medium to high plasticty.	firm to stiff	moist	SM161213-02/03 0.4-1.1	
							Extremely Weathered SHALE- grey and orange / brown, estimated extremely low to very low strength.		dry		
		1.5	41				**End of Hole at 1.20m** Refusal.				
		2.0									
		2.5	40								
		3.0									
		3.5	39								
		4.0									
		4.5	38								

Additional Comments

Logged By: **Stephen McCormack** Date: **16/12/2013**
Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:46 AM

Monitoring Well Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

geo-environmental ENGINEERING

Hole ID. **BH2**
Hole Depth: **8.00 m**
Sheet: **1 of 2**

Project Name: **Stage 2 Detailed Site Investigation**
Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW**
Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd**
Date Started: **16/12/2013**
Ground Level: **RL43.6m** (approx)
Drill Method: **Push Tube / Solid Stem Auger**
Date Completed: **16/12/2013**
Easting: ----------
Equipment: **Geoprobe 7822DT**
Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments	Well Details	Well Construction
Push Tube		0.0	43			Fill	**ASPHALT**.						
							FILL- Gravelly Clayey SAND, dark brown and brown, medium to coarse grained sand, fine to coarse gravel.	loose	moist	SM161213-04 0.1-0.25			Gattic
		0.5											
		1.0					**FILL**- Gravelly SAND with Silt (Ash), black and dark grey.	loose	moist	SM161213-05 0.7-0.8			
							Silty CLAY- red brown and orange brown, medium to high plasticty.	firm to stiff	moist	SM161213-06 0.9-1.0			
		1.5	42		CH					SM161213-07 1.5-1.7			Grout
		2.0					Becoming pale grey with depth.						
Solid Stem Auger	3.47m BTOC 6/01/2014	2.5	41			Natural	**Extremely Weathered SHALE / SILTSTONE**- pale grey / brown, estimated extremely low to very low strength.		dry	SM161213-08 2.5-3.0		2.20	
		3.0										3.30	Bentonite
		3.5	40							SM161213-09 4.0-4.3		3.80	
		4.0											Screen
		4.5											

Additional Comments

Logged By: **Stephen McCormack** Date: **16/12/2013**
Checked By: **Stephen McCormack** Date: **5/03/2014**

Monitoring Well Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

Hole ID. **BH2**
Hole Depth: **8.00 m**
Sheet: **2 of 2**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **16/12/2013** Ground Level: **RL43.6m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **16/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments	Well Details	Well Construction
Solid Stem Auger		5.0	39			Natural	**Extremely Weathered SHALE / SILTSTONE**- pale grey / brown, estimated extremely low to very low strength.*(continued)*		dry				
		5.5	38										
		6.0											
		6.5	37										
		7.0					Dark grey and grey from 7.0mbgl, increased hardness, estimate low to medium strength.						
		7.5	36										
		8.0										7.80	Gravel Pack
		8.5	35				**Hole Terminated at 8.00m**						Cave-in
		9.0											

Additional Comments

Logged By: **Stephen McCormack** Date: **16/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:47 AM

Monitoring Well Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

geo-environmental ENGINEERING

Hole ID. **BH3**
Hole Depth: **7.00 m**
Sheet: **1 of 2**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **16/12/2013** Ground Level: **RL44.8m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **16/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments	Well Details	Well Construction
CC							**CONCRETE**.						
Push Tube		0.5				Fill	**FILL**- Silty Gravelly CLAY, dark brown, low to medium plasticity, fine to coarse gravel, some sand.	firm	dry to moist	SM161213-10 0.1-0.2			Gattic
		1.0	44		CH		**Silty CLAY**- dark brown, medium to high plasticty. Becoming red brown / orange brown from 0.6mbgl. Becoming pale grey and red brown from 1.0mbgl.	firm to stiff	moist	SM161213-11 0.4-0.55		0.90	Grout
		1.5								SM161213-12 1.2-1.4			
Solid Stem Auger		2.0	43			Natural	**Completely to Extremely Weathered SHALE**- grey and red brown, estimated extremely low to very low strength.		dry	SM161213-13 1.8-2.0		1.90	Bentonite
	3.81m BTOC 6/01/2014	2.5	42				Becoming estimated very low to low strength Class IV rock from 2.8mbgl, some ironstone bands.					2.60	
		3.0								SM161213-14 3.0-3.5			Screen
		3.5	41										
		4.0											
		4.5											

Additional Comments

Logged By: **Stephen McCormack** Date: **16/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:49 AM

Monitoring Well Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

Hole ID. **BH3**
Hole Depth: **7.00 m**
Sheet: **2 of 2**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **16/12/2013** Ground Level: **RL44.8m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **16/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments	Well Details	Well Construction
Solid Stem Auger		5.0	40			Natural	**Completely to Extremely Weathered SHALE**- grey and red brown, estimated extremely low to very low strength.*(continued)*		dry				
		5.5								SM161213-15 5.0-5.5			
		6.0	39										
		6.5					Dark grey from 6.5mbgl, increased hardness, estimated low to medium strength.						
		7.0	38									6.60	
							Hole Terminated at 7.00m						
		7.5											
		8.0	37										
		8.5											
		9.0	36										

Gravel Pack
Cave-in

Additional Comments

Logged By: **Stephen McCormack** Date: **16/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:49 AM

Monitoring Well Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

geo-environmental ENGINEERING

Hole ID. **BH4**
Hole Depth: **6.50 m**
Sheet: **1 of 2**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **16/12/2013** Ground Level: **RL44.5m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **16/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Depth (m)	RL (m)	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
CC				Fill	**CONCRETE**.				
Push Tube				Fill	**Silty Gravelly CLAY**- dark brown, low to medium plasticity, some roots.		moist	SM161213-22 0.15-0.3	
	0.5	44	CH	Natural	**Silty CLAY**- grey and orange brown, medium to high plasticty.	firm to stiff	moist	SM161213-23 0.4-0.6	
	1.0				Becoming predominantly grey with orange brown bands, ironstone gravel.	becoming stiff to very stiff		SM161213-24 1.0-1.2	
	1.5	43							
Solid Stem Auger	2.0				**Extremely Weathered SHALE / SILTSTONE**- grey and brown, estimated extremely low to very low strength.		dry	SM161213-25 2.0-2.5	
	2.5	42							
	3.0				Estimated very low to low strength from 3.2mbgl.				
	3.5	41							
	4.0							SM161213-26 4.0-4.5	
	4.5	40							

Well Details: Gattic; Grout; 1.50; Bentonite; 2.50; 3.00; Screen

Well Construction

Additional Comments

Logged By: **Stephen McCormack** Date: **16/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:50 AM

Monitoring Well Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

Hole ID. **BH4**
Hole Depth: **6.50 m**
Sheet: **2 of 2**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **16/12/2013** Ground Level: **RL44.5m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **16/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments	Well Details	Well Construction
Solid Stem Auger		5.0				Natural	**Extremely Weathered SHALE / SILTSTONE**- grey and brown, estimated extremely low to very low strength.*(continued)*		dry				Gravel Pack
		5.5	39										
		6.0					Estimated low to medium strength from 6.1mbgl.					6.00	
		6.5	38										Cave-in
		7.0					**Hole Terminated at 6.50m**						
		7.5	37										
		8.0											
		8.5	36										
		9.0											

Additional Comments

Logged By: **Stephen McCormack** Date: **16/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:50 AM

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

geo-environmental ENGINEERING

Hole ID. **BH5**
Hole Depth: **3.50 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **16/12/2013** Ground Level: **RL44.8m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **16/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
CC						Fill	**CONCRETE**.				
Push Tube		0.5				Fill	**FILL**- SAND, yellow / brown, fine to coarse grained.	firm	moist	SM161213-33 0.14-0.2	
						Fill	**FILL**- Silty CLAY, dark brown, some gravel.		slightly moist	SM161213-34 0.2-0.6	
		1.0	44		CH	Natural	**Silty CLAY**- red brown and orange brown, medium to high plasticty.	firm to stiff	moist	SM161213-35 0.6-0.8	
		1.5			CH	Natural	Becoming predominantly grey and orange brown from 1.1mbgl.	very stiff		SM161213-36 1.0-1.2	
Solid Stem Auger		2.0	43			Natural	**Extremely Weathered SHALE**- grey brown, estimated very low strength.		dry	SM161213-37 1.8-2.0	
		2.5									
		3.0	42								
		3.5								SM161213-38 3.3-3.5	
		4.0	41				**Hole Terminated at 3.50m**				
		4.5									

Additional Comments

Logged By: **Stephen McCormack** Date: **16/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

Hole ID. **BH6**
Hole Depth: **4.00 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **16/12/2013** Ground Level: **RL44.7m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **16/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Depth (m)	RL (m)	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
CC			**CONCRETE**.				
Push Tube	0.5	44	**FILL**- SAND, yellow brown, fine to coarse grained, some fine to coarse gravel.	loose to very loose	moist	SM161213-39 0.2-0.35	Likely tankpit sands.
	1.0					SM161213-40 0.8-1.0	
	1.5	43				SM161213-41 1.3-1.5	
	2.0						
Solid Stem Auger	2.5	42	**Extremely Weathered SHALE**- brown / grey, estimated extremely low to very low strength.		dry	SM161213-42 2.3-2.5	
	3.0						
	3.5	41				SM161213-43 3.5-4.0	
	4.0		**Hole Terminated at 4.00m**				
	4.5						

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **16/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:53 AM

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

Hole ID. **BH7**
Hole Depth: **4.00 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **16/12/2013** Ground Level: **RL44.7m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **16/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
Push Tube		0.0	44			Fill	**TOPSOIL / FILL**- Clayey SILT, dark brown, low plasticity, some roots.	firm	dry to moist	SM161213-44 0.0-0.2	
		0.5					**FILL**- SAND, yellow brown, fine to coarse grained, trace medium to coarse gravel.	loose to very loose	moist	SM161213-45 0.3-0.5	Likely tankpit sands.
		1.0								SM161213-46 1.1-1.3	
		1.5	43								
		2.0									
		2.5	42							SM161213-47/48 2.5-2.8	
Solid Stem Auger		3.0				Natural	**Extremely Weathered SHALE**- brown / grey, estimated extremely low to very low strength.		dry		
		3.5	41							SM161213-49 3.0-3.5	
		4.0					**Hole Terminated at 4.00m**				
		4.5									

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **16/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:53 AM

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

geo-environmental ENGINEERING

Hole ID. **BH8**
Hole Depth: **3.50 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **16/12/2013** Ground Level: **RL44.8m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **16/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
CC							**CONCRETE**.				
Push Tube		0.5	44			Fill	**FILL**- SAND, brown, fine to coarse grained.	very loose to loose	moist	SM161213-16/17 0.2-0.4	Likely tankpit sands.
		1.0					**FILL**- Gravelly SAND, brown, fine to coarse grained, some concrete fragments.	very loose to loose	moist	SM161213-18 1.1-1.3	
		1.5								SM161213-19 1.5-1.6	
Solid Stem Auger		2.0	43				**FILL**- CONCRETE.				Likely tank anchor.
		2.5	42				**FILL**- SAND, yellow brown, fine to coarse grained.	very loose to loose	moist	SM161213-20 2.3-2.55	Likely tankpit sands.
		3.0				Natural	**Extremely to Highly Weathered SHALE**- dark brown and red brown, estimated very low strength.		dry	SM161213-21 2.8-3.0	
		3.5									
		4.0	41				**Hole Terminated at 3.50m**				
		4.5									

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **16/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:54 AM

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

geo-environmental ENGINEERING

Hole ID. **BH9**
Hole Depth: **4.00 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **16/12/2013** Ground Level: **RL44.7m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **16/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Depth (m)	RL (m)	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
CC				Fill	**CONCRETE**.				
Push Tube	0.5	44		Fill	**FILL**- SAND, yellow / brown, fine to coarse grained.	firm	moist	SM161213-27 0.15-0.2	
				Fill	**FILL**- Silty Gravelly CLAY, dark brown, low to medium plasticity, fine to coarse gravel, some ash.		moist	SM161213-28 0.2-0.35	
			CH	Natural	**Silty CLAY**- red brown and orange brown, medium to high plasticty. Becoming grey and orange brown from 0.8m, some shale structure.	stiff	moist	SM161213-29 0.5-0.7	
	1.0							SM161213-30 1.1-1.2	
Solid Stem Auger	1.5	43		Natural	**Extremely Weathered SHALE**- grey brown, estimated extremely low to very low strength.		dry		
	2.0							SM161213-31 2.0-2.5	
	2.5	42							
	3.0								
	3.5	41						SM161213-32 3.5-4.0	
	4.0								
					Hole Terminated at 4.00m				
	4.5								

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **16/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:55 AM

Monitoring Well Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
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Hole ID. **BH10**
Hole Depth: **6.50 m**
Sheet: **1 of 2**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **16/12/2013** Ground Level: **RL42.0m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **16/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Depth (m)	RL (m)	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
CC				Fill	**CONCRETE**.				
Push Tube	0.5			Fill	**FILL**- SAND, yellow brown, fine to coarse grained.		moist	SM161213-50 0.2-0.3	
				Fill	**FILL**- Silty CLAY, dark brown, low plasticity, with fine to medium grained sand.	firm	very moist	SM161213-51 0.3-0.5	
						stiff		SM161213-52 0.5-0.7	
	1.0	41	CH	Natural	**Silty CLAY**- red brown and orange brown, medium to high plasticty.		moist		
Solid Stem Auger	1.5			Natural	**Extremely Weathered SHALE**- grey / brown, frequent clay bands, estimated extremely low to very low strength.		dry	SM161213-53 1.3-1.5	
	2.0	40							
	2.5							SM161213-54 2.5-3.0	
	3.0	39							
	3.5								
	4.0	38							
	4.5								

Water Level: 3.37m BTOC 6/01/2014

Well Details: 1.50, 2.50, 3.00

Well Construction: Gattic, Grout, Bentonite, Screen

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **16/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:56 AM

Monitoring Well Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

Hole ID. **BH10**
Hole Depth: **6.50 m**
Sheet: **2 of 2**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **16/12/2013** Ground Level: **RL42.0m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **16/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments	Well Details	Well Construction
Solid Stem Auger		5.0	37			Natural	**Extremely Weathered SHALE**- grey / brown, frequent clay bands, estimated extremely low to very low strength.*(continued)*		dry	SM161213-55 4.5-5.0			Gravel Pack
		5.5											
		6.0	36				Becoming dark grey from 6.0mgl, estimated low to medium strength.			SM161213-56 5.5-6.0		6.00	
		6.5											Cave-in
		7.0	35				**Hole Terminated at 6.50m**						
		7.5											
		8.0	34										
		8.5											
		9.0	33										

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **16/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
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Hole ID. **BH11**
Hole Depth: **1.00 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation**
Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW**
Client: **City Alliance Property**

Drilling Company: **GEE**
Drill Method: **Manual**
Equipment: **Hand Auger**
Date Started: **17/12/2013**
Date Completed: **17/12/2013**
Ground Level: **RL43.1m** (approx)
Easting: ----------
Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests: ID No.	Samp. / Tests: DCP blows/100mm	Observations / Comments
											5 10 15	
Hand Auger		0.5	43			Fill	**TOPSOIL / FILL**- Silty Gravelly CLAY, dark brown, fine to coarse gravel.	stiff	moist	SM171213-81 0.0-0.15	Start 0.5m	
		1.0			CH	Natural	**Silty CLAY**- red brown and brown, medium to high plasticty, with fine to coarse ironstone gravel.	stiff	moist	SM171213-82 0.5-1.0		
		1.5	42				**Hole Terminated at 1.00m**				+20 Ref. 1.6m	Likely depth to Shale Bedrock (1.6m).
		2.0	41									
		2.5										
		3.0	40									
		3.5										
		4.0	39									
		4.5										

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **17/12/2013**
Checked By: **Stephen McCormack** Date: **5/03/2014**

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Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
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Hole ID. **BH12**
Hole Depth: **1.50 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation**
Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW**
Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd**
Date Started: **17/12/2013**
Ground Level: **RL43.3m** (approx)
Drill Method: **Push Tube**
Date Completed: **17/12/2013**
Easting: **----------**
Equipment: **Geoprobe 7822DT**
Northing: **----------**

Method	Depth (m)	RL (m)	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
CC				Fill	**ASPHALT**.		dry		
					ROADBASE- Sandy GRAVEL, grey / brown.			SM171213-60 0.1-0.15	
	0.5	43			**CONCRETE**- not reinforced.	firm	moist	SM171213-61 0.3-0.4	
					FILL- Silty Gravelly CLAY, dark grey, low plasticity.				
Push Tube	1.0	42	CH	Natural	**Silty CLAY**- red brown and brown, medium plasticity.	firm	moist	SM171213-62 0.6-0.8	
	1.5				**Extremely Weathered SHALE**- grey brown, estimated extremely low to very low strength.		dry	SM171213-63 1.4-1.5	
					Hole Terminated at 1.50m				
	2.0	41							
	2.5								
	3.0	40							
	3.5								
	4.0	39							
	4.5								

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **17/12/2013**
Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:58 AM

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

Hole ID. **BH13**
Hole Depth: **1.20 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **GEE** Date Started: **17/12/2013** Ground Level: **RL44.8m** (approx)
Drill Method: **Manual** Date Completed: **17/12/2013** Easting: **----------**
Equipment: **Hand Auger** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests: ID No.	Samp. / Tests: DCP blows/100mm	Observations / Comments
											5 10 15	
CC						Fill	**CONCRETE**.					
Hand Auger		0.5	44		CH	Fill	**FILL**- SAND, yellow brown, fine to coarse grained.	loose to very loose	moist	SM171213-64/65 0.2-0.4	Pushed to 0.4m	
		1.0				Natural	**Silty CLAY**- dark brown, medium plasticity, with ironstone gravel. Becoming red brown and orange brown from 0.7mbgl.	firm to stiff	moist	SM171213-66 0.4-0.6		
										SM171213-71 1.0-1.2		
		1.5	43				**Hole Terminated at 1.20m**				+20 Ref. 1.9m	Likely depth to Shale Bedrock (1.9m).
		2.0										
		2.5	42									
		3.0										
		3.5	41									
		4.0										
		4.5										

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **17/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:22:59 AM

Monitoring Well Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

Hole ID. **BH14**
Hole Depth: **6.50 m**
Sheet: **1 of 2**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **17/12/2013** Ground Level: **RL44.4m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **17/12/2013** Easting: ----------
Equipment: **Geoprobe 7822DT** Northing: ----------

Method	Depth (m)	RL (m)	USCS	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
Push Tube	0.0	44		Fill	**ASPHALT**.		dry		
					ROADBASE- Sandy GRAVEL, grey / brown.				
					BRICKS.	firm	moist	SM171213-67 0.25-0.4	
	0.5				FILL- Silty Gravelly CLAY, dark brown.				
			CH		**Silty CLAY**- brown and grey, medium to high plasticty, some ironstone gravel.	firm to stiff		SM171213-68 0.5-0.7	
	1.0	43			Becoming grey and orange brown from 1.0mbgl.	becoming stiff to very stiff			
	1.5								
	2.0							SM171213-69 1.8-2.0	
Solid Stem Auger		42		Natural	**Extremely Weathered SHALE**- grey brown, estimated extremely low to very low strength.		dry	SM171213-70 2.0-2.2	
	2.5								
	3.0	41			Becoming estimated very low to low strength from 3.3mbgl.				
	3.5								
	4.0	40							
	4.5								

Well Details: Gattic; Grout; 1.50; Bentonite; 2.50; 3.00; Screen
Well Construction

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **17/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:23:00 AM

Monitoring Well Log Report

Geo Environmental Engineering
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Lane Cove NSW 2066
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Hole ID. **BH14**
Hole Depth: **6.50 m**
Sheet: **2 of 2**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **17/12/2013** Ground Level: **RL44.4m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **17/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments	Well Details	Well Construction
Solid Stem Auger		5.0	39			Natural	**Extremely Weathered SHALE**- grey brown, estimated extremely low to very low strength.*(continued)*		dry			6.00	Gravel Pack
		5.5											
		6.0					Becoming estimated low to medium strength from 5.8mbgl.						
		6.5	38										Cave-in
		7.0					**Hole Terminated at 6.50m**						
		7.5	37										
		8.0											
		8.5	36										
		9.0											

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **17/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
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Hole ID. **BH15**
Hole Depth: **2.30 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **17/12/2013** Ground Level: **RL44.8m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **17/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Depth (m)	RL (m)	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
Push Tube	0.0	44		Fill	**ASPHALT**.				
					ROADBASE- Sandy GRAVEL, grey / brown.	medium dense	dry	SM171213-74 0.1-0.2	
	0.5				**FILL**- Silty CLAY, dark brown, low to medium plasticity, some black fragments (ash?).	firm	slightly moist	SM171213-75 0.3-0.5	
	1.0		CH	Natural	**Silty CLAY**- red brown and brown, medium to high plasticty.	stiff	moist	SM171213-76 0.9-1.1	
	1.5	43							
	2.0				**Extremely Weathered SHALE**- grey to orange brown, estimated extremely low to very low strength.		dry	SM171213-77 2.1-2.3	
	2.5	42			**Hole Terminated at 2.30m**				
	3.0								
	3.5	41							
	4.0								
	4.5								

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **17/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

Hole ID. **BH16**
Hole Depth: **0.30 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **GEE** Date Started: **17/12/2013** Ground Level: **RL44.8m** (approx)
Drill Method: **Manual** Date Completed: **17/12/2013** Easting: **----------**
Equipment: **Hand Auger** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samp. / Tests ID No.	Observations / Comments
CC						Fill	**CONCRETE**.			
HA							**ROADBASE**- Sandy GRAVEL, grey / brown.	dry	SM171213-72/73 0.2-0.3	
		0.5	44				**Hole Terminated at 0.30m** Refusal on concrete slab.			
		1.0								
		1.5	43							
		2.0								
		2.5	42							
		3.0								
		3.5	41							
		4.0								
		4.5								

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **17/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

Borehole Log Report

Geo Environmental Engineering
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Hole ID. **BH17**
Hole Depth: **1.10 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation**
Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW**
Client: **City Alliance Property**

Drilling Company: **GEE**
Drill Method: **Manual**
Equipment: **Hand Auger**
Date Started: **17/12/2013**
Date Completed: **17/12/2013**
Ground Level: **RL44.5m** (approx)
Easting: ----------
Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	DCP blows/100mm	Observations / Comments
											5 10 15	
CC							**CONCRETE**.				Start 0.2m	
Push Tube		0.5	44			Fill	**FILL**- Silty Gravelly CLAY, dark brown, medium to high plasticty, fine to coarse gravel, some coal like fragments and ironstone.	firm to stiff	moist	SM171213-78 0.15-0.3		
		1.0			CH	Natural	**Silty CLAY**- red brown and brown, medium to high plasticty, with ironstone gravel. Becoming pale grey and orange brown from 1.0m.	stiff	moist	SM171213-79 0.5-0.7 SM171213-80 1.0-1.1		
		1.5	43				**Hole Terminated at 1.10m** Refusal, likely caused by Shale Bedrock.				+20 Bouncing Ref. 1.1m	
		2.0										
		2.5	42									
		3.0										
		3.5	41									
		4.0										
		4.5	40									

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **17/12/2013**
Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:23:03 AM

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

geo-environmental ENGINEERING

Hole ID. **BH18**
Hole Depth: **1.30 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation**
Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW**
Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd**
Date Started: **17/12/2013**
Ground Level: **RL43.3m** (approx)
Drill Method: **Push Tube**
Date Completed: **17/12/2013**
Easting: **----------**
Equipment: **Geoprobe 7822DT**
Northing: **----------**

Method	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
CC						**CONCRETE**.				
Push Tube	0.5	43			Fill	**FILL**- Gravelly SAND, yellow brown, medium to coarse grained, medium to coarse gravel.	loose	moist	SM171213-83 0.1-0.2	
						FILL- Silty CLAY, dark brown, medium to high plasticty, with gravel.	firm to stiff	moist	SM171213-84 0.2-0.3	
	1.0			CH	Natural	**Silty CLAY**- red brown and pale brown, medium to high plasticty.	stiff	moist	SM171213-85 0.5-0.7	
		42				**Extremely Weathered SHALE**- orange brown and grey, estimated extremely low to very low strength.		dry	SM171213-86 1.2-1.3	
	1.5					**Hole Terminated at 1.30m**				
	2.0	41								
	2.5									
	3.0	40								
	3.5									
	4.0	39								
	4.5									

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **17/12/2013**
Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:23:04 AM

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

geo-environmental ENGINEERING

Hole ID. **BH19**
Hole Depth: **1.50 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **17/12/2013** Ground Level: **RL44.0m** (approx)
Drill Method: **Push Tube** Date Completed: **17/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Depth (m)	RL (m)	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
CC			**CONCRETE**.				
Push Tube	0.5		**FILL**- SAND, yellow brown, fine to coarse grained. (Fill)	loose	moist	SM171213-87/88 0.2-0.3	
			FILL- Silty Gravelly CLAY, dark brown / dark grey, fine to coarse gravel. (Fill)	firm to stiff	moist	SM171213-89 0.3-0.5	
	1.0	43				SM171213-90 1.0-1.2	
			CONCRETE.				
	1.5		**Extremely Weathered SHALE**- brown and orange brown, estimated extremely low to very low strength. (Nat.)		dry	SM171213-91 1.3-1.5	
			Hole Terminated at 1.50m				
	2.0	42					
	2.5						
	3.0	41					
	3.5						
	4.0	40					
	4.5						

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **17/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

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Monitoring Well Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

Hole ID. **BH20**
Hole Depth: **7.50 m**
Sheet: **1 of 2**

Project Name: **Stage 2 Detailed Site Investigation**
Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW**
Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd**
Date Started: **17/12/2013**
Ground Level: **RL44.7m** (approx)
Drill Method: **Push Tube / Solid Stem Auger**
Date Completed: **17/12/2013**
Easting: ----------
Equipment: **Geoprobe 7822DT**
Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments	Well Details	Well Construction
CC							**CONCRETE**.						
Push Tube						Fill	**FILL**- SAND, yellow brown, medium to coarse grained.		moist	SM171213-92/93 0.2-0.3			
		0.5	44				**FILL**- Silty Gravelly CLAY, dark brown, medium plasticity, fine to coarse gravel, coal-like fragments.	firm	moist	SM171213-94 0.35-0.5			
		1.0								SM171213-95 1.0-1.1		1.00	
							Some concrete present 1.2 to 1.3mbgl.						
		1.5	43				**Silty CLAY**- grey and red brown, medium to high plasticty, with fine to coarse ironstone gravel.	stiff	moist	SM171213-96 1.3-1.45			
Solid Stem Auger	3.96m BTOC 6/01/2014					Natural	**Extremely Weathered SHALE**- red brown and grey, estimated extremely low to very low strength.		dry			2.00	Bentonite
		2.0								SM171213-97 2.0-2.3			
		2.5	42									2.90	
		3.0											Screen
		3.5	41							SM171213-98 3.5-4.0			
		4.0					Becoming estimated very low to low strength from 3.7mbgl.						
		4.5											

Gattic
Grout

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **17/12/2013**
Checked By: **Stephen McCormack** Date: **5/03/2014**

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Monitoring Well Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
M. 0431 480 980

Hole ID. **BH20**
Hole Depth: **7.50 m**
Sheet: **2 of 2**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **Epoca Environmental Pty Ltd** Date Started: **17/12/2013** Ground Level: **RL44.7m** (approx)
Drill Method: **Push Tube / Solid Stem Auger** Date Completed: **17/12/2013** Easting: **----------**
Equipment: **Geoprobe 7822DT** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments	Well Details	Well Construction
Solid Stem Auger		5.0	40			Natural	**Extremely Weathered SHALE**- red brown and grey, estimated extremely low to very low strength.*(continued)*		dry	SM171213-99 4.5-5.0			Gravel Pack
		5.5	39										
		6.0											
		6.5	38										
		7.0					Becoming dark grey from 7.0mbgl, estimated low to medium strength.					6.90	Cave-in
		7.5											
							Hole Terminated at 7.50m						
		8.0	37										
		8.5											
		9.0	36										

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **17/12/2013** Checked By: **Stephen McCormack** Date: **5/03/2014**

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Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
Lane Cove NSW 2066
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Hole ID. **BH21**
Hole Depth: **0.45 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **GEE** Date Started: **6/01/2014** Ground Level: **RL45.2m** (approx)
Drill Method: **Manual** Date Completed: **6/01/2014** Easting: **----------**
Equipment: **Hand Auger / Crow Bar** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samp. / Tests ID No.	Observations / Comments
HA / Crow Bar		0.0	45			Fill	**CONCRETE**.			
							FILL- Sandy GRAVEL with Bricks, fine to coarse grained sand, fine to coarse gravel.	moist	SM060114-80 0.2-0.4	
		0.5					**Hole Terminated at 0.45m** Refusal.			
		1.0	44							
		1.5								
		2.0	43							
		2.5								
		3.0	42							
		3.5								
		4.0	41							
		4.5								

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **6/01/2014** Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:23:07 AM

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
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Hole ID. **BH22**
Hole Depth: **0.50 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation**
Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW**
Client: **City Alliance Property**

Drilling Company: **GEE**
Drill Method: **Manual**
Equipment: **Hand Auger / Crow Bar**
Date Started: **6/01/2014**
Date Completed: **6/01/2014**
Ground Level: **RL45.2m** (approx)
Easting: ----------
Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests: ID No.	Samp. / Tests: DCP blows/100mm	Observations / Comments
											5 10 15	
CC HA / Crow Bar		0.5	45			Fill	**CONCRETE**. **FILL**- Sandy GRAVEL, brown / grey, crushed concrete.	medium dense	moist	SM060114-81/82 0.2-0.4	Start 0.5m	
		1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5	44 43 42 41				**Hole Terminated at 0.50m** HA and DCP Refusal.				+20 Bouncing Ref. 0.6m	

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **6/01/2014**
Checked By: **Stephen McCormack** Date: **5/03/2014**

GEE BH LOG BELMORE E13017BEL.GPJ GEE CH.GDT 5/3/14 10:23:07 AM

Borehole Log Report

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Hole ID. **BH23**
Hole Depth: **1.40 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation**
Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW**
Client: **City Alliance Property**

Drilling Company: **GEE**
Drill Method: **Manual**
Equipment: **Hand Auger**
Date Started: **6/01/2014**
Date Completed: **6/01/2014**
Ground Level: **RL45.2m** (approx)
Easting: ----------
Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests: ID No.	Samp. / Tests: DCP blows/100mm	Observations / Comments
											5 10 15	
CC							**CONCRETE**.				Start 0.1m	
Hand Auger		0.0	45			Fill	**FILL**- Silty CLAY, grey brown and red brown, medium plasticity, some ironstone gravel.	firm	moist	SM060114-83 0.2-0.4		
		0.5				Fill	**FILL**- Silty CLAY, dark brown, low to medium plasticity, with gravel.	firm	moist	SM060114-84/85 0.6-0.8		
		1.0	44		CH	Natural	**Silty CLAY**- red / brown, medium to high plasticty.	firm	moist	SM060114-86 0.9-1.1		
		1.5					**Hole Terminated at 1.40m**				+20 for 50mm Ref. 1.85m	Likely depth to Shale Bedrock (1.85m).
		2.0	43									
		2.5										
		3.0	42									
		3.5										
		4.0	41									
		4.5										

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **6/01/2014**
Checked By: **Stephen McCormack** Date: **5/03/2014**

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Borehole Log Report

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Hole ID. **BH24**
Hole Depth: **0.70 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation**
Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW**
Client: **City Alliance Property**

Drilling Company: **GEE**
Drill Method: **Manual**
Equipment: **Hand Auger / Crow Bar**
Date Started: **6/01/2014**
Date Completed: **6/01/2014**
Ground Level: **RL45.2m** (approx)
Easting: ----------
Northing: ----------

Method	Depth (m)	RL (m)	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
CC		45	**CONCRETE**.				
HA / Crow Bar	0.5		**FILL**- SAND, yellow brown, medium to coarse grained.	loose	moist	SM060114-87/88 0.1-0.25	
			FILL- Sandy GRAVEL / Gravelly SAND, dark brown and brown, some clay, fine to coarse gravel, some cobble sized rocks.	medium dense	moist	SM060114-89 0.3-0.5	
	1.0	44	**Hole Terminated at 0.70m** Refusal on Brick.				
	1.5						
	2.0	43					
	2.5						
	3.0	42					
	3.5						
	4.0	41					
	4.5						

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **6/01/2014**
Checked By: **Stephen McCormack** Date: **5/03/2014**

Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
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Hole ID. **BH25**
Hole Depth: **0.75 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **GEE** Date Started: **6/01/2014** Ground Level: **RL42.7m** (approx)
Drill Method: **Manual** Date Completed: **6/01/2014** Easting: **----------**
Equipment: **Hand Auger / Crow Bar** Northing: **----------**

Method	Depth (m)	RL (m)	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
CC			Fill	**CONCRETE**.				
HA / Crow Bar	0.5	42	Fill	**FILL**- BRICKS.	firm	moist	SM060114-90/91 0.2-0.4	
			Natural	**FILL**- Silty CLAY, orange brown and grey, medium to high plasticty, with fine to coarse gravel.	firm to stiff	moist	SM060114-92 0.4-0.55	
				Silty CLAY- pale grey, some orange brown, medium to high plasticty, with ironstone gravel.				
	1.0			**Hole Terminated at 0.75m** Refusal on inferred Shale Bedrock.				
	1.5	41						
	2.0							
	2.5	40						
	3.0							
	3.5	39						
	4.0							
	4.5							

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **6/01/2014** Checked By: **Stephen McCormack** Date: **5/03/2014**

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Borehole Log Report

Geo Environmental Engineering
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Hole ID. **BH26**
Hole Depth: **1.20 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation**
Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW**
Client: **City Alliance Property**

Drilling Company: **GEE**
Drill Method: **Manual**
Equipment: **Hand Auger / Crow Bar**
Date Started: **6/01/2014**
Date Completed: **6/01/2014**
Ground Level: **RL45.2m** (approx)
Easting: ----------
Northing: ----------

Method	Depth (m)	RL (m)	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	DCP blows/100mm (5 10 15)	Observations / Comments
CC			**CONCRETE**.					
HA / Crow Bar	0.5	45	**FILL**- SAND and CLAY, yellow brown and dark brown.	loose	moist	SM060114-93 0.15-0.3	Start 0.3m	
						SM060114-94 0.5-0.6		
	1.0	44	**Silty CLAY**- red brown, medium to high plasticty, with some fine to coarse ironstone gravel. Becoming pale grey and orange brown from 1.0mbgl.	firm	moist	SM060114-95 0.6-0.8		
	1.5		**Hole Terminated at 1.20m**				+20 for 50mm Ref. 1.55m	Likely depth to Shale Bedrock (1.55m).
	2.0	43						
	2.5							
	3.0	42						
	3.5							
	4.0	41						
	4.5							

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **6/01/2014**
Checked By: **Stephen McCormack** Date: **5/03/2014**

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Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
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Hole ID. **BH27**
Hole Depth: **1.20 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation** Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW** Client: **City Alliance Property**

Drilling Company: **GEE** Date Started: **6/01/2014** Ground Level: **RL45.2m** (approx)
Drill Method: **Manual** Date Completed: **6/01/2014** Easting: **----------**
Equipment: **Hand Auger / Crow Bar** Northing: **----------**

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests ID No.	Observations / Comments
CC			45			Fill	**CONCRETE**.				
							FILL- SAND.				
HA / Crow Bar		0.5			CL		**Silty CLAY**- dark brown, low to medium plasticity.	firm	moist	SM060114-96/97 0.2-0.4	
		1.0	44		CH	Natural	**Silty CLAY**- red brown, medium to high plasticty. Becoming pale grey and orange brown from 1.0m.	firm to stiff	moist	SM060114-98 0.5-0.7	
		1.5					**Hole Terminated at 1.20m**				
		2.0	43								
		2.5									
		3.0	42								
		3.5									
		4.0	41								
		4.5									

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **6/01/2014** Checked By: **Stephen McCormack** Date: **5/03/2014**

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Borehole Log Report

Geo Environmental Engineering
82 Bridge Street
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Hole ID. **BH28**
Hole Depth: **1.00 m**
Sheet: **1 of 1**

Project Name: **Stage 2 Detailed Site Investigation**
Project Number: **E13017BEL**
Location / Site: **677-687 Canterbury Road, Sydney NSW**
Client: **City Alliance Property**

Drilling Company: **GEE**
Date Started: **6/01/2014**
Ground Level: **RL45.2m** (approx)
Drill Method: **Manual**
Date Completed: **6/01/2014**
Easting: ----------
Equipment: **Hand Auger / Crow Bar**
Northing: ----------

Method	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samp. / Tests: ID No.	Samp. / Tests: DCP blows/100mm	Observations / Comments
										5 10 15	
CC		45			Fill	**CONCRETE**.				Start 0.2m	
HA / Crow Bar	0.5			CH	Natural	**FILL**- Silty Gravelly CLAY, dark brown.	firm	moist	SM060114-99 0.2-0.3		
						Silty CLAY- grey and brown, medium to high plasticty, some fine to coarse ironstone gravel.	stiff	moist	SM060114-100 0.3-0.5		
	1.0					Becoming pale grey and orange brown mottled from 0.7mbgl.					
		44				**Hole Terminated at 1.00m**				+20 Ref. 1.5m	Likely depth to Shale Bedrock (1.5m).
	1.5										
	2.0	43									
	2.5										
	3.0	42									
	3.5										
	4.0	41									
	4.5										

Additional Comments

No obvious evidence of contamination, no adverse odour and no potential asbestos containing materiel (such as fibro) observed during drilling.

Logged By: **Stephen McCormack** Date: **6/01/2014**
Checked By: **Stephen McCormack** Date: **5/03/2014**

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