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Report on
Preliminary Site Investigation
(Contamination and Acid Sulphate Soils)

Proposed Gallipoli Aged Care Facility
9-13 Gelibolu Parade and 2-6 St Hilliers Road
Auburn

Prepared for
NSW Auburn Turkish Islamic Cultural Centre
Incorporated

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Executive Summary

This report presents the results of a Preliminary Site Investigation (Contamination and Acid Sulphate Soils) (PSI) undertaken for a proposed aged care facility at 9-13 Gelibolu Parade and 2-6 St Hilliers Road, Auburn. A preliminary waste classification is also included in this report. The work was commissioned by Impact Group on behalf of NSW Auburn Turkish Islamic Cultural Centre Incorporated.

The investigation has been undertaken to support a development application for the site. The PSI has been prepared to address the requirements of *State Environmental Planning Policy No 55 – Remediation of Land*. The purpose of the PSI is to provide a "Stage 1" investigation which assesses the risk of contamination being present at the site, the need (or otherwise) for further investigation and to comment on the suitability of the site for the proposed development from a contamination perspective.

This PSI is based on the proposed development, which comprises an Aged Care Facility. The project involves the demolition of existing residential buildings (six houses), removal of all filling from the site, excavation for a single basement level over a portion of the site and the construction of a three-storey aged care building. proposed land use is considered to be fall into the category of "residential with minimal access to soils" for contamination investigation purposes.

A geotechnical investigation (DP Project 84769.00, dated April 2015) was undertaken concurrently with this PSI and is reported separately.

The scope of works included a review of site history, published site information on geology and soil, a site walkover, soil sampling from four borehole locations and analysis of samples for the identified contaminants of potential concern.

The reviewed site history information and walkover indicates that the site has been used for residential purposes since at least the early 1900s. Identified potential contamination sources for the site comprised filling of unknown origin and the potential for hazardous building materials from current/ former site structures.

The results of the limited sampling identified one fragment of asbestos cement at the ground surface near a shed and slightly elevated results of lead (relative to health and ecological investigation levels) and zinc and benzo(a)pyrene (relative to the ecological investigation/ screening levels). The elevated concentrations of lead, zinc and benzo(a)pyrene were all detected in filling at the ground surface and may have been from either of the two identified potential sources.

No contamination issues of concern were identified in natural soils at the site.

Based on the details of the proposed development, including the removal of all filling, and the results of this investigation, it is considered that the site is suitable for the proposed development from a contamination perspective. A detailed site (contamination) investigation is not considered to be warranted.

It is recommended that a hazardous building material survey be undertaken of the site structures in accordance with the requirements of the NSW *Work Health and Safety Regulation* (2011) prior to demolition. It is understood that this has already been undertaken. Recommendations of the survey

should be implemented, and all hazardous building materials, including any at the ground surface, should be removed as part of the demolition process. A clearance certificate for the cleared site should be issued by an Occupational Hygienist prior to commencement of general excavation and construction works.

The risk of acid sulphate soils (ASS) being present at the site is considered to be very low. The site levels are between approximately 13.8 and 16 m AHD, with a one level basement. The proposed works will not lower the water table at the nearby Class 2 mapped ASS planning area below a depth of 1 m AHD. As such no further assessment or management for ASS is considered necessary from a technical perspective or to meet Council planning requirements.

A provisional waste classification has been provided in Section 11, with the filling provisionally classified as General Solid Waste (non-putrescible) and the natural soils provisionally classified as Virgin Excavated Natural Material.

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Report on Preliminary Site Investigation (Contamination and Acid Sulphate Soils) Proposed Gallipoli Aged Care Facility 9-13 Gelibolu Parade and 2-6 St Hilliers Road, Auburn

1. Introduction

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This PSI is based on the proposed development, which comprises an Aged Care Facility. The project involves the demolition of existing residential buildings (six houses), removal of all filling from the site, excavation for a single basement level over a portion of the site and the construction of a three-storey aged care building. Preliminary drawings of the proposed development are provided in Appendix A. The proposed land use is considered to be fall into the category of "residential with minimal access to soils" for contamination investigation purposes.

A geotechnical investigation (DP Project 84769.00, dated April 2015) was undertaken concurrently with this PSI and is reported separately.

2. Scope of Works

The scope of the PSI including preliminary waste classification and acid sulphate soil assessment was as follows:

- Review various historical documents including aerial photographs, historical title deeds and Council records to determine the nature of previous activities that may have occurred on the site;
- Review the EPA Contaminated Land register and groundwater bore licences;
- Collect soil samples from four boreholes drilled on the site as part of the concurrent geotechnical investigation;
- Screen all soil samples for volatile organic compounds (VOC) using a photo-ionisation detection (PID) instrument;

- Analyse selected soil samples at a NATA accredited laboratory as follows:
  - Eight priority heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) (6 samples);
  - Polycyclic aromatic hydrocarbons (PAH) (6 samples);
  - Total recoverable hydrocarbons (TRH) (6 samples);
  - Benzene, toluene, ethyl benzene and xylenes (BTEX) (6 samples);
  - Total phenols (5 samples);
  - Organochlorine pesticides (OCP) (5 samples);
  - Organophosphate pesticides (OPP) (5 samples);
  - Polychlorinated biphenyls (PCB) (5 samples);
  - Asbestos (5 soil samples and 2 fibre cement samples);
  - Toxicity Characteristic Leaching Procedure (TCLP) lead (2 samples) and PAH (1 sample); and
  - Full Chromium Suite (for acid sulphate soil) (1 sample);
- Provide this PSI report detailing the methodology and results of the investigation, including a conceptual site model and recommendations regarding the suitability of the site and the need for further work (if considered necessary). The report also includes preliminary assessment results for waste classification and acid sulphate soils.

3. Site Information

3.1 Identification

The site is a trapezoidal shape comprising a total area of approximately 0.4 hectares. It is comprised of seven lots: Lots 10-13 D.P.16298 and Lots A-C D.P.374304 across several street address as detailed in Table 1, below. The site is bounded by Gelibolu Parade to the south, St Hilliers Road to the east, a lane way to the west and residential lots to the north.

The site is located in the Parish of Liberty Plains in the County of Cumberland.

Table 1: Addresses and Lots Comprising the Site

Address	Lot, Deposited Plan (D.P.)
2A St Hilliers Rd, Auburn	Lot A, D.P. 374304
9 Gelibolu Pde, Auburn	Lot B, D.P. 374304
11 Gelibolu Pde, Auburn	Lot C, D.P. 374304
13 Gelibolu Pde, Auburn	Lot 13, D.P. 16298
2 St Hilliers Rd, Auburn	Lot 12, D.P. 16298
4 St Hilliers Rd, Auburn	Lot 11, D.P. 16298
6 St Hilliers Rd, Auburn	Lot 10, D.P. 16298

3.2 Description and Current Land Use

At the time of the investigation the site was occupied by six residential properties and a vacant lot. The residential properties each comprised a single storey house with mostly grassed backyards, some concrete or brick pavement and various metal and fibre cement sheds. The vacant lot was grassed and used as storage for a small number of cars and a single storage "shipping" container, some minor areas of concrete pavement at the surface and a minor amount of general rubbish.

Several fragments of fibre cement were observed at the ground surface of 6 St Hilliers Road at the time of inspection. Most of the fragments were of modern construction located near the rear fence. One fragment was identified to the north of the garage and was of older construction, generally associated with asbestos. Samples of both types of fibre cement (Samples F1-A and F1-B) were collected and analysed for asbestos.

The insides of all but three of the sheds were able to be inspected (one on 2 St Hilliers Road and two on 4 St Hilliers Road were not accessible). The accessed sheds were observed to be generally used for storage with only minor amounts of normal household chemicals in sealed containers observed (including paints, cleaners etc).

Site photographs are provided in Appendix B.

3.3 Surrounding Land Use

The land uses observed surrounding the site at the time of investigation were as follows:

- North (cross-gradient): Residential houses;
- East (down-gradient): St Hilliers Road, then residential houses;
- South (cross-gradient): Gelibolu Parade then railway line, then an industrial estate;
- South East (down-gradient): Industrial building (recently occupied by Master Plumbers Association), then sports fields with a canal (Haslam's Creek);
- West (up-gradient): Laneway, then Auburn Gallipoli Mosque.

No contaminating activities were identified up-gradient of the site.

4. Regional Topography, Geology and Hydrogeology

4.1 Topography and Surface Water

The ground surface falls gently to the east to south east, with an approximate change in surface level of 1.7 m across the site. Site levels are between approximately 13.8 and 16 m AHD (based on the survey plan by Norton Surveyor Partners reference 02248 dated 4 February 2015).

Surface water is likely to follow the surface topography, flowing towards Haslam's Creek, flowing in a canal, passing closest to the site approximately 350 m to the south east of the site. Haslams Creek enters the Parramatta River at Homebush Bay, adjacent to the Rhodes Peninsula, approximately 4 km north east of the site. Haslams Creek and Homebush Bay are considered to be highly disturbed from historical industrial land uses.

4.2 Geology

The *Sydney 1:100 000 Geological Series Sheet* indicates that the site is underlain by Ashfield Shale of the Wianamatta Group, which typically comprises black to dark grey shale and laminite. The Ashfield Shale typically weathers to form clayey soils of high plasticity.

An extract from the geological map is shown in Figure 1.

Figure 1: Extract from geological map

4.3 Hydrogeology and NOW Registered Bores

Groundwater observations from the site are reported in Section 9. Near-surface Ashfield Shale generally exhibits low permeabilities which result in very low groundwater yields. Groundwater use from this aquifer is therefore unlikely to be significant.

A search of bores registered with the NSW Office of Water (NOW) was undertaken on 10 April 2015. There are no licenced groundwater wells recorded on the site or within 1 km of the site.

4.4 Acid Sulphate Soils

Data supplied by NSW Department of Environment and Climate Change based on published 1:25,000 Acid Sulfate Soil Risk Mapping, 1994-1998 indicates that the site is within 500 m of an area of disturbed terrain potentially containing acid sulphate soils (classified by Council as Class 2 for ASS Planning purposes). An extract from the potential ASS map is shown in Figure 2.

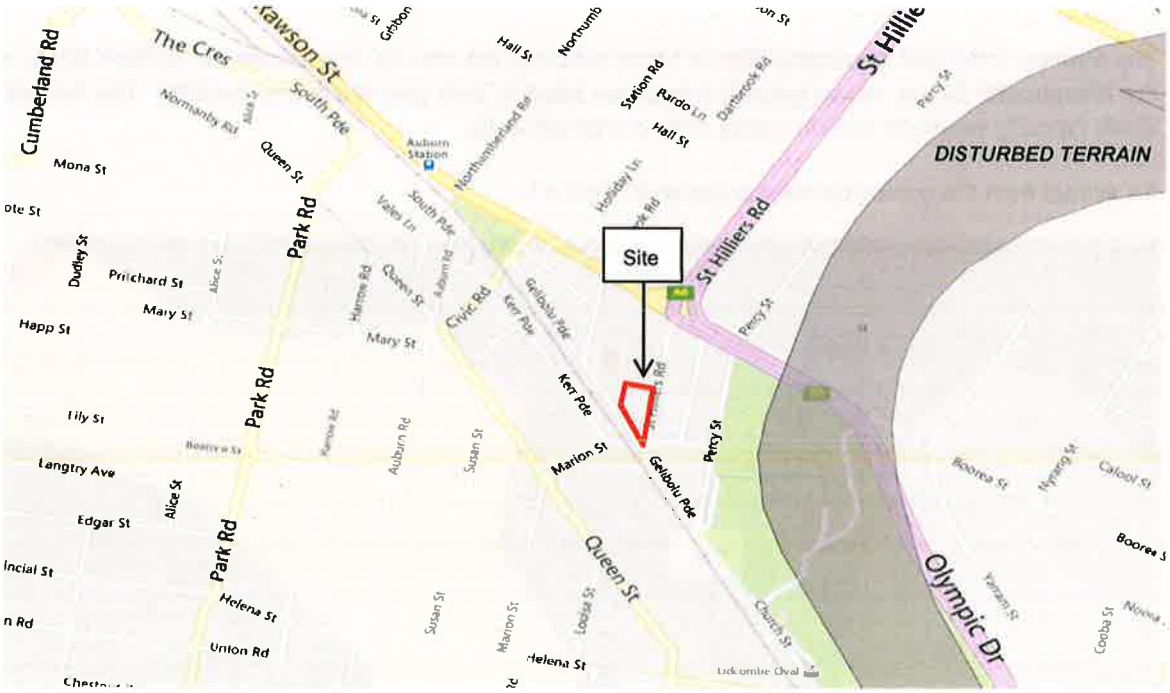

Figure 2: Extract from potential Acid Sulphate Soils map

5. Site History

5.1 Historical Aerial Photographs

Aerial photographs from 1930, 1951, 1961, 1970, 1978, 1982, 1991 and 1999 were used to assess historical land use patterns on the site. Extracts of the aerial photographs are attached in Appendix C.

1930: the 1930 photograph shows structures consistent with residential houses at properties 2-6 St Hilliers Road and 9-13 Gelibolu Parade. No house is present at 2A St Hilliers Road. The railway line was present to the south, residential houses were present immediately to the north and east and larger structures, possibly for commercial use, large houses or residential units, were present to the west. Vacant/ semi-developed land was present to the south east (in the location of the current industrial-style building). Further to the east was an industrial-style building and Haslam's Creek. The alignment of Haslam's Creek was meandering and closer to the site in the east (approximately 300-350 m east of the site).

1951: the land use pattern appears to be generally consistent with the 1930 photograph, although there now appears to be a house at 2A St Hilliers Road (although the photograph is not clear). The properties to the west of the site appear to be consistent with larger residential houses. Industrial development appears to have increased further to the east of the site, including a potential commercial/ industrial use of to the south east of the site. Haslam's Creek was beyond the frame of the photograph.

1961: in the 1961 photograph the house at 2A St Hilliers Road can be clearly seen along with sheds at the rear of properties 4 St Hilliers Road and 9 Gelibolu Parade, and possibly 11 Gelibolu Parade. Rear extensions appear to have occurred at the houses at 4 and 6 St Hilliers Road. The land to the south east of the site was again vacant, and significant industrial development was present further to the east. Haslam's Creek had been diverted into a canal along its modern alignment.

1970: the 1970 photograph shows that a shed has been erected in the rear of the 6 St Hilliers Road property. It appears that the shed at the rear of 4 St Hilliers Road has been extended. Extensions to the rear of the house at 2 St Hilliers Road appear to have occurred. The surrounding land use appears to be generally the same as the 1961 photograph, with parking occurring at the vacant site to the south east.

The 1978 photograph shows that a section of the 4 St Hilliers Road backyard has been concreted. The surrounding land use appears to be generally the same as the 1970 photograph, although the industrial area further to the east had been redeveloped.

The 1982 photograph is somewhat unclear but it appears there may be a shed at 2 St Hilliers Road. The surrounding land use appears to be generally the same as the 1978 photograph with the exception of the land to the south east, which contained an industrial-style building and land further to the east, which appears to have been redeveloped from industrial to playing fields and associated facilities.

The 1991 photograph shows the same general land use patterns at and surrounding the site as the 1982 photograph, with the exception of the Mosque which had been constructed to the west of the site.

The 1999 photograph shows that the house at 13 Gelibolu Parade has been demolished. The other properties and surrounding land use appear to be generally unchanged from the 1991 photograph. The site layout appears to be generally consistent with that observed during the current investigation.

5.2 Historical Title Deed Search

The historical land title information indicates that each of the seven lots that comprise the site were originally purchased in 1914 by a George Peirson, who is recorded as a builder, and then passed onto his family. It is possible that the houses were built whilst under the ownership of George Peirson or his family. Following this time, the title deeds records indicate that the ownership of the site has been consistent with individual residential owners until between 2012 to 2014 when all lots except 6 St Hilliers Road were purchased by NSW Auburn Turkish Islamic Centre Incorporated.

A Registered Plan dated 1929 labelled *subdivision of Lots 3 to 13A of Section 2, Deposited Plan 2647* shows the site with the current lots excluding 2A St Hilliers Road, with the plan showing this lot as part of the Lots at 9 and 11 Gelibolu Parade. The remaining lots, including 13 Gelibolu Parade are shown with structures consistent with residential houses.

A plan dated 1951 shows the subdivision of 9 and 11 Gelibolu Parade to form their current areas and 2A St Hilliers Road.

The title deed search results are provided in Appendix D.

5.3 Regulatory Notices Search

The EPA publishes records under the *Contaminated Land Management Act* 1997 (CLM Act) and the *Protection of the Environment Operations Act* 1997 (POEO Act). These records were searched for the site on 9 April 2015.

The EPA records of contaminated sites are published under Section 58 of the CLM Act on a public database accessed via the Internet. The notices relate to investigation and/or remediation of site contamination considered to pose a significant risk of harm under the definition in the CLM Act. More specifically, the Notices cover the following:

- actions taken by the EPA under Section 15, 17, 19, 21, 23, 26 or 28 of the CLM Act;
- actions taken by the EPA under Section 35 or 36 of the Environmentally Hazardous Chemicals Act 1985; and
- site audit statements provided to the EPA under Section 52 of the CLM Act on sites subject to an in-force declaration or order.

The EPA record of Notices for Contaminated Land does not provide a record of ALL contaminated land in NSW.

The search of the public database revealed that the subject site is not listed. There are also no listed sites within close proximity to the site.

A search was also undertaken of sites reported to the EPA under Section 60 of the CLM Act (duty to report contaminated sites). The contamination at sites on this list may not warrant regulatory intervention. Neither the subject site nor any neighbouring sites were listed.

The EPA also issues environmental protection licenses to the owners or operators of various industrial premises under the POEO Act. License conditions relate to pollution prevention and monitoring, and cleaner production through recycling and reuse and the implementation of best practice.

The EPA has made available a public register of licenses under Section 308 of the POEO Act. The register contains:

- environment protection licenses;
- applications for new licenses and to transfer or vary existing licenses;

- environment protection and noise control notices;
- convictions in prosecutions under the POEO Act;
- the results of civil proceedings;
- license review information;
- exemptions from the provisions of the POEO Act or Regulations;
- approvals granted under clause 9 of the POEO (Control of Burning) Regulation; and
- approvals granted under clause 7A of the POEO (Clean Air) Regulation.

A search of the public register on did not locate any listing for the subject site.

5.4 Council Records Search

Council property records where searched under an informal application under the Government Information (Public Access) Act 2009. The requested information included development applications, building applications, planners reports, plans and complaints.

Documents provided by Council were viewed, and generally did not indicate any information pertinent to contamination issues at the site, with the exception of the following:

- 9 North Parade (now Gelibolu Parade): surveyors report dated 23/10/1981:
  - Plan shows a fibro cottage and roof consistent with current site structures;
- 9 North Parade (now Gelibolu Parade): valuation report dated 19/08/1986:
  - Improvements are listed as including a double fronted asbestos cement residence, which appears to be about 60-65 years old, with a rear garage;
  - Surrounding development is described as mainly older style residences with evidence of industrial development in close proximity; and
  - The property is close to a properties which are to be redeveloped with a mosque.

6. Preliminary Conceptual Site Model

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM provides the framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or the future i.e. it enables an assessment of the potential source – pathway – receptor linkages.

The CSM has been prepared for the proposed development and is based on available site information and site history as detailed in Sections 3 to 5. The CSM has been used in determining an appropriate investigation scope for the site.

6.1 Potential Contamination Sources

Table 2: Potential Contamination Sources and Contaminants of Concern

Potential Source	Description of Potential Contaminating Activity	Contaminants of Concern
(S1) Imported fill of unknown origin	The site comprising residential buildings and backyards has the potential of filling during past activities.	Common contaminants associated with fill are metals, TPH, BTEX, PAH, PCB, OCP, phenol and asbestos, dependant on the nature of the source.
(S2) Buildings potentially containing hazardous building materials	Presence of/ and potential previous demolition of buildings constructed prior to 31 December 2003.	Asbestos, lead

6.2 Potential Receptors (under proposed land use)

Human Health Receptors

R1 – Proposed site users (residential)

R2 – Land users in adjacent areas (residential being the most sensitive neighbouring land use)

R3 – Intrusive maintenance workers

R4 – Construction workers

Environmental Receptors

R5 – Groundwater

R6 – Surface Water

R7 – Ecology

Other Receptors

R8 – Buried infrastructure

R9 – Buildings

6.3 Potential Pathways

Potential pathways for contamination include the following:

P1 – Direct contact with soil/ groundwater

P2 – Vapour intrusion and inhalation of dust and/or vapours

P3 – Vapour intrusion and explosion/ fire

P4 – Leaching of contaminants and vertical mitigation into groundwater

P5 – Migration of contaminants in groundwater

P6 – Surface water run-off

P7 – Extraction of groundwater for potable/ agricultural use

6.4 Summary of CSM

A 'source–pathway–receptor' approach has been used to assess the potential risks of harm being caused to human, water or environmental receptors from contamination sources on or in the vicinity of the Site, via exposure pathways. The possible pathways between the above sources and receptors are provided in Table 3 below.

Table 3: Conceptual Site Model

Source	Transport Pathway	Receptor	Comments
(S1) Imported fill of unknown origin (S2) Buildings potentially containing hazardous building materials	**Human Health**		
	P1 – Direct contact with soil (dermal/ ingestion)	R1 – Proposed site users (residential)	Risk is considered to be generally low given that all filling is proposed to be removed from the site. Assessment of soils is recommended to confirm actual contaminant levels and risk.
		R3 – Intrusive Maintenance workers	
		R4 – Construction workers	Risk can be managed by appropriate WHS measures.
	P1 – Direct contact with groundwater (dermal/ ingestion)	R1 – Proposed site users (residential)	Risk is considered to be generally low, however investigation of soils recommended as a screening assessment
		R2 – Land users in adjacent areas (residential)	
		R3 – Intrusive Maintenance workers	Risk can be managed by appropriate WHS measures
		R4 – Construction workers	
	P2 – Vapour intrusion and inhalation of dust and/or vapours	R1 – Proposed site users (residential)	Risk is considered to be generally low, however investigation of soils recommended as a screening assessment
		R2 – Land users in adjacent areas (residential)	
		R3 – Intrusive Maintenance workers	
		R4 – Construction workers	
	P7 – Extraction of groundwater for potable/ agricultural use	R1 – Proposed site users (residential)	No complete pathway considered to exist, based on no registered bores near the site, no near surface aquifer suitable for extraction expected to be present near the site, and location being an urban area with reticulated water supply.
		R2 – Land users in adjacent areas (residential)	

Source	Transport Pathway	Receptor	Comments
	Environment		
	P1 – Direct contact with soil	R7 – Ecology	Risk is considered to be generally low given that all filling is proposed to be removed from the site. Assessment of soils is recommended to confirm actual contaminant levels and risk.
	P4 – Leaching of contaminants and vertical mitigation into groundwater	R5 – Groundwater	Risk is considered to be generally low, however investigation of soils recommended as a screening assessment.
	P5 – Migration of contaminants in groundwater	R5 – Groundwater	Risk is considered to be generally low, however investigation of soils recommended as a screening assessment.
		R6 – Surface Water	
	P6 – Surface water run-off	R6 – Surface Water	Risk is considered to be generally low, however investigation of soils recommended as a screening assessment. Note the receptor (Haslam's Creek) is not considered to be a sensitive environment.
	P7 – Extraction of groundwater for potable/ agricultural use	R6 – Surface Water	No complete pathway considered to exist, based on no registered agricultural bores registered near the site, no agriculture near the site, and no near surface aquifer suitable for extraction expected to be present near the site.
	Buildings and Structures		
	P1 – Direct contact with soil or groundwater	R8 – Buried infrastructure	Risk is considered to be generally low, however assessment of soils recommended as a screening assessment
		R9 – Buildings	
	P3 – Vapour intrusion and explosion/ fire	R8 – Buried infrastructure	
		R9 – Buildings	

7. Sampling Methodology and Rationale

7.1 Data Quality Objectives and Quality Control and Assurance

A data quality assessment is provided in Appendix H, and details the methodology and results for QA/QC for the project.

7.2 Sample Location Density and Rationale

The site area is understood to be approximately 0.4 ha. According to the NSW EPA publication, *Sampling Design Guidelines* (1995), a minimum of 11 systematic sampling locations is recommended to characterise the site for a detailed investigation. Given the low risk historic site use, four sampling locations are considered suitable for this current PSI.

The four boreholes were positioned at locations roughly spread across the site at rig accessible locations, and primarily for geotechnical investigation purposes. The boreholes did not target specific areas of environmental concern.

Samples were collected at regular intervals through the soil profile to allow logging and analysis as required.

7.3 Drilling Methods

Boreholes were drilled to depths between 6.0 and 6.4 m below ground level (bgl) as part of the geotechnical investigation. Boreholes were drilled using a truck-mounted rig and were augered then rotary drilled to the top of rock, then extended into the underlying bedrock using NMLC (50 mm diameter) diamond coring equipment.

One borehole (BH 2) was converted into a groundwater monitoring bore for groundwater level monitoring for the geotechnical investigation. Although groundwater sampling was not conducted during the current assessment, DP constructed the well in compliance with current industry practice.

7.4 Sampling Procedure

All sampling data was recorded on DP's borehole logs with essential information included in the chain-of-custody sheets. The general sampling procedure adopted for the collection of environmental samples is summarised below:

- collect soil samples directly from the auger tip or standard penetration test (SPT) tube using disposable sampling equipment;
- transfer samples into laboratory-prepared glass jars, completely filled to ensure the headspace within the sample jar is minimised, and capping immediately to minimise loss of volatiles;
- label sample containers with individual and unique identification, including project number, sample location and sample depth; and

- place the glass jars, with Teflon lined lid, into a cooled, insulated and sealed container for transport to the laboratory.

7.5 Analytical Rationale

The analytical scheme was designed to obtain an indication of the potential presence and possible distribution of contaminants that may be attributable to past and present activities, features within the site, and to assess identified areas of environmental concern.

In general, the main strata of potential concern for contamination was considered to be the filling and near surface soils, and these materials were therefore targeted for analysis. Deeper, natural soils were also analysed to provide data on the potential for deeper contamination.

Based on fieldwork observations, there was only up to 0.3 m of filling at each of the bore locations. One sample of near-surface filling from each bore was therefore considered appropriate to target the main horizon of concern.

Envirolab Services (NATA accreditation number: 2901) was used for the analysis of soil samples. The laboratory is required to carry out routine in-house QC procedures.

8. Site Assessment Criteria

The proposed development comprises a residential aged care facility with up to three storeys and a single basement level over a portion of the site.

The Site Assessment Criteria (SAC) applied in the current investigation is informed by the CSM which identified human and ecological receptors to potential contamination on the site (refer to Section 6). Analytical results were assessed (as a Tier 1 assessment) against the SAC comprising the investigation and screening levels of Schedule B1, *National Environment Protection (Assessment of Site Contamination) Measure* 1999, as amended 2013 (NEPC, 2013). The NEPC (2013) guidelines are endorsed by the NSW EPA under the CLM Act 1997. Petroleum based health screening levels for direct contact have been adopted from the *Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) Technical Report no.10 Health screening levels for petroleum hydrocarbons in soil and groundwater* (2011) as referenced by NEPC (2013).

The investigation and screening levels are applicable to generic land use settings and include consideration of, where relevant, the soil type and the depth of contamination. The investigation and screening levels are not intended to be used as clean up levels. Rather, they establish concentrations above which further appropriate investigation (e.g. Tier 2 assessment) should be undertaken. They are intentionally conservative and are based on a reasonable worst-case scenario.

The investigation and screening levels applied in the current investigation comprise levels adopted for a generic residential land use with minimal access to soil scenario.

8.1 Contamination Investigation

8.1.1 Health Investigation and Screening Levels

The Health Investigation Levels (HIL) and Health Screening Levels (HSL) are scientifically-based, generic assessment criteria designed to be used in the first stage (Tier 1) of an assessment of potential human health risk from chronic exposure to contaminants.

HIL are applicable to assessing health risk arising *via* all relevant pathways of exposure for a range of metals and organic substances. The HIL are generic to all soil types and apply generally to a depth of 3 m below the surface for residential use. Site-specific conditions may determine the depth to which HIL apply for other land uses.

HSL are applicable to selected petroleum compounds and fractions to assess the risk to human health via inhalation and direct contact pathways. HSL have been developed for different land uses, soil types and depths to contamination.

The generic HIL and HSL are considered to be appropriate for the assessment of contamination at the site. Given the proposed land use the adopted HIL and HSL are:

- **HIL - B** – residential B; and
- **HSL - AB** – residential AB.

In addition, the HSL adopted are predicated on the inputs summarised in Table 4.

Table 4: Inputs to the Derivation of HSLs

Variable	Input	Rationale
Potential exposure pathway	Soil vapour intrusion (inhalation) / Direct contact *	There is a potential for vapour intrusion into buildings and direct contact with soil.
Soil Type	Sand	Sand HSL have been adopted as a conservative screen, as both sand and clay have been logged as a component of the sub-surface profile. The sand was present as filling with the underlying natural soils generally comprising clays.
Depth to contamination	0 m to <1 m	Fill and near surface soils are identified as the most likely horizon to be impacted. This depth is also considered most suitable to provide an initial screen, any exceedances detected deeper in the profile will be assessed against the relevant depth range thresholds.

** Developed by CRC CARE (2011)*

The adopted soil HIL and HSL for the potential contaminants of concern are presented in Table 5.

Table 5: Health Investigation and Screening Levels (HIL and HSL) in mg/kg

Contaminants		HIL- B and HSL- AB Direct Contact	HSL- AB Vapour Intrusion
Metals	Arsenic	500	-
	Cadmium	150	-
	Chromium (VI)	500	-
	Copper	30,000	-
	Lead	1,200	-
	Manganese	14,000	-
	Mercury (inorganic)	120/30	-
	Nickel	1,200	-
	Zinc	60,000	-
PAH	Benzo(a)pyrene TEQ[1]	4	-
	Naphthalene	2,200	3
	Total PAH	400	-
TRH	C6 – C10 (less BTEX) [F1]	5,600	45
	>C10-C16 (less Naphthalene) [F2]	4,200	110
	>C16-C34 [F3]	5,800	-
	>C34-C40 [F4]	8,100	-
BTEX	Benzene	140	0.5
	Toluene	21,000	160
	Ethylbenzene	5,900	55
	Xylenes	17,000	40
Phenol	Pentachlorophenol (used as an initial screen)	130	-
OCP	Aldrin + Dieldrin	10	-
	Chlordane	90	-
	DDT+DDE+DDD	600	-
	Endosulfan	400	-
	Endrin	20	-
	Heptachlor	10	-
	HCB	15	-
	Methoxychlor	500	-
OPP	Chlorpyrifos	340	-
PCB[2]		1	-
VOC		PQL as initial screening concentration. Reference to national or international standards above the PQL.	

Notes:

1 sum of carcinogenic PAH

2 non dioxin-like PCBs only.

3 The soil saturation concentration (Csat) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds Csat, a soil vapour source concentration for a petroleum mixture could not exceed a level that would results in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limited' or 'NL'.

8.1.2 Ecological Investigation Levels

Ecological Investigation Levels (EIL) have been derived for selected metals and organic compounds and are applicable for assessing risk to terrestrial ecosystems (NEPC, 2013). EIL depend on specific soil physiochemical properties and land use scenarios and generally apply to the top 2 m of soil, which corresponds to the root zone and habitation zone of many species. The EIL is determined for a contaminant based on the sum of the ambient background concentration (ABC) and an added contaminant limit (ACL). The ABC of a contaminant is the soil concentration in a specific locality that is the sum of naturally occurring background levels and the contaminants levels that have been introduced from diffuse or non-point sources (e.g. motor vehicle emissions). The ACL is the added concentration (above the ABC) of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values is required.

The EIL is calculated using the following formula:

EIL = ABC + ACL,

The ABC is determined through direct measurement at an appropriate reference site (preferred) or through the use of methods defined by Olszowy et al *Trace element concentrations in soils from rural and urban areas of Australia*, Contaminated Sites monograph no. 4, South Australian Health Commission, Adelaide, Australia 1995 (Olszowy, 1995) or Hamon et al, *Geochemical indices allow estimation of heavy metal background concentrations in soils*, Global Biogeochemical Cycles, vol. 18, GB1014, (Hamon, 2004). ACL is based on the soil characteristics of pH, CEC and clay content.

EIL (and ACLs where appropriate) have been derived in NEPC (2013) for only a short list of contaminants comprising As, Cu, Cr (III), DDT, naphthalene, Ni, Pb and Zn. The *Interactive (Excel) Calculation Spreadsheet* provided in the ASC NEPM Toolbox available on the SCEW (Standing Council on Environment and Water) website (http://www.scew.gov.au/node/941) has been used for calculating site-specific EIL for these contaminants for this project.

The adopted EIL, derived from Tables 1B(1) to 1B(5), Schedule B1 of NEPC (2013) and the *Interactive (Excel) Calculation Spreadsheet* are shown in the following Table 6. The following site specific data and assumptions have been used to determine the EILs:

- a protection level of 80% has been adopted;
- the EILs will apply to the top 2 m;
- given the likely source of soil contaminants (i.e. historical site use/fill) the contamination is considered as "aged" (>2 years);
- ABCs have been derived using the *Interactive (Excel) Calculation Spreadsheet* using input parameters of NSW for the State in which the site is located, and low for traffic volumes. Note: no background concentration is assumed for lead, which is considered to be conservative;
- Site specific pH values have been used to calculate the input parameter for the *Interactive (Excel) Calculation Spreadsheet*. The average pH values for filling samples was used, being a pH of 7 (based on measured pH values between 6.2 and 8.4 in filing soils);

- An assumed clay content value has been used as input parameters in the *Interactive (Excel) Calculation Spreadsheet*. A conservative clay content of 10% was adopted based on the soil description of filling soils, which generally comprised clayey silty sand topsoil; and
- An assumed CEC value has been used as input parameters in the *Interactive (Excel) Calculation Spreadsheet*. A conservative CEC value of 10% was adopted based on the soil description of filling soils, which generally comprised clayey silty sand topsoil.

Table 6: Ecological Investigation Levels (EIL) in mg/kg

Analyte		EIL	Comments
Metals	Arsenic	100	Based on data discussed in above dot points
	Copper	210	
	Nickel	170	
	Chromium III	410	
	Lead	1,100	
	Zinc	480	
PAH	Naphthalene	170	
OCP	DDT	180	

8.1.3 Ecological Screening Levels – Petroleum Hydrocarbons

Ecological Screening Levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene (BaP) to terrestrial ecosystems. ESL apply to the top 2 m of the soil profile as for EIL.

ESL have been derived in NEPC (2013) for petroleum fractions F1 to F4 as well as BTEX and BaP. Site specific data and assumptions as summarised in Table 7 have been used to determine the ESL. The adopted ESL, from Table 1B(6), Schedule B1 of NEPC (2013) are shown in Table 8.

Table 7: Inputs to the Derivation of ESL

Variable	Input	Rationale
Depth of ESL application	Top 2 m of the soil profile	The top 2 m depth below ground level corresponds to the root zone and habitation zone of many species.
Land use	Urban residential	Proposed residential development
Soil Texture	Coarse	Filling encountered at the site comprised sandy topsoil.

Table 8: Ecological Screening Levels (ESL) in mg/kg

Analyte		ESL	Comments
TRH	C6 – C10 (less BTEX) [F1]	180*	All ESLs are low reliability apart from those marked with * which are moderate reliability
	>C10-C16 [F2]	120 *	
	>C16-C34 [F3]	1,300	
	>C34-C40 [F4]	5,600	
BTEX	Benzene	65	
	Toluene	105	
	Ethylbenzene	125	
	Xylenes	45	
PAH	Benzo(a)pyrene	0.7	

8.1.4 Management Limits – Petroleum Hydrocarbons

In addition to appropriate consideration and application of the HSL and ESL, there are additional considerations which reflect the nature and properties of petroleum hydrocarbons, including:

- Formation of observable light non-aqueous phase liquids (LNAPL);
- Fire and explosion hazards;
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services.

Management Limits to avoid or minimise these potential effects have been adopted in NEPC (2013) as interim Tier 1 guidance. Management Limits have been derived in NEPC (2013) for the same four petroleum fractions as the HSL (F1 to F4). The adopted Management Limits, from Table 1B(7), Schedule B1 of NEPC (2013) are shown in the following Table 9. The following site specific data and assumptions have been used to determine the Management Limits:

- the Management Limits will apply to any depth within the soil profile;
- the Management Limits for residential, parkland and public open space apply;
- Management Limits for both "coarse" and "fine" soil texture has been adopted for the sandy filling and underlying clays respectively.

Table 9: Management Limits in mg/kg

Analyte		Management Limit	
		Fine	Course
TRH	$C_6 - C_{10}$ (F1) #	800	700
	$>C_{10}-C_{16}$ (F2) #	1,000	1,000
	$>C_{16}-C_{34}$ (F3)	3,500	2,500
	$>C_{34}-C_{40}$ (F4)	10,000	10,000

Separate management limits for BTEX and naphthalene are not available hence these have not been subtracted from the relevant fractions to obtain F1 and F2

8.1.5 Asbestos in Soil

The presence of detectable asbestos was considered significant for the current investigation as a screening threshold. If asbestos is detected, further assessment could allow the use of threshold levels in accordance with NEPC (2013).

8.2 Waste Classification

The waste classification was undertaken in general accordance with the NSW EPA *Waste Classification Guidelines* (2014).

8.3 Acid Sulphate Soils

The following guidelines apply to ASS in NSW:

- NSW Acid Sulfate Soil Management Advisory Committee (ASSMAC), 1998. *Acid Sulfate Soil Manual* (ASSMAC, 1998); and
- Ahern CR, McElnea AE, Sullivan LA (2004). *Acid Sulfate Soils Laboratory Methods Guidelines*. Queensland Department of Natural Resources, Mines and Energy, Indooroopilly, Queensland, Australia (Ahern et al, 2004).

In addition, Council require ASS to be addressed and an ASS Management Plan to be submitted where the subject site is below 5 m AHD and by which the water table is likely to be lowered below 1 m AHD on adjacent Class 2 land.

9. Results

9.1 Field Work

The locations of the boreholes are shown on Drawing 1 in Appendix A. The borehole logs are attached in Appendix E.

The bores encountered some surface filling overlying a relatively consistent natural subsurface soil profile across the site, which may be summarised as follows:

- **FILLING** – extending to between 0.08 m and 0.3 m depth at the bore locations and variably comprising silty sand and sandy silt (disturbed topsoil) with gravel sized fragments of concrete, slag, charcoal, ironstone and plastic. A concrete driveway was encountered in Bore 3 between 0.03 m and 0.08 m depth.

  It is possible that some areas of deeper filling may exist between the test locations along backfilled trenches for the service lines associated with the existing residential dwellings.
- **NATURAL SILTY CLAY** – underlying the filling, generally firm to stiff with some very stiff to hard zones, grey-brown, orange-brown and red-brown silty clay with some sandy layers and gravel,

which was in a moist to humid condition. The silty clay extended to between 2.25 m and 2.9 m depth and was underlain by

- **BEDROCK** – comprising either shale, laminite or fine grained sandstone, initially extremely low to very low strength and extremely to highly weathered, increasing in strength with depth to be high to very high strength below 4.4 m to 5.8 m depth. The extremely weathered bedrock layer was absent in Bore 1, with medium to high strength sandstone found to directly underlie the silty clays.

All PID screening results were low, suggesting an absence of volatile contaminants in the soil samples.

No free groundwater was observed within the bores during auger drilling to depths of 2.5 m. Subsequent observation of groundwater levels during rotary drilling or bedrock coring were obscured by drilling water introduced to flush out cuttings.

Following the construction of the piezometer standpipe in Bore 2, the standpipe was purged and then the standing water level measured approximately one day later at the conclusion of the field work. A second measurement of the water level was taken approximately three weeks after the field work. Details of the groundwater observations made in Bore 2 are summarised in Table 10 below.

Table 10: Summary of Groundwater Observations

Standpipe Location	Subsequent measurement in standpipe (and date)			
	Date	Period since drilling	Groundwater Depth (m)	Groundwater RL (AHD)
Bore 2	20-3-15	1 day	3.0	11.7
	10-4-15	21 days	2.4	12.3

9.2 QA/QC Assessment

Quality assurance and quality control (QA/QC) were an integral part of the investigation. An assessment of the QA/QC procedures and results is provided in Appendix H. The QA/QC assessment found that the data was suitable for use in this investigation.

9.3 Potential Contaminants

Laboratory Certificates of Analysis are provided in Appendix G, with a summary table provided in Appendix F.

All reported analyte concentrations were within the SAC with the following exceptions:

- Sample 1/0-0.1:
  - Lead at 1,200 mg/kg compared to the HIL of 1,200 mg/kg and the EIL of 1,100 mg/kg; and
  - Zinc at 840 mg/kg compared to the EIL of 480 mg/kg;

- Sample 2/0-0.1:
  - Benzo(a)pyrene (BaP) at 1.1 mg/kg compared to the ESL of 0.7 mg/kg;
- Sample F1-A (fibre cement from the ground surface of 6 St Hilliers Road):
  - Chrysotile asbestos detected,

A provisional waste classification of the soil is provided in Section 11.

9.4 Acid Sulphate Soils

The fieldwork results indicated that soils at the site were filling or residual, with groundwater present general in the bedrock, with possible minor perched or seepage water at the clay/ rock interface. On this basis the risk of ASS being present at the site is considered to be very low.

To confirm these observations one sample, considered to be have the highest potential for ASS based on its depth (Sample 2/1-1.45) and appearance was tested for the full chromium suite. The results, summarised in Table 11, below, indicated that ASS was not present, which confirms the fieldwork observations.

Table 11: Summary of Results of Acid Sulphate Soil Testing

Bore	/	Depth	pH_{KCl}	Chromium Reducible Sulphur	Total Actual Acidity	Net Acid Soluble Sulphur	Net Acidity
				(S_{POS})	(s-TAA)	(s-S_{NAS})	
		(m)	pH units	(%w/w S)			
2	/	1-1.45	4.5	<0.005	0.01	Not tested	0.01
ASSMAC Action Criteria							
Disturbance of more than 1,000 tonnes							0.03

Laboratory Certificates of Analysis are provided in Appendix G.

10. Updated Preliminary Conceptual Site Model

The summary CSM from Section 6 has been updated based on the findings of the limited sampling, as provided in Table 12, below.

Table 12: Conceptual Site Model

Source	Transport Pathway	Receptor	Comments
(S1) Imported fill of unknown origin (S2) Buildings potentially containing hazardous building materials (lead, PAH and asbestos)	**Human Health**		
	P1 – Direct contact with soil (dermal/ ingestion)	R1 – Proposed site users (residential)	The laboratory results indicate a generally low risk with the exception of one fragment of fibre cement on the ground surface adjacent to a shed and one detection of lead in filling at the ground surface at the HIL concentration. No contaminants of concern were detected in the natural soils. Given that the proposed development includes removal of all site structures, associated hazardous building materials and filling, no unacceptable risks will remain at the time of occupation of the site.
		R3 – Intrusive Maintenance workers	The risk is considered to be low following removal of the current structures and clearance of the ground surface for hazardous building materials
		R4 – Construction workers	There may be some risk of asbestos and lead-based paint residues from the current site structures. This would be expected to be present immediately surrounding the current structure footprints, or potentially in a larger area following demolition. These issues are standard for buildings of this age, and should be managed by removal of all hazardous building materials by a suitably licenced contractor in accordance with WorkCover NSW requirements, with a clearance certificate issues prior to commencement of general site works.
	Environment		
	P1 – Direct contact with soil	R7 – Ecology	The laboratory results indicate a generally low risk with the exception of slightly elevated results for lead, zinc and BaP in filling one sample each. No

Source	Transport Pathway	Receptor	Comments
			contaminants of concern were detected in the natural soils. Based on the removal of all filling as part of the proposed development, no unacceptable risks will remain at the time of occupation of the site.

Notes:
1. Based on the site history, adjacent land uses and soil laboratory results, the following are considered to be of low risk for the site/project:
   a. unacceptable levels of/ impacts from contaminants in groundwater
   b. unacceptable levels of/ impacts from contaminants in soil vapour/ dust
   c. unacceptable levels of/ impacts from contaminants in surface water from the site
   d. Risk to engineered structures from contamination

11. Preliminary Waste Classification

A preliminary waste classification of the material was conducted with reference to the six step process as set out in EPA (2014) guideline which is summarised in Table 13 below.

Table 13: Six Step Classification

Step	Classification	Rationale
1. Is it special waste?	No	Waste not observed to contain clinical, asbestos, tyres or any other form of special waste.
2. Is it liquid waste?	No	Waste composed of soil matrix (*i.e.* no liquids)
3. Is the waste "pre-classified"?	No	Waste not considered to be consistent with any of the pre-classified waste streams
4. Does the waste have hazardous waste characteristics?	No	Waste not observed to/ or considered at risk to contain explosives, gases, flammable solids, oxidising agents, organic peroxides, toxic substances or corrosive substances.
5. Chemical Assessment	Undertaken	See below
6. Is the waste putrescible?	No	All observed components of material were composed of materials pre-classified as non-putrescible (*i.e.* soils). Organic content is assessed to be minor.

All specific contaminant concentrations (SCCs) were within the contaminant thresholds (CT1s) for General Solid Waste (GSW) except for lead and PAH. TCLP testing was undertaken on the samples with CT1 exceedances. Using both the SCC and TCLP results the test values for lead and PAH where within the threshold values for General Solid Waste.

No asbestos was observed or detected in soils at the site, although one fragment of asbestos cement was observed at the ground surface.

Based on the available data the majority of filling at the site is provisionally classifiable as General Solid Waste (non-putrescible) subject to removal of all hazardous building materials from the ground surface following demolition and clearance of the site by an Occupational Hygienist. It is recommended that this waste classification is confirmed by further sampling following demolition of structures and inspection during excavation for asbestos containing materials.

Any materials not meeting the descriptions in the attached borehole logs (Appendix E) or displaying additional signs of concern will require further assessment.

Natural material at the site is provisionally classifiable as virgin excavated natural material (VENM), subject to further assessment.

12. Conclusions and Recommendations

The reviewed site history information and walkover indicates that the site has been used for residential purposes since at least the early 1900s. Identified potential contamination sources for the site comprised filling of unknown origin and the potential for hazardous building materials from current/ former site structures.

The results of the limited sampling identified one fragment of asbestos cement at the ground surface near a shed and slightly elevated results of lead (relative to the HIL and EIL) and zinc and BaP (relative to the EIL/ESL). The elevated concentrations of lead, zinc and BaP were all detected in filling at the ground surface and may have been from either of the two identified potential sources.

No contamination issues of concern were identified in natural soils at the site.

The proposed development comprises a residential aged care facility with minimal access to soils. All current site structures, hazardous building materials and filling will be removed as part of the development.

Based on the details of the proposed development, including the removal of all filling, and the results of this investigation, it is considered that the site is suitable for the proposed development from a contamination perspective. A detailed site (contamination) investigation is not considered to be warranted.

It is recommended that a hazardous building material survey be undertaken of the site structures in accordance with the requirements of the NSW *Work Health and Safety Regulation* (2011) prior to demolition. It is understood that this has already been undertaken. Recommendations of the survey should be implemented, and all hazardous building materials, including any at the ground surface, should be removed as part of the demolition process. A clearance certificate for the cleared site should be issued by an Occupational Hygienist prior to commencement of general excavation and construction works.

The risk of acid sulphate soils (ASS) being present at the site is considered to be very low. The site levels are between approximately 13.8 and 16 m AHD, with a one level basement. The proposed works will not lower the water table at the nearby Class 2 mapped ASS planning area below a depth of 1 m AHD. As such no further assessment or management for ASS is considered necessary from a technical perspective or to meet Council planning requirements.

A provisional waste classification has been provided in Section 11, with the filling provisionally classified as General Solid Waste (non-putrescible) and the natural soils provisionally classified as Virgin Excavated Natural Material.

13. Limitations

Douglas Partners (DP) has prepared this report for this project at 9-13 Gelibolu Parade and 2-6 St Hilliers Road, Auburn in accordance with DP's proposal dated 12 March 2014 and acceptance received from NSW Auburn Turkish Islamic Cultural Centre Incorporated. The work was carried out under DP's Conditions of Engagement. This report is provided for the use of NSW Auburn Turkish

Islamic Cultural Centre Incorporated for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

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

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report.

Asbestos has not been detected by observation or by laboratory analysis other than in one fragment of fibre cement observed at the surface. Building demolition materials (concrete fragments) were, however, observed in below-ground filling, and these are considered as indicative of the possible presence of hazardous building materials (HBM), including asbestos.

Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the site that have not been sampled and analysed. This is either due to undetected variations in ground conditions or to budget constraints (as discussed above). It is therefore considered possible that HBM, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present.

Douglas Partners Pty Ltd