REPORT TO

NSW DEPARTMENT OF EDUCATION

ON

REMEDIATION ACTION PLAN

FOR

PROPOSED ALTERATIONS AND ADDITIONS

AT

KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Date: 26 March 2025
Ref: E32976BT2rpt7-RAP

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Executive Summary

The NSW Department of Education ('the client') commissioned JK Environments (JKE) to prepare a RAP for the proposed alterations and additions at Kogarah Public School, 24B Gladstone Street, Kogarah, NSW. For the purpose of the RAP, 'the site' includes the activity area only (i.e. the activity area). The site location is shown on Figure 1 and the RAP applies to the site as shown on Figure 2 attached in Appendix A.

JKE has previously undertaken several phases of investigation at the site. The investigations identified asbestos fines/fibrous asbestos (AF/FA) in fill soil at concentrations below the Health Screening Level (HSL) Site Assessment Criteria (SAC). A bonded Fibre Cement Fragment (FCF) of Asbestos Containing Material (ACM) was also identified at the ground surface. Data gaps also exist due to access constraints associated with the existing buildings and guideline requirements to increase the soil sampling density where asbestos is known to exist in soil. A summary of relevant information from these investigations is included in Section 2 and data gaps are to be addressed under the framework of this RAP.

The proposed Kogarah Public School upgrade works include the following:

- Demolition of existing playground facilities and Covered Outdoor Learning Area (COLA) in addition to footings and services associated with former demountable buildings;
- Tree removal;
- Construction of a new three storey Classroom building and attached amenities facilities;
- Construction of a single storey Hall with attached Covered Outdoor Learning Area;
- New pedestrian pathway connections providing access throughout the site;
- Service upgrades; and
- Site landscaping works.

The goal of the remediation is to reduce contamination-related risks to human health and the environment, and to render the site suitable for the proposed development from a contamination viewpoint. The primary aim of the remediation is to mitigate risks from the occurrence of asbestos or other contamination in soil.

The objectives of this RAP are to:

- Document the requirements for pre-remediation (supplementary) investigation;
- Provide a rationale to support the extent of the proposed remediation and the remedial/site validation approach based on the current dataset;
- Document a methodology that is to be implemented to remediate and validate the site; and
- Document a strategy that can be implemented in the event of uncovering any unexpected, contamination-related finds, and provide other relevant contingency plans.

Previous investigations have not identified contamination at the site that triggered a need for remediation. However, asbestos (as AF/FA) was detected in fill soils at one location (although the concentration of asbestos was below the health-based SAC) and the DSI identified various data gaps due in part to access constraints. Therefore, this RAP has been prepared to outline contingencies for remediation and requirements for pre-remediation (supplementary) investigation.

The supplementary investigation will be used to establish whether contamination is present that requires remediation and implementation of the contingencies outlined in this RAP. The remedial contingencies in this RAP include 'excavation and off-site disposal' of contaminated soil, or 'cap and containment' of contaminated soil. Depending on the nature and extent of such remediation, we consider that the 'excavation and off-site disposal' option would most likely be applicable for small quantities of contaminated soils, and the 'cap and containment' option would be applicable for larger quantities of contaminated soils. Capping and containing contaminated soils on site would trigger a requirement for long-term management of the site via an Environmental Management Plan (EMP).

The RAP also includes validation requirements for imported materials which apply for the project.

We are of the opinion that the site can be made suitable for the proposed development via the implementation of this RAP. A validation report is to be prepared on completion of any remediation/validation activities and submitted to the

determining authority to demonstrate that the site is suitable for the proposed use following completion of remediation/validation. If contaminated material is capped on site (e.g. if the capping contingency needs to be implemented), a long-term EMP will also be prepared as part of the validation documentation.

The conclusions and recommendations should be read in conjunction with the limitations presented in the body of this report.

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Abbreviations

Asbestos Fines/Fibrous Asbestos	**AF/FA**
Ambient Background Concentrations	**ABC**
Added Contaminant Limits	**ACL**
Asbestos Containing Material	**ACM**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
Acid Sulfate Soil	**ASS**
Below Ground Level	**BGL**
Benzene, Toluene, Ethylbenzene, Xylene	**BTEX**
Before You Dig Australia	**BYDA**
Contaminated Land Management	**CLM**
Contaminant(s) of Potential Concern	**CoPC**
Chain of Custody	**COC**
Covered Outdoor Learning Area	**COLA**
Conceptual Site Model	**CSM**
Department of Education	**DoE**
Detailed Site Investigation	**DSI**
Ecological Investigation Level	**EIL**
Ecological Screening Level	**ESL**
Environmental Management Plan	**EMP**
Environment Protection Authority	**EPA**
Fibre Cement Fragment(s)	**FCF**
Georges River Local Environmental Plan	**GRLEP**
Health Investigation Level(s)	**HIL**
Health Screening Level(s)	**HSL**
JK Environments	**JKE**
Map Grid of Australia	**MGA**
National Association of Testing Authorities	**NATA**
National Environmental Protection Measure	**NEPM**
Organochlorine Pesticides	**OCP**
Organophosphate Pesticides	**OPP**
Preliminary Site Investigation	**PSI**
Polycyclic Aromatic Hydrocarbons	**PAH**
Polychlorinated Biphenyls	**PCB**
Photo-ionisation Detector	**PID**
Protection of the Environment Operations	**POEO**
Practical Quantitation Limit	**PQL**
Remediation Action Plan	**RAP**
Review of Environmental Factors	**REF**
Sampling, Analysis and Quality Plan	**SAQP**
State Environmental Planning Policy	**SEPP**
Source, Pathway, Receptor	**SPR**
Standard Sampling Procedure	**SSP**
Standing Water Level	**SWL**
Total Recoverable Hydrocarbons	**TRH**
Virgin Excavated Natural Material	**VENM**
Work Health and Safety	**WHS**

Units

Litres	**L**
Metres BGL	**mBGL**
Metres	**m**
Millivolts	**mV**

Millilitres	**ml or mL**
Milliequivalents	**meq**
micro Siemens per Centimetre	**µS/cm**
Micrograms per Litre	**µg/L**
Milligrams per Kilogram	**mg/kg**
Milligrams per Litre	**mg/L**
Parts Per Million	**ppm**
Percentage weight for weight	**%w/w**
Percentage	**%**

1 CLIENT SUPPLIED INTRODUCTION

This Remediation Action Plan (RAP) has been prepared to support the Review of Environmental Factors (REF) being prepared on behalf of the NSW Department of Education (DoE) for the proposed Kogarah Public School upgrade (the activity).

The purpose of the REF is to assess the potential environmental impacts of the activity prescribed by State Environmental Planning Policy (Transport and Infrastructure) 2021 (T&I SEPP) as "development permitted without consent" on land carried out by or on behalf of a public authority (NSW DoE) under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The activity is to be undertaken pursuant to Chapter 3, Part 3.4, Clause 3.37 of the T&I SEPP.

The purpose of this report is to provide a contingency method to remediate and validate the site.

1.1 Client Provided Site Description

Kogarah Public School is located at 24B Gladstone Street, Kogarah and has area of 1.644ha per Detail Survey. The school is accommodated within the following allotments:

- Lots 1-3 DP 999122;
- Lot 1 DP 179779
- Lot 1 DP 667959
- Lot 2 DP 175247; and
- Lot A DP 391026.

The school site is irregular in shape with existing vehicular access and the car park provided from Gladstone Street along the south western boundary. Pedestrian access is provided from Gladstone Street and Princes Highway. The site accommodates eight (8) permanent buildings and number of modular school buildings with play areas largely confined to the central and north eastern portions of the site.

Development surrounding the school site includes:

- North: Residential flat building at 71 Regent Street, retail tenancies orientated to Princes Highway (39-43 Princes Highway) and a smaller residential flat building at No 41 Princes Highway;
- East: Princes Highway and further to a mix of commercial and mid-rise residential development;
- South: St Paul's Church complex comprising St Paul's Childcare Centre, St Paul's Anglican Church and a residential flat building located at 24-30 Gladstone Street; and
- West: A mix of single dwelling and residential flat building development with Regent Street beyond.

The site is zoned SP2 Educational Establishment in accordance with Georges River Local Environmental Plan 2021 (GRLEP).

An aerial image of the school site is provided in Figure 1 on the next page.

Figure 1: Aerial image of the site (Nearmap, 2024)

1.2 Proposed Activity Description

The proposed Kogarah Public School upgrade works include the following:

- Demolition of existing playground facilities and Covered Outdoor Learning Area (COLA) in addition to footings and services associated with former demountable buildings;
- Tree removal;
- Construction of a new three storey Classroom building and attached amenities facilities;
- Construction of a single storey Hall with attached Covered Outdoor Learning Area;
- New pedestrian pathway connections providing access throughout the site;
- Service upgrades; and
- Site landscaping works.

Any works relating to the existing demountable classrooms will be undertaken via a separate planning pathway. Figure 2 below presents an extract of the proposed Site Plan.

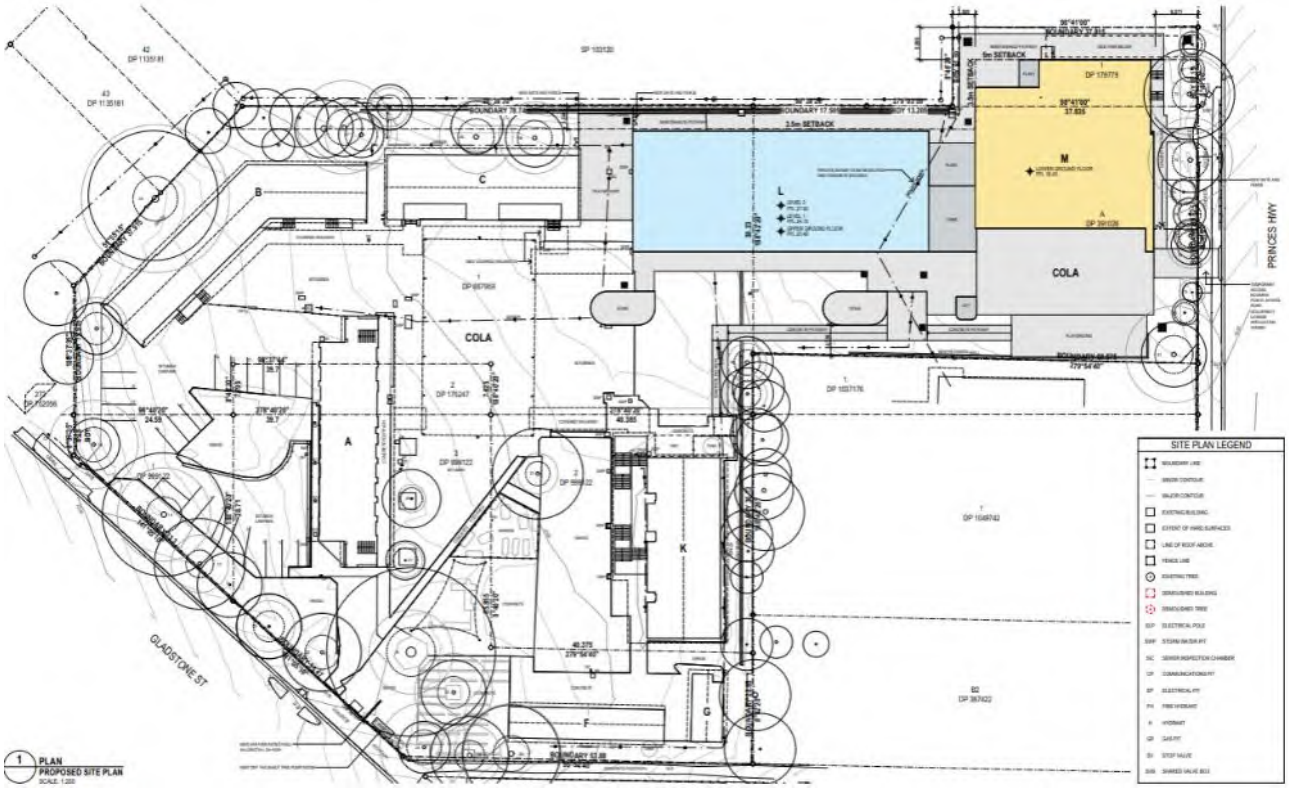


Figure 2: Extract of proposed Site Plan (Fulton Trotter, 2024)

2 RAP INTRODUCTION

The NSW Department of Education ('the client') commissioned JK Environments (JKE) to prepare a RAP for the proposed alterations and additions at Kogarah Public School, 24B Gladstone Street, Kogarah, NSW. For the purpose of the RAP, 'the site' includes the activity area only (i.e. the activity area). The site location is shown on Figure 1 and the RAP applies to the site as shown on Figure 2 attached in Appendix A.

JKE has previously undertaken several phases of investigation at the site. The investigations identified asbestos fines/fibrous asbestos (AF/FA) in fill soil at concentrations below the Health Screening Level (HSL) Site Assessment Criteria (SAC). A bonded Fibre Cement Fragment (FCF) of Asbestos Containing Material (ACM) was also identified at the ground surface. Data gaps also exist due to access constraints associated with the existing buildings and due to site boundary revisions. A summary of relevant information from these investigations is included in Section 2 and data gaps are to be addressed under the framework of this RAP.

2.1 Remediation Goals, Aims and Objectives

The goal of the remediation is to reduce contamination-related risks to human health and the environment, and to render the site suitable for the proposed development from a contamination viewpoint. The primary aim of the remediation is to mitigate risks from the occurrence of asbestos or other contamination in soil.

The objectives of this RAP are to:

- Document the requirements for pre-remediation (supplementary) investigation;
- Provide a rationale to support the extent of the proposed remediation and the remedial/site validation approach based on the current dataset;
- Document a methodology that is to be implemented to remediate and validate the site; and
- Document a strategy that can be implemented in the event of uncovering any unexpected, contamination-related finds, and provide other relevant contingency plans.

2.2 Scope of Work

The investigation was undertaken generally in accordance with a JKE proposal (Ref: EP71307PT) of 3 March 2025 and written acceptance from the client. The scope of work included a review of the previous JKE reports, review of the available proposed development details, consultation with the client and their nominated project manager, and preparation of a RAP.

The scope of work was undertaken with reference to the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)[1], Consultants Reporting on Contaminated Land (2020)[2] guidelines, other guidelines made under or with regards to the Contaminated Land Management Act (1997)[3] and SEPP Resilience and Hazards 2021. A list of reference documents/guidelines is included in Appendix F.

[1] National Environment Protection Council (NEPC), (2013). *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013).* (referred to as NEPM 2013)

[2] NSW EPA, (2020). *Consultants reporting on contaminated land, Contaminated Land Guidelines.* (referred to as Consultants Reporting Guidelines)

[3] Contaminated Land Management Act 1997 (NSW) (referred to as CLM Act 1997)

3 SITE INFORMATION

3.1 Previous Investigations

JKE undertook previous investigations at the site and wider school property in 2020 and early 2025, and WSP undertook a previous investigation in 2023. The western portion of the wider school property did not form part of the site for the purpose of the detailed investigation (see Figures 1 and 2 in Appendix A). A summary of relevant information from the previous investigations is outlined in the table below:

Table 3-1: Previous information summary

Report	Summary of relevant information
Phase 1 Desktop Assessment, 2020[4]	The desktop included review of site information, including: background and historical information; a walkover site inspection; and preparation of a report presenting the results of the assessment, including a CSM. Site history information indicated that residential style structures had been present on the site, and one of the lots within the site had been utilised as a bus depot. The site and wider school property was progressively developed into the primary school site from 1956. During this time, demolition of the original site structures occurred, along with potential filling of the site. The age of the former and existing buildings indicated the potential for hazardous building materials to be present. During the JKE site inspection, a FCF of suspected ACM was identified on the site, and fill material (i.e. imported/disturbed soils) was also observed at the site surface in several areas. Based on the scope of work undertaken for desktop, the CSM identified the following potential contamination sources/areas of environmental concern (AEC): • Fill material - It was considered possible that minor historical filling had occurred to achieve the existing levels. The fill may have been imported from various sources and could be contaminated. It was also considered possible that fill was generated from the native (on-site soils) and was mixed with debris during various phases of redevelopment; • Historical use as a bus depot - Historical title records indicated that the site was owned by a company providing bus service operations and aerial photographs confirmed buses were being stored on this section of the site. Fuels, oils and solvents (e.g. toluene/mineral spirit/thinners) may have been used during this site use; • Use of pesticides - Pesticides may have been used beneath the buildings and/or around the site; • Hazardous building materials (i.e. ACM) - Hazardous building materials may be present as a result of former building and demolition activities. These materials may also be present in the existing buildings/ structures on site. Hazardous building materials can also occur in fill due to historical demolition activities; and • Up-gradient off-site historical dry cleaners and motor garage/service stations – historical business directories indicated that several of these businesses were located upgradient of the site and may pose a risk to the site via migration of contaminated groundwater. The desktop recommended undertaking a preliminary intrusive investigation to make an initial assessment of contamination-related risks and to inform the design of a detailed (Stage 2) site investigation (DSI).

[4] JKE, (2020a). *Report to School Infrastructure NSW on Phase 1 Desktop Assessment for Proposed School Redevelopment (SINSW00330/19) at Kogarah Public School, 24B Gladstone Street, Kogarah, NSW.* (Ref: E32976PTrpt-KPS, dated 28 February 2020) (referred to as desktop)

Report	Summary of relevant information
Phase 2 Preliminary Intrusive Investigation, 2020[5]	The intrusive investigation included a review of existing project information, a site inspection, and soil sampling from 10 boreholes, of which four were located on the current site, including BH107 to BH110 inclusive (refer to Figure 2). Fill material was encountered to depths of between approximately 0.2m below ground level (BGL) and 1.7m BGL, underlain by natural residual sandy soils. The fill contained inclusions of igneous and ironstone gravel, glass fragments, sand and root fibres. A selection of soil samples was analysed for the contaminants of potential concern (CoPC) identified in the CSM. A surficial FCF was identified in the south of the site as shown on Figure 2. The surficial FCF was removed from the site (as sample FCF1) by JKE during the desktop was also analysed and was found to contain asbestos. Based on the data from the intrusive investigation, JKE was of the opinion that the potential risk of widespread subsurface contamination in the intrusive investigation area was low as the soil samples analysed did not identify contamination that was assessed to pose an unacceptable risk. FCF1 was non-friable ACM. The source of the asbestos appeared to be a fibre cement board at the base of the neighbouring fence and was considered unlikely to be associated with on-site soils in that vicinity. The ACM was removed and no further fragments were identified in the area. The intrusive investigation report recommended that the investigation data obtained should be supplemented via a detailed investigation in order to fully characterise the contamination conditions at the site and establish whether remediation is required.
Site Contamination Services – Preliminary Desktop Site Investigation, 2023[6]	The PSI comprised a desktop study to review general site details, site environmental setting and history, regulatory databases and client provided reports and information. The site history review was limited to historical aerial photographs and publicly available information on online databases. Based on the scope of work undertaken for desktop, the CSM identified the following potential contamination sources/ AEC: • Uncontrolled fill materials potentially used historically to raise or level portions of the site; • Historical or recent waste dumping; • Potential ACM or hazardous building materials associated with imported materials or demolished structures; and • Pesticides used historically and recently to maintain the site. The report concluded that the site presented a low to moderate risk of inground contamination due to the potential for uncontrolled fill and poor demolition practices associated with historic development and demolition of residential buildings on the site. It is noted that the investigation did not include a site inspection.
Detailed Site Investigation, 2025[7]	The DSI included a review of existing site information, soil sampling from 12 boreholes and groundwater sampling from three monitoring wells (see Figure 2 in Appendix A). The boreholes/test pits encountered fill materials to depths of approximately 0.2mBGL to 1.4mBGL in all locations and was generally underlain by sandstone bedrock. No FCFACM was encountered in the fill material during the fieldwork.

[5] JKE, (2020b). *Report to School Infrastructure NSW on Phase 2 Preliminary Intrusive Investigation for Proposed School Redevelopment (SINSW00330/19) at Kogarah Public School, 24B Gladstone Street, Kogarah, NSW.* (Ref: E32976PTrpt2-KPS, dated 8 May 2020) (referred to as intrusive investigation)

[6] WSP, (2023). *Report to School Infrastructure NSW on Site Contamination Services – Preliminary Desktop Site Investigation, Kogarah Public School.* (Project Ref: PS206292, report dated 7 December 2023) (referred to as WSP PSI)

[7] JKE, (2025a). *Report to NSW Department of Education on Detailed Site Investigation (DSI) for Proposed Alterations and Additions at Kogarah Public School, 24B Gladstone Street, Kogarah, NSW.* (Ref: E32976BT2rpt4-DSI, dated 24 March 2025) (referred to as DSI)

Report	Summary of relevant information
	A selection of soil and groundwater samples were analysed for the CoPC identified in the CSM. In fill soil, carcinogenic polycyclic aromatic hydrocarbons (PAHs) were reported at concentrations above the health-based SAC. Asbestos (as AF/FA) was also detected in fill soils at one location, although the concentration of asbestos was below the health-based SAC. Copper and total recoverable hydrocarbons were identified in fill marginally above the ecological SAC however, these concentrations were not of concern as they were assessed to pose a low risk to ecological receptors. In groundwater, copper, zinc and PAHs (phenanthrene, anthracene, fluoranthene, and benzo(a)pyrene) were reported above the freshwater ecological SAC, and the benzo(a)pyrene concentration also exceeded the drinking water and recreational SAC. Despite the SAC exceedances, the Tier 1 risk assessment did not identify a trigger for remediation as risks were assessed to be low. However, further investigation of the site was noted to be required due to the occurrence of asbestos in fill and to better understand the potential impacts from PAHs in the groundwater. The DSI concluded that further investigation of the site is required to supplement the existing data. Notwithstanding, we were of the opinion that the DSI has provided adequate data to enable further refinement of the CSM and for JKE to be confident that the site can be made suitable for the activity via remediation, should the further investigation confirm that remediation is required. We recommended the following: 1. Prepare an interim AMP to manage potential risks from asbestos in/on soil until the activity occurs; 2. Completion of further investigation (referred to above), together with an associated addendum/supplementary report presenting the results; 3. Preparation and implementation of a RAP, if the need for a RAP is confirmed in the addendum/supplementary report; and 4. Preparation and implementation of a construction-phase AMP. Based on the results of the preliminary waste classification assessment, and at the time of reporting, the fill material at the site is assigned a preliminary classification of General Solid Waste (non-putrescible) containing Special Waste (asbestos). At the time of reporting, it was also considered possible that some of the natural soils and bedrock at the site could classifiable as virgin excavated natural material (VENM) for off-site disposal or re-use purposes. Confirmatory waste classification assessment is required.

A copy of the DSI figures, soil and groundwater laboratory data summary tables and boreholes logs, is attached in Appendix B.

3.2 Site Identification

Table 3-2: Site Identification

Site Address:	24B Gladstone Street, Kogarah, NSW
Lot & Deposited Plan:	Lot 1 in DP179779, Lot A in DP391026, and part of Lot 1 in DP667959.
Current Land Use:	Primary School (Kindergarten to year 6)

Proposed Land Use:	Continued use as a primary school
Local Government Area:	Georges River Council
Current Zoning:	SP2: Infrastructure
Site Area (m^2) (approx.):	4,375
Geographical Location (decimal degrees) (approx.):	Latitude: -33.9618430 Longitude: 151.1370970
Site Location Plans:	Appendix A

3.3 Summary of Site Setting and Description

The site is located in the eastern portion of the existing Kogarah Public School property, which itself is in a mixed-use area of Kogarah and is bound by the Princes Highway to the east and Gladstone Street to the west. The site is located approximately 535m to the south-west of Muddy Creek and 1.7km to the west of Botany Bay.

The site is situated in gently undulating regional topography, with the site itself gently sloping towards the east at approximately 1° to 2°. Parts of the site appear to have been levelled to account for the slope and accommodate the existing development.

JKE undertook a walkover as part of the DSI on 15 January 2025. A summary of the inspection findings is outlined below:

- At the time of the inspection, the site comprised a COLA, over asphaltic concrete paved playground in the west of the site. The east of the site comprised soft-fall and artificial grass covered playground areas with garden and landscaped areas around the boundaries of the site. A small toilet block and goods store was also positioned along the southern boundary, and construction fencing was positioned along the central north of the site in an east-west alignment, due to recent demolition activities (removal of demountable classrooms) in this section of the site;
- Where the demolition/removal had taken place in the north of the site, exposed soils and debris from demolition/removal activities were observed at the site surface;
- During the inspection, an unsealed bag of FCF/suspected ACM was identified in the central north of the site. The bag was assumed to be associated with an emu-pick following demolition removal works. JKE sealed the bag and informed the client of this find at the time of the fieldwork;
- There were no other visible or olfactory indicators of contamination observed during the inspection;
- Fill was observed at the ground surface in areas of exposed soils across the site. Imported material/fill was considered likely to be present in garden beds and as a result of general (minor) levelling works across the site; and
- Medium to large trees were observed around the site and a number of grass-covered sections of the site were also observed. Grass coverage was generally good in the unpaved areas, with the exception of some areas beneath large trees and isolated areas of the playground (generally around the interface with pavements).

During the DSI site inspection, JKE observed the following land uses in the immediate surrounds:

- North – high-density high-rise residential apartment buildings, a construction site and Regent Street;
- South – St Paul's Anglican Church (heritage), children's centre (church run);
- East – Princes Highway and low-density residential houses; and
- West – Kogarah Public School (main buildings).

JKE did not observe any land uses in the immediate surrounds that were identified as potential contamination sources for the site.

4 SUMMARY OF GEOLOGY AND HYDROGEOLOGY

4.1 Regional Geology and Soil Landscapes

Regional geological information reviewed for the previous investigations indicated that the site is underlain by underlain by Triassic aged deposits of medium to coarse-grained quartz sandstone, and very minor shale and laminate lenses (Hawksbury Sandstone).

A summary of the subsurface conditions encountered during the DSI is present in the table below:

Table 7.1: Summary of Subsurface Conditions

Profile	Description
Pavement	Asphaltic concrete pavement was encountered at the surface in BH203, BH210, BH211, BH212, and BH214, between approximately 50mm to 100mm in thickness.
Fill	Fill was encountered at the surface or immediately beneath the pavement in all locations and extended to depths of approximately 0.2mBGL to 1.4mBGL. BH209 to BH217 and BH219 were terminated in the fill soil as a maximum depth of 1.4mBGL. The fill typically comprised of silty sand, silty sandy clay, gravel, gravelly sand, sandy clay, and silty sandy gravel with inclusions of igneous, ironstone, and sandstone gravel, plastic, glass, tile, metal and brick fragments, slag, ash, wood and root fibres. Neither staining nor odours were encountered in the fill material during fieldwork. No FCF or ACM was encountered in the fill material during the fieldwork.
Bedrock	Sandstone bedrock was encountered beneath the fill material in BH201, BH203, BH207, BH208 and BH218. Neither staining nor odours were recorded in the bedrock during fieldwork.
Groundwater	Groundwater seepage was encountered in boreholes BH201, BH209, BH212, BH214, BH216 and BH219 at depths of approximately 0.4mBGL to 0.8mBGL. All other boreholes remained dry during and on completion of drilling.

A copy of the borehole logs from the DSI is included in Appendix B.

4.2 Acid Sulfate Soil (ASS) Risk and Planning

The site is not located in an acid sulfate soil (ASS) risk area according to the risk maps prepared by the Department of Land and Water Conservation. (1997)[8].

The site is not mapped as being within an ASS risk area in the GRLEP.

[8] Department of Land and Water Conservation, (1997). *1:25,000 Acid Sulfate Soil Risk Map (Series 9130N3, Ed 2)*

4.3 Hydrogeology

Hydrogeological information reviewed for the previous investigations indicated that the regional aquifer on-site and in the areas immediately surrounding the site includes porous, extensive aquifers of low to moderate productivity. There was a total of 521 registered bores within the report buffer of 2,000m. In summary:

- The nearest registered bore was located approximately 400m from the site. This was utilised for domestic purposes. The nearest downgradient bore registered for domestic uses was located over 1,500m to the north of the site;
- The majority of the bores were registered for domestic purposes;
- The drillers log information from the closest (within 500m) registered bores typically identified fill and/or sand and clay soil to depths of 3.65m-6.50m. Standing water levels (SWLs) in the bores ranged from 1.5m below ground level (BGL) to 3.0mBGL; and
- Groundwater is likely to be encountered at depths ranging from 3m to 5m below existing surface levels based on previous JKG investigations of nearby properties.

A summary of the groundwater field screening conditions encountered during the DSI is presented in the following table:

Table 4-1: Summary of Field Screening

Aspect	Details
Groundwater Depth & Flow	The relative heights of the ground surface at each monitoring well location were recorded using a GPS and the relative levels (RLs) of groundwater in each well were calculated based of the SWLs during the DSI. A contour plot was prepared for the groundwater flow direction using Surfer v8.08 (Surface Mapping Program), and was presented in the DSI. The contour plot indicated that groundwater generally flow towards the north, which is generally consistent with expectations based on the topography, and down-gradient water bodies.
Groundwater Field Parameters	Field measurements recorded during the DSI sampling were as follows: - pH ranged from 4.90 to 5.22; - EC ranged from 941µS/cm to 1,385µS/cm; - Eh ranged from 64.9mV to 180.7mV; and - DO ranged from 1.0mg/L to 5.7mg/L. The PID readings in the monitoring well headspace recorded during sampling ranged from 0ppm in MW203 and MW207, and 1ppm in MW208.
LNAPLs petroleum hydrocarbons	Phase separated product (i.e. LNAPL) was not detected using the interphase probe during groundwater sampling.

4.4 Receiving Water Bodies

Surface water bodies were not identified in the immediate vicinity of the site. The closest surface water body is Muddy Creek, a tributary of the Cooks River located approximately 535m to the north-east of the site. This is down-gradient from the site, and is considered to be a potential receptor.

5 CONCEPTUAL SITE MODEL / SITE CHARACTERISATION

NEPM (2013) defines a CSM as a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM for the site is presented in the following sub-sections and is based on the site information and investigation data to date. Reference should also be made to the figures attached in the appendices.

5.1 Summary of Contamination (Site Characterisation)

A copy of the soil and groundwater data summary tables and borehole logs from the DSI report are included in Appendix B. The SAC exceedances are shown on Figure 3 in Appendix A.

There were carcinogenic PAH exceedances of the health-based SAC in two locations, however statistical analysis demonstrated that the upper confidence limit (UCL) of the entire data set was below the SAC and risks were assessed to be low based on the weight of evidence. Copper and TRH F3 exceedances of the ecological SAC was also reported in fill, however, risks associated with these exceedances were also assessed to be low and therefore remediation is not currently proposed.

Although below the SAC, asbestos as AF/FA was detected in fill soil at one location (refer to Figure 3). Based on the available data, we consider that any occurrences of asbestos, should they be found at concentrations greater than the HSL SAC, could be treated as a hotspot. The RAP includes remediation contingencies to address this approach. At this stage the RAP has been prepared on the basis that there may a need for remediation and the remedial options provided are framed as contingencies.

The occurrence of PAHs (phenanthrene, anthracene, fluoranthene, and benzo(a)pyrene) in groundwater were considered likely associated with sediment in the sample and/or potentially due to the shorter time between development and sampling of MW208. This is being addressed via an additional round of groundwater sampling as part of the pre-remediation (supplementary) investigation.

Concentrations of copper and zinc exceeded the ecological SAC in groundwater however these exceedances were not considered to be associated with on-site contamination, the risks were assessed to be low and acceptable, and therefore remediation of groundwater is not currently proposed.

The RAP includes provisions for a pre-remediation (supplementary) investigation (refer to Section 7.3). The primary aim of the pre-remediation (supplementary) investigation is to provide additional data in relation to the occurrence and concentrations of asbestos in soil, provide an increased soil sampling density for asbestos, and to provide additional groundwater data in order to assess site risks in relation to contamination and establish whether remediation is required. A secondary aim of the investigation is to provide additional waste classification data for off-site disposal of soil waste which may be generated during the proposed development works.

6 EXTENT OF REMEDIATION AND REMEDIATION OPTIONS

6.1 Extent of Remediation

As the RAP includes provisions for managing unexpected finds and completing further investigation, the RAP applies to the whole site at this stage.

At this point, as there has been no contamination found that requires remediation, the extent of remediation is not defined. However, a review of the remediation extent is to occur as part of the pre-remediation (supplementary) investigation process. The RAP includes a suitable contingency remedial actions framework to address any additional risks that may be identified in this context.

6.2 Soil Remediation Options Assessment

The NSW EPA follows the hierarchy set out in NEPM 2013 for the remediation of contaminated sites. The preferred order for soil remediation and management is as follows:

1. On-site treatment of soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2. Off-site treatment of excavated material 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;

Or if the above are not practicable:

3. Consolidation and isolation of the soil by on-site containment within a properly designed barrier; and
4. Removal of contaminated material to an approved site or facility, followed where necessary by replacement with clean material; or
5. Where the assessment indicates that remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

For simplicity herein, the above hierarchy are respectively referred to as Option 1, Option 2, Option 3 etc.

The NEPM 2013 and the associated Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (2021)[9] prefer the following asbestos remediation hierarchy:

1. Minimisation of public risk;
2. Minimisation of contaminated soil disturbance; and
3. Minimisation of contaminated material/soil moved to landfill.

The NSW EPA Contaminated Land Management Guidelines for the NSW Site Auditor Scheme (3rd Edition) (2017)[10] provides the following additional requirements to be taken into consideration:

- Remediation should not proceed in the event that it is likely to cause a greater adverse effect than leaving the site undisturbed; and

[9] Western Australian (WA) Department of Health (DoH), (2021). *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*. (referred to as WA DoH 2021)

[10] NSW EPA, (2017). *Contaminated land Management, Guidelines for the NSW Site Auditor Scheme (3rd ed.).* (referred to as Site Auditor Guidelines 2017)

- Where there are large quantities of soil with low levels of contamination, alternative strategies should be considered or developed.

The table below discusses a range of remediation options:

Table 6-1: Consideration of Soil Remediation Options

Option	Discussion	Applicability
Option 1 **On-site treatment of contaminated soil**	On-site treatment can provide a mechanism to reuse the processed material, and in some instances, avoid the need for large scale earthworks. Treatment options are contaminant-specific and can include bio-remediation, soil washing, air sparging and soil vapour extraction and thermal desorption. Depending on the treatment option, licenses may be necessary for specific individual waste streams due to the potential for air pollution and the formation of harmful by-products during incineration processes. Licences for re-use of treated material/waste may also be required.	Not applicable for friable asbestos. May be suitable for sporadic, surficial occurrences of FCF/ACM. On-site treatment of soil is unlikely to be applicable for the remaining CoPC.
Option 2 **Off-site treatment of contaminated soil**	Contaminated soils are excavated, transported to an approved/licensed treatment facility, treated to remove/stabilise the contaminants then returned to the subject site, transported to an alternative site or disposed to an approved landfill facility. This option is also contaminant-specific. The cost per tonne for transport to and from the site and for treatment is considered to be relatively high. The material would also have to be assessed in terms of suitability for reuse as part of the proposed development works under the waste and resource recovery regulatory framework.	Not applicable for asbestos in soil and would also not likely be viable or practicable for small quantities of soils impacted by the other CoPC.
Option 3 **Consolidation and isolation of impacted soil by cap and containment**	This would include capping material in-situ beneath appropriate barriers, or the consolidation of contaminated soil within an appropriately designed cell, followed by the placement of an appropriate barrier over the material to reduce the potential for future disturbance. The capping and/or containment must be appropriate for the specific contaminants of concern. Depending on the concentrations of contaminants being encapsulated, an ongoing Environmental Management Plan (EMP) may be required and an EMP would need to be publicly notified and made to be legally enforceable (e.g. via listings in the Section 10.7 planning certificate and on the land title).	Applicable for asbestos where the asbestos concentrations exceed the HSLs, and also applicable for the other CoPC provided there is no migration risk to groundwater. This option may have limited applicability for volatile CoPC. This generally would not be the preferred method if relatively small quantities if contaminated soils are involved.

Option	Discussion	Applicability
<u>Option 4</u> Removal of contaminated material to an appropriate facility and reinstatement with clean material	Contaminated soils would be classified in accordance with NSW EPA guidelines for waste disposal, excavated and disposed of off-site to a licensed landfill. The material would have to meet the requirements for landfill disposal. Landfill gate fees would apply in addition to transport costs.	This option is applicable to the CoPC and is easy to implement, particularly for small quantities of contaminated soils. This may not be economically viable for larger quantities of material due to costs for disposal.
<u>Option 5</u> Implementation of management strategy	Contaminated soils would be managed in such a way to reduce risks to the receptors and monitor the conditions over time so that there is an on-going minimisation of risk. This may occur via the implementation of monitoring programs, potentially also involving capping systems.	This is a potential option for managing low concentrations of asbestos (below the HSL) in soil, or for managing capped contamination in conjunction with Option 4.

6.3 Rationale for the Preferred Option for Remediation

Based on the existing data for the site, the preferred remedial contingency options include:

- Option 4 excavation and off-site disposal to a licensed landfill facility; and
- A combination of Option 3 cap and containment, and Option 5 long-term management.

In relation to the potential for additional occurrences of asbestos in fill, a management approach is to be implemented to manage risks to workers during construction. The findings of the pre-remediation (supplementary) investigation will establish whether there are any asbestos (or any other contaminant) concentrations in soil that exceed the SAC that warrant remediation. Depending on the nature and extent of such remediation, we consider that Option 4 would most likely be applicable for small quantities of contaminated soils, and a combination of Options 3 and 5 would be applicable for larger quantities of contaminated soils, should contamination impacts be identified.

The appropriateness of which contingency to be implemented would be assessed subsequent to completion of the pre-remediation (supplementary) investigation as outlined in Section 7.3.

7 REMEDIATION DETAILS

Prior to commencement of demolition and any soil disturbance, the client, project manager and remediation contractor must review and make arrangements to meet the remediation site management requirements for the project as outlined in Section 10 of this RAP.

The following general sequence of works is anticipated:

- Pre-commencement meeting;
- Site establishment and demolition;
- Pre-remediation (supplementary) investigation and any additional associated reporting;
- Remediation and validation of remedial works (where applicable); and
- Validation of remedial works and validation of imported soil materials. This includes materials imported to reinstate the remedial excavations, together with engineering material such as sub-base and drainage materials (e.g. recovered aggregate etc), landscaping materials or any other materials imported for service trenches etc, to the point in time that the validation report is issued.

Validation of the works will occur progressively throughout the remediation and construction program.

Details in relation to the above are outlined in the respective subsection below.

7.1 Roles and Responsibilities

Table 7-1: Roles and Responsibilities

Role	Responsibility
Developer/ client	NSW Department of Education The client (also acting as project manager) is required to appoint the project team for the remediation/validation, review all documents prepared for the project and manage the implementation of the procedures outlined in this RAP. The project manager is to take reasonable steps so that the remediation contractor and others have understood the RAP and will implement it in its totality. The project manager will review the RAP and other documents and will update the parties involved of any changes to the development or remediation sequence (in consultation with the validation consultant).
Principal Contractor / Remediation Contractor	To be confirmed. The principal contractor is required to review all documents prepared for the project and manage the implementation of the procedures outlined in this RAP. The principal contractor is to take reasonable steps so that the remediation contractor and others have understood the RAP and will implement it in its totality. With regards to the need for a construction/remediation phase AMP, the principal contractor/remediation contractor must engage a (and/or engage with a) suitably qualified consultant to prepare the AMP required in accordance with Section 9.1 of this RAP. The principal contractor will review the RAP and other documents and will update the parties involved of any changes to the development or remediation sequence (in consultation with the validation consultant).

Role	Responsibility
Remediation Contractor	To be confirmed. The remediation contractor (this may be the same entity as the principal contractor) is required to review all relevant documents prepared for the project, apply for any relevant removal licences or permits and implement the remediation requirements and relevant validation requirements (that are the remediation contractor's responsibility) outlined in this RAP. The remediation contractor should be or must subcontract a Class A licensed asbestos removalist to manage and undertake any works associated with the removal/disturbance of asbestos. The Class A contractor will need to submit the required notification to SafeWork NSW for asbestos removal works, should removal of asbestos in soils occur. With regards to the need for a construction/remediation phase AMP, the remediation contractor must engage a (and/or engage with a) suitably qualified consultant to prepare the AMP required in accordance with Section 10.1 of this RAP, unless this responsibility is already addressed by the principal contractor as noted above. The remediation contractor is required to collect all documentation associated with the remediation activities and forward this documentation onto the principal contractor, client and project manager as they become available.
Validation Consultant	To be confirmed. The validation consultant[11] provides consulting advice and validation services in relation to the remediation. The validation consultant undertakes the pre-remediation (supplementary) investigation (s) and prepares the validation report (and EMP where applicable), as required. The validation consultant is required to review any deviation to this RAP or any unexpected finds if and when encountered during the site work. The validation consultant should have a Licensed Asbestos Assessor (LAA) on staff. The validation consultant is required to liaise with the principal contractor, client, project manager and remediation contractor on all matters pertaining to the site contamination, remediation and validation, carry out the required pre-remediation (supplementary) investigation, validation sampling and inspections.

7.2 Pre-commencement Meeting

The project team is to have a pre-commencement meeting to discuss the sequence of remediation, and the remediation and validation tasks. The site management plan for remediation works (see Section 10) must be reviewed by project manager and remediation contractor, and appropriate steps are to be taken to ensure the adequate implementation of the plan.

7.3 Pre-remediation (supplementary) investigation and Reporting

Prior to preparation of this RAP, JKE prepared a detailed SAQP for the pre-remediation (supplementary) investigation. The SAQP is attached as Appendix C.

[11] The validation consultant must be a certified practitioner (specialising in site contamination), under one of the NSW EPA endorsed certification schemes, i.e. CEnvP SC or equivalent

This investigation is currently underway at the date of this report and the supplementary investigation will confirm whether or not there is a need for remediation (i.e. a need to implement the remediation action contingencies outlined in this RAP) and where applicable, it will also define the extent of the remediation.

In the event that there is a need for remediation that falls outside the scope of contingency remedial actions outlined in this RAP, a new RAP must be prepared and submitted to the client/determining authority, principal contractor and remediation contractor etc (as applicable). The client/determining authority and project manager must then establish the appropriate course of action in relation to any additional planning requirements prior to making arrangements to carry out the additional works.

The project team must factor the above requirements into the project timeline so that all of the above can be closed out/finalised prior to the commencement of earthworks/construction.

7.4 Site Establishment and Demolition

The remediation contractor is to establish on site as required to facilitate the remediation and validation works. Consideration must be given to the work sequence and extent of remediation/excavation so that the site establishment (e.g. site sheds, fencing, access points etc) does not inhibit the required works. Any soil/gravel-type materials imported during the site establishment (e.g. DGB, 40/70 etc) must be validated in accordance with Section 8 of this report.

The demolition of buildings/structures etc must occur with regards to the findings of the hazardous building materials survey report.

As part of the demolition process, all visible FCF/ACM must be removed from the ground surface across the entire site prior to any works that disturb the existing pavements. An asbestos surface clearance for the ground surface across the entire site must be provided by a LAA to demonstrate this has occurred. This ground surface clearance will be in addition to any specific clearances associated with the demolition works.

All waste from the demolition is to be disposed to facilities that are licenced by the NSW EPA to accept the waste. The demolition contractor is to maintain adequate records and retain all documentation for such activities including:

- A summary register including details such as waste disposal dates, waste materials descriptions, disposal locations (i.e. facility details) and reconciliation of this information with waste disposal docket numbers;
- Waste tracking records and transport certificates (where waste is required to be tracked/transported in accordance with the regulations); and
- Disposal dockets for the waste. Legible dockets are to be provided for all waste materials so they can be reconciled with the register.

The above information is to be supplied to the validation consultant for assessment and inclusion in the site validation report.

7.5 Remedial Actions – Excavate and Dispose Contingency

Prior to commencement of excavation work, a waste classification must occur for the material to be excavated and removed from the remediation area (this should occur during the data gap investigation process as noted previously). The classification must occur with regards to the NSW EPA Waste Classification Guidelines, Part 1: Classifying Waste (2014)[12] and the NSW EPA Sampling Design Part 1 – Application (2022)[13]. A waste classification report must be prepared and the receiving landfill facility should be contacted to obtain disposal approval. This waste classification documentation should be arranged at least 3-4 weeks prior to commencement of any excavation works in order to avoid unnecessary delays.

The procedure for excavation and disposal of contaminated soil is outlined in the following tables and includes a procedure for non-asbestos impacted soil (Section 6.5.1) and asbestos-impacted fill (Section 6.5.2):

7.5.1 Excavate and Dispose Contaminated Soil – Non-Asbestos Impacted

Table 7-2: Remediation Details – Excavate and Dispose Contaminated Soil – Non-Asbestos Impacted

Step	Primary Role/ Responsibility	Procedure
1.	Remediation contractor	Address Stability Issues and Underground Services: Geotechnical advice must be sought regarding the stability of adjacent structures and/or adjacent areas prior to commencing remediation (as required). Stability issues are to be addressed to the satisfaction of a suitably qualified geotechnical engineer. This may require the installation of temporary shoring, if specified by the engineer. All underground services are to be appropriately disconnected or rerouted to facilitate the works.
2.	Remediation contractor Validation consultant (inspections)	Excavation and Disposal of Contaminated Fill: Remediation will be undertaken as follows: • Submit an application to dispose of the soil (in accordance with the assigned waste classification) to a facility that is appropriately licensed by the NSW EPA to receive the waste, and obtain authorisation to dispose; • Contact the validation consultant to arrange for the consultant to be present to witness the remedial excavation works; • The area where fill is to be removed must be marked out using an appropriate method (i.e. star pickets), so the extent of remediation is clear to the excavator operator and other relevant parties; • Excavate the fill from the remediation area, down to the surface of the underlying soil/bedrock (whichever is shallower); • Load the fill directly into trucks and dispose of the soil to a facility licensed by the NSW EPA to receive the waste; and • All documents including landfill disposal dockets must be retained by the remediation contractor and forwarded to the client and validation consultant. This documentation forms a key part of the validation process and is to be included in the validation report.
3.	Validation consultant	Validation of Excavation: Once all contaminated soil is removed to required levels, the base and walls of the excavation are to be validated in accordance with the validation plan outlined in Section 8.

[12] NSW EPA, (2014). *Waste Classification Guidelines, Part 1: Classifying Waste.* (referred to as Waste Classification Guidelines 2014)

[13] NSW EPA, (2022). *Sampling design part 1 - application.* (referred to as EPA Sampling Design Guidelines 2022)

Step	Primary Role/ Responsibility	Procedure
4.	Remediation contractor and validation consultant	Backfilling/Reinstatement of Excavation: Where required, the remedial excavation is to be reinstated with clean (validated) materials, to meet the geotechnical and landscape requirements of the project. Imported materials must be validated in accordance with the validation plan outlined in Section 8.

7.5.2 Excavate and Dispose Contaminated Fill – Asbestos Impacted

Table 7-3: Remediation Details – Excavate and Dispose Contaminated Fill – Asbestos impacted

Step	Primary Role/ Responsibility	Procedure
1.	Remediation contractor	Address Stability Issues and Underground Services: Geotechnical advice must be sought regarding the stability of adjacent structures and/or adjacent areas prior to commencing remediation (as required). Stability issues are to be addressed to the satisfaction of a suitably qualified geotechnical engineer. This may require the installation of temporary shoring, if specified by the engineer. All underground services are to be appropriately disconnected or rerouted to facilitate the works.
2.	Remediation contractor (or nominated licenced sub-contractor)	Establish Asbestos Related Controls and Arrange Licenses and Tracking Requirements: Prior to the commencement of any excavation of asbestos impacted fill/soil, asbestos related controls, licences and tracking requirements should be implemented as outlined in the AMP (refer to Section 10 of this RAP).
3.	Remediation contractor (or nominated Class A licensed sub-contractor) Validation consultant (inspections)	Excavation and Disposal of Contaminated Fill: Remediation will be undertaken as follows: • Submit an application to dispose of the fill (in accordance with the assigned waste classification) to a facility that is appropriately licensed by the NSW EPA to receive the waste, and obtain authorisation to dispose. Establish the required waste tracking using the EPA-endorsed waste tracking system; • Contact the validation consultant to arrange for the consultant to be present to witness the remedial excavation works; • The excavation and removal of contaminated soil must be completed in accordance with the construction phase AMP; • The area where fill is to be removed must be marked out using an appropriate method (i.e. star pickets), so the extent of remediation is clear to the excavator operator and other relevant parties; • Excavate the fill from the remediation area, down to the surface of the underlying soil/bedrock (whichever is shallower); • Load the fill directly into trucks and dispose of the soil to a facility licensed by the NSW EPA to receive the waste; and • All documents including landfill disposal dockets must be retained by the remediation contractor/asbestos removal contractor and forwarded to the client and validation consultant. This documentation forms a key part of the validation process and is to be included in the validation report.
4.	Validation consultant	Validation of Excavation: Once all fill is removed to required levels, the base and walls of the excavation are to be validated in accordance with the validation plan outlined in Section 8, which includes bulk field screening and completion of a surface asbestos clearance by a LAA.

Step	Primary Role/ Responsibility	Procedure
5.	Remediation contractor and validation consultant	Backfilling/Reinstatement of Excavation: Where required, the remedial excavation is to be reinstated with clean (validated) materials, to meet the geotechnical and landscape requirements of the project. Imported materials must be validated in accordance with the validation plan outlined in Section 8.

Part 7 of the Protection of the Environment (POEO) Waste Regulation (2014)[14] sets out the requirements for the transportation and management of asbestos waste and Clause 79 of the POEO Waste Regulation requires waste transporters to provide information to the NSW EPA regarding the movement of any load in NSW of more than 10m^2 of asbestos sheeting, or 100 kilograms of asbestos waste. To fulfil these legal obligations, asbestos waste transporters must use the EPA-endorsed waste tracing system.

Clause 78 of the POEO Waste Regulation requires that a person who transports asbestos waste must ensure that:

- Any part of any vehicle in which the person transports the waste is covered, and leak-proof, during the transportation; and
- If the waste consists of bonded asbestos material—it is securely packaged during the transportation; and
- If the waste consists of friable asbestos material—it is kept in a sealed container during transportation; and
- If the waste consists of asbestos-contaminated soils—it is wetted down.

Asbestos waste cannot be re-used or recycled.

7.6 Remedial Actions - Capping Contingency

In the event that contaminated soil cannot be practicably removed, or if the quantity of contaminated material is cost-prohibitive to dispose of, an assessment must be made by the validation consultant regarding the risks posed by this material in the context of the proposed development, should it remain on site and be capped. For hydrocarbon impacted material, it may not be possible to simply cap/contain and manage this material if it poses an unacceptable vapour risk beneath a proposed building. Therefore, further sampling, analysis and risk assessment will be required in this scenario in order to establish a suitable course of action. This contingency is well suited to asbestos contamination however.

In the event that this contingency is to be implemented, a rationale for applying the contingency must be documented, the details below must be reviewed and updated for the situation, and approval must be sought from the project manager/client and the determining authority prior to proceeding with the remedial works (i.e. within an addendum RAP). A validation plan must also be documented.

[14] *Protection of the Environment Operations (Waste) Regulation 2019* (NSW). (referred to as POEO Waste Regulation)

In relation to asbestos, if all asbestos-contaminated fill cannot be practicably removed and disposed off-site, the contaminated fill must be capped with a robust capping layer and consequently the site and this area will be managed under a long-term EMP. This can occur in-situ, or within a suitably designed cell. The minimum capping requirements in such a circumstance are as follows:

- Installation of a brightly coloured (i.e. orange) geotextile marker layer over the contaminated fill;
- Installation of a minimum of 500mm of clean (validated) materials if the area is to be landscaped, and all landscaping must be shallow and must not penetrate the geotextile. If shallow landscaping is not achievable, then the capping thickness must be increased accordingly to meet this requirement; and
- In areas that are to be paved with hardstand (e.g. pavements, new building slabs etc), there is no need for 500mm of clean material and the pavements can be constructed directly over the top of the geotextile marker in accordance with the engineering requirements for the project.

The proposed remediation and validation steps associated with in-situ capping are outlined in the following table.

Table 7-4: Remediation Details – Capping Contingency

Step	Primary Role/ Responsibility	Procedure
1.	Remediation contractor/principal contractor	Service Trenching, Piling/Footing Excavations and Establishment of Pre-Capping Site Levels: The principal contractor/remediation contractor are to undertake the relevant site preparation works, piling/footing excavations and any excavations required to facilitate the capping procedures. Any surplus excavated materials must be managed and (if required) disposed off-site appropriately in accordance with the relevant requirements outlined previously in this RAP applicable to an excavation/disposal procedure.
2.	Remediation contractor	Installation of Marker Layers and Survey of site levels: After the bulk excavation levels are achieved to facilitate the minimum capping requirements, the geotextile marker is to be installed over the fill and secured appropriately using 'U' nails, pegs or other means. A pre-capping levels survey is to be completed by the remediation contractor prior to the placement of any overlying clean capping layers or construction of pavements etc. The purpose of the survey is to provide factual information of the site levels, and the horizontal extent of the geotextile marker, prior to installation of the clean capping layers. Survey points must be taken at appropriate frequencies (say every 5m lineal for narrow areas, a 5m grid for broader areas, at the corners/edges of the geotextile, and more frequently for significant change in surface elevation. The pre-capping levels survey is to be provided to the client/project manager and the validation consultant prior to any further capping works commencing.
3.	Validation consultant and remediation contractor	Importation of Capping Materials: Imported materials are to be validated in accordance with Section 8. Validated materials can then be used to achieve the minimum capping requirements for the project.

Step	Primary Role/ Responsibility	Procedure
4.	Remediation contractor	Post-Capping Survey of site levels: After completion of capping, a post-capping levels survey is to be completed by the remediation contractor. The purpose of the survey is to provide factual information regarding the capping thickness and confirm that the minimum capping requirements have been achieved. Survey points must be taken at appropriate frequencies as noted for the pre-capping survey. The post-capping levels survey is to be provided to the client/project manager and the validation consultant.

Where contaminated soil is capped on site, a long-term EMP will be required to manage the contamination capped at the site and the long-term EMP will be documented as part of the overall validation process. Public notification and enforcement mechanisms for the long-term EMP are to be arranged and the determining authority (and local council, if applicable) is to be provided with a draft copy of the long-term EMP for consultation prior to finalisation of the document.

The notification and enforcement mechanisms are to include notation on the planning certificate under Section 10.7 of the Environmental Planning and Assessment Act (1979) and a covenant registered on the title to land under Section 88B of the Conveyancing Act (1919).

The long-term EMP will include requirements for passive management of the capping system that will focus on maintaining the capping layers to minimise the potential of exposure to the underlying contaminated soil. The long-term EMP will also include contingencies for managing minor intrusive works in the event that the capping system is breached.

7.7 Remediation Documentation

The remediation contractor must retain all documentation associated with the site management and remediation, including but not limited to:

- Asbestos management documentation, including all relevant notifications and monitoring reports, and clearance certificates where applicable (additional details in this regard are to be outlined in the construction-phase AMP);
- Photographs of remediation works;
- Waste disposal dockets and waste tracking documentation (see below and the example waste tracking form in Appendix D); and
- Imported materials documentation (see below and the example imported material tracking form in Appendix D).

Copies of these documents must be forwarded to the project manager and the validation consultant for assessment and inclusion in the validation report.

7.7.1 Waste

All waste removed from the site is to be appropriately classified, tracked and managed in accordance with the relevant guidelines and regulations. The remediation contractor (and/or their nominated licensed asbestos removalist) is to maintain adequate records and retain all documentation for waste disposal activities including:

- A summary register (in Microsoft Excel format) including details such as waste disposal dates, waste materials descriptions, disposal locations (i.e. facility details) and reconciliation of this information with the associated waste classification documentation and the waste disposal docket numbers;
- Waste tracking records and transport certificates (where waste is required to be tracked/transported in accordance with the regulations). This includes consignment details via the EPA-endorsed waste tracking system for asbestos waste; and
- Disposal dockets for the waste (i.e. weighbridge dockets for each load).

Any soil waste classification documentation is to be prepared in accordance with the reporting requirements specified by the NSW EPA.

A review of the disposal facility's Environment Protection Licence (EPL) issued under the Protection of the Environment Operations (POEO) Act (1997)[15] is to be undertaken to assess whether the facility is appropriately licensed to receive the waste.

The above information is to be provided to the validation consultant for inclusion in the validation report. The register must be set up at the beginning of the project and provided to the validation consultant regularly so the details can be checked and any rectification of the record keeping process can occur in a timely manner.

An example template for the register is provided in Appendix D.

7.7.2 Imported Materials Register

The remediation contractor (and/or their nominated construction contractor) is to maintain, for the duration of the project, an imported material register. This must include a register (in Microsoft Excel format) with details of each imported material type, supplier details, summary record of where the imported materials were placed on site, and importation docket numbers and a tally of quantities (separated for each import stream). Dockets for imported materials are to be provided electronically so these can be reconciled with the register.

Examples of imported materials for this project may include but would not be limited to: site preparation materials (e.g. DGB, 40/70, material to create the pavement base or piling platforms etc); clean capping or backfill material such as virgin excavated natural material (VENM); and landscaping materials such as topsoil garden mixes, mulches etc.

[15] NSW Government, (1997). *Protection of Environment Operations Act.* (referred to as POEO Act 1997)

The above information is to be provided to the validation consultant for inclusion in the validation report. The register be set up at the beginning of the project and provided to the validation consultant regularly so the details can be checked and any rectification of the record keeping process can occur in a timely manner.

An example template for the register is provided in Appendix D.

8 VALIDATION PLAN

Validation is necessary to demonstrate that remedial measures described in the RAP have been successful and that the site is suitable for the intended land use. The sampling program for the validation is outlined in Section 8.1. This is the minimum requirement based on the remedial strategies provided. Additional validation sampling may be required based on observations made during remediation.

8.1 Validation Sampling and Documentation

The validation requirements for the site are outlined below:

8.1.1 Validation of Excavation of Contamination Soil – Non-Asbestos Impacted

Table 8-1: Validation Requirements – Non-Asbestos Impacted Soil

Aspect	Sampling	Analysis	Observations and Documentation
Validation sampling (non-asbestos) for removal of contaminated soil, excavation base	Sampling density to meet minimum number recommended in the NSW EPA Sampling design part 1 – application (2022)[16] for larger areas from say 400m^2 upwards. Or for smaller areas, the higher density of either: - An 8m by 8m square grid plan; or - At least two judgmental locations for areas that are less than 8m by 8m in area.	Contaminant of concern to be identify as part of pre-remediation (supplementary) investigation process.	Observations to be recorded by the validation consultant to confirm soil removal is acceptable. Observations to be recorded by the validation consultant to document fill/soil lithology on the base and walls of the excavation. A sample location plan is to be prepared by the validation consultant, documenting the sample locations and final extent of the remediation area. Photographs to be taken. Samples to be screened using PID. Observations of staining and odour to be recorded. Disposal dockets to be retained by the remediation contractor and forwarded to validation consultant for inclusion in the validation report.
Validation sampling (non-asbestos) for removal of	One sample per exposed fill profile along the/each excavation wall (minimum one sample per 5m lineal), and per vertical metre where a single fill	As above	As above

[16] NSW EPA, (2022). *Sampling design part 1 – application* (referred to as NSW EPA Sampling design guidelines Part 1).

Aspect	Sampling	Analysis	Observations and Documentation
contaminated soil, excavation walls	profile extends beyond 1m deep. One sample per exposed natural soil profile along the/each excavation wall (minimum one sample per 5m lineal), and per vertical metre where a single profile extends beyond 1m deep.		

8.1.2 Validation of Excavation of Contamination Fill – Asbestos Impacted

Table 8-2: Validation Requirements – Asbestos Impacted Fill

Aspect	Sampling	Analysis	Observations and Documentation
Validation sampling for asbestos contaminated fill following removal of fill, base of excavation	Sampling to occur on a 5m by 5m square grid. Or, for areas smaller than 5m by 5m, a minimum of two judgmental locations in the area. Where the asbestos impacted is associated with bonded ACM, sampling is to included bulk sampling (10L field screening) for asbestos, unless the excavation is terminated in natural soil. Where natural soil is confirmed, a visual surface clearance for asbestos is sufficient. For AF/FA impacts, sampling (500ml NEPM 2013 method) is required. Bulk (10L) field screening is not proposed in this instance.	Any ACM to be analysed for asbestos. For AF/FA impacts, analysis of samples for asbestos (500ml NEPM 2013 method) is required.	Observations to be recorded by the validation consultant to document fill/soil lithology on the base and walls of the excavation. Each bulk sample is to be weighed (in kg) using an accurate scale to two decimal places. A sample location plan is to be prepared by the validation consultant, documenting the sample locations and final extent of the remediation area. Photographs are to be taken by the validation consultant. LAA to provide asbestos surface clearance for the base and walls of the remedial excavation. Air monitoring results to be reviewed (where air monitoring is specified under the AMP). Disposal dockets to be retained by the remediation contractor and forwarded to validation consultant for inclusion in the validation report.
Validation sampling asbestos contaminated fill following removal	One sample per exposed fill profile along the/each excavation wall (minimum one sample per 5m lineal), and per vertical metre where a single fill	As above	As above

Aspect	Sampling	Analysis	Observations and Documentation
of fill, exposed walls of excavation	profile extends beyond 1m deep. One sample per exposed natural soil profile along the/each excavation wall (minimum one sample per 5m lineal), and per vertical metre where a single profile extends beyond 1m deep. Where the asbestos impacted is associated with bonded ACM, sampling is to included bulk sampling (10L field screening) for asbestos, excluding natural soil. Where natural soil is confirmed, a visual surface clearance for asbestos is sufficient. For AF/FA impacts, sampling (500ml NEPM 2013 method) is required. Bulk (10L) field screening is not proposed in this instance. Sampling is to include fill and natural soil.		

8.1.3 Validation of Cap and Containment

Table 8-3: Validation Requirements – Capping

Aspect	Sampling	Analysis	Observations and Documentation
Survey of site levels.	NA	NA	Remediation contractor to obtain the survey as required in Section 7. It is also expected that the remediation contractor or their nominated construction contractor will provide as-built drawings for the project which document the capping layers.
Inspections.	NA	NA	Validation consultant to carry out inspections to document the installation of the cap. Key hold points for inspections include: - Geotextile installation; - During importation of materials used to construct the cap; and - Finished surface levels. A photographic record is to be maintained by the remediation contractor and validation consultant.

Aspect	Sampling	Analysis	Observations and Documentation
Validation of imported materials.	As indicated below in Section 8.1.4	As indicated below in Section 8.1.4.	As indicated below in Section 8.1.4

8.1.4 Imported Materials

The table below outlines the validation requirements for material imported onto the site:

Table 8-4: Validation Requirements – Imported Materials

Aspect	Sampling	Analysis	Observations and Documentation
Imported VENM backfill (if required)	Minimum of three samples per source	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), TRHs, BTEX, PAHs, OCPs, PCBs and asbestos (500ml NEPM 2013 analysis). Additional analysis may be required depending on the site history of the source property.	**Remediation contractor** to supply existing VENM documentation/report (report to be prepared in accordance with the NSW EPA waste classification reporting requirements). A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Material is to be inspected upon importation by the **validation consultant** to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Photographic documentation and an inspection log are to be maintained. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing VENM documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the Validation Assessment Criteria (VAC).
Imported engineering materials such as recycled aggregate, road base etc	Minimum of three samples per source/material type. Except for coarse 40/70 materials which will only be visually inspected for FCF and other indicators of contamination.	Heavy metals (as above), TRHs, BTEX, PAHs, OCPs, PCBs and asbestos (500ml quantification).	**Remediation contractor** to provide product specification and documentation to confirm the material has been classified with reference to a relevant Resource Recovery Order/Exemption. A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Review of the facility's EPL, where applicable.

Aspect	Sampling	Analysis	Observations and Documentation
Excavated Natural Material (ENM)	ENM testing must meet the specification within the ENM Order. If the analysis is not compliant, the validation consultant must carry out an ENM assessment and prepare a report in accordance with the ENM Order/Exemption prior to material being imported.	As required in the ENM Order.	Material is to be inspected by the **validation consultant** upon importation to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the VAC.
Imported engineering materials comprising only natural quarried products.	At the validation consultant's discretion based on robustness of supplier documentation.	At the validation consultant's discretion based on robustness of supplier documentation.	**Remediation contractor** to provide documentation from the supplier confirming the material is a product comprising only natural quarried material. A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Review of the quarry's EPL. Material is to be inspected by the **validation consultant** upon importation to confirm it is free of anthropogenic materials, visible and olfactory indicators of contamination, and is consistent with documentation. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the VAC.
Imported garden mix/turf underlay/topsoil	Minimum of three samples per source.	Heavy metals (as above), TRHs, BTEX, PAHs, OCPs, PCBs and asbestos (500ml). Analysis of mulch can be limited to	**Remediation contractor** to provide documentation from the supplier confirming the product specification. This must include a description of the Australian Standard or other relevant product specification under which the material is produced, and the components. A hold point remains until the **validation**

Aspect	Sampling	Analysis	Observations and Documentation
		asbestos (500ml) and visual observations to confirm there are no anthropogenic materials.	**consultant** approves the material for importation or advises on the next steps. Material is to be inspected by the **validation consultant** upon importation to confirm it is free of anthropogenic materials, visible and olfactory indicators of contamination, and is consistent with documentation. The validation consultant is to review any existing/available analysis results for the materials. A minimum of one batch for each imported material type (from each individual supplier) must be inspected by the validation consultant. This inspection must be repeated for each material type from each supplier, a minimum of once per month thereafter. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the VAC.
Mulch	Minimum of three samples per source.	Asbestos (500ml).	As above.

8.2 Validation Assessment Criteria and Data Assessment

The VAC to be adopted for the validation assessment are outlined in the table below:

Table 8-5: Validation Assessment Criteria (VAC)

Validation Aspect	VAC
Validations of excavations following fill removal.	**For asbestos:** Quantitative – Asbestos/ACM concentrations in bulk soil validation samples collected from the excavation walls must be below 0.01%w/w. This VAC is based on the HSL-A criterion in Schedule B1 of NEPM 2013. Where asbestos as AF/FA is being validated, concentrations are to be below 0.001%w/w. We consider these criteria are reasonable and suitably protective of the receptors in the primary school land use setting. Qualitative/visual – base and walls of excavation must be free of visible FCF/ACM, verified by the LAA asbestos clearance certificate. The base of the excavation must also be confirmed to include only natural soil or bedrock (no remnant fill or debris).

	For all other CoC: Concentration below the appropriate SAC for land use type A 'residential with accessible soils' land scenario outlined in Schedule B1 of the NEPM 2013.
Imported materials	The validation of imported materials is two-fold: the validation is to demonstrate that the imported material will not pose a risk in the context of the proposed land use; and also, that the imported material meets the requirements where applicable under a relevant resource recovery exemption/order under which they are produced ENM and recycled materials are to meet the criteria of the relevant exemption/order under which they are produced. Analytical results for VENM and other imported materials will need to be consistent with expectations for those materials. For VENM, it is expected that: - Heavy metal concentrations are to be less than the most conservative Added Contaminant Limit (ACL) concentrations for an 'urban residential and public open space' (URPOS) exposure setting presented in Schedule B1 of the NEPM 2013, except for lead which should be nominally less than 100mg/kg; and - Organic compounds are to be less than the laboratory PQLs and asbestos to be absent. The lower lead VAC nominated above is based on the fact that the lead ACL is quite high and is not consistent with expectations for natural material in the area. The concentration of 100mg/kg is nominal and is considered to be protective of human health and the environment in the proposed land use setting. Whilst a lead concentration of 100mg/kg may still be relatively high for natural material from some areas, it is well below the Health Investigation Level (HIL-A) criteria applicable to sensitive land uses and is deemed to be appropriate considering the other validation requirements for imported materials. All materials imported onto the site must also be adequately assessed as being appropriate for the final use of the site. A risk-based assessment approach is to be adopted with regards to the tier 1 screening criteria presented in Schedule B1 of NEPM 2013, consistent with the approach taken for the DSI. Aesthetics: all imported materials are to be free of staining and odours.

Laboratory data are to be assessed as above or below the VAC. Statistical analysis is not proposed. Notwithstanding, statistical analysis can be applied by the validation consultant if deemed appropriate and if the analysis occurs with regards to the relevant guidelines.

8.3 Validation Sampling, Analysis and Quality Plan (SAQP)

Data Quality Objectives (DQOs) and Data Quality Indicators (DQIs) should be clearly outlined and assessed as part of the validation process. A framework for the DQO and DQI process is outlined below and should be reflected in the validation report. These relate to the remediation only and it is anticipated that the SAQP(s) for the pre-remediation (supplementary) investigation(s) will include this information in the contexed of those works.

DQOs have been broadly established for the validation with regards to the seven-step process outlined NEPM (2013). The seven steps include the following which are detailed further in the following subsections:

- State the problem;
- Identify the decisions/goal of the study;
- Identify information inputs;
- Define the study boundary;
- Develop the analytical approach/decision rule;
- Specify the performance/acceptance criteria; and
- Optimise the design for obtaining the data.

DQIs are to be assessed based on field and laboratory considerations for precision, accuracy, representativeness, completeness and comparability.

8.3.1 Step 1 - State the Problem

Validation data is required to demonstrate that the remediation is successful and that the site is suitable for the proposed land use described in Section 1.1.

8.3.2 Step 2 - Identify the Decisions of the Study

The remediation goal, aims and objectives are defined in Section 2.1. The decisions to be made reflect these objectives and are as follows:

- Were the relevant reports prepared prior to commencement of the remediation (e.g. supplementary investigation reports, revised/addendum RAP where applicable, waste classification, AMP, etc)?
- Was the remediation undertaken in accordance with the RAP and any supplementary reports?
- If there were any deviations, what were these and how do they impact the outcome of the validation?
- Are any of the validation results above the VAC and what is the implication of this in relation to the remediation/validation and future site management?
- Is the site suitable for the proposed development from a contamination viewpoint?

8.3.3 Step 3 - Identify Information Inputs

The primary information inputs required to address the decisions outlined in Step 2 include the following:

- Existing relevant data from previous reports;
- Site information, including site observations, inspections, asbestos clearance certificates, waste and imported materials registers;
- Validation sampling and laboratory analysis results for the remedial excavation and for imported materials;
- Laboratory analysis (as required); and
- Field and laboratory QA/QC data.

8.3.4 Step 4 - Define the Study Boundary

The remediation and validation will be confined to the site boundaries as shown in Figure 2 in Appendix A. The final remediation extent will be confirmed via the pre-remediation (supplementary) investigation and validation process.

8.3.5 Step 5 - Develop an Analytical Approach (or Decision Rule)

8.3.5.1 VAC

The validation data will be assessed in accordance with the requirements outlined in Section 8.1.

8.3.5.2 Field and Laboratory QA/QC

Field QA/QC is required for imported materials. This is to include:

- Analysis of inter-laboratory duplicates (5% frequency) and intra-laboratory duplicates (5% frequency), analysed for the same analytical suite as the primary samples;
- Trip blank samples (one per batch/day of sampling), analysed for the same analytical suite as the primary samples excluding asbestos;
- Trip spike samples (one per batch/day of sampling), analysed for BTEX, only where samples within that batch have been scheduled for analysis of TRH or BTEX; and
- Rinsate samples (one per batch), analysed for the same analytical suite as the primary samples excluding asbestos, only where re-usable sampling equipment is utilised.

DQIs for field and laboratory QA/QC samples are defined below:

Field Duplicates

Acceptable targets for precision of field duplicates will be 30% or less, consistent with NEPM (2013). RPD failures will be considered qualitatively on a case-by-case basis taking into account factors such as the concentrations used to calculate the RPD (i.e. RPD exceedance where concentrations are close to the PQL are typically not as significant as those where concentrations are reported at least five or 10 times the PQL), sample type, collection methods and the specific analyte where the RPD exceedance was reported.

Trip Blanks

Acceptable targets for trip blank samples will be less than the PQL.

Trip Spikes

Acceptable targets for trip spike samples will be 70% to 130%.

Laboratory QA/QC

The suitability of the laboratory data will be assessed against the laboratory QA/QC criteria. These criteria are developed and implemented in accordance with the laboratory's NATA accreditation and align with the acceptable limits for QA/QC samples as outlined in NEPM (2013) and other relevant guidelines.

A summary of the typical limits is provided below:

RPDs

- Results that are <5 times the PQL, any RPD is acceptable; and
- Results >5 times the PQL, RPDs between 0-50% are acceptable.

Laboratory Control Samples (LCS) and Matrix Spikes

- 70-130% recovery acceptable for metals and inorganics; and
- 60-140% recovery acceptable for organics.

Surrogate Spikes

- 60-140% recovery acceptable for general organics.

Method Blanks

- All results less than PQL.

In the event that acceptable limits are not met by the laboratory analysis, other lines of evidence will be reviewed (e.g. field observations of samples, preservation, handling etc) and, where required, consultation with the laboratory is to be undertaken in an effort to establish the cause of the non-conformance. Where uncertainty exists, the validation consultant is to adopt the most conservative concentration reported.

8.3.5.3 Appropriateness of PQLs

The PQLs of the analytical methods are to be considered in relation to the VAC to confirm that the PQLs are less than the VAC. In cases where the PQLs are greater than the VAC, a discussion of this is to be provided.

8.3.6 Step 6 – Specify Limits on Decision Errors

To limit the potential for decision errors, a range of quality assurance processes are adopted. A quantitative assessment of the potential for false positives and false negatives in the analytical results is to be undertaken with reference to Schedule B(3) of NEPM (2013) using the data quality assurance information collected. Data will be assessed as above or below the VAC. Statistical analysis is not proposed, therefore there have been no limits on decision errors set for validation purposes.

8.3.7 Step 7 - Optimise the Design for Obtaining Data

The design is to be optimised via the collection of validation data to demonstrate the success of the key aspects of the remediation. Data collection will be via various methods including inspections and sampling.

The proposed sampling plan for the validation is described in Section 8.1.

8.4 Validation Report

As part of the site validation process, a site validation report will be prepared by the validation consultant. The report will present the results of the validation assessment and will be prepared in accordance with the Consultants Reporting Guidelines.

The need for a post-remediation (i.e. long-term) AMP or EMP must be assessed based on the outcome of the validation.

9 CONTINGENCY PLAN

The contingency plan for the project in the context of the site remediation is provided in the following sub-sections:

9.1 Unexpected Finds

Residual hazards that may exist at the site would generally be expected to be detectable through visual or olfactory means. At this site, these types of hazards may include stained or odorous soils, or buried infrastructure such as underground tanks etc. The procedure to be followed in the event of an unexpected find is presented below:

- In the event of an unexpected find, all work in the immediate vicinity should cease and the remediation contractor must contact the validation consultant and the client/project manager;
- Temporary barricades should be erected to isolate the area from access to workers;
- The validation consultant is to attend the site to inspect the find;
- The validation consultant is to adequately characterise the contamination and provide advice in relation to site management and remediation. In the event that remediation differs from that outlined in this RAP, an addendum RAP must be prepared in consultation with the project stakeholders and submitted to the determining authority; and
- Contamination is to be remediated and validated in accordance with the advice provided, and the results are to be included in the validation report.

9.2 Validation Failure for Excavate and dispose

In the event of a validation failure during excavate and dispose, additional material is to be 'chased out' from the area that failed and disposed off-site, then the area re-validated. Due to the potential cost implications for disposal of additional materials, the client and project manager must be informed in the event of a validation failure, an estimate of the additional waste quantity must be provided, and approval must be sought from the client/project manager prior to any off-site disposal of waste.

9.3 Importation Failure for VENM or other Imported Materials

Where material to be imported onto the site does not meet the importation VAC, the material should not be imported. Alternative material must be sourced that meets the importation requirements.

9.4 Remediation Strategy Changes

Any material change to the proposed remediation strategy will require an addendum to or a revision of the RAP. This must not occur without appropriate consultation and approvals from the client/determining authority and other relevant parties.

10 SITE MANAGEMENT PLAN FOR REMEDIATION WORKS

The information outlined in this section of the RAP is for the remediation work only. The client and project manager must also make reference to the REF for specific site management requirements for the overall development of the site.

10.1 Asbestos Management Plan (AMP)

A construction/remediation-phase AMP must be prepared for the site and implemented for the site remediation and development works. The AMP must include the minimum PPE, WHS and other requirements outlined in the documents published by Safe Work Australia, WorkCover Authority of NSW, National Occupational Health and Safety Commission, and other relevant authorities as applicable. An asbestos removal control plan (ARCP) should be prepared by the remediation contractor and issued to SafeWork, and notification of asbestos removal is to be provided to SafeWork at least five days prior to commencement of works.

The client and project team must consider the need for a post-remediation AMP for the site to fulfil the obligations under Clause 429 of the Work Health and Safety Regulation (2017). The need for a post-remediation AMP must be assessed based on the outcome of the validation.

10.2 Interim Site Management

Interim site management (i.e. prior to construction) is to occur in accordance with the interim AMP (as recommended in the DSI).

10.3 Project Contacts and Signage

Emergency procedures and contact telephone numbers should be displayed in a prominent position at the site entrance gate and within the main site working areas. These details are to be confirmed when the various roles and responsibilities are assigned.

A sign displaying the contact details of the remediation contractor and site manager (if different from the remediation contractor) must be displayed on the site adjacent to the site access, including a contact telephone number that is available 24 hours a day, 7 days a week. The sign must be clearly legible from the street and be displayed for the duration of the remediation works.

10.4 Security

Appropriate fencing should be installed as required to secure the site and to isolate the remediation areas. Warning signs should be erected, which outline the PPE required for remediation work.

10.5 Timing and Sequencing of Remediation Works

The anticipated sequence of remediation works is outlined at the beginning of Section 7 of this RAP. Remediation and validation activities, including the data gap investigation, will occur concurrently with the demolition/development works to facilitate the implementation of the requirements under this RAP.

10.6 Site Soil and Water Management Plan

The remediation contractor should prepare a detailed soil and water management plan prior to the commencement of site works and this must consider the requirements of the AMP. Silt fences should be used to control the surface water runoff at all appropriate locations of the site and appropriate measures are to be implemented to manage soil/water disturbance to the satisfaction of the determining authority.

All stockpiled materials should be placed within an erosion containment boundary with silt fences and sandbags employed to limit sediment movement. The containment area should be located away from drainage lines/low-points, gutters, stormwater pits and inlets and the site boundary. No liquid waste or runoff should be discharged to the stormwater or sewerage system without the approval of the appropriate authorities.

10.7 Noise and Vibration Control Plan

The guidelines for minimisation of noise on construction sites outlined in AS-2460 (2002)[17] should be adopted. Noise producing machinery and equipment should only be operated between the hours approved by the determining authority/any additional planning requirements).

All practicable measures should be taken to reduce the generation of noise and vibration to within acceptable limits. In the event that short-term noisy operations are necessary, and where these are likely to affect residences, notifications should be provided to the relevant authorities and the residents by the project manager, specifying the expected duration of the noisy works.

10.8 Dust Control Plan

All practicable measures should be taken to reduce dust emanating from the site. Factors that contribute to dust production are:

- Wind over a cleared surface;
- Wind over stockpiled material; and
- Movement of machinery in unpaved areas.

Visible dust should not be present at the site boundary. Measures to minimise the potential for dust generation include:

- Use of water sprays on unsealed or exposed soil surfaces;

[17] Australian Standard, (2002). *AS2460: Acoustics - Measurement of the Reverberation Time in Rooms.*

- Covering of stockpiled materials and excavation faces (particularly during periods of site inactivity and/or during windy conditions) or alternatively the erection of hessian fences around stockpiled soil or large exposed areas of soil;
- Establishment of dust screens consisting of a 2m high shade cloth or similar material secured to a chain wire fence;
- Maintenance of dust control measures to keep the facilities in good operating condition;
- Stopping work during strong winds;
- Loading or unloading of dry soil as close as possible to stockpiles to prevent spreading of loose material around the development area; and
- Geofabric could be placed over exposed soils in the event that excavation is staged.

If stockpiles are to remain on-site or soil remains exposed for a period of longer than several days, dust monitoring should be undertaken at the site. If excessive dust is generated all site activities should cease until either wind conditions are more acceptable or a revised method of excavation/remediation is developed.

Dust is also produced during the transfer of material to and from the site. All material should be covered during transport and should be properly disposed of on delivery. No material is to be left in an exposed, un-monitored condition.

All equipment and machinery should be brushed or washed down before leaving the site to limit dust and sediment movement off-site. In the event of prolonged rain and lack of paved areas all vehicles should be washed down prior to exit from the site, and any soil or dirt on the wheels of the vehicles removed. Water used to clean the vehicles should be collected and tested prior to appropriate disposal under the relevant waste classification guidelines.

Reference is also to be made to the AMP in this regard.

10.9 Dewatering

Temporary dewatering is not anticipated to be required as part of the scope of remediation works. If a rain event occurs during the construction, this water should be managed appropriately on site in accordance with the remediation contractor's soil and water management plan. This water should not be pumped to stormwater or sewer unless a prior application is made and this is approved by the relevant authorities.

10.10 Air Monitoring

Air monitoring details must be outlined as part of the AMP to be prepared for the construction/remediation works. Air monitoring must only be carried out by personnel registered and accredited by NATA (National Association of Testing Authorities). Filter analysis must only be carried out within a NATA certified laboratory. The monitoring results must conform to the requirements of the NOHSC Guidance note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition [NOHSC:3003 (2005)].

A monitoring program will be used to assess whether the control procedures being applied are satisfactory and that criteria for airborne asbestos fibre levels are not being exceeded. The following levels will be used as action criteria during the air monitoring:

- <0.01 Fibres/ml: Work procedures deemed to be successful;
- 0.01 to 0.02 Fibres/ml: Inspection of the site and review of procedures; and
- >0.02 Fibres/ml: Stop work, inspection of the site, review of procedures, clean-up, rectification works where required and notify the relevant regulator.

10.11 Odour Control Plan

All activities undertaken at the site should be completed in a manner that minimises emissions of smoke, fumes and vapour into the atmosphere and any odours arising from the works or stockpiled material should be controlled. Control measures may include:

- Maintenance of construction equipment so that exhaust emissions comply with the Clean Air Regulations issued under the POEO Act 1997;
- Demolition materials and other combustible waste should not be burnt on site;
- The spraying of a suitable proprietary product to suppress any odours that may be generated by excavated materials; and
- Use of protective covers (e.g. builder's plastic).

All practicable measures should be taken to reduce fugitive emissions emanating from the site so that associated odours do not constitute a nuisance and that the ambient air quality is not adversely impacted. The following odour management plan should be implemented to limit the exposure of site personnel and surrounding residents to unpleasant odours:

- Excavation and stockpiling of material should be scheduled during periods with low winds if possible;
- A suitable proprietary product could be sprayed on material during excavation and following stockpiling to reduce odours (subject to an appropriate assessment of the product by the validation consultant);
- All complaints from workers and neighbours should be logged and a response provided. Work should be rescheduled as necessary to minimise odour problems;
- The site foreman should consider the following odour control measures as outlined in NEPM:
  - reduce the exposed surface of the odorous materials;
  - time excavation activities to reduce off-site nuisance (particularly during strong winds); and
  - cover exposed excavation faces overnight or during periods of low excavation activity.
- If continued complaints are received, alternative odour management strategies should be considered and implemented.

10.12 WHS Plan

A site specific WHS plan must be prepared by the remediation contractor for all work to be undertaken at the site. The WHS plan should meet all the requirements outlined in SafeWork NSW WHS regulations.

As a minimum requirement, personnel must wear appropriate protective clothing, including long sleeve shirts, long trousers, steel cap boots and hard hats. Additional asbestos-related PPE will be required and this will be specified in the AMP. Washroom and lunchroom facilities should also be provided to allow workers to remove potential contamination from their hands and clothing prior to eating or drinking.

10.13 Waste Management

Prior to commencement of remedial works and excavation for the proposed development, the remediation contractor should develop a waste management plan to minimise the amount of waste produced from the site and promote recycling of building materials such as concrete pavement to the extent practicable.

10.14 Incident Management Contingency

The validation consultant should be contacted if any unexpected conditions are encountered at the site. This should enable the scope of remedial/validation works to be adjusted as required. Similarly, if any incident occurs at the site (e.g. a fuel spill during refuelling of machinery), the validation consultant should be advised to assess potential impacts on contamination conditions and the remediation/validation timetable.

10.15 Hours of Operation

Hours of operation should be between those approved by the determining authority under the development approval process.

10.16 Community Consultation and Complaints

The remediation contractor should provide details for managing community consultation and complaints within their construction plans.

11 CONCLUSIONS

Previous investigations have not identified contamination at the site that triggered a need for remediation. However, asbestos (as AF/FA) was detected in fill soils at one location (although the concentration of asbestos was below the health-based SAC) and the DSI identified various data gaps due in part to access constraints and guideline requirements to increase the soil sampling density where asbestos is known to exist in soil. Therefore, this RAP has been prepared to outline contingencies for remediation and requirements for pre-remediation (supplementary) investigation.

The supplementary investigation will be used to establish whether contamination is present that requires remediation and implementation of the contingencies outlined in this RAP. The remedial contingencies in this RAP include 'excavation and off-site disposal' of contaminated soil, or 'cap and containment' of contaminated soil. Depending on the nature and extent of such remediation, we consider that the 'excavation and off-site disposal' option would most likely be applicable for small quantities of contaminated soils, and the 'cap and containment' option would be applicable for larger quantities of contaminated soils. Capping and containing contaminated soils on site would trigger a requirement for long-term management of the site via an EMP.

The RAP also includes validation requirements for imported materials which apply for the project.

We are of the opinion that the site can be made suitable for the proposed development via the implementation of this RAP.

A validation report is to be prepared on completion of any remediation/validation activities and submitted to the determining authority to demonstrate that the site is suitable for the proposed use following completion of remediation/validation. If contaminated material is capped on site (e.g. if the capping contingency needs to be implemented), a long-term EMP will also be prepared as part of the validation documentation.

The RAP has met the objectives outlined in Section 2.1.

11.1 Remediation Category

JKE has undertaken a preliminary assessment of the remediation Category with regards to the Category 1 remediation triggers in Clause 4.8 of SEPP Resilience and Hazards 2021. We consider that the Category 1 triggers have not been met and therefore we have assessed that the remediation falls within Category 2. This should be confirmed by the client's expert planner.

11.2 Regulatory Requirements

The regulatory requirements applicable for the remediation are discussed in the following table:

Table 11-1: Regulatory Requirement

Guideline / Legislation / Policy	Applicability
SEPP Resilience and Hazards 2021	As noted in the DSI, the remediation category should be confirmed by the client's expert planner. The client's expert planner is to assess the remedial requirements and any implications of Georges River Council Contaminated Land Policy (where present), and provide their planning advice in relation to the remediation category and approvals/planning pathway. Any relevant notices for remediation and/or completion of remediation are to be issued/supplied where required and in accordance with SEPP Resilience and Hazards 2021.
POEO Act 1997 (and associated regulations)	Section 143 of the POEO Act 1997 states that if waste is transported to a place that cannot lawfully be used as a waste facility for that waste, then the transporter and owner of the waste are each guilty of an offence. The transporter and owner of the waste have a duty to ensure that the waste is disposed of in an appropriate manner. Appropriate waste tracking must occur for all waste that is disposed off-site, where required. Activities must be carried out in a manner which does not result in the pollution of waters.
POEO (Waste) Regulation 2014	Part 7 of the POEO Waste Regulation 2014 set outs the requirements for the transportation and management of asbestos waste and Clause 79 of the POEO Waste Regulation requires waste transporters to provide information to the NSW EPA regarding the movement of any load in NSW of more than 10 square meters of asbestos sheeting, or 100 kilograms of asbestos waste. To fulfil these legal obligations, asbestos waste transporters must use the NSW EPA-endorsed asbestos waste tracking system. Appropriate waste tracking is required for all waste that is disposed off-site, in accordance with the regulations.
Work Health and Safety Regulation (2017) SafeWork NSW Code of Practice: How to manage and control asbestos in the workplace (2022)	Sites with asbestos become a 'workplace' when work is carried out there and require a register and AMP. Appropriate SafeWork NSW notification will be required for licensed asbestos removal works or handling. These requirements must be evaluated following the hazardous building materials survey and on completion of the additional soil sampling associated with the pre-remediation DGI.
NSW EPA Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997	The requirement to notify the NSW EPA should be assessed as part of the site validation process.

12 LIMITATIONS

The report limitations are outlined below:

- JKE accepts no responsibility for any unidentified contamination issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- Previous use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during construction work;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the JKE proposal; and terms of contract between JKE and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The investigation and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, JKE has not undertaken any verification process, except where specifically stated in the report;
- JKE has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination, except where specifically stated in the report;
- JKE accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- JKE have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or landuse. JKE should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa; and
- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose.

Important Information About This Report

These notes have been prepared by JKE to assist with the interpretation of this report.

The Report is based on a Unique Set of Project Specific Factors:
This report has been prepared in response to specific project requirements as stated in the JKE proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- The proposed land use is altered;
- The defined subject site is increased or sub-divided;
- The proposed development details including size, configuration, location, orientation of the structures or landscaped areas are modified;
- The proposed development levels are altered, eg addition of basement levels; or
- Ownership of the site changes.

JKE will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the assessment. If the subject site is sold, ownership of the assessment report should be transferred by JKE to the new site owners who will be informed of the conditions and limitations under which the assessment was undertaken. No person should apply an assessment for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions:
Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (e.g. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater contaminant concentrations may also vary over time through contaminant migration, natural attenuation of organic contaminants, ongoing contaminating activities and placement or removal of fill material. The conclusions of an assessment report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Report is based on Professional Interpretations of Factual Data:
Site assessments identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on the proposed development and appropriate remediation measures.

Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Investigation Limitations:
Although information provided by an investigation can reduce exposure to the risk of the presence of contamination, no investigation can eliminate the risk. Even a rigorous professional assessment may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

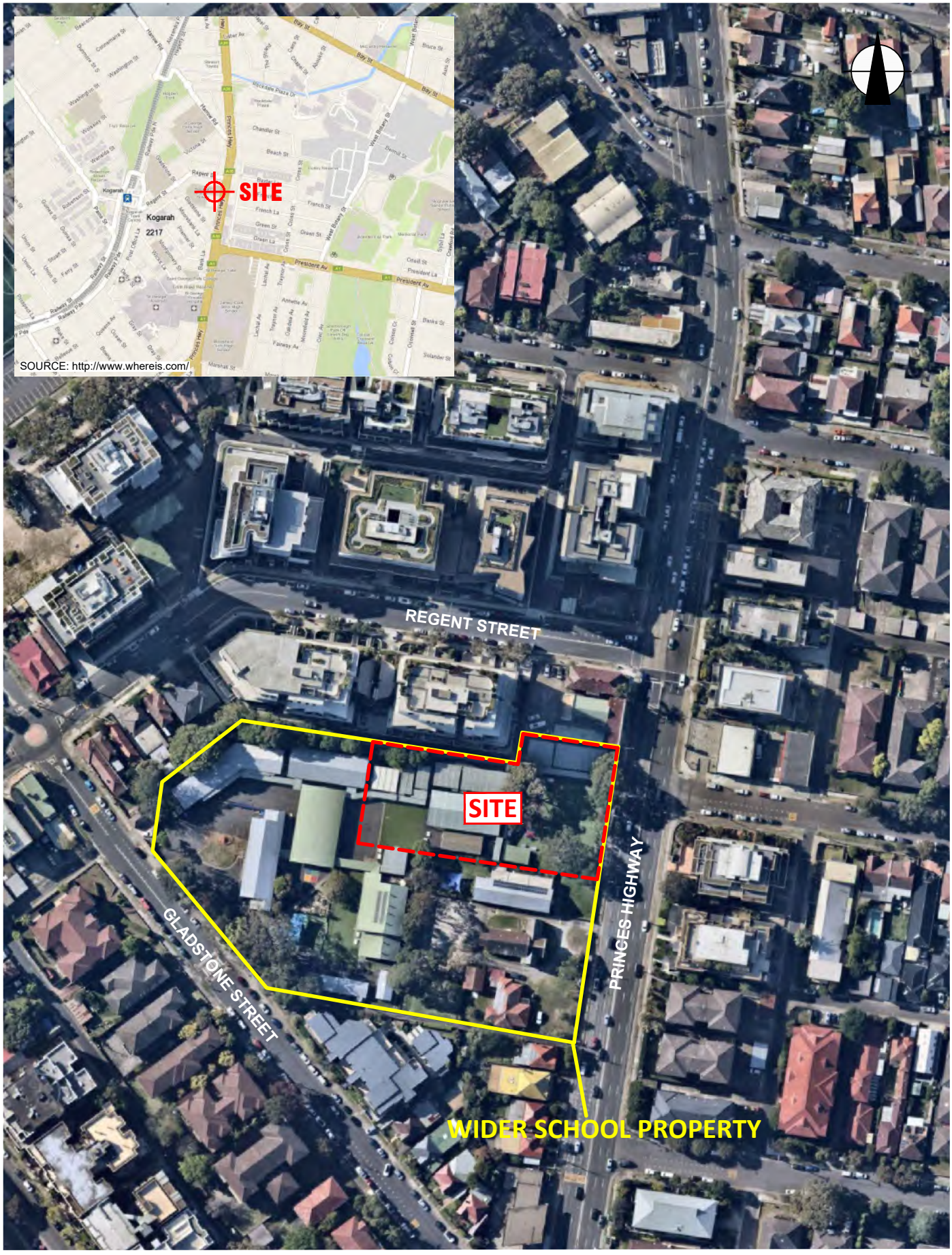
Misinterpretation of Reports by Design Professionals:
Costly problems can occur when design professionals develop plans based on misinterpretation of the report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Logs Should not be Separated from the Report:
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the rest of the report to obtain a proper understanding of the assessment. Please note that logs with the 'Environmental Log' header are not suitable for geotechnical purposes as they have not been peer reviewed by a Senior Geotechnical Engineer.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete report should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

Read Responsibility Clauses Closely:
As the investigation is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the report, and you are encouraged to read them closely.

Appendix A: Report Figures



AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the Environmental report.

Title: **SITE LOCATION PLAN**

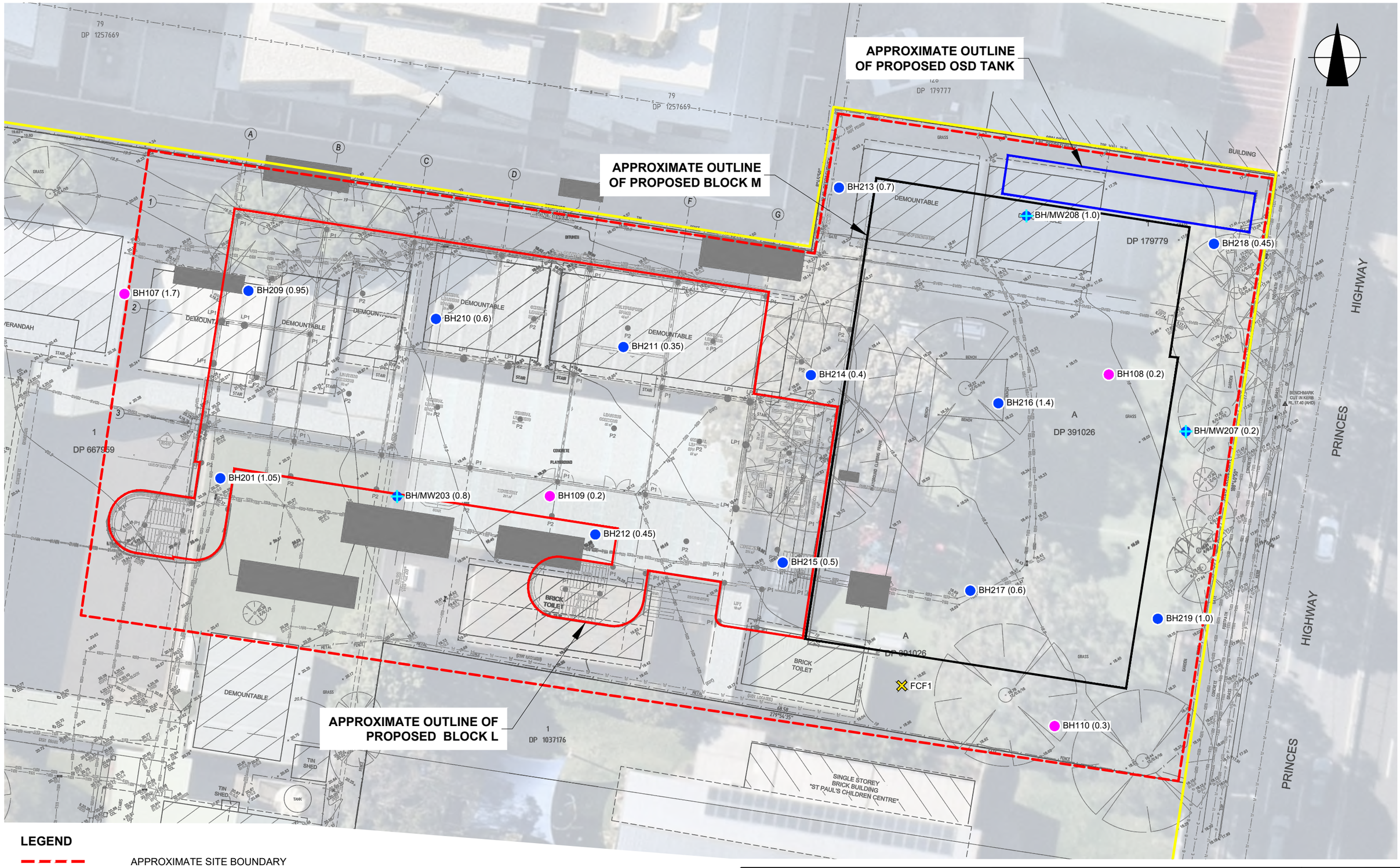
Location: 24B GLADSTONE STREET, KOGARAH, NSW

Project No: E32976BT2

Figure No: 1

JKEnvironments

PLOT DATE: 4/03/2025 2:32:32 PM DWG FILE: K:\5C EIS JOBS\32000'S\E32976BT KOGARAH (KPS_JCHS)\CAD\E32976BT2.DWG



LEGEND

APPROXIMATE SITE BOUNDARY	
APPROXIMATE WIDER PROPERTY BOUNDARY	
BH(Fill Depth)	JKE BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE INTRUSIVE INVESTIGATION, 2020)
BH202	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, PSI, 2025)
BH/MW203	BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, PSI 2025)
FCF(Surface)	FIBRE CEMENT FRAGMENT LOCATION, NUMBER AND DEPTH (Surface/m)

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

0 3 6 9 12 15

SCALE 1:300 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **SAMPLE LOCATION PLAN**

Location: 24B GLADSTONE STREET, KOGARAH, NSW

Project No: E32976BT2 | Figure No: 2

JKEnvironments

PLOT DATE: 4/03/2025 2:32:48 PM DWG FILE: K:\5C EIS JOBS\32000'S\E32976BT KOGARAH (KPS_JCHS)\CAD\E32976BT2.DWG

BH208	0.45-0.55m
C_PAH	4.9mg/kg
MW208	
Copper	2µg/L
Zinc	71µg/L
Phenanthrene	0.9µg/L
Anthracene	0.2µg/L
Fluoranthene	1.2µg/L
Benzo(a)pyrene	0.4µg/L

BH210	0.05-0.1m
TRH F3	370mg/kg

BH211	0.2-0.3m
C_PAH	5mg/kg

BH209	0-0.1m
TRH F3	440mg/kg

BH214	0.3-0.4m
Copper	260mg/kg

BH203	0.1-0.2m
AF/FA Detected	
TRH F3	460mg/kg

APPROXIMATE OUTLINE OF PROPOSED OSD TANK

APPROXIMATE OUTLINE OF PROPOSED BLOCK M

APPROXIMATE OUTLINE OF PROPOSED BLOCK L

BH213 (0.7)
BH/MW208 (1.0)
BH218 (0.45)
BH107 (1.7)
BH209 (0.95)
BH210 (0.6)
BH211 (0.35)
BH214 (0.4)
BH108 (0.2)
BH216 (1.4)
BH/MW207 (0.2)
BH201 (1.05)
BH/MW203 (0.8)
BH109 (0.2)
BH212 (0.45)
BH215 (0.5)
BH217 (0.6)
BH219 (1.0)
FCF1
BH110 (0.3)

DP 1257669
DP 179777
DP 179779
DP 391026
DP 667959
DP 1037176

HIGHWAY
PRINCES

LEGEND

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE WIDER PROPERTY BOUNDARY
- BH(Fill Depth) — JKE BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE INTRUSIVE INVESTIGATION, 2020)
- BH202 — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, PSI, 2025)
- BH/MW203 — BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, PSI 2025)
- FCF(Surface) — FIBRE CEMENT FRAGMENT LOCATION, NUMBER AND DEPTH (Surface/m)

SAMPLE ID	DEPTH (metres)
CHEMICAL	CONCENTRATION

SOIL/SURFACE SAMPLE EXCEEDANCE

SAMPLE ID	-
CHEMICAL	CONCENTRATION (µg/L)

GROUNDWATER SAMPLE EXCEEDANCE

- SOIL/SURFACE CONTAMINATION ABOVE SAC FOR HUMAN HEALTH RISK
- SOIL/SURFACE CONTAMINATION ABOVE SAC FOR ECOLOGICAL RISK
- GROUNDWATER CONTAMINATION ABOVE SAC
- ASBESTOS DETECTED - NOT ABOVE SAC

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

0 3 6 9 12 15

SCALE 1:300 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **SAC EXCEEDANCE PLAN**

Location: 24B GLADSTONE STREET, KOGARAH, NSW

Project No: E32976BT2

Figure No: 3

JKEnvironments

PLOT DATE: 4/03/2025 2:33:07 PM DWG FILE: K:\5C EIS JOBS\32000'S\E32976BT KOGARAH (KPS_JCHS)\CAD\E32976BT2.DWG

Appendix B: DSI Laboratory Summary Tables and Logs

Laboratory Summary Tables

ABBREVIATIONS AND EXPLANATIONS

Abbreviations used in the Tables:

ABC:	Ambient Background Concentration
ACM:	Asbestos Containing Material
ADWG:	AustralianDrinking Water Guidelines
AF:	Asbestos Fines
ANZG	Australian and New Zealand Guidelines
B(a)P:	Benzo(a)pyrene
CEC:	Cation Exchange Capacity
CRC:	Cooperative Research Centre
CT:	Contaminant Threshold
EILs:	Ecological Investigation Levels
ESLs:	Ecological Screening Levels
FA:	Fibrous Asbestos
GIL:	Groundwater Investigation Levels
GSW:	General Solid Waste
HILs:	Health Investigation Levels
HSLs:	Health Screening Levels
HSL-SSA:	Health Screening Level-SiteSpecific Assessment
kg/L	kilograms per litre
NA:	Not Analysed
NC:	Not Calculated
NEPM:	National Environmental Protection Measure
NHMRC:	National Health and Medical Research Council
NL:	Not Limiting
NSL:	No Set Limit
OCP:	Organochlorine Pesticides
OPP:	Organophosphorus Pesticides
PAHs:	Polycyclic Aromatic Hydrocarbons
%w/w:	weight per weight
ppm:	Parts per million
PCBs:	Polychlorinated Biphenyls
PCE:	Perchloroethylene (Tetrachloroethylene or Teterachloroethene)
pH_{KCL} :	pH of filtered 1:20, 1M KCL extract, shaken overnight
pH_{ox} :	pH of filtered 1:20 1M KCl after peroxide digestion
PQL:	Practical Quantitation Limit
RS:	Rinsate Sample
RSL:	Regional Screening Levels
RSW:	Restricted Solid Waste
SAC:	Site Assessment Criteria
SCC:	Specific Contaminant Concentration
S_{Cr}:	Chromium reducible sulfur
S_{POS}:	Peroxide oxidisable Sulfur
SSA:	Site Specific Assessment
SSHSLs:	Site Specific Health Screening Levels
TAA:	Total Actual Acidity in 1M KCL extract titrated to pH6.5
TB:	Trip Blank
TCA:	1,1,1 Trichloroethane (methyl chloroform)
TCE:	Trichloroethylene (Trichloroethene)
TCLP:	Toxicity Characteristics Leaching Procedure
TPA:	Total Potential Acidity, 1M KCL peroxide digest
TS:	Trip Spike
TRH:	Total Recoverable Hydrocarbons
TSA:	Total Sulfide Acidity (TPA-TAA)
UCL:	Upper Level Confidence Limit on Mean Value
USEPA	United States Environmental Protection Agency
VOCC:	Volatile Organic Chlorinated Compounds
WHO:	World Health Organisation

Table Specific Explanations:

HIL Tables:

- The chromium results are for Total Chromium which includes Chromium III and VI. For initial screening purposes, we have assumed that the samples contain only Chromium VI unless demonstrated otherwise by additional analysis.
- Carcinogenic PAHs is a toxicity weighted sum of analyte concentrations for a specific list of PAH compounds relative to B(a)P. It is also refered to as the B(a)P Toxic Equivalence Quotient (TEQ).
- Statistical calculations are undertaken using ProUCL (USEPA). Statistical calculation is usually undertaken using data from fill samples.

EIL/ESL Table:

Site specific ABC values for specific metals have been adopted.

Waste Classification and TCLP Table:

- Data assessed using the NSW EPA Waste Classification Guidelines, Part 1: Classifying Waste (2014).
- The assessment of Total Moderately Harmful pesticides includes: Dichlorovos, Dimethoate, Fenitrothion, Ethion, Malathion and Parathion.
- Assessment of Total Scheduled pesticides include: HBC, alpha-BHC, gamma-BHC, beta-BHC, Heptachlor, Aldrin, Heptachlor Epoxide, gamma-Chlordane, alpha-chlordane, pp-DDE, Dieldrin, Endrin, pp-DDD, pp-DDT, Endrin Aldehyde.

QA/QC Table:

- Field blank, Inter and Intra laboratory duplicate results are reported in mg/kg.
- Trip spike results are reported as percentage recovery.
- Field rinsate results are reported in µg/L.

TABLE S1
SOIL LABORATORY RESULTS COMPARED TO NEPM 2013.
HIL-A: 'Residential with garden/accessible soils; children's day care centers; preschools; and primary schools'

All data in mg/kg unless stated otherwise			HEAVY METALS								PAHs		ORGANOCHLORINE PESTICIDES (OCPs)							OP PESTICIDES (OPPs)	TOTAL PCBs	ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	Carcinogenic PAHs	HCB	Endosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos		
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	100
Site Assessment Criteria (SAC)			100	20	100	6000	300	40	400	7400	300	3	10	270	300	6	50	240	6	160	1	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																				
BH201	0.1-0.2	Fill: Silty Gravel	<4	<0.4	**15**	**43**	**6**	<0.1	**7**	**29**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH201 - [LAB_DUP]	0.1-0.2	Fill: Silty Gravel	<4	<0.4	**17**	**50**	**6**	<0.1	**9**	**28**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH201	0.9-1	Fill: Silty Sandy Clay	**6**	<0.4	**15**	**38**	**130**	**0.4**	**3**	**120**	**8.1**	**1.2**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH203	0.1-0.2	Fill: Silty Sand	<4	<0.4	**17**	**89**	**32**	<0.1	**26**	**54**	**9.5**	**1.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Detected
BH203 - [LAB_DUP]	0.1-0.2	Fill: Silty Sand	<4	<0.4	**18**	**74**	**67**	<0.1	**22**	**79**	**6.4**	**0.9**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH203 - [TRIPLICATE]	0.1-0.2	Fill: Silty Sand	<4	**0.5**	**11**	**32**	**290**	**0.4**	**6**	**400**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH203	0.3-0.4	Fill: Silty Sandy Clay	**4**	<0.4	**12**	**20**	**120**	<0.1	**4**	**84**	**5**	**0.7**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH207	0-0.1	Fill: Silty Sand	<4	<0.4	**15**	**23**	**11**	<0.1	**8**	**44**	**0.06**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH208	0-0.1	Fill: Silty Sand	**5**	<0.4	**12**	**15**	**36**	<0.1	**6**	**67**	**6.2**	**0.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH208	0.45-0.55	Fill: Silty Sandy Clay	**7**	<0.4	**22**	**11**	**84**	**0.2**	**10**	**78**	**50**	**4.9**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH209	0-0.1	Fill: Silty Sand	**4**	<0.4	**14**	**24**	**55**	**0.1**	**6**	**160**	**1.7**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH209	0.6-0.8	Fill: Sandy Clay	**5**	<0.4	**20**	<1	**23**	<0.1	**2**	**12**	**0.07**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH210	0.05-0.1	Fill: Gravel	<4	<0.4	**5**	**50**	**9**	<0.1	**29**	**25**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH210	0.55-0.6	Fill: Silty Sandy Clay	**4**	<0.4	**10**	**18**	**140**	**0.8**	**4**	**250**	**3.2**	**0.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH211	0.2-0.3	Fill: Silty Sand	**4**	**0.5**	**12**	**32**	**250**	**0.4**	**7**	**400**	**37**	**4.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH211 - [LAB_DUP]	0.2-0.3	Fill: Silty Sand	**10**	**0.5**	**13**	**36**	**240**	**0.3**	**15**	**400**	**40**	**5**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH212	0.1-0.15	Fill: Gravel	**5**	<0.4	**12**	**35**	**29**	<0.1	**33**	**47**	**4.6**	**0.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH213	0-0.1	Fill: Silty Sand	<4	<0.4	**17**	**15**	**17**	<0.1	**10**	**42**	**0.4**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH214	0.2-0.3	Fill: Silty Sand	**6**	<0.4	**12**	**24**	**92**	**0.1**	**3**	**73**	**1.4**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH214	0.3-0.4	Fill: Silty Sand	<4	<0.4	**7**	**260**	**100**	<0.1	**2**	**83**	**23**	**2.7**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH215	0-0.1	Fill: Silty Sand	<4	<0.4	**12**	**17**	**25**	<0.1	**8**	**60**	**3.6**	**0.5**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH215	0.2-0.3	Fill: Silty Sand	<4	<0.4	**12**	**9**	**65**	**0.1**	**4**	**140**	**4.3**	**0.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH216	0-0.1	Fill: Silty Sand	<4	<0.4	**11**	**16**	**9**	<0.1	**5**	**35**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH216	1-1.3	Fill: Sandy Clay	<4	<0.4	**15**	<1	**4**	<0.1	**1**	**16**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH217	0-0.1	Fill: Silty Sand	<4	<0.4	**15**	**21**	**18**	<0.1	**8**	**60**	**0.95**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH217	0.2-0.3	Fill: Silty Sand	<4	<0.4	**12**	**25**	**170**	**0.1**	**7**	**450**	**5**	**0.7**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH218	0-0.1	Fill: Silty Sand	<4	<0.4	**9**	**19**	**160**	**0.1**	**6**	**110**	**6.6**	**0.9**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH219	0-0.1	Fill: Silty Sand	<4	<0.4	**13**	**27**	**13**	<0.1	**9**	**44**	**1.5**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH219 - [LAB_DUP]	0-0.1	Fill: Silty Sand	<4	<0.4	**15**	**21**	**12**	<0.1	**7**	**45**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH219	0.5-0.6	Fill Silty Sand	<4	<0.4	**9**	**7**	**23**	<0.1	**2**	**19**	**2.7**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
SDUP201	BH217 (0-0.1m)	Fill: Silty Sand	<4	<0.4	**13**	**23**	**20**	<0.1	**14**	**50**	**1.4**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
SDUP202	BH207 (0-0.1m)	Fill: Silty Sand	<4.0	<0.40	**12**	**18**	**17**	<0.10	**5.9**	**60**	**6.6**	**0.82**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
Total Number of Samples			32	32	32	32	32	32	32	32	31	31	22	22	22	22	22	22	22	22	22	11
Maximum Value			10	0.5	22	260	290	0.8	33	450	50	5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	Detected
Statistical Analysis on Fill Samples																						
Number of Fill Samples			NC	NC	NC	NC	NC	NC	NC	NC	NC	**25**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mean Value			NC	NC	NC	NC	NC	NC	NC	NC	NC	**1.07**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Standard Deviation			NC	NC	NC	NC	NC	NC	NC	NC	NC	**1.3**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
% UCL			NC	NC	NC	NC	NC	NC	NC	NC	NC	**95**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
UCL Value			NC	NC	NC	NC	NC	NC	NC	NC	NC	**2.158**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Concentration above the SAC — **VALUE**
Concentration above the PQL — **Bold**
Asbestos Detected — **Detected**

Standard deviation exceeds data assessment criteria — **VALUE**

TABLE S2
SOIL LABORATORY RESULTS COMPARED TO HSLs
All data in mg/kg unless stated otherwise

					C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	Field PID Measurement
PQL - Envirolab Services					25	50	0.2	0.5	1	1	1	ppm
NEPM 2013 HSL Land Use Category					**HSL-A/B: LOW/HIGH DENSITY RESIDENTIAL**							
Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**								
BH201	0.1-0.2	Fill: Silty Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.2
BH201 - [LAB_DUP]	0.1-0.2	Fill: Silty Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.2
BH201	0.9-1	Fill: Silty Sandy Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH203	0.1-0.2	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.2
BH203 - [LAB_DUP]	0.1-0.2	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.2
BH203	0.3-0.4	Fill: Silty Sandy Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH207	0-0.1	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH208	0-0.1	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH208	0.45-0.55	Fill: Silty Sandy Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH209	0-0.1	Fill: Silty Sand	0m to <1m	Sand	<25	**65**	<0.2	<0.5	<1	<1	<1	0
BH209	0.6-0.8	Fill: Sandy Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH210	0.05-0.1	Fill: Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	1
BH210	0.55-0.6	Fill: Silty Sandy Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	1.8
BH211	0.2-0.3	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH211 - [LAB_DUP]	0.2-0.3	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH212	0.1-0.15	Fill: Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH213	0-0.1	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH214	0.2-0.3	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.4
BH214	0.3-0.4	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.5
BH215	0-0.1	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH215	0.2-0.3	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH216	0-0.1	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH216	1-1.3	Fill: Sandy Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH217	0-0.1	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH217	0.2-0.3	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.2
BH218	0-0.1	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH219	0-0.1	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH219 - [LAB_DUP]	0-0.1	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0
BH219	0.5-0.6	Fill Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.3
SDUP201	BH217 (0-0.1m)	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	-
SDUP202	BH207 (0-0.1m)	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	-
Total Number of Samples					31	31	31	31	31	31	31	29
Maximum Value					<PQL	65	<PQL	<PQL	<PQL	<PQL	<PQL	1.8

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the concentration above the SAC is highlighted in grey in the Site Assessment Criteria Table below

HSL SOIL ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
BH201	0.1-0.2	Fill: Silty Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH201 - [LAB_DUP]	0.1-0.2	Fill: Silty Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH201	0.9-1	Fill: Silty Sandy Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH203	0.1-0.2	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH203 - [LAB_DUP]	0.1-0.2	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH203	0.3-0.4	Fill: Silty Sandy Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH207	0-0.1	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH208	0-0.1	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH208	0.45-0.55	Fill: Silty Sandy Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH209	0-0.1	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH209	0.6-0.8	Fill: Sandy Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH210	0.05-0.1	Fill: Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH210	0.55-0.6	Fill: Silty Sandy Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH211	0.2-0.3	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH211 - [LAB_DUP]	0.2-0.3	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH212	0.1-0.15	Fill: Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH213	0-0.1	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH214	0.2-0.3	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH214	0.3-0.4	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH215	0-0.1	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH215	0.2-0.3	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH216	0-0.1	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH216	1-1.3	Fill: Sandy Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH217	0-0.1	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH217	0.2-0.3	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH218	0-0.1	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH219	0-0.1	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH219 - [LAB_DUP]	0-0.1	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH219	0.5-0.6	Fill Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP201	BH217 (0-0.1m)	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP202	BH207 (0-0.1m)	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3

TABLE S3
SOIL LABORATORY RESULTS COMPARED TO MANAGEMENT LIMITS
All data in mg/kg unless stated otherwise

			C_6-C_{10} (F1) plus BTEX	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)
PQL - Envirolab Services			25	50	100	100
NEPM 2013 Land Use Category			**RESIDENTIAL, PARKLAND & PUBLIC OPEN SPACE**			
Sample Reference	**Sample Depth**	**Soil Texture**				
BH201	0.1-0.2	Coarse	<25	<50	<100	<100
BH201 - [LAB_DUP]	0.1-0.2	Coarse	<25	<50	<100	<100
BH201	0.9-1	Fine	<25	<50	<100	<100
BH203	0.1-0.2	Coarse	<25	<50	**460**	**680**
BH203 - [LAB_DUP]	0.1-0.2	Coarse	<25	<50	**400**	**610**
BH203	0.3-0.4	Fine	<25	<50	**130**	**140**
BH207	0-0.1	Coarse	<25	<50	<100	<100
BH208	0-0.1	Coarse	<25	<50	**200**	**100**
BH208	0.45-0.55	Fine	<25	<50	**260**	<100
BH209	0-0.1	Coarse	<25	**65**	**440**	**190**
BH209	0.6-0.8	Fine	<25	<50	<100	<100
BH210	0.05-0.1	Coarse	<25	<50	**370**	**490**
BH210	0.55-0.6	Fine	<25	<50	<100	<100
BH211	0.2-0.3	Coarse	<25	<50	**120**	<100
BH211 - [LAB_DUP]	0.2-0.3	Coarse	<25	<50	**140**	<100
BH212	0.1-0.15	Coarse	<25	<50	**160**	**200**
BH213	0-0.1	Coarse	<25	<50	<100	<100
BH214	0.2-0.3	Coarse	<25	<50	<100	<100
BH214	0.3-0.4	Coarse	<25	<50	**140**	<100
BH215	0-0.1	Coarse	<25	<50	<100	<100
BH215	0.2-0.3	Coarse	<25	<50	**100**	<100
BH216	0-0.1	Coarse	<25	<50	<100	<100
BH216	1-1.3	Fine	<25	<50	<100	<100
BH217	0-0.1	Coarse	<25	<50	<100	<100
BH217	0.2-0.3	Coarse	<25	<50	<100	<100
BH218	0-0.1	Coarse	<25	<50	<100	<100
BH219	0-0.1	Coarse	<25	<50	**100**	**130**
BH219 - [LAB_DUP]	0-0.1	Coarse	<25	<50	<100	<100
BH219	0.5-0.6	Coarse	<25	<50	<100	<100
SDUP201	BH217 (0-0.1m)	Coarse	<25	<50	<100	<100
SDUP202	BH207 (0-0.1m)	Coarse	<25	<50	<100	<100
Total Number of Samples			31	31	31	31
Maximum Value			<PQL	65	460	680

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

MANAGEMENT LIMIT ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Soil Texture**	C_6-C_{10} (F1) plus BTEX	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)
BH201	0.1-0.2	Coarse	700	1000	2500	10000
BH201 - [LAB_DUP]	0.1-0.2	Coarse	700	1000	2500	10000
BH201	0.9-1	Fine	800	1000	3500	10000
BH203	0.1-0.2	Coarse	700	1000	2500	10000
BH203 - [LAB_DUP]	0.1-0.2	Coarse	700	1000	2500	10000
BH203	0.3-0.4	Fine	800	1000	3500	10000
BH207	0-0.1	Coarse	700	1000	2500	10000
BH208	0-0.1	Coarse	700	1000	2500	10000
BH208	0.45-0.55	Fine	800	1000	3500	10000
BH209	0-0.1	Coarse	700	1000	2500	10000
BH209	0.6-0.8	Fine	800	1000	3500	10000
BH210	0.05-0.1	Coarse	700	1000	2500	10000
BH210	0.55-0.6	Fine	800	1000	3500	10000
BH211	0.2-0.3	Coarse	700	1000	2500	10000
BH211 - [LAB_DUP]	0.2-0.3	Coarse	700	1000	2500	10000
BH212	0.1-0.15	Coarse	700	1000	2500	10000
BH213	0-0.1	Coarse	700	1000	2500	10000
BH214	0.2-0.3	Coarse	700	1000	2500	10000
BH214	0.3-0.4	Coarse	700	1000	2500	10000
BH215	0-0.1	Coarse	700	1000	2500	10000
BH215	0.2-0.3	Coarse	700	1000	2500	10000
BH216	0-0.1	Coarse	700	1000	2500	10000
BH216	1-1.3	Fine	800	1000	3500	10000
BH217	0-0.1	Coarse	700	1000	2500	10000
BH217	0.2-0.3	Coarse	700	1000	2500	10000
BH218	0-0.1	Coarse	700	1000	2500	10000
BH219	0-0.1	Coarse	700	1000	2500	10000
BH219 - [LAB_DUP]	0-0.1	Coarse	700	1000	2500	10000
BH219	0.5-0.6	Coarse	700	1000	2500	10000
SDUP201	BH217 (0-0.1m)	Coarse	700	1000	2500	10000
SDUP202	BH207 (0-0.1m)	Coarse	700	1000	2500	10000

TABLE S4
SOIL LABORATORY RESULTS COMPARED T0 DIRECT CONTACT CRITERIA
All data in mg/kg unless stated otherwise

Analyte		C_6-C_{10}	>C_{10}-C_{16}	>C_{16}-C_{34}	>C_{34}-C_{40}	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID
PQL - Envirolab Services		25	50	100	100	0.2	0.5	1	1	1	
CRC 2011 -Direct contact Criteria		82,000	62,000	85,000	120,000	1,100	120,000	85,000	130,000	29,000	
Site Use		**Intrusive Maintenance Worker - DIRECT SOIL CONTACT**									
Sample Reference	**Sample Depth**										
BH201	0.1-0.2	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.2**
BH201 - [LAB_DUP]	0.1-0.2	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.2**
BH201	0.9-1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	0
BH203	0.1-0.2	<25	<50	**460**	**680**	<0.2	<0.5	<1	<1	<1	**0.2**
BH203 - [LAB_DUP]	0.1-0.2	<25	<50	**400**	**610**	<0.2	<0.5	<1	<1	<1	**0.2**
BH203	0.3-0.4	<25	<50	**130**	**140**	<0.2	<0.5	<1	<1	<1	0
BH207	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	0
BH208	0-0.1	<25	<50	**200**	**100**	<0.2	<0.5	<1	<1	<1	0
BH208	0.45-0.55	<25	<50	**260**	<100	<0.2	<0.5	<1	<1	<1	0
BH209	0-0.1	<25	**65**	**440**	**190**	<0.2	<0.5	<1	<1	<1	0
BH209	0.6-0.8	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	0
BH210	0.05-0.1	<25	<50	**370**	**490**	<0.2	<0.5	<1	<1	<1	**1**
BH210	0.55-0.6	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**1.8**
BH211	0.2-0.3	<25	<50	**120**	<100	<0.2	<0.5	<1	<1	<1	0
BH211 - [LAB_DUP]	0.2-0.3	<25	<50	**140**	<100	<0.2	<0.5	<1	<1	<1	0
BH212	0.1-0.15	<25	<50	**160**	**200**	<0.2	<0.5	<1	<1	<1	0
BH213	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	0
BH214	0.2-0.3	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.4**
BH214	0.3-0.4	<25	<50	**140**	<100	<0.2	<0.5	<1	<1	<1	**0.5**
BH215	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	0
BH215	0.2-0.3	<25	<50	**100**	<100	<0.2	<0.5	<1	<1	<1	0
BH216	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	0
BH216	1-1.3	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	0
BH217	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	0
BH217	0.2-0.3	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.2**
BH218	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	0
BH219	0-0.1	<25	<50	**100**	**130**	<0.2	<0.5	<1	<1	<1	0
BH219 - [LAB_DUP]	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	0
BH219	0.5-0.6	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.3**
SDUP201	BH217 (0-0.1m)	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	-
SDUP202	BH207 (0-0.1m)	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	-
Total Number of Samples		31	31	31	31	31	31	31	31	31	29
Maximum Value		<PQL	65	460	680	<PQL	<PQL	<PQL	<PQL	<PQL	1.8

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

TABLE S5
ASBESTOS QUANTIFICATION - FIELD OBSERVATIONS AND LABORATORY RESULTS
HSL-A: Residential with garden/accessible soils; children's day care centers; preschools; and primary schools

FIELD DATA															LABORATORY DATA											
Date Sampled	Sample reference	Sample Depth	Visible ACM in top 100mm	Approx. Volume of Soil (L)	Soil Mass (g)	Mass ACM (g)	Mass Asbestos in ACM (g)	[Asbestos from ACM in soil] (%w/w)	Mass ACM <7mm (g)	Mass Asbestos in ACM <7mm (g)	[Asbestos from ACM <7mm in soil] (%w/w)	Mass FA (g)	Mass Asbestos in FA (g)	[Asbestos from FA in soil] (%w/w)	Lab Report Number	Sample refeference	Sample Depth	Sample Mass (g)	Asbestos ID in soil (AS4964) >0.1g/kg	Trace Analysis	Total Asbestos (g/kg)	Asbestos ID in soil <0.1g/kg	ACM >7mm Estimation (g)	FA and AF Estimation (g)	ACM >7mm Estimation %(w/w)	FA and AF Estimation %(w/w)
SAC			**No**					**0.01**			**0.001**			**0.001**											**0.01**	**0.001**
31/01/2025	BH201	0-0.05	No	10L	1,160	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	371803	BH201	0-0.05	710.96	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
31/01/2025	BH201	0.1-0.25	No	10L	1,270	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	371803	BH201	0.6-0.8	153.98	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	371803	BH201	0.9-1	715.12	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
15/01/2025	BH203	0.1-0.4	No	<10L	60	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	370762	BH203	0.1-0.2	828.21	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	Chrysotile	–	0.0001	<0.01	<0.001
15/01/2025	BH203	0.5-0.8	No	<10L	150	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16/01/2025	BH205	0.1-0.5	No	<10L	305	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
15/01/2025	BH206	0-0.05	No	<10L	776	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16/01/2025	BH207	0-0.1	No	10L	1,235	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	370762	BH207	0-0.1	775.06	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
31/01/2025	BH208	0-0.1	No	10L	1,055	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	371803	BH208	0-0.1	286.88	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
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31/01/2025	BH209	0-0.1	No	10L	1,025	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	371803	BH209	0.85-0.95	431.65	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
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16/01/2025	BH212	0.15-0.45	No	<10L	85	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	370762	BH212	0.1-0.15	717.73	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
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15/01/2025	BH215	0-0.1	No	10L	1,488	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	370762	BH215	0-0.1	926.09	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
15/01/2025	BH215	0.2-0.5	No	10L	1,165	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16/01/2025	BH216	0-0.1	No	10L	1,265	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	370762	BH216	0-0.1	939.21	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
16/01/2025	BH216	0.1-0.2	No	10L	1,070	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16/01/2025	BH216	0.4-0.7	No	<10L	215	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16/01/2025	BH216	0.9-1.3	No	<10L	225	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
15/01/2025	BH217	0-0.1	No	10L	1,322	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	370762	BH217	0-0.1	869.43	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
15/01/2025	BH217	0.1-0.3	No	10L	1,014	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
15/01/2025	BH219	0-01	No	10L	1,003	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	370762	BH219	0-0.1	920.43	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
15/01/2025	BH219	0.1-0.5	No	10L	1,215	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	370762	BH219	0.5-0.6	808.71	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
15/01/2025	BH219	0.7-1	No	10L	74	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Concentration above the SAC **VALUE**

JKEnvironments

TABLE S6
SOIL LABORATORY RESULTS COMPARED TO NEPM 2013 EILs AND ESLs
All data in mg/kg unless stated otherwise

Land Use Category				URBAN RESIDENTIAL AND PUBLIC OPEN SPACE																		
							AGED HEAVY METALS-EILs						EILs		ESLs							
				pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
PQL - Envirolab Services				-	1	-	4	1	1	1	1	1	1	0.1	25	50	100	100	0.2	0.5	1	1	0.05
Ambient Background Concentration (ABC)				-	-	-	NSL	13	28	163	5	122	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL
Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**																			
BH201	0.1-0.2	Fill: Silty Gravel	Coarse	NA	NA	NA	<4	**15**	**43**	**6**	**7**	**29**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
BH201 - [LAB_DUP]	0.1-0.2	Fill: Silty Gravel	Coarse	NA	NA	NA	<4	**17**	**50**	**6**	**9**	**28**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
BH201	0.9-1	Fill: Silty Sandy Clay	Fine	NA	NA	NA	**6**	**15**	**38**	**130**	**3**	**120**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<1	**0.79**
BH203	0.1-0.2	Fill: Silty Sand	Coarse	**7.9**	**8.53**	NA	<4	**17**	**89**	**32**	**26**	**54**	<1	<0.1	<25	<50	**460**	**680**	<0.2	<0.5	<1	<1	**0.74**
BH203 - [LAB_DUP]	0.1-0.2	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**18**	**74**	**67**	**22**	**79**	<1	<0.1	<25	<50	**400**	**610**	<0.2	<0.5	<1	<1	**0.58**
BH203 - [TRIPLICATE]	0.1-0.2	Fill: Silty Sand	Coarse	**7.9**	**8.53**	NA	<4	**11**	**32**	**290**	**6**	**400**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH203	0.3-0.4	Fill: Silty Sandy Clay	Fine	NA	NA	NA	**4**	**12**	**20**	**120**	**4**	**84**	<1	NA	<25	<50	**130**	**140**	<0.2	<0.5	<1	<1	**0.5**
BH207	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**15**	**23**	**11**	**8**	**44**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	**0.06**
BH208	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	**5**	**12**	**15**	**36**	**6**	**67**	<1	<0.1	<25	<50	**200**	**100**	<0.2	<0.5	<1	<1	**0.5**
BH208	0.45-0.55	Fill: Silty Sandy Clay	Fine	NA	NA	NA	**7**	**22**	**11**	**84**	**10**	**78**	<1	NA	<25	<50	**260**	<100	<0.2	<0.5	<1	<1	**3.3**
BH209	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	**4**	**14**	**24**	**55**	**6**	**160**	<1	<0.1	<25	**65**	**440**	**190**	<0.2	<0.5	<1	<1	**0.2**
BH209	0.6-0.8	Fill: Sandy Clay	Fine	NA	NA	NA	**5**	**20**	<1	**23**	**2**	**12**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<1	**0.07**
BH210	0.05-0.1	Fill: Gravel	Coarse	NA	NA	NA	<4	**5**	**50**	**9**	**29**	**25**	<1	<0.1	<25	<50	**370**	**490**	<0.2	<0.5	<1	<1	<0.05
BH210	0.55-0.6	Fill: Silty Sandy Clay	Fine	**7.7**	**11**	NA	**4**	**10**	**18**	**140**	**4**	**250**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<1	**0.4**
BH211	0.2-0.3	Fill: Silty Sand	Coarse	**7.9**	**8.53**	NA	**4**	**12**	**32**	**250**	**7**	**400**	<1	<0.1	<25	<50	**120**	<100	<0.2	<0.5	<1	<1	**3.3**
BH211 - [LAB_DUP]	0.2-0.3	Fill: Silty Sand	Coarse	**7.9**	**8.53**	NA	**10**	**13**	**36**	**240**	**15**	**400**	<1	<0.1	<25	<50	**140**	<100	<0.2	<0.5	<1	<1	**3.5**
BH212	0.1-0.15	Fill: Gravel	Coarse	NA	NA	NA	**5**	**12**	**35**	**29**	**33**	**47**	<1	<0.1	<25	<50	**160**	**200**	<0.2	<0.5	<1	<1	**0.4**
BH213	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**17**	**15**	**17**	**10**	**42**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	**0.07**
BH214	0.2-0.3	Fill: Silty Sand	Coarse	NA	NA	NA	**6**	**12**	**24**	**92**	**3**	**73**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	**0.2**
BH214	0.3-0.4	Fill: Silty Sand	Coarse	**7.9**	**8.53**	NA	<4	**7**	**260**	**100**	**2**	**83**	<1	NA	<25	<50	**140**	<100	<0.2	<0.5	<1	<1	**1.9**
BH215	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**12**	**17**	**25**	**8**	**60**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	**0.3**
BH215	0.2-0.3	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**12**	**9**	**65**	**4**	**140**	<1	NA	<25	<50	**100**	<100	<0.2	<0.5	<1	<1	**0.4**
BH216	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**11**	**16**	**9**	**5**	**35**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
BH216	1-1.3	Fill: Sandy Clay	Fine	NA	NA	NA	<4	**15**	<1	**4**	**1**	**16**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
BH217	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**15**	**21**	**18**	**8**	**60**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	**0.1**
BH217	0.2-0.3	Fill: Silty Sand	Coarse	**7.9**	**8.53**	NA	<4	**12**	**25**	**170**	**7**	**450**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<1	**0.4**
BH218	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**9**	**19**	**160**	**6**	**110**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	**0.62**
BH219	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**13**	**27**	**13**	**9**	**44**	<1	<0.1	<25	<50	**100**	**130**	<0.2	<0.5	<1	<1	**0.2**
BH219 - [LAB_DUP]	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**15**	**21**	**12**	**7**	**45**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
BH219	0.5-0.6	Fill Silty Sand	Coarse	NA	NA	NA	<4	**9**	**7**	**23**	**2**	**19**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	**0.2**
SDUP201	BH217 (0-0.1m)	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**13**	**23**	**20**	**14**	**50**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	**0.2**
SDUP202	BH207 (0-0.1m)	Fill: Silty Sand	Coarse	NA	NA	NA	<4.0	**12**	**18**	**17**	**5.9**	**60**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.55**
Total Number of Samples				7	7	0	32	32	32	32	32	32	31	22	31	31	31	31	31	31	31	31	31
Maximum Value				7.9	11	NA	10	22	260	290	33	450	<PQL	<PQL	<PQL	65	460	680	<PQL	<PQL	<PQL	<PQL	3.5

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the elevated value is highlighted in grey in the EIL and ESL Assessment Criteria Table below

EIL AND ESL ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**	pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
BH201	0.1-0.2	Fill: Silty Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH201 - [LAB_DUP]	0.1-0.2	Fill: Silty Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH201	0.9-1	Fill: Silty Sandy Clay	Fine	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	1300	5600	65	105	125	45	20
BH203	0.1-0.2	Fill: Silty Sand	Coarse	7.9	8.53	NA	100	200	220	1300	180	520	170	180	180	120	300	2800	50	85	70	105	20
BH203 - [LAB_DUP]	0.1-0.2	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH203 - [TRIPLICATE]	0.1-0.2	Fill: Silty Sand	Coarse	7.9	8.53	NA	100	200	220	1300	180	520	--	--	--	--	--	--	--	--	--	--	--
BH203	0.3-0.4	Fill: Silty Sandy Clay	Fine	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	1300	5600	65	105	125	45	20
BH207	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH208	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH208	0.45-0.55	Fill: Silty Sandy Clay	Fine	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	1300	5600	65	105	125	45	20
BH209	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH209	0.6-0.8	Fill: Sandy Clay	Fine	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	1300	5600	65	105	125	45	20
BH210	0.05-0.1	Fill: Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH210	0.55-0.6	Fill: Silty Sandy Clay	Fine	7.7	11	NA	100	200	240	1300	280	820	170	--	180	120	1300	5600	65	105	125	45	20
BH211	0.2-0.3	Fill: Silty Sand	Coarse	7.9	8.53	NA	100	200	220	1300	180	520	170	180	180	120	300	2800	50	85	70	105	20
BH211 - [LAB_DUP]	0.2-0.3	Fill: Silty Sand	Coarse	7.9	8.53	NA	100	200	220	1300	180	520	170	180	180	120	300	2800	50	85	70	105	20
BH212	0.1-0.15	Fill: Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH213	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH214	0.2-0.3	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH214	0.3-0.4	Fill: Silty Sand	Coarse	7.9	8.53	NA	100	200	220	1300	180	520	170	--	180	120	300	2800	50	85	70	105	20
BH215	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH215	0.2-0.3	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH216	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH216	1-1.3	Fill: Sandy Clay	Fine	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	1300	5600	65	105	125	45	20
BH217	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH217	0.2-0.3	Fill: Silty Sand	Coarse	7.9	8.53	NA	100	200	220	1300	180	520	170	--	180	120	300	2800	50	85	70	105	20
BH218	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH219	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH219 - [LAB_DUP]	0-0.1	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH219	0.5-0.6	Fill Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
SDUP201	BH217 (0-0.1m)	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
SDUP202	BH207 (0-0.1m)	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20

TABLE S7
SOIL LABORATORY RESULTS COMPARED TO WASTE CLASSIFICATION GUIDELINES
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs		OC/OP PESTICIDES				Total PCBs	TRH					BTEX COMPOUNDS				ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P	Total Endosulfans	Chloropyrifos	Total Moderately Harmful	Total Scheduled		C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	Total C_{10}-C_{36}	Benzene	Toluene	Ethyl benzene	Total Xylenes	
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.05	0.1	0.1	0.1	0.1	0.1	25	50	100	100	50	0.2	0.5	1	1	100
General Solid Waste CT1			100	20	100	NSL	100	4	40	NSL	200	0.8	60	4	250	50	50	650		NSL		10,000	10	288	600	1,000	-
General Solid Waste SCC1			500	100	1900	NSL	1500	50	1050	NSL	200	10	108	7.5	250	50	50	650		NSL		10,000	18	518	1,080	1,800	-
Restricted Solid Waste CT2			400	80	400	NSL	400	16	160	NSL	800	3.2	240	16	1000	50	50	2600		NSL		40,000	40	1,152	2,400	4,000	-
Restricted Solid Waste SCC2			2000	400	7600	NSL	6000	200	4200	NSL	800	23	432	30	1000	50	50	2600		NSL		40,000	72	2,073	4,320	7,200	-
Sample Reference	**Sample Depth**	**Sample Description**																									
BH201	0.1-0.2	Fill: Silty Gravel	<4	<0.4	**15**	**43**	**6**	<0.1	**7**	**29**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
BH201 - [LAB_DUP]	0.1-0.2	Fill: Silty Gravel	<4	<0.4	**17**	**50**	**6**	<0.1	**9**	**28**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
BH201	0.9-1	Fill: Silty Sandy Clay	**6**	<0.4	**15**	**38**	**130**	**0.4**	**3**	**120**	**8.1**	**0.79**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
BH203	0.1-0.2	Fill: Silty Sand	<4	<0.4	**17**	**89**	**32**	<0.1	**26**	**54**	**9.5**	**0.74**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	**220**	**430**	**650**	<0.2	<0.5	<1	<1	Detected
BH203 - [LAB_DUP]	0.1-0.2	Fill: Silty Sand	<4	<0.4	**18**	**74**	**67**	<0.1	**22**	**79**	**6.4**	**0.58**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	**180**	**400**	**580**	<0.2	<0.5	<1	<1	NA
BH203 - [TRIPLICATE]	0.1-0.2	Fill: Silty Sand	<4	**0.5**	**11**	**32**	**290**	**0.4**	**6**	**400**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH203	0.3-0.4	Fill: Silty Sandy Clay	**4**	<0.4	**12**	**20**	**120**	<0.1	**4**	**84**	**5**	**0.5**	NA	NA	NA	NA	NA	<25	<50	<100	**100**	**100**	<0.2	<0.5	<1	<1	NA
BH207	0-0.1	Fill: Silty Sand	<4	<0.4	**15**	**23**	**11**	<0.1	**8**	**44**	**0.06**	**0.06**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
BH208	0-0.1	Fill: Silty Sand	**5**	<0.4	**12**	**15**	**36**	<0.1	**6**	**67**	**6.2**	**0.5**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	**180**	**180**	<0.2	<0.5	<1	<1	NA
BH208	0.45-0.55	Fill: Silty Sandy Clay	**7**	<0.4	**22**	**11**	**84**	**0.2**	**10**	**78**	**50**	**3.3**	NA	NA	NA	NA	NA	<25	<50	**180**	**110**	**290**	<0.2	<0.5	<1	<1	NA
BH209	0-0.1	Fill: Silty Sand	**4**	<0.4	**14**	**24**	**55**	**0.1**	**6**	**160**	**1.7**	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	**59**	**270**	**260**	**589**	<0.2	<0.5	<1	<1	NA
BH209	0.6-0.8	Fill: Sandy Clay	**5**	<0.4	**20**	<1	**23**	<0.1	**2**	**12**	**0.07**	**0.07**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
BH210	0.05-0.1	Fill: Gravel	<4	<0.4	**5**	**50**	**9**	<0.1	**29**	**25**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	**120**	**390**	**510**	<0.2	<0.5	<1	<1	Not Detected
BH210	0.55-0.6	Fill: Silty Sandy Clay	**4**	<0.4	**10**	**18**	**140**	**0.8**	**4**	**250**	**3.2**	**0.4**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
BH211	0.2-0.3	Fill: Silty Sand	**4**	**0.5**	**12**	**32**	**250**	**0.4**	**7**	**400**	**37**	**3.3**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
BH211 - [LAB_DUP]	0.2-0.3	Fill: Silty Sand	**10**	**0.5**	**13**	**36**	**240**	**0.3**	**15**	**400**	**40**	**3.5**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	**100**	<100	**100**	<0.2	<0.5	<1	<1	NA
BH212	0.1-0.15	Fill: Gravel	**5**	<0.4	**12**	**35**	**29**	<0.1	**33**	**47**	**4.6**	**0.4**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	**150**	**150**	<0.2	<0.5	<1	<1	Not Detected
BH213	0-0.1	Fill: Silty Sand	<4	<0.4	**17**	**15**	**17**	<0.1	**10**	**42**	**0.4**	**0.07**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
BH214	0.2-0.3	Fill: Silty Sand	**6**	<0.4	**12**	**24**	**92**	**0.1**	**3**	**73**	**1.4**	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
BH214	0.3-0.4	Fill: Silty Sand	<4	<0.4	**7**	**260**	**100**	<0.1	**2**	**83**	**23**	**1.9**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
BH215	0-0.1	Fill: Silty Sand	<4	<0.4	**12**	**17**	**25**	<0.1	**8**	**60**	**3.6**	**0.3**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
BH215	0.2-0.3	Fill: Silty Sand	<4	<0.4	**12**	**9**	**65**	**0.1**	**4**	**140**	**4.3**	**0.4**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
BH216	0-0.1	Fill: Silty Sand	<4	<0.4	**11**	**16**	**9**	<0.1	**5**	**35**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
BH216	1-1.3	Fill: Sandy Clay	<4	<0.4	**15**	<1	**4**	<0.1	**1**	**16**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
BH217	0-0.1	Fill: Silty Sand	<4	<0.4	**15**	**21**	**18**	<0.1	**8**	**60**	**0.95**	**0.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
BH217	0.2-0.3	Fill: Silty Sand	<4	<0.4	**12**	**25**	**170**	**0.1**	**7**	**450**	**5**	**0.4**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
BH218	0-0.1	Fill: Silty Sand	<4	<0.4	**9**	**19**	**160**	**0.1**	**6**	**110**	**6.6**	**0.62**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
BH219	0-0.1	Fill: Silty Sand	<4	<0.4	**13**	**27**	**13**	<0.1	**9**	**44**	**1.5**	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
BH219 - [LAB_DUP]	0-0.1	Fill: Silty Sand	<4	<0.4	**15**	**21**	**12**	<0.1	**7**	**45**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
BH219	0.5-0.6	Fill Silty Sand	<4	<0.4	**9**	**7**	**23**	<0.1	**2**	**19**	**2.7**	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
SDUP201	BH217 (0-0.1m)	Fill: Silty Sand	<4	<0.4	**13**	**23**	**20**	<0.1	**14**	**50**	**1.4**	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
SDUP202	BH207 (0-0.1m)	Fill: Silty Sand	<4.0	<0.40	**12**	**18**	**17**	<0.10	**5.9**	**60**	**6.6**	**0.55**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
Total Number of Samples			32	32	32	32	32	32	32	32	31	31	22	22	22	22	22	31	31	31	31	31	31	31	31	31	11
Maximum Value			10	0.5	22	260	290	0.8	33	450	50	3.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	59	270	430	650	<PQL	<PQL	<PQL	<PQL	Detected
Statistical Analysis on Fill Samples																											
Number of Fill Samples			NC	NC	NC	NC	**25**	NC	NC	NC	NC	**25**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mean Value			NC	NC	NC	NC	**75**	NC	NC	NC	NC	**0.63**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Standard Deviation			NC	NC	NC	NC	**78.4**	NC	NC	NC	NC	**0.92**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
% UCL			NC	NC	NC	NC	**95**	NC	NC	NC	NC	**95**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
UCL Value			NC	NC	NC	NC	**114.8**	NC	NC	NC	NC	**0.992**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Concentration above the CT1 — **VALUE**
Concentration above SCC1 — **VALUE**
Concentration above the SCC2 — **VALUE**
Concentration above PQL — **Bold**
Asbestos Detected > Special Waste (asbestos) — **Detected**

Standard deviation exceeds data assessment criteria — **VALUE**

TABLE S8
SOIL LABORATORY TCLP RESULTS
All data in mg/L unless stated otherwise

			Lead	B(a)P
PQL - Envirolab Services			0.03	0.001
TCLP1 - General Solid Waste			5	0.04
TCLP2 - Restricted Solid Waste			20	0.16
TCLP3 - Hazardous Waste			>20	>0.16
Sample Reference	**Sample Depth**	**Sample Description**		
BH201	0.9-1.0	Fill: Silty Sandy Clay	**0.34**	NA
BH201 - LAB DUP	0.9-1.0	Fill: Silty Sandy Clay	**0.34**	NA
BH203	0.1-0.2	Fill: Silty Sand	**0.06**	NA
BH208	0.45-0.55	Fill: Silty Sandy Clay	NA	<0.0001
BH211	0.2-0.3	Fill: Silty Sand	**0.1**	<0.0001
BH211 - LAB DUP	0.2-0.3	Fill: Silty Sand	NA	<0.0001
BH214	0.3-0.4	Fill: Silty Sand	NA	<0.0001
BH217	0.2-0.3	Fill: Silty Sand	**0.3**	NA
BH218	0.3-0.45	Fill: Silty Sand	<0.07	NA
Total Number of samples			6	4
Maximum Value			0.34	<PQL

General Solid Waste	**VALUE**
Restricted Solid Waste	**VALUE**
Hazardous Waste	**VALUE**
Concentration above PQL	**Bold**

TABLE Q1
SOIL QA/QC SUMMARY

			TRH C6 - C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-Xylene	Naphthalene	Acenaphthylene	Acenaph-thene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthra-cene	Benzo(g,h,i)perylene
	PQL Envirolab SYD		*25*	*50*	*100*	*100*	*0.2*	*0.5*	*1*	*2*	*1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.05*	*0.1*	*0.1*	*0.1*
	PQL Envirolab VIC		*25*	*50*	*100*	*100*	*0.2*	*0.5*	*1.0*	*2.0*	*1.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*
Intra	BH217	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.1	0.1	<0.2	0.1	0.1	<0.1	0.1
laboratory	SDUP201	BH217 (0-0.1m)	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.2	0.1	0.1	0.2	0.2	<0.1	<0.1	0.1
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.075	nc	0.2	0.2	0.1	0.1	0.15	0.15	0.075	nc	0.1
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	67%	nc	0%	0%	0%	0%	67%	67%	67%	nc	0%
Inter	BH207	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	0.06	<0.1	<0.1	<0.1
laboratory	SDUP202	BH207 (0-0.1m)	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.10	<0.10	<0.10	<0.10	0.75	0.23	1.2	1.3	0.46	0.5	0.81	0.55	0.37	<0.10	0.42
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.4	0.14	0.625	0.675	0.255	0.275	0.455	0.305	0.21	nc	0.235
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	175%	129%	184%	185%	161%	164%	156%	161%	152%	nc	157%
Field	TB-S201	-	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
Blank	15/01/25																									
Field	FR-HA-201	µg/L	<10	180	<100	<100	<1	<1	<1	<2	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rinsate	16/01/25																									
Trip	TS-S201		-	-	-	-	82%	82%	81%	82%	81%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spike	15/01/25																									

			HCB	alpha- BHC	gamma- BHC	beta- BHC	Heptachlor	delta- BHC	Aldrin	Heptachlor Epoxide	Gamma- Chlordane	alpha- chlordane	Endosulfan I	pp- DDE	Dieldrin	Endrin	pp- DDD	Endosulfan II	pp- DDT	Endrin Aldehyde	Endosulfan Sulphate	Methoxychlor
	PQL Envirolab SYD		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
	PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Intra	BH217	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
laboratory	SDUP201	BH217 (0-0.1m)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Inter	BH207	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
laboratory	SDUP202	BH207 (0-0.1m)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Field	TB-S201	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blank	15/01/25																					
Field	FR-HA-201	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rinsate	16/01/25																					
Trip	TS-S201		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spike	15/01/25																					

			Azinphos-methyl (Guthion	Bromophos-ethyl	Chlorpyriphos	Chlorpyriphos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Parathion	Ronnel	Total PCBS	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
	PQL Envirolab SYD		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*4*	*0.4*	*1*	*1*	*1*	*0.1*	*1*	*1*
	PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*4.0*	*0.4*	*1.0*	*1.0*	*1.0*	*0.1*	*1.0*	*1.0*
Intra	BH217	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<4	<0.4	15	21	18	<0.1	8	60
laboratory	SDUP201	BH217 (0-0.1m)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<4	<0.4	13	23	20	<0.1	14	50
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	14	22	19	nc	11	55
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	14%	9%	11%	nc	55%	18%
Inter	BH207	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<4	<0.4	15	23	11	<0.1	8	44
laboratory	SDUP202	BH207 (0-0.1m)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<4.0	<0.40	12	18	17	<0.10	5.9	60
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	13.5	20.5	14	nc	6.95	52
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	22%	24%	43%	nc	30%	31%
Field	TB-S201	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4	<0.4	<1	<1	<1	<0.1	<1	<1
Blank	15/01/25																						
Field	FR-HA-201	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.01	<0.01	<0.01	<0.03	<0.0005	<0.02	<0.02
Rinsate	16/01/25																						
Trip	TS-S201		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spike	15/01/25																						

Result outside of QA/QC acceptance criteria (highlighted)

Rinsate metals results in mg/L

ABBREVIATIONS AND EXPLANATIONS

Abbreviations used in the Tables:

ADWG: AustralianDrinking Water Guidelines
ANZG Australian and New Zealand Guidelines
B(a)P: Benzo(a)pyrene
CRC: Cooperative Research Centre
ESLs: Ecological Screening Levels
GIL: Groundwater Investigation Levels
HILs: Health Investigation Levels
HSLs: Health Screening Levels
HSL-SSA: Health Screening Level-SiteSpecific Assessment
NA: Not Analysed
NC: Not Calculated
NEPM: National Environmental Protection Measure
NHMRC: National Health and Medical Research Council
NL: Not Limiting
NSL: No Set Limit
OCP: Organochlorine Pesticides
OPP: Organophosphorus Pesticides
PAHs: Polycyclic Aromatic Hydrocarbons
ppm: Parts per million
PCBs: Polychlorinated Biphenyls
PCE: Perchloroethylene (Tetrachloroethylene or Tetrachloroethene)
PQL: Practical Quantitation Limit
RS: Rinsate Sample
RSL: Regional Screening Levels
SAC: Site Assessment Criteria
SSA: Site Specific Assessment
SSHSLs Site Specific Health Screening Levels
TB: Trip Blank
TCA: 1,1,1 Trichloroethane (methyl chloroform)
TCE: Trichloroethylene (Trichloroethene)
TS: Trip Spike
TRH: Total Recoverable Hydrocarbons
UCL: Upper Level Confidence Limit on Mean Value
USEPA United States Environmental Protection Agency
VOCC: Volatile Organic Chlorinated Compounds
WHO: World Health Organisation

TABLE G1
SUMMARY OF GROUNDWATER LABORATORY RESULTS COMPARED TO ECOLOGICAL GILs SAC
All results in µg/L unless stated otherwise.

	PQL Envirolab Services	ANZG 2018 Fresh Waters	SAMPLES				
			MW203	ME203 - LAB DUP	MW207	MW208	GWDUP-201 (MW207)
Metals and Metalloids							
Arsenic (As III)	1	24	**1**	**1**	**5**	<1	**5**
Cadmium	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (SAC for Cr III adopted)	1	3.3	**2**	**2**	**2**	**1**	**2**
Copper	1	1.4	<1	<1	<1	**2**	<1
Lead	1	3.4	<1	<1	<1	<1	<1
Total Mercury (inorganic)	0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel	1	11	**1**	**1**	**3**	**7**	**3**
Zinc	1	8	**4**	**4**	**4**	**71**	**6**
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)							
Benzene	1	950	<1	NA	<1	<1	<1
Toluene	1	180	<1	NA	<1	<1	<1
Ethylbenzene	1	80	<1	NA	<1	<1	<1
m+p-xylene	2	75	<2	NA	<2	<2	<2
o-xylene	1	350	<1	NA	<1	<1	<1
Total xylenes	2	NSL	<2	NA	<2	<2	<2
Volatile Organic Compounds (VOCs), including chlorinated VOCs							
Dichlorodifluoromethane	10	NSL	<10	NA	<10	<10	<10
Chloromethane	10	NSL	<10	NA	<10	<10	<10
Vinyl Chloride	10	100	<10	NA	<10	<10	<10
Bromomethane	10	NSL	<10	NA	<10	<10	<10
Chloroethane	10	NSL	<10	NA	<10	<10	<10
Trichlorofluoromethane	10	NSL	<10	NA	<10	<10	<10
1,1-Dichloroethene	1	700	<1	NA	<1	<1	<1
Trans-1,2-dichloroethene	1	NSL	<1	NA	<1	<1	<1
1,1-dichloroethane	1	90	<1	NA	<1	<1	<1
Cis-1,2-dichloroethene	1	NSL	<1	NA	<1	<1	<1
Bromochloromethane	1	NSL	<1	NA	<1	<1	<1
Chloroform	1	370	<1	NA	<1	**4**	<1
2,2-dichloropropane	1	NSL	<1	NA	<1	<1	<1
1,2-dichloroethane	1	1900	<1	NA	<1	<1	<1
1,1,1-trichloroethane	1	270	<1	NA	<1	<1	<1
1,1-dichloropropene	1	NSL	<1	NA	<1	<1	<1
Cyclohexane	1	NSL	<1	NA	<1	<1	<1
Carbon tetrachloride	1	240	<1	NA	<1	<1	<1
Benzene	1	950	<1	NA	<1	<1	<1
Dibromomethane	1	NSL	<1	NA	<1	<1	<1
1,2-dichloropropane	1	900	<1	NA	<1	<1	<1
Trichloroethene	1	330	<1	NA	<1	<1	<1
Bromodichloromethane	1	NSL	<1	NA	<1	<1	<1
trans-1,3-dichloropropene	1	NSL	<1	NA	<1	<1	<1
cis-1,3-dichloropropene	1	NSL	<1	NA	<1	<1	<1
1,1,2-trichloroethane	1	6500	<1	NA	<1	<1	<1
Toluene	1	180	<1	NA	<1	<1	<1
1,3-dichloropropane	1	1100	<1	NA	<1	<1	<1
Dibromochloromethane	1	NSL	<1	NA	<1	<1	<1
1,2-dibromoethane	1	NSL	<1	NA	<1	<1	<1
Tetrachloroethene	1	70	<1	NA	<1	<1	<1
1,1,1,2-tetrachloroethane	1	NSL	<1	NA	<1	<1	<1
Chlorobenzene	1	55	<1	NA	<1	<1	<1
Ethylbenzene	1	80	<1	NA	<1	<1	<1
Bromoform	1	NSL	<1	NA	<1	<1	<1
m+p-xylene	2	75	<2	NA	<2	<2	<2
Styrene	1	NSL	<1	NA	<1	<1	<1
1,1,2,2-tetrachloroethane	1	400	<1	NA	<1	<1	<1
o-xylene	1	350	<1	NA	<1	<1	<1
1,2,3-trichloropropane	1	NSL	<1	NA	<1	<1	<1
Isopropylbenzene	1	30	<1	NA	<1	<1	<1
Bromobenzene	1	NSL	<1	NA	<1	<1	<1
n-propyl benzene	1	NSL	<1	NA	<1	<1	<1
2-chlorotoluene	1	NSL	<1	NA	<1	<1	<1
4-chlorotoluene	1	NSL	<1	NA	<1	<1	<1
1,3,5-trimethyl benzene	1	NSL	<1	NA	<1	<1	<1
Tert-butyl benzene	1	NSL	<1	NA	<1	<1	<1
1,2,4-trimethyl benzene	1	NSL	<1	NA	<1	<1	<1
1,3-dichlorobenzene	1	260	<1	NA	<1	<1	<1
Sec-butyl benzene	1	NSL	<1	NA	<1	<1	<1
1,4-dichlorobenzene	1	60	<1	NA	<1	<1	<1
4-isopropyl toluene	1	NSL	<1	NA	<1	<1	<1
1,2-dichlorobenzene	1	160	<1	NA	<1	<1	<1
n-butyl benzene	1	NSL	<1	NA	<1	<1	<1
1,2-dibromo-3-chloropropane	1	NSL	<1	NA	<1	<1	<1
1,2,4-trichlorobenzene	1	85	<1	NA	<1	<1	<1
Hexachlorobutadiene	1	NSL	<1	NA	<1	<1	<1
1,2,3-trichlorobenzene	1	3	<1	NA	<1	<1	<1
Polycyclic Aromatic Hydrocarbons (PAHs)							
Naphthalene	0.2	16	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	0.1	NSL	<0.1	<0.1	<0.1	**0.1**	<0.1
Acenaphthene	0.1	NSL	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	0.1	NSL	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	0.1	0.6	<0.1	<0.1	<0.1	**0.9**	<0.1
Anthracene	0.1	0.01	<0.1	<0.1	<0.1	**0.2**	<0.1
Fluoranthene	0.1	1	<0.1	<0.1	<0.1	**1.2**	<0.1
Pyrene	0.1	NSL	<0.1	<0.1	<0.1	**1.2**	<0.1
Benzo(a)anthracene	0.1	NSL	<0.1	<0.1	<0.1	**0.5**	<0.1
Chrysene	0.1	NSL	<0.1	<0.1	<0.1	**0.6**	<0.1
Benzo(b,j+k)fluoranthene	0.2	NSL	<0.2	<0.2	<0.2	**0.7**	<0.2
Benzo(a)pyrene	0.1	0.1	<0.1	<0.1	<0.1	**0.4**	<0.1
Indeno(1,2,3-c,d)pyrene	0.1	NSL	<0.1	<0.1	<0.1	**0.2**	<0.1
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	0.1	NSL	<0.1	<0.1	<0.1	**0.3**	<0.1

Concentration above the SAC	**VALUE**
Concentration above the PQL	**Bold**
GIL >PQL	Red

TABLE G2
SUMMARY OF GROUNDWATER LABORATORY RESULTS COMPARED TO HUMAN CONTACT GILs
All results in µg/L unless stated otherwise.

	PQL Envirolab Services	Recreational (10 x NHMRC ADWG)	SAMPLES				
			MW203	ME203 - LAB DUP	MW207	MW208	GWDUP-201 (MW207)
Metals and Metalloids							
Arsenic (As III)	1	100	**1**	**1**	**5**	<1	**5**
Cadmium	0.1	20	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (total)	1	500	**2**	**2**	**2**	**1**	**2**
Copper	1	20000	<1	<1	<1	**2**	<1
Lead	1	100	<1	<1	<1	<1	<1
Total Mercury (inorganic)	0.05	10	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel	1	200	**1**	**1**	**3**	**7**	**3**
Zinc	1	30000	**4**	**4**	**4**	**71**	**6**
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)							
Benzene	1	10	<1	NA	<1	<1	<1
Toluene	1	8000	<1	NA	<1	<1	<1
Ethylbenzene	1	3000	<1	NA	<1	<1	<1
m+p-xylene	2	NSL	<2	NA	<2	<2	<2
o-xylene	1	NSL	<1	NA	<1	<1	<1
Total xylenes	2	6000	<2	NA	<2	<2	<2
Volatile Organic Compounds (VOCs), including chlorinated VOCs							
Dichlorodifluoromethane	10	NSL	<10	NA	<10	<10	<10
Chloromethane	10	NSL	<10	NA	<10	<10	<10
Vinyl Chloride	10	3	<10	NA	<10	<10	<10
Bromomethane	10	NSL	<10	NA	<10	<10	<10
Chloroethane	10	NSL	<10	NA	<10	<10	<10
Trichlorofluoromethane	10	NSL	<10	NA	<10	<10	<10
1,1-Dichloroethene	1	300	<1	NA	<1	<1	<1
Trans-1,2-dichloroethene	1	600	<1	NA	<1	<1	<1
1,1-dichloroethane	1	NSL	<1	NA	<1	<1	<1
Cis-1,2-dichloroethene	1	600	<1	NA	<1	<1	<1
Bromochloromethane	1	2500	<1	NA	<1	<1	<1
Chloroform	1		<1	NA	<1	**4**	<1
2,2-dichloropropane	1	NSL	<1	NA	<1	<1	<1
1,2-dichloroethane	1	30	<1	NA	<1	<1	<1
1,1,1-trichloroethane	1	NSL	<1	NA	<1	<1	<1
1,1-dichloropropene	1	NSL	<1	NA	<1	<1	<1
Cyclohexane	1	NSL	<1	NA	<1	<1	<1
Carbon tetrachloride	1	30	<1	NA	<1	<1	<1
Benzene	1	10	<1	NA	<1	<1	<1
Dibromomethane	1	NSL	<1	NA	<1	<1	<1
1,2-dichloropropane	1	NSL	<1	NA	<1	<1	<1
Trichloroethene	1	NSL	<1	NA	<1	<1	<1
Bromodichloromethane	1	NSL	<1	NA	<1	<1	<1
trans-1,3-dichloropropene	1	1000	<1	NA	<1	<1	<1
cis-1,3-dichloropropene	1	1000	<1	NA	<1	<1	<1
1,1,2-trichloroethane	1	NSL	<1	NA	<1	<1	<1
Toluene	1	8000	<1	NA	<1	<1	<1
1,3-dichloropropane	1	NSL	<1	NA	<1	<1	<1
Dibromochloromethane	1	NSL	<1	NA	<1	<1	<1
1,2-dibromoethane	1	NSL	<1	NA	<1	<1	<1
Tetrachloroethene	1	500	<1	NA	<1	<1	<1
1,1,1,2-tetrachloroethane	1	NSL	<1	NA	<1	<1	<1
Chlorobenzene	1	3000	<1	NA	<1	<1	<1
Ethylbenzene	1	3000	<1	NA	<1	<1	<1
Bromoform	1	NSL	<1	NA	<1	<1	<1
m+p-xylene	2	NSL	<2	NA	<2	<2	<2
Styrene	1	300	<1	NA	<1	<1	<1
1,1,2,2-tetrachloroethane	1	NSL	<1	NA	<1	<1	<1
o-xylene	1	NSL	<1	NA	<1	<1	<1
1,2,3-trichloropropane	1	NSL	<1	NA	<1	<1	<1
Isopropylbenzene	1	NSL	<1	NA	<1	<1	<1
Bromobenzene	1	NSL	<1	NA	<1	<1	<1
n-propyl benzene	1	NSL	<1	NA	<1	<1	<1
2-chlorotoluene	1	NSL	<1	NA	<1	<1	<1
4-chlorotoluene	1	NSL	<1	NA	<1	<1	<1
1,3,5-trimethyl benzene	1	NSL	<1	NA	<1	<1	<1
Tert-butyl benzene	1	NSL	<1	NA	<1	<1	<1
1,2,4-trimethyl benzene	1	NSL	<1	NA	<1	<1	<1
1,3-dichlorobenzene	1	200	<1	NA	<1	<1	<1
Sec-butyl benzene	1	NSL	<1	NA	<1	<1	<1
1,4-dichlorobenzene	1	400	<1	NA	<1	<1	<1
4-isopropyl toluene	1	NSL	<1	NA	<1	<1	<1
1,2-dichlorobenzene	1	15000	<1	NA	<1	<1	<1
n-butyl benzene	1	NSL	<1	NA	<1	<1	<1
1,2-dibromo-3-chloropropane	1	NSL	<1	NA	<1	<1	<1
1,2,4-trichlorobenzene	1	300	<1	NA	<1	<1	<1
1,2,3-trichlorobenzene	1		<1	NA	<1	<1	<1
Hexachlorobutadiene	1	7	<1	NA	<1	<1	<1
Polycyclic Aromatic Hydrocarbons (PAHs)							
Naphthalene	0.2	NSL	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	0.1	NSL	<0.1	<0.1	<0.1	**0.1**	<0.1
Acenaphthene	0.1	NSL	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	0.1	NSL	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	0.1	NSL	<0.1	<0.1	<0.1	**0.9**	<0.1
Anthracene	0.1	NSL	<0.1	<0.1	<0.1	**0.2**	<0.1
Fluoranthene	0.1	NSL	<0.1	<0.1	<0.1	**1.2**	<0.1
Pyrene	0.1	NSL	<0.1	<0.1	<0.1	**1.2**	<0.1
Benzo(a)anthracene	0.1	NSL	<0.1	<0.1	<0.1	**0.5**	<0.1
Chrysene	0.1	NSL	<0.1	<0.1	<0.1	**0.6**	<0.1
Benzo(b,j+k)fluoranthene	0.2	NSL	<0.2	<0.2	<0.2	**0.7**	<0.2
Benzo(a)pyrene	0.1	0.1	<0.1	<0.1	<0.1	**0.4**	<0.1
Indeno(1,2,3-c,d)pyrene	0.1	NSL	<0.1	<0.1	<0.1	**0.2**	<0.1
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	0.1	NSL	<0.1	<0.1	<0.1	**0.3**	<0.1
Organochlorine Pesticides (OCPs)							
alpha-BHC	0.001	NSL	NA	NA	NA	NA	NA
HCB	0.001	NSL	NA	NA	NA	NA	NA
beta-BHC	0.001	NSL	NA	NA	NA	NA	NA
gamma-BHC	0.001	NSL	NA	NA	NA	NA	NA
delta-BHC	0.001	NSL	NA	NA	NA	NA	NA
Heptachlor	0.001	3	NA	NA	NA	NA	NA
Heptachlor Epoxide	0.001		NA	NA	NA	NA	NA
Aldrin	0.001	3	NA	NA	NA	NA	NA
Dieldrin	0.001		NA	NA	NA	NA	NA
gamma-Chlordane	0.001	20	NA	NA	NA	NA	NA
alpha-Chlordane	0.001		NA	NA	NA	NA	NA
Endosulfan I	0.002	200	NA	NA	NA	NA	NA
Endosulfan II	0.002		NA	NA	NA	NA	NA
Endosulfan Sulphate	0.001		NA	NA	NA	NA	NA
DDT	0.001	90	NA	NA	NA	NA	NA
pp-DDD	0.001		NA	NA	NA	NA	NA
pp-DDE	0.001		NA	NA	NA	NA	NA
Endrin	0.001	NSL	NA	NA	NA	NA	NA
Endrin Aldehyde	0.001	NSL	NA	NA	NA	NA	NA
Methoxychlor	0.001	3,000	NA	NA	NA	NA	NA
Organophosphate Pesticides (OPPs)							
Azinphos-methyl (Guthion)	0.02	300	NA	NA	NA	NA	NA
Bromophos ethyl	0.01	100	NA	NA	NA	NA	NA
Chlorpyriphos	0.009	100	NA	NA	NA	NA	NA
Chlorpyriphos-methyl	0.01	NSL	NA	NA	NA	NA	NA
Diazinon	0.01	40	NA	NA	NA	NA	NA
Dichlorovos	0.01	50	NA	NA	NA	NA	NA
Dimethoate	0.01	70	NA	NA	NA	NA	NA
Ethion	0.01	40	NA	NA	NA	NA	NA
Fenitrothion	0.01	70	NA	NA	NA	NA	NA
Malathion (Maldison)	0.05	700	NA	NA	NA	NA	NA
Ronnel (Fenchlorphos)	0.01	NSL	NA	NA	NA	NA	NA
Parathion	0.004	200	NA	NA	NA	NA	NA
Methyl Parathion	0.01	7	NA	NA	NA	NA	NA
Polychlorinated Biphenyls (PCBs)							
Aroclor 1016	0.01	NSL	NA	NA	NA	NA	NA
Aroclor 1221	0.01	NSL	NA	NA	NA	NA	NA
Aroclor 1232	0.01	NSL	NA	NA	NA	NA	NA
Aroclor 1242	0.01	NSL	NA	NA	NA	NA	NA
Aroclor 1248	0.01	NSL	NA	NA	NA	NA	NA
Aroclor 1254	0.01	NSL	NA	NA	NA	NA	NA
Aroclor 1260	0.01	NSL	NA	NA	NA	NA	NA
Total PCBs	0.01	NSL	NA	NA	NA	NA	NA

Concentration above the SAC — **VALUE**
Concentration above the PQL — **Bold**
GIL >PQL — Red

TABLE G3
SUMMARY OF GROUNDWATER LABORATORY RESULTS COMPARED TO DRINKING WATER GILs
All results in µg/L unless stated otherwise.

	PQL Envirolab Services	NHMRC ADWG 2011	SAMPLES				
			MW203	ME203 - LAB DUP	MW207	MW208	GWDUP-201 (MW207)
Metals and Metalloids							
Arsenic (As III)	1	10	**1**	**1**	**5**	<1	**5**
Cadmium	0.1	2	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (total)	1	50	**2**	**2**	**2**	**1**	**2**
Copper	1	2000	<1	<1	<1	**2**	<1
Lead	1	10	<1	<1	<1	<1	<1
Total Mercury (inorganic)	0.05	1	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel	1	20	**1**	**1**	**3**	**7**	**3**
Zinc	1	3000	**4**	**4**	**4**	**71**	**6**
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)							
Benzene	1	1	<1	NA	<1	<1	<1
Toluene	1	800	<1	NA	<1	<1	<1
Ethylbenzene	1	300	<1	NA	<1	<1	<1
m+p-xylene	2	NSL	<2	NA	<2	<2	<2
o-xylene	1	NSL	<1	NA	<1	<1	<1
Total xylenes	2	600	<2	NA	<2	<2	<2
Volatile Organic Compounds (VOCs), including chlo	1						
Dichlorodifluoromethane	10	NSL	<10	NA	<10	<10	<10
Chloromethane	10	NSL	<10	NA	<10	<10	<10
Vinyl Chloride	10	0.3	<10	NA	<10	<10	<10
Bromomethane	10	NSL	<10	NA	<10	<10	<10
Chloroethane	10	NSL	<10	NA	<10	<10	<10
Trichlorofluoromethane	10	NSL	<10	NA	<10	<10	<10
1,1-Dichloroethene	1	30	<1	NA	<1	<1	<1
Trans-1,2-dichloroethene	1	60	<1	NA	<1	<1	<1
1,1-dichloroethane	1	NSL	<1	NA	<1	<1	<1
Cis-1,2-dichloroethene	1	60	<1	NA	<1	<1	<1
Bromochloromethane	1	250	<1	NA	<1	<1	<1
Chloroform	1		<1	NA	<1	**4**	<1
2,2-dichloropropane	1	NSL	<1	NA	<1	<1	<1
1,2-dichloroethane	1	3	<1	NA	<1	<1	<1
1,1,1-trichloroethane	1	NSL	<1	NA	<1	<1	<1
1,1-dichloropropene	1	NSL	<1	NA	<1	<1	<1
Cyclohexane	1	NSL	<1	NA	<1	<1	<1
Carbon tetrachloride	1	3	<1	NA	<1	<1	<1
Benzene	1	1	<1	NA	<1	<1	<1
Dibromomethane	1	NSL	<1	NA	<1	<1	<1
1,2-dichloropropane	2	NSL	<1	NA	<1	<1	<1
Trichloroethene	1	NSL	<1	NA	<1	<1	<1
Bromodichloromethane	2	NSL	<1	NA	<1	<1	<1
trans-1,3-dichloropropene	1	100	<1	NA	<1	<1	<1
cis-1,3-dichloropropene	1	100	<1	NA	<1	<1	<1
1,1,2-trichloroethane	1	NSL	<1	NA	<1	<1	<1
Toluene	1	800	<1	NA	<1	<1	<1
1,3-dichloropropane	1	NSL	<1	NA	<1	<1	<1
Dibromochloromethane	1	NSL	<1	NA	<1	<1	<1
1,2-dibromoethane	1	NSL	<1	NA	<1	<1	<1
Tetrachloroethene	1	50	<1	NA	<1	<1	<1
1,1,1,2-tetrachloroethane	1	NSL	<1	NA	<1	<1	<1
Chlorobenzene	1	300	<1	NA	<1	<1	<1
Ethylbenzene	1	300	<1	NA	<1	<1	<1
Bromoform	1	NSL	<1	NA	<1	<1	<1
m+p-xylene	2	NSL	<2	NA	<2	<2	<2
Styrene	1	30	<1	NA	<1	<1	<1
1,1,2,2-tetrachloroethane	1	NSL	<1	NA	<1	<1	<1
o-xylene	1	NSL	<1	NA	<1	<1	<1
1,2,3-trichloropropane	1	NSL	<1	NA	<1	<1	<1
Isopropylbenzene	1	NSL	<1	NA	<1	<1	<1
Bromobenzene	1	NSL	<1	NA	<1	<1	<1
n-propyl benzene	1	NSL	<1	NA	<1	<1	<1
2-chlorotoluene	1	NSL	<1	NA	<1	<1	<1
4-chlorotoluene	1	NSL	<1	NA	<1	<1	<1
1,3,5-trimethyl benzene	1	NSL	<1	NA	<1	<1	<1
Tert-butyl benzene	1	NSL	<1	NA	<1	<1	<1
1,2,4-trimethyl benzene	1	NSL	<1	NA	<1	<1	<1
1,3-dichlorobenzene	1	20	<1	NA	<1	<1	<1
Sec-butyl benzene	1	NSL	<1	NA	<1	<1	<1
1,4-dichlorobenzene	1	40	<1	NA	<1	<1	<1
4-isopropyl toluene	1	NSL	<1	NA	<1	<1	<1
1,2-dichlorobenzene	1	1500	<1	NA	<1	<1	<1
n-butyl benzene	1	NSL	<1	NA	<1	<1	<1
1,2-dibromo-3-chloropropane	1	NSL	<1	NA	<1	<1	<1
1,2,4-trichlorobenzene	1	30	<1	NA	<1	<1	<1
1,2,3-trichlorobenzene	1		<1	NA	<1	<1	<1
Hexachlorobutadiene	1	0.7	<1	NA	<1	<1	<1
Polycyclic Aromatic Hydrocarbons (PAHs)							
Naphthalene	0.2	NSL	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	0.1	NSL	<0.1	<0.1	<0.1	**0.1**	<0.1
Acenaphthene	0.1	NSL	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	0.1	NSL	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	0.1	NSL	<0.1	<0.1	<0.1	**0.9**	<0.1
Anthracene	0.1	NSL	<0.1	<0.1	<0.1	**0.2**	<0.1
Fluoranthene	0.1	NSL	<0.1	<0.1	<0.1	**1.2**	<0.1
Pyrene	0.1	NSL	<0.1	<0.1	<0.1	**1.2**	<0.1
Benzo(a)anthracene	0.1	NSL	<0.1	<0.1	<0.1	**0.5**	<0.1
Chrysene	0.1	NSL	<0.1	<0.1	<0.1	**0.6**	<0.1
Benzo(b,j+k)fluoranthene	0.2	NSL	<0.2	<0.2	<0.2	**0.7**	<0.2
Benzo(a)pyrene	0.1	0.01	<0.1	<0.1	<0.1	**0.4**	<0.1
Indeno(1,2,3-c,d)pyrene	0.1	NSL	<0.1	<0.1	<0.1	**0.2**	<0.1
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	0.1	NSL	<0.1	<0.1	<0.1	**0.3**	<0.1

Concentration above the SAC — **VALUE**
Concentration above the PQL — **Bold**
GIL >PQL — Red

TABLE G4
GROUNDWATER LABORATORY RESULTS COMPARED TO SITE SPECIFIC HSLs - RISK ASSESSMENT
All results in µg/L unless stated otherwise.

	PQL Envirolab Services	NHMRC ADWG 2011	WHO 2008	USEPA RSL Tapwater 2017	SAMPLES BH203	BH203 - LAB DUP	BH207	BH208	GWDUP-201
Total Recoverable Hydrocarbons (TRH)									
C_6-C_9 Aliphatics (assessed using F1)	10	-	100	-	<10	NA	<10	<10	<10
>C_9-C_{14} Aliphatics (assessed using F2)	50	-	100	-	<50	[NT]	<50	**62**	<50
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)									
Benzene	1	1	-	-	<1	NA	<1	<1	<1
Toluene	1	800	-	-	<1	NA	<1	<1	<1
Ethylbenzene	1	300	-	-	<1	NA	<1	<1	<1
Total xylenes	2	600	-	-	<2	NA	<2	<2	<2
Polycyclic Aromatic Hydrocarbons (PAHs)									
Naphthalene	1	-	-	6.1	<1	NA	<1	<1	<1
Volatile Organic Compounds (VOCs), including chlorinated VOCs									
Dichlorodifluoromethane	10	-	-	-	<10	NA	<10	<10	<10
Chloromethane	10	-	-	-	<10	NA	<10	<10	<10
Vinyl Chloride	10	0.3	-	-	<10	NA	<10	<10	<10
Bromomethane	10	-	-	-	<10	NA	<10	<10	<10
Chloroethane	10	-	-	-	<10	NA	<10	<10	<10
Trichlorofluoromethane	10	-	-	-	<10	NA	<10	<10	<10
1,1-Dichloroethene	1	30	-	-	<1	NA	<1	<1	<1
Trans-1,2-dichloroethene	1	60	-	-	<1	NA	<1	<1	<1
1,1-dichloroethane	1	-	-	-	<1	NA	<1	<1	<1
Cis-1,2-dichloroethene	1	60	-	-	<1	NA	<1	<1	<1
Bromochloromethane	1	250	-	-	<1	NA	<1	<1	<1
Chloroform	1		-	-	<1	NA	<1	**4**	<1
2,2-dichloropropane	1	-	-	-	<1	NA	<1	<1	<1
1,2-dichloroethane	1	3	-	-	<1	NA	<1	<1	<1
1,1,1-trichloroethane	1	-	-	-	<1	NA	<1	<1	<1
1,1-dichloropropene	1	-	-	-	<1	NA	<1	<1	<1
Cyclohexane	1	-	-	-	<1	NA	<1	<1	<1
Carbon tetrachloride	1	3	-	-	<1	NA	<1	<1	<1
Benzene	1	1	-	-	<1	NA	<1	<1	<1
Dibromomethane	1	-	-	-	<1	NA	<1	<1	<1
1,2-dichloropropane	1	-	-	-	<1	NA	<1	<1	<1
Trichloroethene	1	-	-	-	<1	NA	<1	<1	<1
Bromodichloromethane	1	-	-	-	<1	NA	<1	<1	<1
trans-1,3-dichloropropene	1	100	-	-	<1	NA	<1	<1	<1
cis-1,3-dichloropropene	1	100	-	-	<1	NA	<1	<1	<1
1,1,2-trichloroethane	1	-	-	-	<1	NA	<1	<1	<1
Toluene	1	800	-	-	<1	NA	<1	<1	<1
1,3-dichloropropane	1	-	-	-	<1	NA	<1	<1	<1
Dibromochloromethane	1	-	-	-	<1	NA	<1	<1	<1
1,2-dibromoethane	1	-	-	-	<1	NA	<1	<1	<1
Tetrachloroethene	1	50	-	-	<1	NA	<1	<1	<1
1,1,1,2-tetrachloroethane	1	-	-	-	<1	NA	<1	<1	<1
Chlorobenzene	1	300	-	-	<1	NA	<1	<1	<1
Ethylbenzene	1	300	-	-	<1	NA	<1	<1	<1
Bromoform	1	-	-	-	<1	NA	<1	<1	<1
m+p-xylene	2	-	-	-	<2	NA	<2	<2	<2
Styrene	1	30	-	-	<1	NA	<1	<1	<1
1,1,2,2-tetrachloroethane	1	-	-	-	<1	NA	<1	<1	<1
o-xylene	1	-	-	-	<1	NA	<1	<1	<1
1,2,3-trichloropropane	1	-	-	-	<1	NA	<1	<1	<1
Isopropylbenzene	1	-	-	-	<1	NA	<1	<1	<1
Bromobenzene	1	-	-	-	<1	NA	<1	<1	<1
n-propyl benzene	1	-	-	-	<1	NA	<1	<1	<1
2-chlorotoluene	1	-	-	-	<1	NA	<1	<1	<1
4-chlorotoluene	1	-	-	-	<1	NA	<1	<1	<1
1,3,5-trimethyl benzene	1	-	-	-	<1	NA	<1	<1	<1
Tert-butyl benzene	1	-	-	-	<1	NA	<1	<1	<1
1,2,4-trimethyl benzene	1	-	-	-	<1	NA	<1	<1	<1
1,3-dichlorobenzene	1	20	-	-	<1	NA	<1	<1	<1
Sec-butyl benzene	1	-	-	-	<1	NA	<1	<1	<1
1,4-dichlorobenzene	1	40	-	-	<1	NA	<1	<1	<1
4-isopropyl toluene	1	-	-	-	<1	NA	<1	<1	<1
1,2-dichlorobenzene	1	1500	-	-	<1	NA	<1	<1	<1
n-butyl benzene	1	-	-	-	<1	NA	<1	<1	<1
1,2-dibromo-3-chloropropane	1	-	-	-	<1	NA	<1	<1	<1
1,2,4-trichlorobenzene	1	30	-	-	<1	NA	<1	<1	<1
1,2,3-trichlorobenzene	1		-	-	<1	NA	<1	<1	<1
Hexachlorobutadiene	1	7	-	-	<1	NA	<1	<1	<1

Concentration above the SAC — **VALUE**
Concentration above the PQL — **Bold**
GIL >PQL — Red

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TABLE Q2
GROUNDWATER QA/QC SUMMARY

		Dichlorodifluoromethane	Chloromethane	Vinyl Chloride	Bromomethane	Chloroethane	Trichlorofluoromethane	1,1-Dichloroethene	Trans-1,2-dichloroethene	1,1-dichloroethane	Cis-1,2-dichloroethene	Bromochloromethane	Chloroform	2,2-dichloropropane	1,2-dichloroethane	1,1,1-trichloroethane	1,1-dichloropropene	Cyclohexane	Carbon tetrachloride	Benzene	Dibromomethane	1,2-dichloropropane	Trichloroethene	Bromodichloromethane	trans-1,3-dichloropropene	cis-1,3-dichloropropene	1,1,2-trichloroethane	Toluene	1,3-dichloropropane	Dibromochloromethane	1,2-dibromoethane	Tetrachloroethene	1,1,1,2-tetrachloroethane	Chlorobenzene	Ethylbenzene	Bromoform	m+p-xylene	Styrene	1,1,2,2-tetrachloroethane	o-xylene	1,2,3-trichloropropane	Isopropylbenzene	Bromobenzene	n-propyl benzene	2-chlorotoluene	4-chlorotoluene	1,3,5-trimethyl benzene	Tert-butyl benzene	1,2,4-trimethyl benzene	1,3-dichlorobenzene	Sec-butyl benzene	1,4-dichlorobenzene	4-isopropyl toluene	1,2-dichlorobenzene	n-butyl benzene	1,2-dibromo-3-chloropropane	1,2,4-trichlorobenzene	Hexachlorobutadiene	1,2,3-trichlorobenzene
	PQL Envirolab SYD	10	10	10	10	10	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	PQL Envirolab VIC	10	10	10	10	10	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Intra	MW207	<10	<10	<10	<10	<10	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
laboratory	GWDUP-201	<10	<10	<10	<10	<10	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
duplicate	MEAN	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

		TRH C6 - C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-Xylene	Naphthalene	Acenaphthylene	Acenaph-thene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthra-cene	Benzo(g,h,i)perylene	Arsenic	Cadmium	Chromium VI	Copper	Lead	Mercury	Nickel	Zinc
	PQL Envirolab SYD	10	50	100	100	1	1	1	2	1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	1	0.1	1	1	1	0.05	1	1
	PQL Envirolab VIC	10	50	100	100	1.0	1.0	1.0	2.0	1.0	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	1	0.1	1	1	1	0.05	1	1
Intra	MW207	<10	<50	<100	<100	<1	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	5	<0.1	2	<1	<1	<0.05	3	4
laboratory	GWDUP-201	<10	<50	<100	<100	<1	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	5	<0.1	2	<1	<1	<0.05	3	6
duplicate	MEAN	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	5	nc	2	nc	nc	nc	3	5
	RPD %	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0%	nc	0%	nc	nc	nc	0%	40%
Field	TB-201	<10	<50	<100	<100	<1	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<1	<1	<1	<0.05	<1	<1
Blank	13/02/2025																																
Trip	TS-201	-	-	-	-	111%	111%	106%	106%	107%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Spike	13/02/2025																																

Result outside of QA/QC acceptance criteria: Value (highlighted)

ABBREVIATIONS AND EXPLANATIONS

Abbreviations used in the Tables:

CT:	Contaminant Threshold
FTS:	Fluorotelomer sulfonic acid
NA:	Not Analysed
NC:	Not Calculated
NEMP	National Environmental Management Plan
NSL:	No Set Limit
PFAS	Per- and polyfluoroalkyl substances
PFHxS	Perfluorohexanesulfonic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PQL:	Practical Quantitation Limit
RS:	Rinsate Sample
SAC:	Site Assessment Criteria
SCC:	Specific Contaminant Concentration
TB:	Trip Blank
TCLP:	Toxicity Characteristics Leaching Procedure
TS:	Trip Spike
UCL:	Upper Level Confidence Limit on Mean Value

Table Specific Explanations:

Groundwater Ecology Tables:

- 95% refers to a concentration that has been derived to protect 95% of aquatic species

TABLE P1
SUMMARY OF PFAS CONCENTRATIONS IN GROUNDWATER - HUMAN HEALTH
All results in µg/L unless stated otherwise.

	PQL Envirolab Services	NEMP 2020 Recreational	NEMP 2020 Drinking	SAMPLES MW203	MW207	MW208	GWDUP-201 MW207
PFAS Compound							
Perfluorobutanesulfonic acid	0.1	NSL	NSL	**0.002**	**0.001**	**0.002**	**0.001**
Perfluoropentanesulfonic acid	0.1	NSL	NSL	<0.001	<0.001	**0.001**	<0.001
Perfluorohexanesulfonic acid - PFHxS	0.1	NSL	NSL	<0.0002	<0.0002	**0.0037**	**0.001**
Perfluoroheptanesulfonic acid	0.1	NSL	NSL	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	0.1	NSL	NSL	**0.0029**	<0.0002	**0.0044**	<0.0002
Perfluorodecanesulfonic acid	0.2	NSL	NSL	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	0.2	NSL	NSL	<0.02	<0.02	<0.02	<0.02
Perfluoropentanoic acid	0.2	NSL	NSL	<0.01	<0.01	**0.005**	<0.01
Perfluorohexanoic acid	0.1	NSL	NSL	**0.003**	**0.002**	**0.0096**	**0.004**
Perfluoroheptanoic acid	0.1	NSL	NSL	**0.002**	**0.002**	**0.0049**	**0.001**
Perfluorooctanoic acid PFOA	0.1	10	0.56	**0.0022**	**0.002**	**0.0048**	**0.002**
Perfluorononanoic acid	0.1	NSL	NSL	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	0.5	NSL	NSL	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	0.5	NSL	NSL	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	0.5	NSL	NSL	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	0.5	NSL	NSL	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	5	NSL	NSL	<0.05	<0.05	<0.05	<0.05
4:2 FTS	0.1	NSL	NSL	<0.001	<0.001	<0.002	<0.002
6:2 FTS	0.1	NSL	NSL	**0.003**	**0.001**	<0.0004	**0.002**
8:2 FTS	0.1	NSL	NSL	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	0.1	NSL	NSL	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	1	NSL	NSL	<0.01	<0.01	<0.02	<0.02
N-Methyl perfluorooctane sulfonamide	1	NSL	NSL	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctanesulfon amide	1	NSL	NSL	<0.1	<0.1	<0.1	<0.1
N-Me perfluorooctanesulfonamid oethanol	1	NSL	NSL	<0.05	<0.05	<0.05	<0.05
N-Et perfluorooctanesulfonamid oethanol	5	NSL	NSL	<0.5	<0.5	<0.5	<0.5
MePerfluorooctanesulf-amid oacetic acid	0.2	NSL	NSL	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf-amid oacetic acid	0.2	NSL	NSL	<0.002	<0.002	<0.002	<0.002
Total Positive PFHxS & PFOS	0.1	2	0.07	**0.0029**	<0.0002	**0.0081**	**0.001**
Total Positive PFOS & PFOA	0.1	NSL	NSL	**0.0051**	**0.002**	**0.0092**	**0.002**
Total Positive PFAS	0.1	NSL	NSL	**0.014**	**0.0081**	**0.036**	**0.01**

Positive PFAS result **Bold**
PFAS result above the SAC **Bold**

TABLE P2
SUMMARY OF PFAS CONCENTRATIONS IN GROUNDWATER - ECOLOGY
All results in µg/L unless stated otherwise.

	PQL Envirolab Services	NEMP 2018 95% Freshwater	SAMPLES			
			MW203	MW207	MW208	GWDUP-201 MW207
PFAS Compound						
Perfluorobutanesulfonic acid	0.1	NSL	**0.002**	**0.001**	**0.002**	**0.001**
Perfluoropentanesulfonic acid	0.1	NSL	<0.001	<0.001	**0.001**	<0.001
Perfluorohexanesulfonic acid - PFHxS	0.1	NSL	<0.0002	<0.0002	**0.0037**	**0.001**
Perfluoroheptanesulfonic acid	0.1	NSL	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	0.1	0.13	**0.0029**	<0.0002	**0.0044**	<0.0002
Perfluorodecanesulfonic acid	0.2	NSL	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	0.2	NSL	<0.02	<0.02	<0.02	<0.02
Perfluoropentanoic acid	0.2	NSL	<0.01	<0.01	**0.005**	<0.01
Perfluorohexanoic acid	0.1	NSL	**0.003**	**0.002**	**0.0096**	**0.004**
Perfluoroheptanoic acid	0.1	NSL	**0.002**	**0.002**	**0.0049**	**0.001**
Perfluorooctanoic acid PFOA	0.1	220	**0.0022**	**0.002**	**0.0048**	**0.002**
Perfluorononanoic acid	0.1	NSL	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	0.5	NSL	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	0.5	NSL	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	0.5	NSL	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	0.5	NSL	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	5	NSL	<0.05	<0.05	<0.05	<0.05
4:2 FTS	0.1	NSL	<0.001	<0.001	<0.002	<0.002
6:2 FTS	0.1	NSL	**0.003**	**0.001**	<0.0004	**0.002**
8:2 FTS	0.1	NSL	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	0.1	NSL	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	1	NSL	<0.01	<0.01	<0.02	<0.02
N-Methyl perfluorooctane sulfonamide	1	NSL	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctanesulfon amide	1	NSL	<0.1	<0.1	<0.1	<0.1
N-Me perfluorooctanesulfonamid oethanol	1	NSL	<0.05	<0.05	<0.05	<0.05
N-Et perfluorooctanesulfonamid oethanol	5	NSL	<0.5	<0.5	<0.5	<0.5
MePerfluorooctanesulf-amid oacetic acid	0.2	NSL	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf-amid oacetic acid	0.2	NSL	<0.002	<0.002	<0.002	<0.002
Total Positive PFHxS & PFOS	0.1	NSL	**0.0029**	<0.0002	**0.0081**	**0.001**
Total Positive PFOS & PFOA	0.1	NSL	**0.0051**	**0.002**	**0.0092**	**0.002**
Total Positive PFAS	0.1	NSL	**0.014**	**0.0081**	**0.036**	**0.01**

Positive PFAS result	**Bold**
PFAS result above the SAC	**Bold**

TABLE Q3
SUMMARY OF PFAS FIELD QA/QC IN GROUNDWATER
Units are µg/L unless stated otherwise.

		Perfluorobutanesulfonic acid	Perfluoropentanesulfonic acid	Perfluorohexanesulfonic acid - PFHxS	Perfluoroheptanesulfonic acid	Perfluorooctanesulfonic acid PFOS	Perfluorodecanesulfonic acid	Perfluorobutanoic acid	Perfluoropentanoic acid	Perfluorohexanoic acid	Perfluoroheptanoic acid	Perfluorooctanoic acid PFOA	Perfluorononanoic acid	Perfluorodecanoic acid	Perfluoroundecanoic acid	Perfluorododecanoic acid	Perfluorotridecanoic acid	Perfluorotetradecanoic acid	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	Perfluorooctane sulfonamide	N-Methyl perfluorooctane sulfonamide	N-Ethyl perfluorooctanesulfon amide	N-Me perfluorooctanesulfonamid oethano	N-Et perfluorooctanesulfonamid oethanol	MePerfluorooctanesulf-amid oacetic acid	EtPerfluorooctanesulf-amid oacetic acid	Total Positive PFHxS & PFOS	Total Positive PFOS & PFOA	Total Positive PFAS
PQL Envirolab		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*0.5*	*0.5*	*0.5*	*0.5*	*5*	*0.1*	*0.1*	*0.1*	*0.1*	*1*	*1*	*1*	*1*	*5*	*0.2*	*0.2*	*0.1*	*0.1*	*0.1*
PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*0.5*	*0.5*	*0.5*	*0.5*	*5*	*0.1*	*0.1*	*0.1*	*0.1*	*1*	*1*	*1*	*1*	*5*	*0.2*	*0.2*	*0.1*	*0.1*	*0.1*
Intra	MW207	0.001	<0.001	<0.0002	<0.001	<0.0002	<0.002	<0.02	<0.01	0.002	0.002	0.002	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	0.001	<0.0004	<0.002	<0.01	<0.05	<0.1	<0.05	<0.5	<0.002	<0.002	<0.0002	0.002	0.0081
laboratory	GWDUP-201	0.001	<0.001	0.001	<0.001	<0.0002	<0.002	<0.02	<0.01	0.004	0.001	0.002	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.002	0.002	<0.0004	<0.002	<0.02	<0.05	<0.1	<0.05	<0.5	<0.002	<0.002	0.001	0.002	0.01
duplicate	MEAN	0.001	nc	0.0255	nc	nc	nc	nc	nc	0.003	0.0015	0.002	nc	nc	nc	nc	nc	nc	nc	0.0015	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.0255	0.002	0.00905
	RPD %	0%	nc	192%	nc	nc	nc	nc	nc	67%	67%	0%	nc	nc	nc	nc	nc	nc	nc	67%	nc	nc	nc	nc	nc	nc	nc	nc	nc	192%	0%	21%
Field	TB-201	<0.0004	<0.001	<0.0002	<0.001	<0.0002	<0.002	<0.002	<0.002	<0.0004	<0.0004	<0.0002	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.01	<0.05	<0.1	<0.05	<0.5	<0.002	<0.002	<0.0002	<0.0002	<0.0002
Blank	13/02/2025																															

Result outside of QA/QC acceptance criteria Value

Borehole Logs

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BOREHOLE LOG

Borehole No. 201

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** HAND AUGER / SPIRAL AUGER **R.L. Surface:** ~20.3 m

Date: 31/1/25 TO 12/2/25 **Datum:** AHD

Plant Type: JK305 **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
						20				FILL: Silty sand, fine to coarse grained, brown.	M			SCREEN: 11.60kg, 0-0.05m, NO FCF
										FILL: Sandy gravel, fine to medium grained, grey, igneous, fine to coarse grained sand, trace of cemented sand nodules.	w>PL			SCREEN: 12.7kg(<10L), 0.1-0.25m, NO FCF
ON COMPLETION OF AUGERING							1			FILL: Sandy silty clay, low plasticity, dark brown, fine to coarse grained sand, trace of fine to medium grained ironstone gravel.				HAND AUGER TO 1.05m
									-		MW	M - H		HAWKESBURY SANDSTONE
						19				FILL: Sandy silty clay, low plasticity, dark brown, fine to medium grained sand, trace of fine to medium grained ironstone gravel, and tile fragments.				MODERATE TO HIGH 'TC' BIT RESISTANCE
							2			SANDSTONE: fine to medium grained, light grey and orange brown.				
						18				REFER TO CORED BOREHOLE LOG				
							3							
						17								
							4							
						16								
							5							
						15								
							6							
						14								

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 201

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~20.3 m

Date: 31/1/25 TO 12/2/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK305 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	DEFECT DETAILS: SPACING (mm) (600, 200, 60, 20)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
					START CORING AT 1.24m						
50% RETURN		19	1		SANDSTONE: fine to medium grained, orange brown, with occasional light grey bands, bedded at 0-5°.	MW	M - H	1.1		(1.32m) J, 70°, P, R, Cn	Hawkesbury Sandstone
								0.80		(1.64m) Be, 0°, P, R, Fe Sn, 35 mm.t	
		18	2								
								1.1			
								0.90			
		17	3					0.90			
								1.0			
								0.60			
		16	4					0.40		(4.71m) Be, 5°, P, S, Fe Sn	
					SANDSTONE: fine to medium grained, light grey, bedded at 0-5°.	FR	L	0.30		(4.83m) CS, 0°, 1 mm.t	
			5		Extremely Weathered sandstone: sandy silty CLAY, low plasticity, light grey, fine to medium grained sand.	XW	Hd			(5.10-5.33m) HP: >600, >600, >600 kPa	
		15				FR	M	0.30			
					SANDSTONE: fine to medium grained, light grey, with grey and dark grey laminae, bedded at 0-10°.			1.0			
			6					1.0			
		14								(6.39m) XWS, 0°, 120 mm.t	
										(6.70m) XWS, 0°, 20 mm.t	
			7				H	1.4			
								1.0			
		13			SANDSONTE: fine grained, grey, with occasional dark grey siltstone bands, bedded at 0-5°.					(7.37m) Be, 5°, P, S, Clay Vn	
								2.3		(7.69m) XWS, 0°, 20 mm.t	

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 201

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~20.3 m

Date: 31/1/25 TO 12/2/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK305 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
50% RETURN		12	9		SANDSONTE: fine grained, grey, with occasional dark grey siltstone bands, bedded at 0-5°.	FR	H	2.1		(7.98m) XWS, 0°, 30 mm.t (8.02m) XWS, 0°, 10 mm.t	Hawkesbury Sandstone
					SANDSTONE: fine to medium grained, light grey, with grey and dark grey laminae, bedded at 0-10°.			1.5			
		11						1.1		(8.88m) CS, 5°, 2 mm.t	
					SANDSTONE: fine to medium grained, light brown, bedded at 0-10°.			1.6		(9.42m) XWS, 0°, 20 mm.t (9.47m) Be, 0°, P, S, Clay Ct	
						MW		2.2			
		10	10					1.1			
					END OF BOREHOLE AT 10.38 m						

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 202

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** SPIRAL AUGER **R.L. Surface:** ~18.6 m

Date: 11/2/25 **Datum:** AHD

Plant Type: JK330 **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING									-	ASPHALTIC CONCRETE: 40mm.t FILL: Silty sandy gravel, fine to medium grained, igneous, dark grey, fine to coarse grained sand.	M			
				■	N = 2 3,2,0	18			SP	SAND: fine to coarse grained, orange brown and light brown, trace of fine to medium grained sandstone gravel.	M	VL		RESIDUAL
							1			as above, but light grey mottled orange brown.				
				■	N=SPT 5/ 150mm REFUSAL	17			-	SANDSTONE: fine to medium grained, light grey and orange brown.	MW	VL		HAWKESBURY SANDSTONE
							2					M		VERY LOW 'TC' BIT RESISTANCE MODERATE TO HIGH RESISTANCE
						16				REFER TO CORED BOREHOLE LOG				
						15	3							
						14	4							
						13	5							
						12	6							

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CORED BOREHOLE LOG

Borehole No. 202

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~18.6 m

Date: 11/2/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK330 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS SPACING (mm) DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		16			START CORING AT 2.72m					
			3		SANDSTONE: fine to medium grained, light grey, bedded at 0-5°.	FR	M	0.60		
		15			Extremely Weathered sandstone: sandy silty CLAY, low plasticity, light grey, fine to medium grained sand, with very low strength sandstone bands.	XW	Hd	0.030	(2.96-4.29m) HP: >600, >600, >600 kPa	
			4						(4.29m) Be, 0°, P, R, Fe Sn	
		14			SANDSTONE: fine to medium grained, light grey, with grey laminae, bedded at 0-10°.	HW	VL - L	0.070		
			5					0.10	(4.79m) CS, 0°, 3 mm.t	
						FR	M	0.40	(5.23m) XWS, 0°, 40 mm.t	
98% RETURN		13							(5.55m) XWS, 0°, 25 mm.t	Hawkesbury Sandstone
			6					0.90		
								0.70		
		12					M - H			
			7					1.2		
					as above, but grey and light grey, with dark grey siltstone bands.			0.90	(7.24m) XWS, 0°, 65 mm.t (7.31m) XWS, 0°, 25 mm.t (7.38m) XWS, 0°, 60 mm.t	
		11			SANDSTONE: fine to medium grained, light grey, with dark grey laminae, bedded at 0-5°.			1.4	(7.79m) CS, 5°, 2 mm.t	
			8					1.0	(8.29m) Jh, 60°, P	
					SANDSTONE: fine to medium grained, light brown and light grey, with red brown bands, bedded at 0-10°, and occasional siltstone clasts.	MW	H	1.9	(8.49m) Be, 0°, P, R, Fe Sn, 30 mm.t	
		10								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 202 **3 / 3**

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~18.6 m

Date: 11/2/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK330 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
98% RETURN		9	10		SANDSTONE: fine to medium grained, light brown and light grey, with red brown bands, bedded at 0-10°, and occasional siltstone clasts. *(continued)*	MW	H	1.4, 1.3			Hawkesbury Sandstone
		8	11		SANDSTONE: fine to medium grained, light grey, with dark grey laminae, bedded at 0-15°.	FR		1.5, 2.0, 2.9, 1.3		(10.45m) Be, 15°, P, R, Clay Vn	
		7			END OF BOREHOLE AT 11.82 m						
		6	12								
		5	13								
		4	14								
		3	15								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 203

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** SPIRAL AUGER **R.L. Surface:** ~19.9 m

Date: 15/1/25 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
										ASPHALTIC CONCRETE: 100mm.t				
DRY ON COMPLETION OF AUGERING									-	FILL: Silty sand, fine to medium grained, dark grey.	M w>PL			SCREEN: 0.6kg, 0.1-0.4m, NO FCF
					N > 3 1,3/ 150mm REFUSAL					FILL: Sandy silty clay, low plasticity, dark grey, fine to medium grained sand, trace of fine to medium grained sandstone gravel.				SCREEN: 1.5kg, 0.5-0.8m, NO FCF
						19			-	SANDSTONE: fine to medium grained, light grey.	MW	M		HAWKESBURY SANDSTONE
							1			REFER TO CORED BOREHOLE LOG				MODERATE 'TC' BIT RESISTANCE
						18	2							GROUNDWATER MONITORING WELL INSTALLED TO 12.18m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 2.18m TO 12.18m. CASING 0.1m TO 2.18m. 2mm SAND FILTER PACK 0.85m TO 12.18m. BENTONITE SEAL 0.1m TO 3.85m. BACKFILLED WITH SAND AND CUTTINGS TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						17	3							
						16	4							
						15	5							
						14	6							
						13								

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CORED BOREHOLE LOG

Borehole No. 203

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~19.9 m

Date: 15/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL -0.1, L -0.3, M -1, H -3, VH -10, EH	DEFECT DETAILS SPACING (mm) 600, 200, 60, 20 DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		19			START CORING AT 1.00m					
ON COMPLETION OF CORING		18	1		SANDSTONE: fine to medium grained, light grey, with orange brown bands, bedded at 0-15°.	MW	M - H	0.90	(1.35m) Be, 5°, P, R, Clay Vn	Hawkesbury Sandstone
			2		SANDSTONE: fine to medium grained, orange brown and light brown, with grey laminae, bedded at 0-15°.			0.70 1.1		
98% RETURN		17	3					0.80 0.90	(3.41m) XWS, 5°, 30 mm.t	
		16	4					1.0 1.2		
4 HRS AFTER COMPLETION					SANDSTONE: fine to medium grained, light grey, with grey laminae, bedded at 0-5°.	FR		0.70	(4.44m) Be, 0°, P, R, Fe Vn	
						XW	Hd		(4.61-5.05m) HP: >600, >600, >600 kPa	
ON 13/2/25		15	5		Extremely Weathered sandstone: sandy CLAY, low plasticity, light grey, fine to medium grained sand.					
					SANDSTONE: fine to medium grained, light grey, with grey and dark grey laminae, bedded at 0-10°.	FR	M - H	0.80 0.40	(5.67m) Be, 0°, P, R, Clay Vn	
		14	6					1.1	(6.05m) XWS, 0°, 10 mm.t	
		13						1.0		

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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CORED BOREHOLE LOG

Borehole No. 203 3 / 3

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~19.9 m

Date: 15/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	DEFECT DETAILS: SPACING (mm) (600, 200, 60, 20)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
		12	8		SANDSTONE: as above	FR	M - H	1.6		(7.04m) XWS, 0°, 5 mm.t	Hawkesbury Sandstone
					SANDSTONE: fine grained, grey, with Siltstone, dark grey laminae, bedded at 0-5°.						
					LAMINITE: Sandstone, fine grained, grey, interlaminated with Siltstone, dark grey, bedded at 0-5°.		L - M	0.30		(7.80m) XWS, 0°, 10 mm.t	
					SANDSTONE: fine to medium grained, light grey, with grey laminae, bedded at 0-10°.		H	1.4		(8.23m) Be, 0°, P, S, Clay Ct	
								1.2		(8.79m) Be, 0°, P, S, Clay Ct	
		11	9		SANDSTONE: fine to medium grained, light brown and orange brown, bedded at 0-20°.	MW		1.6		(9.00m) Be, 0°, P, S, Fe Sn	
								2.2			
		10	10					1.8		(10.39m) Be, 10°, P, R, Fe Sn	
								1.7			
		9	11					1.0			
								3.2			
		8	12		SANDSTONE: fine to medium grained, light grey, with grey laminae, bedded at 0-15°.	FR		1.1		(11.96m) Be, 0°, P, R, Clay Ct	
					END OF BOREHOLE AT 12.18 m						
		7	13								
		6									

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. 204

1 / 3

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** SPIRAL AUGER **R.L. Surface:** ~18.5 m

Date: 17/1/25 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING									-	SPRAYED SEAL: 5mm.t	M			APPEARS POORLY COMPACTED
										FILL: Silty sandy gravel, fine to medium grained, dark grey, fine to coarse grained sand.	w>PL			SCREEN: 2.15kg, 0.1-0.5, NO FCF
					N = 3 1,1,2	18				FILL: Sandy silty clay, low plasticity, dark grey, fine to medium grained sand.	M			SCREEN: 3.55kg, 0.5-1.0m, NO FCF
							1			FILL: Silty sand, fine to medium grained, grey, with fine to medium grained ironstone gravel.				
									CL	Sandy silty CLAY: low plasticity, orange brown, fine to medium grained sand.	w>PL	(St)		SCREEN: 4.45kg, 1-1.75m, NO FCF
														RESIDUAL
					N > 20 10,20/ 100mm REFUSAL	17						Hd		TOO FRIABLE FOR HP TESTING
									-	SANDSTONE: fine to medium grained, light grey and orange brown.	MW	M		HAWKESBURY SANDSTONE
							2			REFER TO CORED BOREHOLE LOG				MODERATE 'TC' BIT RESISTANCE
						16	3							
						15	4							
						14	5							
						13	6							
						12								

JK 9.02.4 LIB:GLB Log JK AUGERHOLE - MASTER 32976LT1 KOGARAH - JKE.GPJ <<DrawingFile>> 04/03/2025 14:48 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

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CORED BOREHOLE LOG

Borehole No. 204 **2 / 3**

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~18.5 m

Date: 17/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL -0.1, L -0.3, M -1, H -3, VH -10, EH	DEFECT DETAILS SPACING (mm) DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		17			START CORING AT 1.92m					
			2		NO CORE 0.33m					
		16			SANDSTONE: fine to medium grained, light brown and brown, massive.	MW	M	0.30	(2.37m) Be, 0°, P, R, Clay Ct	Hawkesbury Sandstone
			3		Extremely Weathered sandstone: sandy silty CLAY, low plasticity, light grey, fine to medium grained sand.	XW	Hd		(2.72m) J, 30°, P, R, Clay Ct (2.75-3.44m) HP: >600, >600, >600 kPa	
ON COMPLETION OF CORING		15			SANDSTONE: fine to medium grained, light grey and red brown, bedded at 0-10°.	MW	L	0.20	(3.58m) XWS, 0°, 25 mm.t (3.70m) XWS, 0°, 25 mm.t (3.80m) XWS, 0°, 30 mm.t (3.82m) Be, 0°, P, R, Fe Sn	
			4		SANDSTONE: fine to medium grained, light grey, with grey and dark grey laminae, bedded at 0-10°.	SW		0.20 0.20		
70% RETURN		14				FR	M	0.80	(4.61m) Be, 0°, P, R, XW IN FILL, 10mm.t	
		13	5					0.90		
			6					0.80		
		12						0.90	(6.42m) XWS, 0°, 80 mm.t	
							M - H	1.9		
			7		SANDSTONE: fine grained, grey, bedded at 0-5°.			1.3		
		11				SW		0.90	(7.39m) XWS, 5°, 10 mm.t (7.48m) Be, 0°, P, S, Clay Ct	
					SANDSTONE: as below	MW	H		(7.89m) Be, 0°, P, R, Fe Sn	

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 204 **3 / 3**

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~18.5 m

Date: 17/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DETAILS SPACING (mm) 600 200 60 20	DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
70% RETURN		10			SANDSTONE: fine to medium grained, orange brown, red brown and light grey, grey and dark grey laminae, with fine grained quartz gravel, bedded at 0-20°.	MW	H	1.5			Hawkesbury Sandstone
		9	9					1.4		(8.80m) Be, 10°, P, R, Cb	
								2.1			
		9			SANDSTONE: fine to medium grained, light brown, massive.			2.4			
			10								
		8			SANDSTONE: fine to medium grained, brown, with brown laminae, bedded at 5-20°.			3.0			
								3.1			
			11							(10.94m) Be, 20°, P, S, Clay Vn	
								2.8			
		7			END OF BOREHOLE AT 11.29 m						
			12								
		6									
			13								
		5									
			14								
		4									

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 205

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** SPIRAL AUGER **R.L. Surface:** ~18.8 m

Date: 16/1/25 TO 17/1/25 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING	■			■					-	SPRAYED SEAL: 5mm.t FILL: Silty sandy gravel, fine to medium grained, dark grey, igneous, fine to medium grained sand.	M			SCREEN: 3.05kg, 0.1-0.5m, NO FCF
				■					-	FILL: Silty sand, fine to medium grained, dark grey, trace of igneous gravel.	MW	M		HAWKESBURY SANDSTONE
						18	1			SANDSTONE: fine to medium grained, orange brown. REFER TO CORED BOREHOLE LOG				MODERATE 'TC' BIT RESISTANCE
						17	2							
						16	3							
						15	4							
						14	5							
						13	6							
						12								

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 205 **2 / 3**

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~18.8 m

Date: 16/1/25 TO 17/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	SPACING (mm) (600, 200, 60, 20)	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
					START CORING AT 0.61m						
ON COMPLETION OF CORING	98% RETURN	18	1		SANDSTONE: fine to medium grained, orange brown and light brown, with light grey bands, indistinctly bedded at 0-10°.	MW	M	0.80 0.60 0.70 1.0		(0.75m) J, 25°, P, R, Cn (0.85m) Be, 5°, P, R, Clay Vn	Hawkesbury Sandstone
		17	2								
		16	3		SANDSTONE: fine to medium grained, light grey, with grey and dark grey laminae, bedded at 0-10°.	FR		1.0 0.30		(2.91m) XWS, 0°, 30 mm.t (2.95m) Be, 0°, P, S, Clay Ct (3.32m) XWS, 0°, 30 mm.t	
		15	4		Extremely Weathered sandstone: sandy silty CLAY, low plasticity, light grey, fine to medium grained sand.	XW	Hd			(3.52-4.25m) HP: 420, 430, 450 kPa	
		14	5		SANDSTONE: fine to medium grained, light grey, with grey and dark grey laminae, indistinctly bedded at 0-20°.	FR	M	0.50 0.40 0.30 0.60		(4.88m) Be, 5°, P, S, Clay Vn (5.17m) Be, 0°, P, S, Clay Ct	
		13	6					0.80		(6.16m) Be, 0°, P, S, Clay Ct	
					SANDSTONE: fine grained, grey, with dark grey laminae, bedded at 0-5°.		H	1.2			
		12			SANDSTONE: fine to medium grained, light grey, with grey laminae, bedded at 0-10°.			1.2		(6.66m) XWS, 0°, 20 mm.t	

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 205 3 / 3

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~18.8 m

Date: 16/1/25 TO 17/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	SPACING (mm) 600 200 60 20	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
98% RETURN		11	8		SANDSTONE: fine to medium grained, light grey, with grey and dark grey laminae, bedded at 0-15°.	FR	H	1.8			
							M	0.90		(7.62m) Be, 0°, P, S, Clay Ct (7.77m) Be, 0°, P, R, Clay FILLED, 5 mm.t	
		10	9		SANDSTONE: fine to medium grained, orange brown and light brown, with grey and brown bands, bedded at 0-20°.	MW		0.70		(8.13m) Be, 0°, P, R, Fe Sn	
							H	1.6			
		9	10		SANDSTONE: fine to medium grained, light brown, massive, with occasional fine grained quartz gravel.			2.2		(9.44m) XWS, 0°, 5 mm.t	Hawkesbury Sandstone
		8	11					2.2			
								2.4			
								2.1			
		7	12		SANDSTONE: fine to medium grained, light brown, with brown laminae, bedded at 5-20°.			1.7			
								2.7		(12.11m) XWS, 0°, 30 mm.t	
					SANDSTONE: fine to medium grained, orange brown, massive.			1.4			
								1.0			
		6	13		END OF BOREHOLE AT 12.73 m						
		5									

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 206

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** SPIRAL AUGER **R.L. Surface:** ~19.0 m

Date: 15/1/25 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING	■			■					-	FILL: Silty sand, fine to coarse grained, dark brown, trace of rubber fragments and slag.	M			SYNTHETIC GRASS COVER
									-		M			
									-	CONCRETE: 50mm.t	MW	M		SCREEN: 7.76kg, 0-0.05m, NO FCF
										FILL: Silty sand, fine to medium grained, dark grey brown.				NO OBSERVED REINFORCEMENT
						18	1			SANDSTONE: fine to medium grained, orange brown.				HAWKESBURY SANDSTONE
										REFER TO CORED BOREHOLE LOG				MODERATE 'TC' BIT RESISTANCE
						17	2							HIGH RESISTANCE
														'TC' BIT REFUSAL
						16	3							
						15	4							
						14	5							
						13	6							

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CORED BOREHOLE LOG

Borehole No. 206

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~19.0 m

Date: 15/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DETAILS SPACING (mm) 600 200 60 20 DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
					START CORING AT 0.60m					Hawkesbury Sandstone
98% RETURN					SANDSTONE: fine to medium grained, light brown and orange brown, bedded at 0-5°.	MW	M	0.70 0.60		
		18	1		NO CORE 0.94m					
		17	2		SANDSTONE: fine to medium grained, orange brown and light brown, with occasional light grey and red brown bands, massive.	MW	M	0.90 1.0	(2.07m) Be, 0°, P, R, Clay Vn	Hawkesbury Sandstone
		16	3		as above, but with occasional red brown laminae, bedded at 0-10°.			0.30 0.80	(2.92m) Be, 5°, P, R, Clay Vn	
20% RETURN					SANDSTONE: fine to medium grained, light grey, with dark grey laminae, bedded at 0-10°.	FR	L	0.20		
		15	4		Extremely Weathered sandstone: sandy silty CLAY, low plasticity, light grey, fine to medium grained sand, with very low strength bands.	XW	Hd	0.090	(3.76-4.68m) HP: >600, >600, >600 kPa	
					SANDSTONE: fine to medium grained, light grey, with grey and dark grey laminae, indistinctly bedded at 0-10°.	FR	L	0.20		
		14	5				M	0.60 0.60		
		13	6					0.80		
					LAMINITE: Sandstone, fine grained, grey, interlaminated with Siltstone, dark grey, bedded at 0-5°.		H	1.8 1.8	(6.08m) Be, 0°, P, S, Clay Vn	
					SANDSTONE: as below		M - H	0.70	(6.79m) Be, 0°, P, S, Clay Ct	

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 206 **3 / 3**

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~19.0 m

Date: 15/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	DEFECT DETAILS: SPACING (mm) (600, 200, 60, 20)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
20% RETURN		11	8		SANDSTONE: fine to medium grained, light grey, with grey and dark grey laminae, and occasional siltstone bands, bedded at 0-20°.	FR	M - H	1.0		(7.73m) Be, 0°, P, S, Clay Ct	Hawkesbury Sandstone
								1.0			
								1.0			
		10	9					0.90			
								1.0			
					END OF BOREHOLE AT 9.13 m						
		9	10								
		8	11								
		7	12								
		6	13								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 207

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** SPIRAL AUGER **R.L. Surface:** ~17.9 m

Date: 16/1/25 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING				■						FILL: Silty sand, fine to coarse grained, dark brown, trace of rubber and plastic fragments.	M			SYNTHETIC GRASS COVER
									-	SANDSTONE: fine to medium grained, light grey, red brown and orange brown.	MW	M		SCREEN: 12.35kg, 0-0.1m, NO FCF
										REFER TO CORED BOREHOLE LOG				HAWKESBURY SANDSTONE MODERATE 'TC' BIT RESISTANCE 'TC' BIT REFUSAL GROUNDWATER MONITORING WELL INSTALLED TO 12.7m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 3.0m TO 12.7m. CASING 0.1m TO 3.5m. 2mm SAND FILTER PACK 1.8m TO 12.7m. BENTONITE SEAL 0.5m TO 1.8m. BACKFILLED WITH SAND AND CUTTINGS TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.

17 16 15 14 13 12 11

1 2 3 4 5 6

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CORED BOREHOLE LOG

Borehole No. 207

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~17.9 m

Date: 16/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS SPACING (mm) DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
					START CORING AT 0.68m					
		17	1		SANDSTONE: fine to medium grained, light brown, with light grey bands, massive.	MW	M	0.60		
					as above, but with brown laminae, cross bedded at 0-20°.			0.60 0.70		
ON COMPLETION OF CORING		16	2					0.90		
					SANDSTONE: fine to coarse grained, light grey, with red brown bands and grey laminae, bedded at 0-10°.	HW	L	0.10	(2.32m) XWS, 0°, 25 mm.t (2.38m) Be, 10°, P, R, Clay Vn (2.52m) Be, 10°, P, R, Clay FILLED, 5 mm.t (2.58m) Be, 5°, P, R, Clay FILLED, 5 mm.t (2.71m) Be, 5°, P, R, Clay Vn	
		15	3					0.20	(3.01m) XWS, 5°, 10 mm.t (3.11m) XWS, 1°, 10 mm.t	
98% RETURN								0.20		
					Extremely Weathered sandstone: sandy silty CLAY, low plasticity, light grey and red brown, fine to medium grained sand.	XW	Hd		(3.68m) Be, 0°, P, R, Fe Sn	
ON 13/2/25		14	4		SANDSTONE: fine to medium grained, light grey, with orange brown laminae, bedded at 0-25°.	HW	L	0.30	(4.00m) Be, 0°, P, S, Clay FILLED, 5 mm.t (4.10m) XWS, 0°, 50 mm.t	
					as above, but light grey, with grey and dark grey laminae.			0.20	(4.23m) XWS, 10°, 70 mm.t	
		13	5					0.20		
								0.40	(5.25m) Be, 10°, P, S, Clay Vn	
							M		(5.58m) Be, 5°, P, R, Clay Ct	
		12	6		LAMINITE: Sandstone, fine to medium grained, grey, interbedded with Siltstone, dark grey, bedded at 0-5°.	FR	M - H	0.60 1.2		Hawkesbury Sandstone
					SANDSTONE: as below			0.90	(6.64m) J, 60°, P, R, Cn (6.78m) Be, 0°, P, S, Clay Vn	
		11								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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CORED BOREHOLE LOG

Borehole No. 207

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~17.9 m

Date: 16/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	SPACING (mm) 600 200 60 20	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
98% RETURN		10	8		SANDSTONE: fine to medium grained, light grey, with grey and dark grey laminae, and occasional siltstone bands, bedded at 0-5°	FR	M - H	1.3		(7.37m) Be, 0°, P, S, Clay Vn	Hawkesbury Sandstone
		9	9		SANDSTONE: fine to medium grained, light grey, massive, indistinct occasional grey laminae, indistinctly bedded at 0-5°.		H	1.1 1.8 1.7		(8.13m) CS, 0°, 50 mm.t (9.07m) XWS, 0°, 10 mm.t	
		8	10		SANDSTONE: fine to medium grained, light grey, with grey laminae, cross-bedded at 10-20°.			2.1 1.4 1.0		(10.38m) Be, 0°, P, R, Clay Vn	
		7	11					1.3 0.90 1.1		(11.70m) CS, 0°, 70 mm.t	
		6	12		SANDSTONE: fine to medium grained, light grey, massive, with grey brown indistinctly cross-bedded at 10-20°.			1.1 1.4 2.3		(12.58m) Be, 0°, P, S, Clay Vn	
		5	13		END OF BOREHOLE AT 12.72 m						
		4									

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. 208

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** HAND AUGER / SPIRAL AUGER **R.L. Surface:** ~18.1 m

Date: 31/1/25 TO 10/2/25 **Datum:** AHD

Plant Type: JK330 **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING	■					18				FILL: Silty sand, fine to medium grained, brown, trace of fine to medium grained igneous gravel, plastic fragments, slag and root fibres.	M			GRASS COVER
											w<PL			SCREEN: 10.55kg, 0-0.1m, NO FCF
				■	N = 9 6,6,3					FILL: Silty sandy clay, low to medium plasticity, dark grey brown, fine to medium grained sand, trace of plastic fragments and ash.	M			APPEARS MODERATELY COMPACTED
						17	1		-	FILL: SIlty sand, fine to medium grained, dark grey brown.	DW	M		HAND AUGER TO 0.55m
										SANDSTONE: fine to medium grained, orange brown.				HAWKESBURY SANDSTONE
										REFER TO CORED BOREHOLE LOG				MODERATE 'TC' BIT RESISTANCE
						16	2							GROUNDWATER MONITORING WELL INSTALLED TO 9.4m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 3.4m TO 9.4m. CASING 0.1m TO 3.4m. 2mm SAND FILTER PACK 2.9m TO 9.4m. BENTONITE SEAL 0.1m TO 2.9m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						15	3							
						14	4							
						13	5							
						12	6							

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CORED BOREHOLE LOG

Borehole No. 208 **2 / 3**

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~18.1 m

Date: 31/1/25 TO 10/2/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK330 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS SPACING (mm) DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		17			START CORING AT 1.32m					
98% RETURN					SANDSTONE: fine to medium grained, orange brown, with light grey bands, bedded at 0-5°.	MW	L - M	0.50 0.20	(1.57m) Be, 0°, P, R, Fe Vn (1.62m) Be, 5°, C, R, Fe Vn	
		16	2		NO CORE 0.55m					
					SANDSTONE: fine to medium grained, red brown, with light grey bands and laminae, bedded at 0-20°.	MW	M - H	0.60 1.0	(2.47m) Be, 0°, P, S, Clay Vn	Hawkesbury Sandstone
		15	3		as above, but bedded at 0-10°.	HW	L	0.20	(3.24m) Be, 0°, P, R, Clay Ct (3.38m) XWS, 5°, 40 mm.t	
							VL	0.080	(3.95m) XWS, 0°, 5 mm.t	
		14	4		NO CORE 0.05m					
					SANDSTONE: fine to medium grained, red brown and light grey, bedded at 0-10°.	MW	L	0.20		
0% RETURN					as above, but light grey, with dark grey laminae.	FR		0.20	(4.97m) Be, 0°, P, S, Clay Ct	
ON 13/2/25		13	5					0.20	(5.41m) Be, 5°, P, R, Fe Vn	
							M	0.30	(5.77m) CS, 0°, 1 mm.t	Hawkesbury Sandstone
		12	6					0.50	(6.37m) XWS, 0°, 60 mm.t	
								0.70 1.0		
		11	7					0.60	(7.30m) Be, 0°, P, S, Clay Vn	
								0.70		
					SANDSTONE: as below.	MW	M - H	0.30	(7.73m) Be, 0°, P, R, Fe Ct (7.78m) XWS, 0°, 30 mm.t (7.88m) Be, 5°, P, S, Fe Ct	

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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CORED BOREHOLE LOG

Borehole No. 208 **3 / 3**

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~18.1 m

Date: 31/1/25 TO 10/2/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK330 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	SPACING (mm)	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
0% RETURN		10			SANDSTONE: fine to medium grained, orange brown, with red brown and light grey bands, bedded at 0-15°.	MW	M - H	1.0, 2.2			Hawkesbury Sandstone
					as above, but bedded at 0-30°.						
		9	9		SANDSTONE: fine to medium grained, orange brown and light grey, bedded at 0-15°.			0.20, 0.80		(8.92m) Be, 5°, P, R, Fe Ct	
					SANDSTONE: fine to medium grained, red brown and orange brown, bedded at 0-10°.		H	1.3, 2.0, 1.6, 1.8, 1.0		(9.40m) Be, 0°, P, R, Fe Ct	
		8	10								
		7	11		as above, but with light grey bands.			2.3		(11.64m) Be, 10°, P, S, Clay Vn	
		6	12		END OF BOREHOLE AT 12.05 m						
		5	13								
		4	14								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. **209**

1 / 1

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** HAND AUGER **R.L. Surface:** ~20.0 m

Date: 31/1/25 **Datum:** AHD

Plant Type: - **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	U50	DB	DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
										FILL: Silty sand, fine to medium grained, dark grey, trace of root fibres.	M			GRASS COVER
										FILL: Sandy silty clay, low plasticity, brown, fine to medium grained sand.	w>PL			SCREEN: 10.25kg, 0-0.1m, NO FCF
ON COMPLETION										FILL: Sandy silty clay, low plasticity, light brown, fine to medium grained sand, trace of fine to medium grained ironstone gravel.				
						19	1			as above, but dark grey.				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
										END OF BOREHOLE AT 0.95 m				
						18	2							
						17	3							
						16	4							
						15	5							
						14	6							

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ENVIRONMENTAL LOG

Log No. **BH210** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: E32976BT2 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 16/1/25 **Datum:** -

Plant Type: - **Logged/Checked by:** V.R./T.H.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION	■		■				0		-	ASPHALTIC CONCRETE: 50mm.t	D			ROAD BASE
	■		■							FILL: Gravel, fine to coarse grained, angular igneous, grey, trace of sand, and slag.	M			INSUFFICIENT RETURN FOR BULK SCREEN
	■		■				0.5			FILL: Silty sand, fine to medium grained, grey brown, trace of sandstone gravel.				INSUFFICIENT RETURN FOR BULK SCREEN
										FILL: Silty sandy clay, low to medium plasticity, dark brown.	w≈PL			INSUFFICIENT RETURN FOR BULK SCREEN
										END OF BOREHOLE AT 0.6m				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

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ENVIRONMENTAL LOG

Log No. **BH211** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: E32976BT2 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 16/1/25 **Datum:** -

Plant Type: - **Logged/Checked by:** V.R./T.H.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION	■		■				0		-	ASPHALTIC CONCRETE: 50mm.t	D			INSUFFICIENT RETURN FOR BULK SCREEN
	■		■							FILL: Gravel, fine to coarse grained, angular igneous, trace of sand, and slag.	M			
										FILL: Silty sand, fine to medium grained, dark brown, trace of sandstone gravel and glass fragments.				INSUFFICIENT RETURN FOR BULK SCREEN
							0.5			END OF BOREHOLE AT 0.35m				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

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ENVIRONMENTAL LOG

Log No. BH212 1/1

Environmental logs are not to be used for geotechnical purposes

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: E32976BT2 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 16/1/25 **Datum:** -

Plant Type: - **Logged/Checked by:** J.T.L./T.H.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
							0			ASPHALTIC CONCRETE: 100mm.t				
▶	■		■		■				-	FILL: Gravel, fine to coarse grained, angular igneous, grey, trace of sand.	M			ROAD BASE
	■		■							FILL: Silty sand, fine to medium grained, dark brown, trace of sandstone gravel.	W			INSUFFICIENT RETURN FOR BULK SCREEN
▼							0.5			END OF BOREHOLE AT 0.45m				SCREEN: 0.85kg (<10L) 0.15-0.45m, NO FCF
														HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

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BOREHOLE LOG

Borehole No. 213

1 / 1

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** HAND AUGER **R.L. Surface:** ~18.4 m

Date: 31/1/25 **Datum:** AHD

Plant Type: - **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION						18				FILL: Silty sand, fine to medium grained, dark grey, trace of fine to medium grained igneous gravel, ash, slag and root fibres.	M			GRASS COVER SCREEN: 11.05kg, 0-0.1m, NO FCF
										as above, but trace of fine to medium grained ironstone gravel.				
										END OF BOREHOLE AT 0.70 m				HAND AUGER REFUSAL ON OBSTRUCTION IN FILL
						17	1							
						16	2							
						15	3							
						14	4							
						13	5							
						12	6							

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ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. **BH214** **1/1**

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: E32976BT2 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 16/1/25 **Datum:** -

Plant Type: - **Logged/Checked by:** J.T.L./T.H.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
							0			ASPHALTIC CONCRETE: 50mm.t				
	■	■							-	FILL: Gravel, fine to coarse grained, angular igneous, grey, trace of sand and slag.	M			INSUFFICIENT RETURN FOR BULK SCREEN
	■	■								FILL: Silty sand, fine to medium grained, grey brown, trace of sandstone and ironstone gravel.	M			INSUFFICIENT RETURN FOR BULK SCREEN
▶	■	■					0.5			as above, but dark brown.	W			INSUFFICIENT RETURN FOR BULK SCREEN
										END OF BOREHOLE AT 0.4m				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

JKEnvironments

ENVIRONMENTAL LOG

Log No. **BH215** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: E32976BT2 **Method:** HAND AUGER / HAND TOOLS **R.L. Surface:** N/A

Date: 15/1/25 **Datum:** -

Plant Type: - **Logged/Checked by:** V.R./T.H.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION	■		■		■		0			FILL: Gravelly sand, fine to medium grained, brown, with igneous and sandstone gravel, trace of tile, red brick and plastic fragments.	M			ARTIFICIAL TURF COVER
	■		■		■						M			SCREEN: 14.88kg 0-0.1m, NO FCF
										FILL: Silty sand, fine to medium grained, dark brown, with wood material and root fibres, trace of sandstone and ironstone gravel and slag.	W			INSUFFICIENT RETURN FOR BULK SCREEN
							0.5			END OF BOREHOLE AT 0.5m				SCREEN: 11.65kg 0.2-0.5m, NO FCF
														GEOFABRIC AT BASE OF BOREHOLE
							1							HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
							1.5							
							2							
							2.5							
							3							
							3.5							

JKEnvironments

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. **BH216** **1/1**

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: E32976BT2 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 16/1/25 **Datum:** -

Plant Type: - **Logged/Checked by:** V.R./T.H.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION							0			FILL: Silty sand, fine to medium grained, brown, with igneous and ironstone gravel.	D			SYNTHETIC GRASS TURF COVER
											M			
										FILL: Silty sand, fine to medium grained, dark brown, trace of plastic fragments and wood materials.	M			SCREEN: 12.65kg 0-0.1m, NO FCF
										as above, but light brown and orange.				SCREEN: 10.70kg 0.1-0.2m, NO FCF
							0.5							SCREEN: 2.15kg (<10L) 0.4-0.7m, NO FCF
▶										FILL: Sandy clay, medium plasticity, light brown and yellow, trace of igneous gravel, roots and root fibres.	w>PL			
							1							SCREEN: 2.25kg (<10L) 0.9-1.3m, NO FCF
										as above, but light grey mottled yellow brown.	w>PL			
										END OF BOREHOLE AT 1.4m				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
							1.5							
							2							
							2.5							
							3							
							3.5							

JKEnvironments

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. BH217 1/1

SDUP201: 0-0.1m

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: E32976BT2 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 15/1/25 **Datum:** -

Plant Type: - **Logged/Checked by:** V.R./T.H.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION	■		■		■		0			FILL: Silty sand, fine to medium grained, brown, with igneous and quartz gravel, trace of twigs.	M			SYNTHETIC GRASS TURF COVER
										FILL: Silty sand, fine to medium grained, dark brown, trace of igneous gravel and plastic and wire fragments.	M			SCREEN: 13.22kg 0-0.1m, NO FCF
														SCREEN: 10.14kg 0.1-0.3m, NO FCF
	■						0.5				W			INSUFFICIENT RETURN FOR BULK SCREEN
										END OF BOREHOLE AT 0.6m				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

JKGeotechnics

BOREHOLE LOG

Borehole No. 218

1 / 1

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** HAND AUGER **R.L. Surface:** ~17.5 m

Date: 31/1/25 **Datum:** AHD

Plant Type: - **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■			■						FILL: Silty sand, fine to medium grained, dark brown, trace of fine to medium grained ironstone gravel, brick and concrete fragments, and slag.	M			SCREEN: 13.3kg, 0-0.1m, NO FCF
						17				END OF BOREHOLE AT 0.45 m				HAND AUGER REFUSAL ON OBSTRUCTION IN FILL
							1							
						16								
							2							
						15								
							3							
						14								
							4							
						13								
							5							
						12								
							6							
						11								

JKEnvironments

ENVIRONMENTAL LOG

Log No. **BH219** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: E32976BT2 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 15/1/25 **Datum:** -

Plant Type: - **Logged/Checked by:** V.R./T.H.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
							0			FILL: Silty sand, fine to medium grained, light brown, with igneous and quartz gravel, trace of earthenware and tile fragments.	D			SYNTHETIC GRASS TURF COVER
											M			SCREEN: 10.03kg 0-0.1m, NO FCF
										FILL: Silty sand, fine to medium grained, dark brown, trace of igneous and sandstone gravel, glass and plastic fragments, twigs, roots and root fibres.				SCREEN: 12.15kg 0.1-0.5m, NO FCF
							0.5				W			
▶										as above, but brown, with medium to coarse grained sandstone gravel at base of borehole.				SCREEN: 0.74kg (<10L) 0.7-1.0m, NO FCF
							1			END OF BOREHOLE AT 1.0m				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
							1.5							
							2							
							2.5							
							3							
							3.5							

ENVIRONMENTAL LOGS EXPLANATION NOTES

INTRODUCTION

These notes have been provided to amplify the environmental report in regard to classification methods, field procedures and certain matters relating to the logging of soil and rock. Not all notes are necessarily relevant to all reports.

Where geotechnical borehole logs are utilised for environmental purpose, reference should also be made to the explanatory notes included in the geotechnical report. Environmental logs are not suitable for geotechnical purposes.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies include gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726:2017 *'Geotechnical Site Investigations'*. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geoenvironmental practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached soil classification table qualified by the grading of other particles present (eg. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	< 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2.36mm
Gravel	2.36 to 63mm
Cobbles	63 to 200mm
Boulders	> 200mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose (VL)	< 4
Loose (L)	4 to 10
Medium dense (MD)	10 to 30
Dense (D)	30 to 50
Very Dense (VD)	> 50

Cohesive soils are classified on the basis of strength (consistency) either by use of a hand penetrometer, vane shear, laboratory testing and/or tactile engineering examination. The strength terms are defined as follows.

Classification	Unconfined Compressive Strength (kPa)	Indicative Undrained Shear Strength (kPa)
Very Soft (VS)	≤ 25	≤ 12
Soft (S)	> 25 and ≤ 50	> 12 and ≤ 25
Firm (F)	> 50 and ≤ 100	> 25 and ≤ 50
Stiff (St)	> 100 and ≤ 200	> 50 and ≤ 100
Very Stiff (VSt)	> 200 and ≤ 400	> 100 and ≤ 200
Hard (Hd)	> 400	> 200
Friable (Fr)	Strength not attainable – soil crumbles	

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'shale' is used to describe fissile mudstone, with a weakness parallel to bedding. Rocks with alternating inter-laminations of different grain size (eg. siltstone/claystone and siltstone/fine grained sandstone) are referred to as 'laminite'.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application. All methods except test pits, hand auger drilling and portable Dynamic Cone Penetrometers require the use of a mechanical rig which is commonly mounted on a truck chassis or track base.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils and 'weaker' bedrock if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for a large excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the

structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Refusal of the hand auger can occur on a variety of materials such as obstructions within any fill, tree roots, hard clay, gravel or ironstone, cobbles and boulders, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of limited reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock cuttings. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be assessed from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (eg. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, NMLC or HQ triple tube core barrels, which give a core of about 50mm and 61mm diameter, respectively, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as NO CORE. The location of NO CORE recovery is determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the bottom of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils, as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289.6.3.1–2004 (R2016) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Penetration Resistance of a Soil – Standard Penetration Test (SPT)'*.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63.5kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

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

  N = 13
  4, 6, 7

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

  N > 30
  15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

A modification to the SPT is where the same driving system is used with a solid 60° tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as 'N_c' on the borehole logs, together with the number of blows per 150mm penetration.

LOGS

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

The terms and symbols used in preparation of the logs are defined in the following pages.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than 'straight line' variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

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

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

More reliable measurements can be made by installing standpipes which are read after the groundwater level has stabilised at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg. bricks, steel, etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably assess the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse environmental characteristics or behaviour. If the volume and nature of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing has not been undertaken to confirm the soil classification and rock strengths indicated on the environmental logs unless noted in the report.

SYMBOL LEGENDS

SOIL


FILL


TOPSOIL


CLAY (CL, CI, CH)


SILT (ML, MH)


SAND (SP, SW)


GRAVEL (GP, GW)


SANDY CLAY (CL, CI, CH)


SILTY CLAY (CL, CI, CH)


CLAYEY SAND (SC)


SILTY SAND (SM)


GRAVELLY CLAY (CL, CI, CH)


CLAYEY GRAVEL (GC)


SANDY SILT (ML, MH)


PEAT AND HIGHLY ORGANIC SOILS (Pt)

ROCK


CONGLOMERATE


SANDSTONE


SHALE/MUDSTONE


SILTSTONE


CLAYSTONE


COAL


LAMINITE


LIMESTONE


PHYLLITE, SCHIST


TUFF


GRANITE, GABBRO


DOLERITE, DIORITE


BASALT, ANDESITE


QUARTZITE

OTHER MATERIALS


BRICKS OR PAVERS


CONCRETE


ASPHALTIC CONCRETE

CLASSIFICATION OF COARSE AND FINE GRAINED SOILS

Major Divisions		Group Symbol	Typical Names	Field Classification of Sand and Gravel	Laboratory Classification	
Coarse grained soil (more than 65% of soil excluding oversize fraction is greater than 0.075mm)	GRAVEL (more than half of coarse fraction is larger than 2.36mm	GW	Gravel and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 4$ $1 < C_c < 3$
		GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		GM	Gravel-silt mixtures and gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	Fines behave as silt
		GC	Gravel-clay mixtures and gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	Fines behave as clay
	SAND (more than half of coarse fraction is smaller than 2.36mm)	SW	Sand and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 6$ $1 < C_c < 3$
		SP	Sand and gravel-sand mixtures, little or no fines	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		SM	Sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	N/A
		SC	Sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	

Major Divisions		Group Symbol	Typical Names	Field Classification of Silt and Clay			Laboratory Classification
				Dry Strength	Dilatancy	Toughness	% < 0.075mm
ine grained soils (more than 35% of soil excluding oversize fraction is less than 0.075mm)	SILT and CLAY (low to medium plasticity)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity	None to low	Slow to rapid	Low	Below A line
		CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	Medium to high	None to slow	Medium	Above A line
		OL	Organic silt	Low to medium	Slow	Low	Below A line
	SILT and CLAY (high plasticity)	MH	Inorganic silt	Low to medium	None to slow	Low to medium	Below A line
		CH	Inorganic clay of high plasticity	High to very high	None	High	Above A line
		OH	Organic clay of medium to high plasticity, organic silt	Medium to high	None to very slow	Low to medium	Below A line
	Highly organic soil	Pt	Peat, highly organic soil	–	–	–	–

Laboratory Classification Criteria

A well graded coarse grained soil is one for which the coefficient of uniformity $Cu > 4$ and the coefficient of curvature $1 < C_c < 3$. Otherwise, the soil is poorly graded. These coefficients are given by:

$$C_U = \frac{D_{60}}{D_{10}} \qquad and \qquad C_C = \frac{(D_{30})^2}{D_{10}\,D_{60}}$$

Where D_{10}, D_{30} and D_{60} are those grain sizes for which 10%, 30% and 60% of the soil grains, respectively, are smaller.

NOTES:

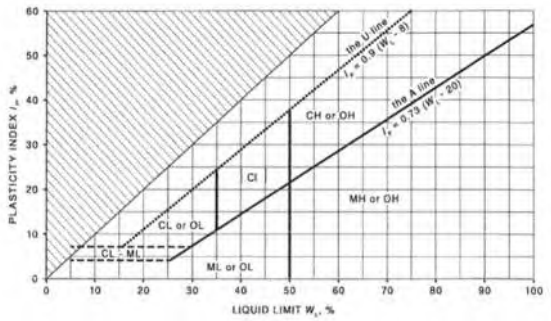
1 For a coarse grained soil with a fines content between 5% and 12%, the soil is given a dual classification comprising the two group symbols separated by a dash; for example, for a poorly graded gravel with between 5% and 12% silt fines, the classification is GP-GM.

2 Where the grading is determined from laboratory tests, it is defined by coefficients of curvature (C_c) and uniformity (C_u) derived from the particle size distribution curve.

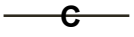
3 Clay soils with liquid limits > 35% and ≤ 50% may be classified as being of medium plasticity.

4 The U line on the Modified Casagrande Chart is an approximate upper bound for most natural soils.

Modified Casagrande Chart for Classifying Silts and Clays according to their Behaviour



LOG SYMBOLS

Log Column	Symbol	Definition
Groundwater Record		Standing water level. Time delay following completion of drilling/excavation may be shown.
		Extent of borehole/test pit collapse shortly after drilling/excavation.
		Groundwater seepage into borehole or test pit noted during drilling or excavation.
Samples	ES	Sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos analysis.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
	PFAS	Soil sample taken over depth indicated, for analysis of Per- and Polyfluoroalkyl Substances.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'Refusal' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60° solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25 PID = 100	Vane shear reading in kPa of undrained shear strength. Photoionisation detector reading in ppm (soil sample headspace test).
Moisture Condition (Fine Grained Soils)	w > PL $w \approx$ PL w < PL $w \approx$ LL w > LL	Moisture content estimated to be greater than plastic limit. Moisture content estimated to be approximately equal to plastic limit. Moisture content estimated to be less than plastic limit. Moisture content estimated to be near liquid limit. Moisture content estimated to be wet of liquid limit.
(Coarse Grained Soils)	D M W	DRY – runs freely through fingers. MOIST – does not run freely but no free water visible on soil surface. WET – free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS S F St VSt Hd Fr ( )	VERY SOFT – unconfined compressive strength ≤ 25kPa. SOFT – unconfined compressive strength > 25kPa and ≤ 50kPa. FIRM – unconfined compressive strength > 50kPa and ≤ 100kPa. STIFF – unconfined compressive strength > 100kPa and ≤ 200kPa. VERY STIFF – unconfined compressive strength > 200kPa and ≤ 400kPa. HARD – unconfined compressive strength > 400kPa. FRIABLE – strength not attainable, soil crumbles. Bracketed symbol indicates estimated consistency based on tactile examination or other assessment.
Density Index/ Relative Density (Cohesionless Soils)	VL L MD D VD ( )	**Density Index (I_D) Range (%)** / **SPT 'N' Value Range (Blows/300mm)** VERY LOOSE ≤ 15 / 0 – 4 LOOSE > 15 and ≤ 35 / 4 – 10 MEDIUM DENSE > 35 and ≤ 65 / 10 – 30 DENSE > 65 and ≤ 85 / 30 – 50 VERY DENSE > 85 / > 50 Bracketed symbol indicates estimated density based on ease of drilling or other assessment.

Log Column	Symbol	Definition
Hand Penetrometer Readings	300 250	Measures reading in kPa of unconfined compressive strength. Numbers indicate individual test results on representative undisturbed material unless noted otherwise.
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Twin pronged tungsten carbide bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.
	Soil Origin	The geological origin of the soil can generally be described as: RESIDUAL – soil formed directly from insitu weathering of the underlying rock. No visible structure or fabric of the parent rock. EXTREMELY WEATHERED – soil formed directly from insitu weathering of the underlying rock. Material is of soil strength but retains the structure and/or fabric of the parent rock. ALLUVIAL – soil deposited by creeks and rivers. ESTUARINE – soil deposited in coastal estuaries, including sediments caused by inflowing creeks and rivers, and tidal currents. MARINE – soil deposited in a marine environment. AEOLIAN – soil carried and deposited by wind. COLLUVIAL – soil and rock debris transported downslope by gravity, with or without the assistance of flowing water. Colluvium is usually a thick deposit formed from a landslide. The description 'slopewash' is used for thinner surficial deposits. LITTORAL – beach deposited soil.

Classification of Material Weathering

Term		Abbreviation		Definition
Residual Soil		RS		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered		XW		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered	Distinctly Weathered (Note 1)	HW	DW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered		MW		The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered		SW		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh		FR		Rock shows no sign of decomposition of individual minerals or colour changes.

NOTE 1: The term 'Distinctly Weathered' is used where it is not practicable to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock. 'Distinctly Weathered' is defined as follows: *'Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores'*. There is some change in rock strength.

Rock Material Strength Classification

Term	Abbreviation	Uniaxial Compressive Strength (MPa)	Guide to Strength	
			Point Load Strength Index $Is_{(50)}$ (MPa)	Field Assessment
Very Low Strength	VL	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30mm thick can be broken by finger pressure.
Low Strength	L	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium Strength	M	6 to 20	0.3 to 1	Scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High Strength	H	20 to 60	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High Strength	VH	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High Strength	EH	> 200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Appendix C: SAQP for Supplementary Environmental Investigation

REPORT TO

NSW DEPARTMENT OF EDUCATION

ON

SAMPLING, ANALYSIS AND QUALITY PLAN FOR SUPPLEMENTARY ENVIRONMENTAL INVESTIGATION

FOR

PROPOSED ALTERATIONS AND ADDITIONS

AT

KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Date: 19 March 2025

Ref: E32976BT2rpt6-SAQP

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DOCUMENT REVISION RECORD

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Attachments

Abbreviations

Asbestos Fines/Fibrous Asbestos	**AF/FA**
Ambient Background Concentrations	**ABC**
Added Contaminant Limits	**ACL**
Asbestos Containing Material	**ACM**
Australian Drinking Water Guidelines	**ADWG**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
Acid Sulfate Soil	**ASS**
Before You Dig Australia	**BYDA**
Below Ground Level	**BGL**
Benzo(a)pyrene Toxicity Equivalent Factor	**BaP TEQ**
Benzene, Toluene, Ethylbenzene, Xylene	**BTEX**
Cation Exchange Capacity	**CEC**
Contaminated Land Management	**CLM**
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Quality Control	**QC**
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State Environmental Planning Policy	**SEPP**
Source, Pathway, Receptor	**SPR**
Standard Penetration Test	**SPT**
Standing Water Level	**SWL**
Trip Blank	**TB**
Toxicity Characteristic Leaching Procedure	**TCLP**
Total Recoverable Hydrocarbons	**TRH**

Trip Spike	**TS**
Upper Confidence Limit	**UCL**
Volatile Organic Compounds	**VOC**

Units

Litres	**L**
Metres BGL	**mBGL**
Metres	**m**
Millivolts	**mV**
Millilitres	**ml or mL**
Milliequivalents	**meq**
micro Siemens per Centimetre	**µS/cm**
Micrograms per Litre	**µg/L**
Milligrams per Kilogram	**mg/kg**
Parts Per Million	**ppm**
Percentage	**%**
Percentage weight for weight	**%w/w**

1 INTRODUCTION

NSW Department of Education ('the client') commissioned JK Environments (JKE) to prepare a Sampling, Analysis and Quality Plan (SAQP) for the Supplementary Environmental Investigation to be undertaken by JKE for the proposed alterations and additions at Kogarah Public School, 24B Gladstone Street, Kogarah, NSW. The site location is shown on Figure 1 and the proposed investigation will be confined to 'the site' boundaries (defined by the proposed development area) as shown on Figure 2 attached in the appendices.

JKE has previously undertaken a Phase 1 Desktop Assessment (desktop), a Phase 2 Preliminary Intrusive Investigation (intrusive investigation), and a Detailed Site Investigation (DSI) at the site. WSP has also previously prepared a Preliminary Desktop Site Investigation at the site. A summary of relevant information from these reports is included in Section 2.

1.1 Proposed Development Details

It is understood that the proposed Kogarah Public School upgrade works include the following:

- Demolition of existing playground facilities and Covered Outdoor Learning Area (COLA) in addition to footings and services associated with former demountable buildings;
- Tree removal;
- Construction of a new three storey Classroom building and attached amenities facilities;
- Construction of a single storey Hall with attached COLA;
- New pedestrian pathway connections providing access throughout the site;
- Service upgrades; and
- Site landscaping works.

A basement level is not proposed.

1.2 Aims and Objectives

The primary aim of the investigation is to provide additional data in relation to the occurrence and concentrations of asbestos in soil, provide an increased soil sampling density for asbestos, and to provide additional groundwater data in order to assess site risks in relation to contamination and establish whether remediation is required. A secondary aim of the investigation is to provide additional waste classification data for off-site disposal of soil waste which may be generated during the proposed development works.

The investigation objectives are to:

- Assess the soil and groundwater contamination conditions via implementation of a sampling and analysis program;
- Document an iteration and review of the conceptual site model (CSM);
- Assess the potential risks posed by contamination to the receptors identified in the CSM (Tier 1 assessment);
- Update the existing waste classification for off-site disposal of soil;
- Assess whether the site is suitable or can be made suitable for the proposed development (from a contamination viewpoint); and
- Assess whether remediation is required.

1.3 Scope of Work

The SAQP was prepared generally in accordance with a JK proposal (Ref: EP71307PT) of 3 March 2025 and written acceptance from the client.

The scope of work included review of the existing project information and preparation of an SAQP with regards to National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)[1], and other guidelines made under or with regards to the Contaminated Land Management Act (1997)[2].

A list of reference documents/guidelines is included in the appendices.

[1] National Environment Protection Council (NEPC), (2013). *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013).* (referred to as NEPM 2013)

[2] Contaminated Land Management Act 1997 (NSW) (referred to as CLM Act 1997)

2 SITE INFORMATION

2.1 Background

JKE undertook previous investigations at the site and wider school property in 2020 and early 2025, and WSP undertook a previous investigation in 2023. The western portion of the wider school property does not form part of the site for the purpose of the DSI (see Figures 1 and 2 in Appendix A). A summary of relevant information from the previous investigations is outlined in the table below:

Table 2-1: Previous information summary

Report	Summary of relevant information
Phase 1 Desktop Assessment, 2020[3]	The desktop included review of site information, including: background and historical information; a walkover site inspection; and preparation of a report presenting the results of the assessment, including a CSM. Site history information indicated that residential style structures had been present on the site, and one of the lots within the site had been utilised as a bus depot. The site and wider school property was progressively developed into the primary school site from 1956. During this time, demolition of the original site structures occurred, along with potential filling of the site. The age of the former and existing buildings indicated the potential for hazardous building materials to be present. During the JKE site inspection, a fibre cement fragment (FCF) of suspected asbestos containing material (ACM) was identified on the site, and fill material (i.e. imported/disturbed soils) was also observed at the site surface in several areas. Based on the scope of work undertaken for desktop, the CSM identified the following potential contamination sources/areas of environmental concern (AEC): • Fill material - It was considered possible that minor historical filling had occurred to achieve the existing levels. The fill may have been imported from various sources and could be contaminated. It was also considered possible that fill was generated from the native (on-site soils) and was mixed with debris during various phases of redevelopment; • Historical use as a bus depot - Historical title records indicated that the site was owned by a company providing bus service operations and aerial photographs confirmed buses were being stored on this section of the site. Fuels, oils and solvents (e.g. toluene/mineral spirit/thinners) may have been used during this site use; • Use of pesticides - Pesticides may have been used beneath the buildings and/or around the site; • Hazardous building materials (i.e. ACM) - Hazardous building materials may be present as a result of former building and demolition activities. These materials may also be present in the existing buildings/ structures on site. Hazardous building materials can also occur in fill due to historical demolition activities; and • Up-gradient off-site historical dry cleaners and motor garage/service stations – historical business directories indicated that several of these businesses were located upgradient of the site and may pose a risk to the site via migration of contaminated groundwater. The desktop recommended undertaking a preliminary intrusive investigation to make an initial assessment of contamination-related risks and to inform the design of a detailed (Stage 2) site investigation (DSI).

[3] JKE, (2020a). *Report to School Infrastructure NSW on Phase 1 Desktop Assessment for Proposed School Redevelopment (SINSW00330/19) at Kogarah Public School, 24B Gladstone Street, Kogarah, NSW.* (Ref: E32976PTrpt-KPS, dated 28 February 2020) (referred to as desktop)

Report	Summary of relevant information
Phase 2 Preliminary Intrusive Investigation, 2020[4]	The intrusive investigation included a review of existing project information, a site inspection, and soil sampling from 10 boreholes, of which four were located on the current site, including BH107 to BH110 inclusive (refer to Figure 2). Fill material was encountered to depths of between approximately 0.2m below ground level (BGL) and 1.7m BGL, underlain by natural residual sandy soils. The fill contained inclusions of igneous and ironstone gravel, glass fragments, sand and root fibres. A selection of soil samples was analysed for the contaminants of potential concern (CoPC) identified in the CSM. A surficial FCF was identified in the south of the site as shown on Figure 2. The surficial FCF was removed from the site (as sample FCF1) by JKE during the desktop was also analysed and was found to contain asbestos. Based on the data from the intrusive investigation, JKE was of the opinion that the potential risk of widespread subsurface contamination in the intrusive investigation area was low as the soil samples analysed did not identify contamination that was assessed to pose an unacceptable risk. FCF1 was non-friable ACM. The source of the asbestos appeared to be a fibre cement board at the base of the neighbouring fence and was considered unlikely to be associated with on-site soils in that vicinity. The ACM was removed and no further fragments were identified in the area. The intrusive investigation report recommended that the investigation data obtained should be supplemented via a detailed investigation in order to fully characterise the contamination conditions at the site and establish whether remediation is required.
Site Contamination Services – Preliminary Desktop Site Investigation, 2023[5]	The PSI comprised a desktop study to review general site details, site environmental setting and history, regulatory databases and client provided reports and information. The site history review was limited to historical aerial photographs and publicly available information on online databases. Based on the scope of work undertaken for desktop, the CSM identified the following potential contamination sources/ AEC: • Uncontrolled fill materials potentially used historically to raise or level portions of the site; • Historical or recent waste dumping; • Potential ACM or hazardous building materials associated with imported materials or demolished structures; and • Pesticides used historically and recently to maintain the site. The report concluded that the site presented a low to moderate risk of inground contamination due to the potential for uncontrolled fill and poor demolition practices associated with historic development and demolition of residential buildings on the site. It is noted that the investigation did not include a site inspection.
Detailed Site Investigation, 2025[6]	The DSI included a review of existing site information, soil sampling from 12 boreholes/test pits and groundwater sampling from three monitoring wells (see Figure 2 in Appendix A). The boreholes/test pits encountered fill materials to depths of approximately 0.2mBGL to 1.4mBGL in all locations and was generally underlain by sandstone bedrock. No FCFACM was encountered in the fill material during the fieldwork.

[4] JKE, (2020b). *Report to School Infrastructure NSW on Phase 2 Preliminary Intrusive Investigation for Proposed School Redevelopment (SINSW00330/19) at Kogarah Public School, 24B Gladstone Street, Kogarah, NSW.* (Ref: E32976PTrpt2-KPS, dated 8 May 2020) (referred to as intrusive investigation)

[5] WSP, (2023). *Report to School Infrastructure NSW on Site Contamination Services – Preliminary Desktop Site Investigation, Kogarah Public School.* (Project Ref: PS206292, report dated 7 December 2023) (referred to as WSP PSI)

[6]

Report	Summary of relevant information
	A selection of soil and groundwater samples were analysed for the CoPC identified in the CSM. In fill soil, carcinogenic polycyclic aromatic hydrocarbons (PAHs) were reported at concentrations above the health-based SAC. Asbestos (as AF/FA) was also detected in fill soils at one location, although the concentration of asbestos was below the health-based SAC. In groundwater, copper, zinc and PAHs (phenanthrene, anthracene, fluoranthene, and benzo(a)pyrene) were reported above the freshwater ecological SAC, and the benzo(a)pyrene concentration also exceeded the drinking water and recreational SAC. Despite the SAC exceedances, the Tier 1 risk assessment did not identify a trigger for remediation as risks were assessed to be low. However, further investigation of the site was noted to be required due to the occurrence of asbestos in fill and to better understand the potential impacts from PAHs in the groundwater. The DSI concluded that further investigation of the site is required to provide a conclusive outcome regarding whether the land is suitable in its current state, or whether remediation is required (relating to Clause 4.6 of the State Environmental Planning Policy [Resilience and Hazards] 2021[7] [formerly known as SEPP55]). The following as recommended: 1. Preparation of an interim asbestos management plan (AMP) to manage potential risks from asbestos in/on soil until the activity occurs; 2. Preparation and implementation of a Remediation Action Plan (RAP). The RAP is to include requirements for a pre-remediation investigation to adequately address the data gaps identified and outline a contingency for remediation if the investigation confirms remediation is necessary; 3. Preparation and implementation of a construction-phase AMP; and 4. Preparation of a validation assessment report, as required, for the remediation works undertaken at the site. Based on the results of the preliminary waste classification assessment, and at the time of reporting, the fill material at the site is assigned a preliminary classification of General Solid Waste (non-putrescible) containing Special Waste (asbestos). At the time of reporting, it was also considered possible that some of the natural soils and bedrock at the site could classifiable as virgin excavated natural material (VENM) for off-site disposal or re-use purposes. Confirmatory waste classification assessment is required.

2.2 Site Identification

Table 2-2: Site Identification

Site Address:	24B Gladstone Street, Kogarah, NSW
Lot & Deposited Plan:	Lot 1 in DP179779, Lot A in DP391026, and part of Lot 1 in DP667959.
Current Land Use:	Primary School (Kindergarten to year 6)
Proposed Land Use:	Continued use as a primary school
Local Government Area:	Georges River Council

[7] *State Environmental Planning Policy (Resilience and Hazards) 2021* (NSW) (referred to as SEPP Resilience and Hazards 2021)

Current Zoning:	SP2: Infrastructure
Site Area (m^2) (approx.):	4,375
Geographical Location (decimal degrees) (approx.):	Latitude: -33.9618430 Longitude: 151.1370970
Site Location Plans:	Appendix A

2.3 Site Location and Regional Setting

The site is located in the eastern portion of the existing Kogarah Public School property, which itself is in a mixed-use area of Kogarah and is bound by the Princes Highway to the east and Gladstone Street to the west. The site is located approximately 535m to the south-west of Muddy Creek and 1.7km to the west of Botany Bay.

2.4 Topography

The site is situated in gently undulating regional topography, with the site itself gently sloping towards the east at approximately 1° to 2°. Parts of the site appear to have been levelled to account for the slope and accommodate the existing development.

2.5 Site Inspection

The most recent walkover inspection of the site was undertaken by JKE on 15 January 2025 as part of the DSI. A summary of the inspection findings is outlined below:

- At the time of the inspection, the site comprised a COLA, over asphaltic concrete paved playground in the west of the site. The east of the site comprised soft-fall and artificial grass covered playground areas with garden and landscaped areas around the boundaries of the site. A small toilet block and goods store was also positioned along the southern boundary, and construction fencing was positioned along the central north of the site in an east-west alignment, due to recent demolition activities (removal of demountable classrooms) in this section of the site;
- Where the demolition/removal had taken place in the north of the site, exposed soils and debris from demolition/removal activities were observed at the site surface;
- During the inspection, an unsealed bag of FCF/suspected ACM was identified in the central north of the site. The bag was assumed to be associated with an emu-pick following demolition removal works. JKE sealed the bag and informed the client of this find at the time of the fieldwork;
- Fill was observed at the ground surface in areas of exposed soils across the site. Imported material/fill was considered likely to be present in garden beds and as a result of general (minor) levelling works across the site;
- Aside from fill, there were no other visible or olfactory indicators of contamination observed during the inspection; and
- Medium to large trees were observed around the site and a number of grass-covered sections of the site were also observed. Grass coverage was generally good in the unpaved areas, with the exception

of some areas beneath large trees and isolated areas of the playground (generally around the interface with pavements).

2.6 Surrounding Land Use

During the DSI site inspection, JKE observed the following land uses in the immediate surrounds:

- North – high-density high-rise residential apartment buildings, a construction site and Regent Street;
- South – St Paul's Anglican Church (heritage), children's centre (church run);
- East – Princes Highway and low-density residential houses; and
- West – Kogarah Public School (main buildings).

JKE did not observe any land uses in the immediate surrounds that were identified as potential contamination sources for the site.

2.7 Underground Services

The 'Before You Dig Australia' (BYDA) plans were reviewed in preparation of this SAQP in order to establish whether any major underground services exist at the site or in the immediate vicinity that could act as a preferential pathway for contamination migration. Major services were not identified that would be expected to act as preferential pathways for contamination migration.

2.8 Summary of Regional Geology and Hydrogeology

2.8.1 Regional Geology

Regional geological information reviewed for the previous investigations indicated that the site is underlain by underlain by Triassic aged deposits of medium to coarse-grained quartz sandstone, and very minor shale and laminate lenses (Hawksbury Sandstone).

A summary of the subsurface conditions encountered during the DSI is present in the table below:

Table 7.1: Summary of Subsurface Conditions

Profile	Description
Pavement	Asphaltic concrete pavement was encountered at the surface in BH203, BH210, BH211, BH212, and BH214, between approximately 50mm to 100mm in thickness.
Fill	Fill was encountered at the surface or immediately beneath the pavement in all locations and extended to depths of approximately 0.2mBGL to 1.4mBGL. BH209 to BH217 and BH219 were terminated in the fill soil as a maximum depth of 1.4mBGL. The fill typically comprised of silty sand, silty sandy clay, gravel, gravelly sand, sandy clay, and silty sandy gravel with inclusions of igneous, ironstone, and sandstone gravel, plastic, glass, tile, metal and brick fragments, slag, ash, wood and root fibres. Neither staining nor odours were encountered in the fill material during fieldwork. No FCF or ACM was encountered in the fill material during the fieldwork.

Profile	Description
Bedrock	Sandstone bedrock was encountered beneath the fill material in BH201, BH203, BH207, BH208 and BH218. Neither staining nor odours were recorded in the bedrock during fieldwork.
Groundwater	Groundwater seepage was encountered in boreholes BH201, BH209, BH212, BH214, BH216 and BH219 at depths of approximately 0.4mBGL to 0.8mBGL. All other boreholes remained dry during and on completion of drilling.

2.8.2 Acid Sulfate Soil (ASS) Risk and Planning

The site is not located in an acid sulfate soil (ASS) risk area according to the risk maps prepared by the Department of Land and Water Conservation. (1997)[8].

The site is not mapped as being within an ASS risk area in the Georges River Local Environmental Plan 2021.

2.8.3 Hydrogeology

Hydrogeological information reviewed for the previous investigations indicated that the regional aquifer on-site and in the areas immediately surrounding the site includes porous, extensive aquifers of low to moderate productivity. There was a total of 521 registered bores within the report buffer of 2,000m. In summary:

- The nearest registered bore was located approximately 400m from the site. This was utilised for domestic purposes. The nearest downgradient bore registered for domestic uses was located over 1,500m to the north of the site;
- The majority of the bores were registered for domestic purposes;
- The drillers log information from the closest (within 500m) registered bores typically identified fill and/or sand and clay soil to depths of 3.65m-6.50m. Standing water levels (SWLs) in the bores ranged from 1.5m below ground level (BGL) to 3.0mBGL; and
- Groundwater is likely to be encountered at depths ranging from 3m to 5m below existing surface levels based on previous JKG investigations of nearby properties.

A summary of the groundwater field screening conditions encountered during the DSI is presented in the following table:

Table 2-3: Summary of Field Screening

Aspect	Details
Groundwater Depth & Flow	The relative heights of the ground surface at each monitoring well location were recorded using a GPS and the relative levels (RLs) of groundwater in each well were calculated based of the SWLs during the DSI. A contour plot was prepared for the groundwater flow direction using Surfer v8.08 (Surface Mapping Program). The contour plot indicated that groundwater generally flow towards the north, which is generally consistent with expectations based on the topography, and down-gradient water bodies.

[8] Department of Land and Water Conservation, (1997). *1:25,000 Acid Sulfate Soil Risk Map (Series 9130N3, Ed 2)*

Aspect	Details
Groundwater Field Parameters	Field measurements recorded during the DSI sampling were as follows: - pH ranged from 4.90 to 5.22; - EC ranged from 941µS/cm to 1,385µS/cm; - Eh ranged from 64.9mV to 180.7mV; and - DO ranged from 1.0mg/L to 5.7mg/L. The PID readings in the monitoring well headspace recorded during sampling ranged from 0ppm in MW203 and MW207, and 1ppm in MW208.
LNAPLs petroleum hydrocarbons	Phase separated product (i.e. LNAPL) was not detected using the interphase probe during groundwater sampling.

2.9 Receiving Water Bodies

Surface water bodies were not identified in the immediate vicinity of the site. The closest surface water body is Muddy Creek, a tributary of the Cooks River located approximately 535m to the north-east of the site. This is down-gradient from the site, and is considered to be a potential receptor.

3 CONCEPTUAL SITE MODEL

NEPM (2013) defines a CSM as a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM for the site is presented in the following sub-sections and is based on the site information (including the site inspection information) and background/site history site history information. Reference should also be made to the figures attached in the appendices.

3.1 Contamination Sources/AEC and CoPC

The contamination sources/areas of environmental concern (AEC) and contaminants of potential concern (CoPC) are presented in the following table:

Table 3-1: Contamination Sources/AEC and Contaminants of Potential Concern

Source / AEC	CoPC
Fill material – It is possible that minor historical filling has occurred to achieve the existing levels. The fill may have been imported from various sources and could be contaminated. It is also possible that fill was generated from the native (on-site soils) and was mixed with debris during various phases of redevelopment. Fill material was encountered to depths of between 0.1m to 1.4mBGL across the site during the DSI. Asbestos was identified as a surficial FCF/ACM during previous investigations, in a bag of FCF/ACM during the site inspection for the DSI and in fill/soil during the DSI, and it is possible the asbestos is associated with this AEC and/or with hazardous building materials from poor demolition practices. Exceedances of carcinogenic PAHs in fill soil and PAHs in groundwater were reported at the site during the DSI.	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), petroleum hydrocarbons (referred to as total recoverable hydrocarbons – TRHs), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), polychlorinated biphenyls (PCBs) and asbestos.
Use of pesticides – Pesticides may have been used beneath the buildings and/or around the site. Risks associated with this AEC are considered to be low. However, sampling has not been completed adjacent to or beneath the existing buildings yet to be demolished (toilet block on southern side of site)	Heavy metals and OCPs.
Hazardous Building Material – Hazardous building materials may be present as a result of former building and demolition activities. These materials may also be present in the existing buildings/ structures on site. Asbestos was identified as a surficial FCF/ACM during previous investigations, in a bag of FCF/ACM during the site inspection for the DSI and in fill/soil during the DSI, and it is possible the asbestos is associated with this AEC and/or with imported fill.	Asbestos and lead.

3.2 Mechanism for Contamination, Affected Media, Receptors and Exposure Pathways

The mechanisms for contamination, affected media, receptors and exposure pathways relevant to the potential contamination sources/AEC are outlined in the following CSM table:

Table 3-2: CSM

Potential mechanism for contamination	The potential mechanisms for contamination are most likely to include 'top-down' impacts and spills. There is a potential for sub-surface releases to have occurred if deep fill (or other buried industrial infrastructure) is present, although this is considered to be the least likely mechanism for contamination.
Affected media	Soil and groundwater have been identified as potentially affected media.
Receptor identification	Human receptors include site occupants/users (including adults and children), construction workers and intrusive maintenance workers. Off-site human receptors include adjacent land users, and groundwater users. Ecological receptors include terrestrial organisms and plants within unpaved areas (including the proposed landscaped areas), and ecology in down-gradient water bodies.
Potential exposure pathways	Potential exposure pathways relevant to the human receptors include ingestion, dermal absorption and inhalation of dust (all contaminants) and vapours (volatile TRH, naphthalene and BTEX). The potential for exposure would typically be associated with the construction and excavation works, and future use of the site. Potential exposure pathways for ecological receptors include direct/primary contact and ingestion. Exposure during future site use could occur via direct contact with soil in unpaved areas such as gardens, inhalation of airborne asbestos fibres during soil disturbance, or inhalation of vapours within enclosed spaces such as buildings and basements. Exposure to groundwater may occur in Muddy Creek and/or the Cooks River through direct migration.
Potential exposure mechanisms	The following have been identified as potential exposure mechanisms for site contamination: • Vapour intrusion into the proposed building (either from soil contamination or volatilisation of contaminants from groundwater); • Contact (dermal, ingestion or inhalation) with exposed soils in landscaped areas and/or unpaved areas; • Contact with groundwater during construction; • Migration of groundwater off-site and into nearby water bodies, including aquatic ecosystems and those being used for recreation; and • Migration of groundwater off-site into areas where groundwater is being utilised as a resource (i.e. for domestic or irrigation).
Presence of preferential pathways for contaminant movement	None

4 SAMPLING, ANALYSIS AND QUALITY PLAN

4.1 Data Quality Objectives (DQO)

Data Quality Objectives (DQOs) have been developed to define the type and quality of data required to achieve the project objectives outlined in Section 1.2. The DQOs were prepared with reference to the process outlined in Schedule B2 of NEPM (2013). The seven-step DQO approach for this project is outlined in the following sub-sections.

The DQO process is validated in part by the Data Quality Assurance/Quality Control (QA/QC) Evaluation. The Data (QA/QC) Evaluation will be summarised in the DSI report.

4.1.1 Step 1 - State the Problem

The previous investigations identified potential sources of contamination/AEC at the site that may pose a risk to human health and the environment. Supplementary investigation data is required to assess the contamination status of the site, assess the risks posed by the contaminants in the context of the proposed development/intended land use, and assess whether remediation is required. This information will be considered by the project team in the design and delivery of the project as well as by the determining authority in exercising its planning functions in relation to the approval of the development proposal under Chapter 4, Clause 4.6 of SEPP Resilience and Hazards 2021.

A waste classification is required prior to off-site disposal of excavated soil/bedrock.

4.1.2 Step 2 - Identify the Decisions of the Study

The objectives of the supplementary environmental investigation are outlined in Section 1.2. The decisions to be made reflect these objectives and are as follows:

- Are any results above the SAC?
- Do potential risks associated with contamination exist, and if so, what are they?
- Is remediation required and what is this likely to involve?
- What is the waste classification of the in-situ fill material and natural soils/bedrock sampled and is further sampling/analysis required to confirm the waste classification(s)?
- Is the site suitable for the proposed development, or can the site be made suitable subject to further characterisation and/or remediation?

4.1.3 Step 3 - Identify Information Inputs

The primary information inputs required to address the decisions outlined in Step 2 include the following:

- Existing relevant environmental data from previous reports;
- Site information, including site observations and site history documentation;
- Sampling of potentially affected media, including soil and groundwater;
- Observations of sub-surface variables such as soil type, photo-ionisation detector (PID) concentrations, odours and staining, and groundwater physiochemical parameters;
- Laboratory analysis of soils, fibre cement (if identified) and groundwater samples for the CoPC identified in the CSM; and

- Field and laboratory QA/QC data.

4.1.4 Step 4 - Define the Study Boundary

The sampling will be confined to the site boundaries as shown in Figure 2 and will be limited vertically to the base of the fill material for asbestos characterisation, approximately 0.5m into the natural soils/bedrock for all other AEC/CoPC in soil (where practicable) and a maximum nominated sampling depth of 12.7mBGL for groundwater (spatial boundary). The final depth could depend on site conditions and will be noted in the DSI. At this stage, the sampling is scheduled to be completed on 22 and 23 March 2025 (temporal boundary). Areas not accessible for sampling will be noted in the report as data gaps.

4.1.5 Step 5 - Develop an Analytical Approach (or Decision Rule)

4.1.5.1 Tier 1 Screening Criteria

The laboratory data will be assessed against relevant Tier 1 screening criteria (referred to as SAC), as outlined in Section 5. Exceedances of the SAC do not necessarily indicate a requirement for remediation or a risk to human health and/or the environment. Exceedances are considered in the context of the CSM and valid SPR-linkages.

For this investigation, the individual results will be assessed as either above or below the SAC. Statistical evaluation of the dataset via calculation of mean values and/or 95% upper confidence limit (UCL) values will not be undertaken due to the spatial distribution of the data and the number of samples submitted for analysis.

4.1.5.2 Field and Laboratory QA/QC

Field QA/QC will include analysis of inter-laboratory duplicates (minimum of 5% of primary samples), intra-laboratory duplicates (minimum of 5% of primary samples), and trip spike (for volatiles), trip blank (for selected organic and inorganic compounds) and rinsate (for selected organic and inorganic compounds) samples (one for each medium sampled to assess the adequacy of field practices).

Further details regarding the sampling and analysis undertaken, and the acceptable limits adopted, will be included in the Data Quality (QA/QC) Evaluation presented in the DSI report.

The suitability of the laboratory data is assessed against the laboratory QA/QC criteria which will be outlined in the laboratory reports. These criteria are developed and implemented in accordance with the laboratory's National Association of Testing Authorities, Australia (NATA) accreditation and align with the acceptable limits for QA/QC samples as outlined in NEPM (2013) and other relevant guidelines.

In the event that acceptable limits are not met by the laboratory analysis, other lines of evidence are reviewed (e.g. field observations of samples, preservation, handling etc) and, where required, consultation with the laboratory is undertaken in an effort to establish the cause of the non-conformance. Where uncertainty exists, the most conservative concentration reported are to be adopted.

4.1.5.3 Appropriateness of Practical Quantitation Limits (PQLs)

The PQLs of the analytical methods are to be considered in relation to the SAC to confirm that the PQLs are less than the SAC. In cases where the PQLs are greater than the SAC, a discussion of this is provided.

4.1.6 Step 6 – Specify Limits on Decision Errors

To limit the potential for decision errors, a range of quality assurance processes are adopted. A quantitative assessment of the potential for false positives and false negatives in the analytical results will be undertaken with reference to Schedule B(3) of NEPM (2013) using the data quality assurance information collected.

Quantitative limits on decision errors are not proposed to be established as the sample plan is not probabilistic. Data will be assessed based on a multiple lines of evidence and risk-based approach.

Data Quality Indicators (DQI) for field and laboratory QA/QC samples are defined below. An assessment of the DQI's is to be made in relation to precision, accuracy, representativeness, completeness and comparability.

Field Duplicates

Acceptable targets for precision of field duplicates will be 30% or less, consistent with NEPM (2013). RPD failures will be considered qualitatively on a case-by-case basis taking into account factors such as the concentrations used to calculate the RPD (i.e. RPD exceedance where concentrations are close to the PQL are typically not as significant as those where concentrations are reported at least five or 10 times the PQL), sample type, collection methods and the specific analyte where the RPD exceedance was reported.

Trip Blanks

Acceptable targets for field blank samples in this report will be less than the PQL for organic analytes. Metals will be considered on a case-by-case basis with regards to typical background concentrations in soils and published drinking water guidelines for waters.

Trip Spikes

Acceptable targets for trip spike samples will be 70% to 130%.

Laboratory QA/QC

The suitability of the laboratory data will be assessed against the laboratory QA/QC criteria. These criteria are developed and implemented in accordance with the laboratory's NATA accreditation and align with the acceptable limits for QA/QC samples as outlined in NEPM (2013) and other relevant guidelines.

A summary of the typical limits is provided below:

RPDs

- Results that are <5 times the PQL, any RPD is acceptable; and
- Results >5 times the PQL, RPDs between 0-50% are acceptable.

Laboratory Control Samples (LCS) and Matrix Spikes

- 70-130% recovery acceptable for metals and inorganics; and
- 60-140% recovery acceptable for organics.

Surrogate Spikes

- 60-140% recovery acceptable for general organics.

Method Blanks

- All results less than PQL.

In the event that acceptable limits are not met by the laboratory analysis, other lines of evidence will be reviewed (e.g. field observations of samples, preservation, handling etc) and, where required, consultation with the laboratory is to be undertaken in an effort to establish the cause of the non-conformance. Where uncertainty exists, we will adopt the most conservative concentration reported.

4.1.7 Step 7 - Optimise the Design for Obtaining Data

The most resource-effective design will be used in an optimum manner to achieve the investigation objectives. The investigation has been designed considering available information however, adjustment of the investigation design can occur following consultation or feedback from project stakeholders. For this investigation, the design was optimised via consideration of the various lines of evidence used to select the sample locations, the media being sampled, and also by the way in which the data will be collected. The sampling plan and methodology are outlined in the following sub-sections.

4.2 Soil Sampling Plan and Methodology

The soil sampling plan and methodology proposed for the DSI is outlined in the table below:

Table 4-1: Proposed Soil Sampling Plan and Methodology

Aspect	Input
Sampling Density	Samples for the supplementary environmental investigation will be collected from 17 locations (TP301 to TP317) as shown on the attached Figure 2. This number of locations meets the requirement for an increased sampling density for asbestos when it is confirmed/known to exist in soil, as outlined in the NSW EPA Sampling Design Part 1 – Application (2022)[9] contaminated land guidelines and the Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (2021)[10]. Soil samples will be collected from TP302, TP307, TP308, TP309 and TP310 for additional waste classification purposes and all AEC and CoPC. Soil samples will be obtained from TP314 and TP315 for the CoPC associated with the AEC use of pesticides.

[9] NSW EPA, (2022). *Sampling design part 1 - application.* (referred to as EPA Sampling Design Guidelines 2022)

[10] Western Australian (WA) Department of Health (DoH), (2021). *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*. (referred to as WA DoH 2021)

Aspect	Input
Sampling Plan	The sampling locations will be placed on a judgemental sampling plan and will be broadly positioned for site coverage in areas outside of the proposed building/structure footprint. This sampling plan is considered suitable to further characterise the fill/soil for asbestos contamination and to make an assessment of potential risks associated with the AEC and CoPC identified in the CSM, and assess whether remediation is required. Fieldwork will occur with regards to the activity specific asbestos management plan (AMP) (report ref: E32976BT2rpt5, dated 19 March 2025). The AMP is attached in the appendices.
Set-out and Sampling Equipment	Sampling locations will be set out using a tape measure. In-situ sampling locations will be checked for underground services by an external contractor prior to sampling. Samples will be collected using an excavator with a mud bucket (flat edged bucket). Samples were obtained from the test pit walls or directly from the bucket by hand. Where sampling occurred from the bucket, JKE collected samples from the central portion of large soil clods, or from material that was unlikely to have come into contact with the bucket.
Sample Collection and Field QA/QC	Soil samples will be obtained in accordance with our standard field procedures. Soil samples will be collected from the fill and natural profiles based on field observations. The sample depths will be shown on the logs included in the DSI report. Soil samples for contamination testing will be placed in glass jars with plastic caps and Teflon seals with minimal headspace. Samples for asbestos analysis will placed in zip-lock plastic bags. During sampling, soil at selected depths will be split into primary and duplicate samples for field QA/QC analysis (chemical contaminants only). The field splitting procedure includes alternate filling of the sampling containers to obtain a representative split sample. Homogenisation of duplicate samples will not occur to minimise the potential for the release of volatile organic compounds.
Field Screening	A portable Photoionisation Detector (PID) fitted with a 10.6mV lamp will be used to screen the samples for the presence of volatile organic compounds (VOCs). PID screening for VOCs will be undertaken on soil samples using the soil sample headspace method. VOC data will be obtained from partly filled zip-lock plastic bags following equilibration of the headspace gases. PID calibration records will be maintained for the project. The field screening for asbestos quantification will include the following: • A representative bulk sample (approximately 10L sample, to the extent achievable based on sample return) is to be collected from fill at 1m intervals, or from each distinct fill profile. The quantity of material for each sample may vary based on the return achieved using the auger. The bulk sample intervals will be shown on the borehole logs; • Each sample will be weighed using an electronic scale; • Each bulk sample will be passed through a sieve with a 7.1mm aperture and inspected for the presence of fibre cement. If the soil are cohesive in nature, the samples will be subsequently placed on a contrasting support (blue tarpaulin) and inspected for the presence of fibre cement. Any soil clumps/nodules will be disaggregated; • The condition of fibre cement or any other suspected asbestos materials will be noted on the field records; and

Aspect	Input
	• If observed, any fragments of fibre cement in the bulk sample will be collected, placed in a zip-lock bag and assigned a unique identifier. Calculations for asbestos content will be undertaken based on the requirements outlined in Schedule B1 of NEPM (2013), as summarised in Section 5.1. Bulk samples in unpaved areas will be taken from the top 100mm, then each distinct fill profile thereafter, with a minimum of one sample per 1m depth of each fill profile.
Decontami-nation and Sample Preservation	Sampling personnel will use disposable nitrile gloves during sampling activities. Re-usable sampling equipment will be decontaminated between sampling events using a Decon and potable water solution, followed by a rinse in potable water. Soil samples for chemical contaminants will be preserved by immediate storage in an insulated sample container with ice. On completion of the fieldwork, these samples may be stored temporarily in fridges in the JKE warehouse before being delivered in the insulated sample container to a NATA registered laboratory for analysis under standard chain of custody (COC) procedures. Soil samples and/or FCF for asbestos analysis will be stored in zip-lock bags and placed in a suitable container for transport. On completion of the fieldwork, these samples will be delivered in the container to a NATA registered laboratory for analysis under standard chain of custody (COC) procedures.

4.3 Groundwater Sampling Plan and Methodology

The groundwater sampling plan and methodology proposed for the DSI is outlined in the table below:

Table 4-2: Proposed Groundwater Sampling Plan and Methodology

Aspect	Input
Sampling Plan	It is proposed to sample from the three groundwater monitoring wells that were installed for the DSI. These include: MW203, MW207 and MW208 (refer to Figure 2 attached).
Monitoring Well Installation	The monitoring well construction details are documented on the appropriate borehole logs attached in Appendix B. The monitoring wells were installed to depths of approximately 9.4mBGL to 12.7mBGL.
Groundwater Sampling	Prior to sampling, the monitoring wells will be checked for the presence of Light Non-Aqueous Phase Liquids (LNAPL) using an inter-phase probe electronic dip meter. The monitoring well head space will be checked for VOCs using a calibrated PID unit. The samples will be obtained using a peristaltic pump/disposable plastic bailer. During sampling, the following parameters will be monitored using calibrated field instruments: • SWL using an electronic dip meter; and • pH, temperature, EC, DO and Eh using a YSI Multi-probe water quality meter. Steady state conditions are considered to have been achieved when the difference in the pH measurements is less than 0.2 units, the difference in conductivity is less than 10%, and when the SWL was not in drawdown.

Aspect	Input
	Groundwater samples will be obtained directly from the single use PVC tubing and placed in the sample containers. Duplicate samples are to be obtained by alternate filling of sample containers. This technique is adopted to minimise disturbance of the samples and loss of volatile contaminants associated with mixing of liquids in secondary containers, etc. Groundwater removed from the wells during development and sampling will be transported to JKE in jerry cans and stored in holding drums prior to collection by a licensed waste water contractor for off-site disposal. The field monitoring record and calibration data will be included in the report.
Decontaminant and Sample Preservation	The inter-phase probe electronic dip meter will be decontaminated between monitoring wells using potable water (with rags and scrubbing brush), followed by a rinse with potable water. The groundwater sampling process utilises a peristaltic pump and single-use tubing, therefore no decontamination procedure for the sampling is considered necessary. The samples will be preserved with reference to the analytical requirements and placed in an insulated container with ice or ice bricks. On completion of the fieldwork, the samples may be temporarily stored in a fridge at the JKE office, before being delivered in the insulated sample container to a NATA registered laboratory for analysis under standard COC procedures.

4.4 Laboratory Analysis and Proposed Analytical Schedule

Samples will analysed by an appropriate, NATA Accredited laboratory using the analytical methods detailed in Schedule B(3) of NEPM 2013. The laboratory details are provided in the table below:

Table 4-3: Laboratory Details

Samples	Laboratory
All primary samples and field QA/QC samples including intra-laboratory duplicates, trip blanks, trip spikes, field rinsate samples	Envirolab Services Pty Ltd NSW, NATA Accreditation Number – 2901 (ISO/IEC 17025 compliance)
Inter-laboratory duplicates	Envirolab Services Pty Ltd VIC, NATA Accreditation Number – 2901 (ISO/IEC 17025 compliance)

For the DSI, an allowance has been made for the following analysis:

- Up to 10 selected soil samples will be analysed for: asbestos (500ml);
- Up to two representative fibre cement fragments, if found on or in soil, will be analysed for asbestos;
- Up to four selected soil samples will be analysed for: heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc); PAHs; TRH; BTEX; OCPs and OPPs; and PCBs;
- Up to two selected soil samples will be analysed for: heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc); and, OCPs and OPPs;
- Up to two selected soil samples for TCLP leachability analysis for PAHs and selected metals has been included to provide a preliminary waste classification for the off-site disposal of soil in accordance with NSW EPA Waste Classification Guidelines - Part 1: Classifying Waste (2014). In the event this budget is not utilised for TCLP analysis, it may be utilised for additional soil analysis, where deemed appropriate; and

- Up to three groundwater samples (allowance of one per well) will be analysed for: heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc); and PAHs.

5 SITE ASSESSMENT CRITERIA (SAC)

The following SAC derived from the NEPM 2013 and other guidelines, as discussed in the following sub-sections, will be adopted for the DSI.

5.1 Soil

Soil data will be compared to relevant Tier 1 screening criteria in accordance with NEPM (2013) as outlined below.

5.1.1 Human Health

- Health Investigation Levels (HILs) for a 'residential with accessible soils' exposure scenario (HIL-A). These SAC also apply to primary schools;
- Health Screening Levels (HSLs) for a 'low-high density residential' exposure scenario (HSL-A & HSL-B), which also apply to primary schools. HSLs will be calculated based on conservative assumptions including a 'sand' type and a depth interval of 0m to 1m;
- HSLs for direct contact presented in the CRC Care Technical Report No. 10 – Health screening levels for hydrocarbons in soil and groundwater Part 1: Technical development document (2011)[11]; and
- Asbestos will be assessed against the HSL-A criteria. A summary of the asbestos criteria is provided in the table below:

Table 5-1: Details for Asbestos SAC

Guideline	Applicability
Asbestos in Soil	The HSL-A criteria will be adopted for the assessment of asbestos in soil. The SAC adopted for asbestos are derived from the NEPM 2013 and based on the Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (2021)[12]. The SAC include the following: • No visible asbestos at the surface/in the top 10cm of soil; • <0.01% w/w bonded asbestos containing material (ACM) in soil; and • <0.001% w/w asbestos fines/fibrous asbestos (AF/FA) in soil. Concentrations for bonded ACM concentrations in soil are based on the following equation which is presented in Schedule B1 of NEPM (2013): **% w/w asbestos in soil = % asbestos content x bonded ACM (kg) / Soil volume (L) x soil density (kg/L)** However, we are of the opinion that the actual soil volume in a 10L bucket varies considerably due to the presence of voids, particularly when assessing cohesive soils. Therefore, each bucket sample was weighed using electronic scales and the above equation was adjusted as follows (we note that the units have also converted to grams): **% w/w asbestos in soil = % asbestos content x bonded ACM (g) / Soil weight (g)**

[11] Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC Care), (2011). Technical Report No. 10 - *Health screening levels for hydrocarbons in soil and groundwater Part 1: Technical development document*

[12] Western Australian (WA) Department of Health (DoH), (2021). *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*. (referred to as WA DoH 2021)

5.1.2 Environment (Ecological – terrestrial ecosystems)

- Ecological Investigation Levels (EILs) and Ecological Screening Levels (ESLs) for an 'urban residential and public open space' (URPOS) exposure scenario. The EILs will only be applied to the top 2m of soil as outlined in NEPM (2013). The criterion for benzo(a)pyrene will be increased from the value presented in NEPM (2013) based on the Canadian Soil Quality Guidelines[13];
- ESLs will be adopted based on the soil type; and
- EILs for selected metals will be calculated based on the most conservative added contaminant limit (ACL) values presented in Schedule B(1) of NEPM (2013) and published ambient background concentration (ABC) values presented in the document titled Trace Element Concentrations in Soils from Rural and Urban Areas of Australia (1995)[14]. This method is considered to be adequate for the Tier 1 screening.

5.1.3 Management Limits for Petroleum Hydrocarbons

Management limits for petroleum hydrocarbons (as presented in Schedule B1 of NEPM 2013) will be considered.

5.1.4 Waste Classification

Data for the waste classification assessment will be assessed in accordance with the Waste Classification Guidelines, Part 1: Classifying Waste (2014)[15] as outlined in the following table:

Table 5-2: Waste Categories

Category	Description
General Solid Waste (non-putrescible)	• If Specific Contaminant Concentration (SCC) ≤ Contaminant Threshold (CT1) then Toxicity Characteristics Leaching Procedure (TCLP) not needed to classify the soil as general solid waste; and • If TCLP ≤ TCLP1 and SCC ≤ SCC1 then treat as general solid waste.
Restricted Solid Waste (non-putrescible)	• If SCC ≤ CT2 then TCLP not needed to classify the soil as restricted solid waste; and • If TCLP ≤ TCLP2 and SCC ≤ SCC2 then treat as restricted solid waste.
Hazardous Waste	• If SCC > CT2 then TCLP must be undertaken to classify the soil as hazardous waste; and • If TCLP > TCLP2 and/or SCC > SCC2 then treat as hazardous waste.
Virgin Excavated Natural Material (VENM)	Natural material (such as clay, gravel, sand, soil or rock fines) that meet the following: • That has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial mining or agricultural activities; • That does not contain sulfidic ores or other waste; and • Includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved from time to time by a notice published in the NSW Government Gazette.

[13] Canadian Council of Ministers of the Environment, (1999). *Canadian soil quality guidelines for the protection of environmental and human health: Benzo(a)Pyrene (1997)* (referred to as the Canadian Soil Quality Guidelines)

[14] Olszowy, H., Torr, P., and Imray, P., (1995), *Trace Element Concentrations in Soils from Rural and Urban Areas of Australia. Contaminated Sites Monograph Series No. 4*. Department of Human Services and Health, Environment Protection Agency, and South Australian Health Commission

[15] NSW EPA, (2014). *Waste Classification Guidelines, Part 1: Classifying Waste.* (referred to as Waste Classification Guidelines 2014)

5.2 Groundwater

Groundwater data will be compared to relevant Tier 1 screening criteria in accordance with NEPM (2013), following an assessment of environmental values in accordance with the Guidelines for the Assessment and Management of Groundwater Contamination (2007)[16]. Environmental values for the supplementary environmental investigation include aquatic ecosystems, human uses (consumption, incidental contact and recreational water use), and human-health risks in non-use scenarios (vapour intrusion).

5.2.1 Human Health

- During the DSI, bedrock was encountered at depths shallower than 2mBGL and groundwater was encountered at depths of 3.84mBGL to 6.34mBGL. On this basis, a site-specific assessment (SSA) for the Tier 1 screening of human health risks posed by volatile contaminants in groundwater will be undertaken. The assessment will include a selection of alternative Tier 1 criteria that are considered suitably protective of human health. These criteria are based on drinking water guidelines and have been referred to as HSL-SSA. The criteria will be based on the USEPA Region 9 screening levels for naphthalene (threshold value for tap water);
- The Australian Drinking Water Guidelines 2011 (updated 2021)[17] will be multiplied by a factor of 10 to assess potential risks associated with incidental/recreational-type exposure to groundwater (e.g. within down-gradient water bodies, with bore water used for irrigation, or with seepage water during construction). These have been deemed as 'recreational' SAC; and
- ADWG 2011 criteria will be adopted as screening criteria for consumption of groundwater.

5.2.2 Environment (Ecological - aquatic ecosystems)

Groundwater Investigation Levels (GILs) for 95% protection of freshwater species will be adopted based on the Default Guideline Values in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018)[18]. The 99% trigger values will be adopted where required to account for bioaccumulation. Low and moderate reliability trigger values will also be adopted for some contaminants where high-reliability trigger values don't exist.

[16] NSW Department of Environment and Conservation, (2007). *Guidelines for the Assessment and Management of Groundwater Contamination.*

[17] National Health and Medical Research Council (NHMRC), (2021). *National Water Quality Management Strategy, Australian Drinking Water Guidelines 2011* (referred to as ADWG 2011)

[18] Australian and New Zealand Governments (ANZG), (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia (referred to as ANZG 2018)

6 REPORTING REQUIREMENTS

A supplementary environmental investigation report is to be prepared presenting the results of the investigation, generally in accordance with the NSW EPA Consultants Reporting on Contaminated Land, Contaminated Land Guidelines (2020)[19].

[19] NSW EPA, (2020). *Consultants Reporting on Contaminated Land, Contaminated Land Guidelines*

7 LIMITATIONS

The report limitations are outlined below:

- This SAQP was developed based on the information available, as documented in this plan. There is always a potential that the proposed investigation will identify contamination impacts (actual or potential) that trigger a need for further investigation;
- JKE accepts no responsibility for any unidentified contamination issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- Previous use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during construction work;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the JKE proposal; and terms of contract between JKE and the client (as applicable);
- The plan is based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The preparation of this report has been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, JKE has not undertaken any verification process, except where specifically stated in the report;
- JKE has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination, except where specifically stated in the report;
- JKE accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- JKE have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or landuse. JKE should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa; and
- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose.

Important Information About This Report

These notes have been prepared by JKE to assist with the assessment and interpretation of this report.

The Report is based on a Unique Set of Project Specific Factors
This report has been prepared in response to specific project requirements as stated in the JKE proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- The proposed land use is altered;
- The defined subject site is increased or sub-divided;
- The proposed development details including size, configuration, location, orientation of the structures or landscaped areas are modified;
- The proposed development levels are altered, eg addition of basement levels; or
- Ownership of the site changes.

JKE will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the investigation. If the subject site is sold, ownership of the investigation report should be transferred by JKE to the new site owners who will be informed of the conditions and limitations under which the investigation was undertaken. No person should apply an investigation for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions
Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (e.g. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater contaminant concentrations may also vary over time through contaminant migration, natural attenuation of organic contaminants, ongoing contaminating activities and placement or removal of fill material. The conclusions of an investigation report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Report is based on Professional Interpretations of Factual Data
Site investigations identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on the proposed development and appropriate remediation measures.

Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an investigation indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Investigation Limitations
Although information provided by a site investigation can reduce exposure to the risk of the presence of contamination, no environmental site investigation can eliminate the risk. Even a rigorous professional investigation may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

Misinterpretation of Site Investigations by Design Professionals

Costly problems can occur when other design professionals develop plans based on misinterpretation of an investigation report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Logs Should not be Separated from the Investigation Report

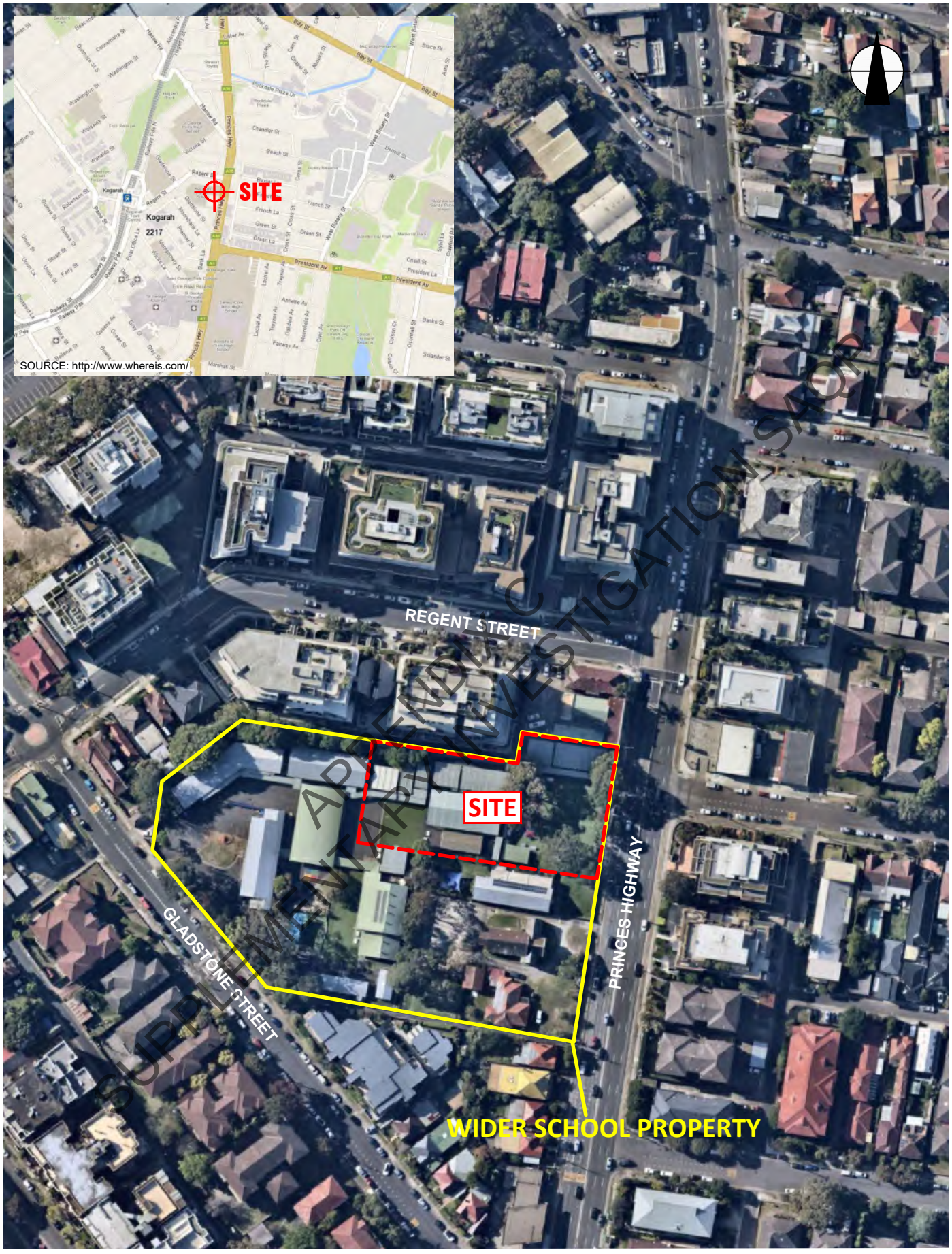
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however contractors can still misinterpret the logs during bid preparation if separated from the text of the investigation. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the rest of the report to obtain a proper understanding of the investigation. Please note that logs with the 'Environmental Log' header are not suitable for geotechnical purposes as they have not been peer reviewed by a Senior Geotechnical Engineer.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete investigation should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

Read Responsibility Clauses Closely

Because an environmental site investigation is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site investigation, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

Appendix A: Report Figures



AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the Environmental report.

Title:	**SITE LOCATION PLAN**
Location:	24B GLADSTONE STREET, KOGARAH, NSW
Project No:	E32976BT2
Figure No:	1

JKEnvironments

PLOT DATE: 4/03/2025 2:32:32 PM DWG FILE: K:\5C EIS JOBS\32000'S\E32976BT KOGARAH (KPS_JCHS)\CAD\E32976BT2.DWG

APPROXIMATE OUTLINE OF PROPOSED OSD TANK

APPROXIMATE OUTLINE OF PROPOSED BLOCK M

APPROXIMATE OUTLINE OF PROPOSED BLOCK L

TP301
TP302
TP303
TP304
TP305
TP306
TP307
TP308
TP309
TP310
TP311
TP312
TP313
TP314
TP315
TP316
TP317

BH107 (1.7)
BH108 (0.2)
BH109 (0.2)
BH110 (0.3)
BH201 (1.05)
BH209 (0.95)
BH210 (0.6)
BH211 (0.35)
BH212 (0.45)
BH213 (0.7)
BH214 (0.4)
BH215 (0.5)
BH216 (1.4)
BH217 (0.6)
BH218 (0.45)
BH219 (1.0)
BH/MW203 (0.8)
BH/MW207 (0.2)
BH/MW208 (1.0)
FCF1

DP 667959
DP 1257669
DP 179777
DP 391026
DP 1037176

SUPPLEMENTARY INVESTIGATION SAQP
APPENDIX C

LEGEND

	APPROXIMATE SITE BOUNDARY
	APPROXIMATE WIDER PROPERTY BOUNDARY
BH(Fill Depth)	JKE BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE INTRUSIVE INVESTIGATION, 2020)
BH202	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, DSI, 2025)
BH/MW203	BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, DSI 2025
FCF(Surface)	)FIBRE CEMENT FRAGMENT LOCATION, NUMBER AND DEPTH (Surface/m)
TP301	PROPOSED TEST PIT LOCATION AND NUMBER

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

0 3 6 9 12 15
SCALE 1:300 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **PROPOSED SUPPLEMENTARY INVESTIGATION SAMPLE LOCATION PLAN**

Location: 24B GLADSTONE STREET, KOGARAH, NSW

Project No: E32976BT2

Figure No: 2

JKEnvironments

PLOT DATE: 5/03/2025 10:35:18 AM DWG FILE: K:\5C EIS JOBS\32000\SIE32976BT KOGARAH (KPS_JCHS)\CAD\EP71307PT.DWG

Appendix B: Borehole Logs for Existing Monitoring Wells

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BOREHOLE LOG

Borehole No. 203

1 / 3

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** SPIRAL AUGER **R.L. Surface:** ~19.9 m

Date: 15/1/25 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
										ASPHALTIC CONCRETE: 100mm.t				
DRY ON COMPLETION OF AUGERING									-	FILL: Silty sand, fine to medium grained, dark grey.	M w>PL			SCREEN: 0.6kg, 0.1-0.4m, NO FCF
					N > 3 1,3/ 150mm REFUSAL					FILL: Sandy silty clay, low plasticity, dark grey, fine to medium grained sand, trace of fine to medium grained sandstone gravel.				SCREEN: 1.5kg, 0.5-0.8m, NO FCF
						19	1		-	SANDSTONE: fine to medium grained, light grey.	DW	M		HAWKESBURY SANDSTONE
										REFER TO CORED BOREHOLE LOG				MODERATE 'TC' BIT RESISTANCE
						18	2							GROUNDWATER MONITORING WELL INSTALLED TO 12.18m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 2.18m TO 12.18m. CASING 0.1m TO 2.18m. 2mm SAND FILTER PACK 0.85m TO 12.18m. BENTONITE SEAL 0.1m TO 3.85m. BACKFILLED WITH SAND AND CUTTINGS TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						17	3							
						16	4							
						15	5							
						14	6							
						13								

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 203 **2 / 3**

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~19.9 m

Date: 15/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
		19	1		START CORING AT 1.00m						
ON COMPLETION OF CORING		18	2		SANDSTONE: fine to medium grained, light grey, with orange brown bands, bedded at 0-15°.	MW	M - H	0.90		(1.35m) Be, 5°, P, R, Clay Vn	Hawkesbury Sandstone
					SANDSTONE: fine to medium grained, orange brown and light brown, with grey laminae, bedded at 0-15°.			0.70 1.1			
98% RETURN		17	3					0.80 0.90		(3.41m) XWS, 5°, 30 mm.t	
		16	4					1.0 1.2			
4 HRS AFTER COMPLETION					SANDSTONE: fine to medium grained, light grey, with grey laminae, bedded at 0-5°.	FR		0.70		(4.44m) Be, 0°, P, R, Fe Vn	
						XW	Hd			(4.61-5.05m) HP: >600, >600, >600 kPa	
ON 13/2/25		15	5		Extremely Weathered sandstone: sandy CLAY, low plasticity, light grey, fine to medium grained sand.						
					SANDSTONE: fine to medium grained, light grey, with grey and dark grey laminae, bedded at 0-10°.	FR	M - H	0.80			
		14	6					0.40 1.1		(5.67m) Be, 0°, P, R, Clay Vn (6.05m) XWS, 0°, 10 mm.t	
		13						1.0			

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 203 3 / 3

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~19.9 m

Date: 15/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness) Specific / General	Formation
		12	8		SANDSTONE: as above	FR	M - H	1.6		(7.04m) XWS, 0°, 5 mm.t	Hawkesbury Sandstone
					SANDSTONE: fine grained, grey, with Siltstone, dark grey laminae, bedded at 0-5°.						
					LAMINITE: Sandstone, fine grained, grey, interlaminated with Siltstone, dark grey, bedded at 0-5°.		L - M	0.30		(7.80m) XWS, 0°, 10 mm.t	
					SANDSTONE: fine to medium grained, light grey, with grey laminae, bedded at 0-10°.		H	1.4		(8.23m) Be, 0°, P, S, Clay Ct	
								1.2		(8.79m) Be, 0°, P, S, Clay Ct	
		11	9		SANDSTONE: fine to medium grained, light brown and orange brown, bedded at 0-20°.	SW				(9.00m) Be, 0°, P, S, Fe Sn	
								1.6			
		10	10					2.2			
								1.8		(10.39m) Be, 10°, P, R, Fe Sn	
		9	11					1.7			
								1.0			
		8	12					3.2			
					SANDSTONE: fine to medium grained, light grey, with grey laminae, bedded at 0-15°.	FR		1.1		(11.96m) Be, 0°, P, R, Clay Ct	
					END OF BOREHOLE AT 12.18 m						
		7	13								
		6									

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 207

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** SPIRAL AUGER **R.L. Surface:** ~17.9 m

Date: 16/1/25 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING				■						FILL: Silty sand, fine to coarse grained, dark brown, trace of rubber and plastic fragments.	M			SYNTHETIC GRASS COVER
									-	SANDSTONE: fine to medium grained, light grey, red brown and orange brown.	DW	M		SCREEN: 12.35kg, 0-0.1m, NO FCF
				■						REFER TO CORED BOREHOLE LOG				HAWKESBURY SANDSTONE MODERATE 'TC' BIT RESISTANCE
						17	1							'TC' BIT REFUSAL
						16	2							GROUNDWATER MONITORING WELL INSTALLED TO 12.7m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 3.0m TO 12.7m. CASING 0.1m TO 3.5m. 2mm SAND FILTER PACK 1.8m TO 12.7m. BENTONITE SEAL 0.5m TO 1.8m. BACKFILLED WITH SAND AND CUTTINGS TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						15	3							
						14	4							
						13	5							
						12	6							
						11								

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 207 **2 / 3**

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~17.9 m

Date: 16/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DETAILS SPACING (mm) 600 200 60 20	DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
					START CORING AT 0.68m						
		17	1		SANDSTONE: fine to medium grained, light brown, with light grey bands, massive.	MW	M	0.60			
					as above, but with brown laminae, cross bedded at 0-20°.			0.60 0.70			
ON COMPLETION OF CORING		16	2					0.90			
					SANDSTONE: fine to coarse grained, light grey, with red brown bands and grey laminae, bedded at 0-10°.	HW	L	0.10		(2.32m) XWS, 0°, 25 mm.t (2.38m) Be, 10°, P, R, Clay Vn (2.52m) Be, 10°, P, R, Clay FILLED, 5 mm.t (2.58m) Be, 5°, P, R, Clay FILLED, 5 mm.t (2.71m) Be, 5°, P, R, Clay Vn	
		15	3					0.20		(3.01m) XWS, 5°, 10 mm.t (3.11m) XWS, 1°, 10 mm.t	
98% RETURN								0.20			
					Extremely Weathered sandstone: sandy silty CLAY, low plasticity, light grey and red brown, fine to medium grained sand.	XW	Hd			(3.68m) Be, 0°, P, R, Fe Sn	
ON 13/2/25		14	4		SANDSTONE: fine to medium grained, light grey, with orange brown laminae, bedded at 0-25°.	HW	L	0.30		(4.00m) Be, 0°, P, S, Clay FILLED, 5 mm.t (4.10m) XWS, 0°, 50 mm.t	
					as above, but light grey, with grey and dark grey laminae.			0.20		(4.23m) XWS, 10°, 70 mm.t	
		13	5					0.20			
								0.40		(5.25m) Be, 10°, P, S, Clay Vn	
							M			(5.58m) Be, 5°, P, R, Clay Ct	
		12	6		LAMINITE: Sandstone, fine to medium grained, grey, interbedded with Siltstone, dark grey, bedded at 0-5°.	FR	M - H	0.60 1.2			
					SANDSTONE: as below			0.90		(6.64m) J, 60°, P, R, Cn (6.78m) Be, 0°, P, S, Clay Vn	
		11									

Hawkesbury Sandstone

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 207 3 / 3

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~17.9 m

Date: 16/1/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION (Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components)	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness)	Formation
98% RETURN		10	8		SANDSTONE: fine to medium grained, light grey, with grey and dark grey laminae, and occasional siltstone bands, bedded at 0-5°	FR	M - H	1.3	600 200 60 20	(7.37m) Be, 0°, P, S, Clay Vn	Hawkesbury Sandstone
		9	9		SANDSTONE: fine to medium grained, light grey, massive, indistinct occasional grey laminae, indistinctly bedded at 0-5°.		H	1.1		(8.13m) CS, 0°, 50 mm.t	
								1.8			
		8	10					1.7		(9.07m) XWS, 0°, 10 mm.t	
					SANDSTONE: fine to medium grained, light grey, with grey laminae, cross-bedded at 10-20°.			2.1			
								1.4			
		7	11					1.0		(10.38m) Be, 0°, P, R, Clay Vn	
								1.3			
								0.90			
		6	12		SANDSTONE: fine to medium grained, light grey, massive, with grey brown indistinctly cross-bedded at 10-20°.			1.1		(11.70m) CS, 0°, 70 mm.t	
								1.1			
								1.4			
		5	13		END OF BOREHOLE AT 12.72 m			2.3		(12.58m) Be, 0°, P, S, Clay Vn	
		4									

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 208

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Method:** HAND AUGER / SPIRAL AUGER **R.L. Surface:** ~18.1 m

Date: 31/1/25 TO 10/2/25 **Datum:** AHD

Plant Type: JK330 **Logged/Checked By:** J.F./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING	■					18				FILL: Silty sand, fine to medium grained, brown, trace of fine to medium grained igneous gravel, plastic fragments, slag and root fibres.	M			GRASS COVER
				■	N = 9 6,6,3					FILL: Silty sandy clay, low to medium plasticity, dark grey brown, fine to medium grained sand, trace of plastic fragments and ash.	w<PL M			SCREEN: 10.55kg, 0-0.1m, NO FCF APPEARS MODERATELY COMPACTED
				■		17	1		-	FILL: SIlty sand, fine to medium grained, dark grey brown.	DW	M		HAND AUGER TO 0.55m
										SANDSTONE: fine to medium grained, orange brown.				HAWKESBURY SANDSTONE
										REFER TO CORED BOREHOLE LOG				MODERATE 'TC' BIT RESISTANCE
						16	2							GROUNDWATER MONITORING WELL INSTALLED TO 9.4m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 3.4m TO 9.4m. CASING 0.1m TO 3.4m. 2mm SAND FILTER PACK 2.9m TO 9.4m. BENTONITE SEAL 0.1m TO 2.9m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						15	3							
						14	4							
						13	5							
						12	6							

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 208 **2 / 3**

Client: NSW DEPARTMENT OF EDUCATION

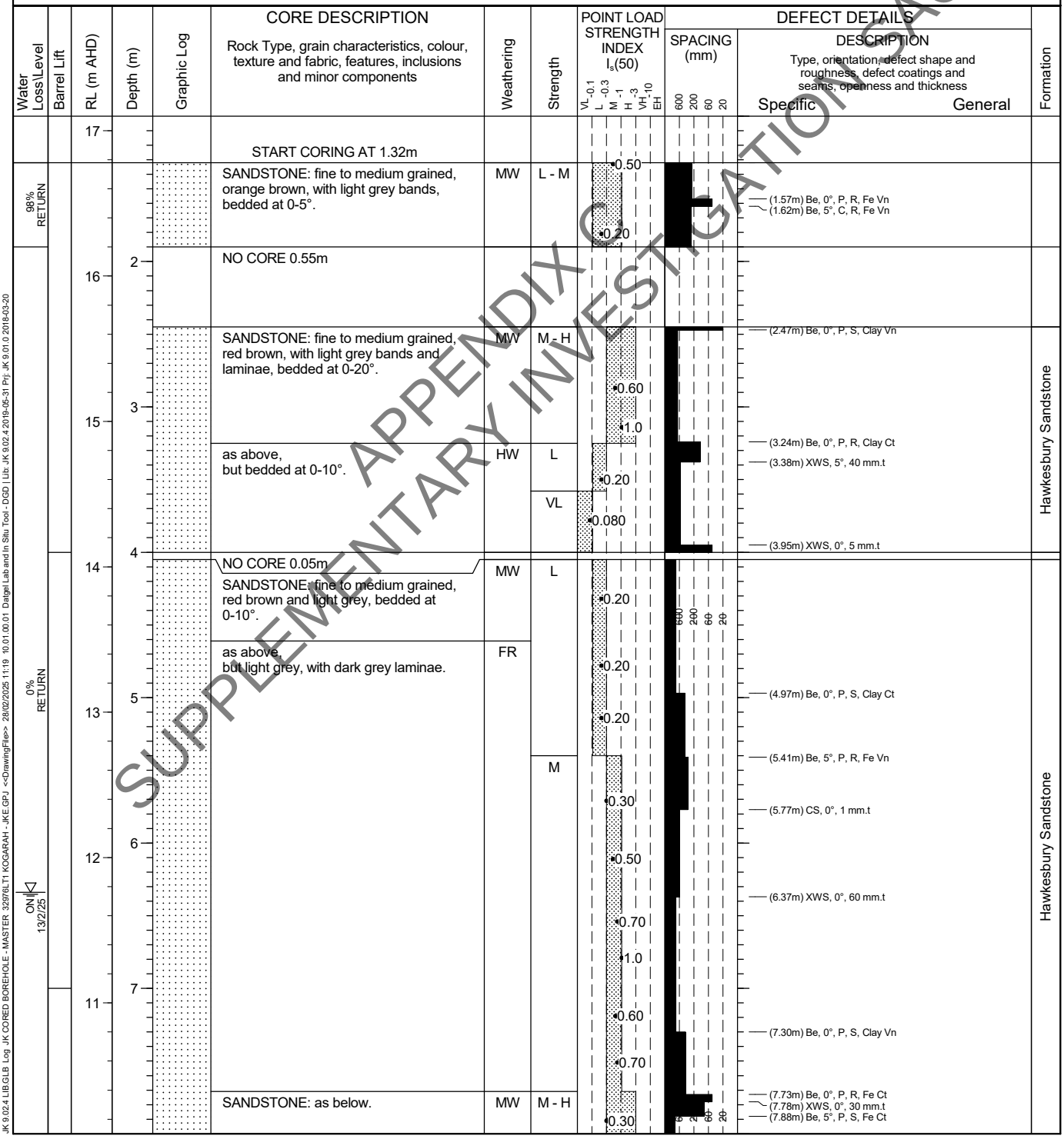
Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~18.1 m

Date: 31/1/25 TO 10/2/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK330 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.



FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 208

Client: NSW DEPARTMENT OF EDUCATION

Project: PROPOSED UPGRADES

Location: KOGARAH PUBLIC SCHOOL, 24B GLADSTONE STREET, KOGARAH, NSW

Job No.: 32976LT1 **Core Size:** NMLC **R.L. Surface:** ~18.1 m

Date: 31/1/25 TO 10/2/25 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK330 **Bearing:** N/A **Logged/Checked By:** J.F./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL -0.1, L -0.3, M -1, H -3, VH -10, EH	DEFECT DETAILS SPACING (mm) DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
0% RETURN		10			SANDSTONE: fine to medium grained, orange brown, with red brown and light grey bands, bedded at 0-15°.	MW	M - H	1.0, 2.2		Hawkesbury Sandstone
					as above, but bedded at 0-30°.					
		9	9		SANDSTONE: fine to medium grained, orange brown and light grey, bedded at 0-15°.			0.20, 0.80	(8.92m) Be, 5°, P, R, Fe Ct	
					SANDSTONE: fine to medium grained, red brown and orange brown, bedded at 0-10°.		H	1.3, 2.0, 1.6, 1.8, 1.0	(9.40m) Be, 0°, P, R, Fe Ct	
		8	10							
		7	11		as above, but with light grey bands.			2.3	(11.64m) Be, 10°, P, S, Clay Vn	
		6	12		END OF BOREHOLE AT 12.05 m					
		5	13							
		4	14							

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

ENVIRONMENTAL LOGS EXPLANATION NOTES

INTRODUCTION

These notes have been provided to amplify the environmental report in regard to classification methods, field procedures and certain matters relating to the logging of soil and rock. Not all notes are necessarily relevant to all reports.

Where geotechnical borehole logs are utilised for environmental purpose, reference should also be made to the explanatory notes included in the geotechnical report. Environmental logs are not suitable for geotechnical purposes.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies include gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726:2017 *'Geotechnical Site Investigations'*. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geoenvironmental practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached soil classification table qualified by the grading of other particles present (eg. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	< 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2.36mm
Gravel	2.36 to 63mm
Cobbles	63 to 200mm
Boulders	> 200mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose (VL)	< 4
Loose (L)	4 to 10
Medium dense (MD)	10 to 30
Dense (D)	30 to 50
Very Dense (VD)	> 50

Cohesive soils are classified on the basis of strength (consistency) either by use of a hand penetrometer, vane shear, laboratory testing and/or tactile engineering examination. The strength terms are defined as follows.

Classification	Unconfined Compressive Strength (kPa)	Indicative Undrained Shear Strength (kPa)
Very Soft (VS)	≤ 25	≤ 12
Soft (S)	> 25 and ≤ 50	> 12 and ≤ 25
Firm (F)	> 50 and ≤ 100	> 25 and ≤ 50
Stiff (St)	> 100 and ≤ 200	> 50 and ≤ 100
Very Stiff (VSt)	> 200 and ≤ 400	> 100 and ≤ 200
Hard (Hd)	> 400	> 200
Friable (Fr)	Strength not attainable – soil crumbles	

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'shale' is used to describe fissile mudstone, with a weakness parallel to bedding. Rocks with alternating inter-laminations of different grain size (eg. siltstone/claystone and siltstone/fine grained sandstone) are referred to as 'laminite'.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application. All methods except test pits, hand auger drilling and portable Dynamic Cone Penetrometers require the use of a mechanical rig which is commonly mounted on a truck chassis or track base.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils and 'weaker' bedrock if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for a large excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the

structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Refusal of the hand auger can occur on a variety of materials such as obstructions within any fill, tree roots, hard clay, gravel or ironstone, cobbles and boulders, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of limited reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock cuttings. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be assessed from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (eg. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, NMLC or HQ triple tube core barrels, which give a core of about 50mm and 61mm diameter, respectively, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as NO CORE. The location of NO CORE recovery is determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the bottom of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils, as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289.6.3.1–2004 (R2016) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Penetration Resistance of a Soil – Standard Penetration Test (SPT)'*.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63.5kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

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

  N = 13
  4, 6, 7

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

  N > 30
  15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

A modification to the SPT is where the same driving system is used with a solid 60° tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as 'N_c' on the borehole logs, together with the number of blows per 150mm penetration.

LOGS

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

The terms and symbols used in preparation of the logs are defined in the following pages.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than 'straight line' variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

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

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

More reliable measurements can be made by installing standpipes which are read after the groundwater level has stabilised at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg. bricks, steel, etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably assess the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse environmental characteristics or behaviour. If the volume and nature of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing has not been undertaken to confirm the soil classification and rock strengths indicated on the environmental logs unless noted in the report.

SYMBOL LEGENDS

SOIL


FILL


TOPSOIL


CLAY (CL, CI, CH)


SILT (ML, MH)


SAND (SP, SW)


GRAVEL (GP, GW)


SANDY CLAY (CL, CI, CH)


SILTY CLAY (CL, CI, CH)


CLAYEY SAND (SC)


SILTY SAND (SM)


GRAVELLY CLAY (CL, CI, CH)


CLAYEY GRAVEL (GC)


SANDY SILT (ML, MH)


PEAT AND HIGHLY ORGANIC SOILS (Pt)

ROCK


CONGLOMERATE


SANDSTONE


SHALE/MUDSTONE


SILTSTONE


CLAYSTONE


COAL


LAMINITE


LIMESTONE


PHYLLITE, SCHIST


TUFF


GRANITE, GABBRO


DOLERITE, DIORITE


BASALT, ANDESITE


QUARTZITE

OTHER MATERIALS


BRICKS OR PAVERS


CONCRETE


ASPHALTIC CONCRETE

CLASSIFICATION OF COARSE AND FINE GRAINED SOILS

Major Divisions		Group Symbol	Typical Names	Field Classification of Sand and Gravel	Laboratory Classification	
Coarse grained soil (more than 65% of soil excluding oversize fraction is greater than 0.075mm)	GRAVEL (more than half of coarse fraction is larger than 2.36mm	GW	Gravel and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 4$ $1 < C_c < 3$
		GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		GM	Gravel-silt mixtures and gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	Fines behave as silt
		GC	Gravel-clay mixtures and gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	Fines behave as clay
	SAND (more than half of coarse fraction is smaller than 2.36mm)	SW	Sand and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 6$ $1 < C_c < 3$
		SP	Sand and gravel-sand mixtures, little or no fines	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		SM	Sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	N/A
		SC	Sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	

Major Divisions		Group Symbol	Typical Names	Field Classification of Silt and Clay			Laboratory Classification
				Dry Strength	Dilatancy	Toughness	% < 0.075mm
ine grained soils (more than 35% of soil excluding oversize fraction is less than 0.075mm)	SILT and CLAY (low to medium plasticity)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity	None to low	Slow to rapid	Low	Below A line
		CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	Medium to high	None to slow	Medium	Above A line
		OL	Organic silt	Low to medium	Slow	Low	Below A line
	SILT and CLAY (high plasticity)	MH	Inorganic silt	Low to medium	None to slow	Low to medium	Below A line
		CH	Inorganic clay of high plasticity	High to very high	None	High	Above A line
		OH	Organic clay of medium to high plasticity, organic silt	Medium to high	None to very slow	Low to medium	Below A line
	Highly organic soil	Pt	Peat, highly organic soil	–	–	–	–

Laboratory Classification Criteria

A well graded coarse grained soil is one for which the coefficient of uniformity $Cu > 4$ and the coefficient of curvature $1 < C_c < 3$. Otherwise, the soil is poorly graded. These coefficients are given by:

$$C_U = \frac{D_{60}}{D_{10}} \qquad \text{and} \qquad C_C = \frac{(D_{30})^2}{D_{10}\, D_{60}}$$

Where D_{10}, D_{30} and D_{60} are those grain sizes for which 10%, 30% and 60% of the soil grains, respectively, are smaller.

NOTES:

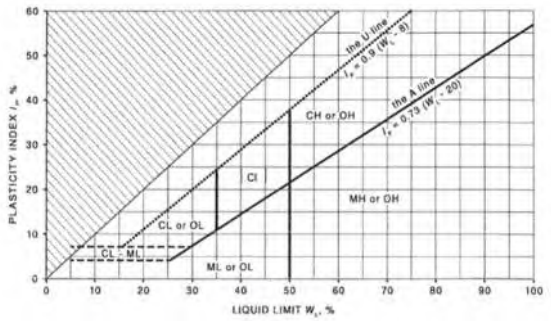
1 For a coarse grained soil with a fines content between 5% and 12%, the soil is given a dual classification comprising the two group symbols separated by a dash; for example, for a poorly graded gravel with between 5% and 12% silt fines, the classification is GP-GM.

2 Where the grading is determined from laboratory tests, it is defined by coefficients of curvature (C_c) and uniformity (C_u) derived from the particle size distribution curve.

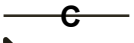
3 Clay soils with liquid limits > 35% and ≤ 50% may be classified as being of medium plasticity.

4 The U line on the Modified Casagrande Chart is an approximate upper bound for most natural soils.

Modified Casagrande Chart for Classifying Silts and Clays according to their Behaviour



LOG SYMBOLS

Log Column	Symbol	Definition
Groundwater Record		Standing water level. Time delay following completion of drilling/excavation may be shown.
		Extent of borehole/test pit collapse shortly after drilling/excavation.
		Groundwater seepage into borehole or test pit noted during drilling or excavation.
Samples	ES	Sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos analysis.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
	PFAS	Soil sample taken over depth indicated, for analysis of Per- and Polyfluoroalkyl Substances.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'Refusal' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60° solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25 PID = 100	Vane shear reading in kPa of undrained shear strength. Photoionisation detector reading in ppm (soil sample headspace test).
Moisture Condition (Fine Grained Soils)	w > PL $w \approx$ PL w < PL $w \approx$ LL w > LL	Moisture content estimated to be greater than plastic limit. Moisture content estimated to be approximately equal to plastic limit. Moisture content estimated to be less than plastic limit. Moisture content estimated to be near liquid limit. Moisture content estimated to be wet of liquid limit.
(Coarse Grained Soils)	D M W	DRY – runs freely through fingers. MOIST – does not run freely but no free water visible on soil surface. WET – free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS S F St VSt Hd Fr ( )	VERY SOFT – unconfined compressive strength ≤ 25kPa. SOFT – unconfined compressive strength > 25kPa and ≤ 50kPa. FIRM – unconfined compressive strength > 50kPa and ≤ 100kPa. STIFF – unconfined compressive strength > 100kPa and ≤ 200kPa. VERY STIFF – unconfined compressive strength > 200kPa and ≤ 400kPa. HARD – unconfined compressive strength > 400kPa. FRIABLE – strength not attainable, soil crumbles. Bracketed symbol indicates estimated consistency based on tactile examination or other assessment.
Density Index/ Relative Density (Cohesionless Soils)	VL L MD D VD ( )	**Density Index (I_D) Range (%)** / **SPT 'N' Value Range (Blows/300mm)** VERY LOOSE ≤ 15 / 0 – 4 LOOSE > 15 and ≤ 35 / 4 – 10 MEDIUM DENSE > 35 and ≤ 65 / 10 – 30 DENSE > 65 and ≤ 85 / 30 – 50 VERY DENSE > 85 / > 50 Bracketed symbol indicates estimated density based on ease of drilling or other assessment.

Log Column	Symbol	Definition
Hand Penetrometer Readings	300 250	Measures reading in kPa of unconfined compressive strength. Numbers indicate individual test results on representative undisturbed material unless noted otherwise.
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Twin pronged tungsten carbide bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.
	Soil Origin	The geological origin of the soil can generally be described as: RESIDUAL – soil formed directly from insitu weathering of the underlying rock. No visible structure or fabric of the parent rock. EXTREMELY WEATHERED – soil formed directly from insitu weathering of the underlying rock. Material is of soil strength but retains the structure and/or fabric of the parent rock. ALLUVIAL – soil deposited by creeks and rivers. ESTUARINE – soil deposited in coastal estuaries, including sediments caused by inflowing creeks and rivers, and tidal currents. MARINE – soil deposited in a marine environment. AEOLIAN – soil carried and deposited by wind. COLLUVIAL – soil and rock debris transported downslope by gravity, with or without the assistance of flowing water. Colluvium is usually a thick deposit formed from a landslide. The description 'slopewash' is used for thinner surficial deposits. LITTORAL – beach deposited soil.

Classification of Material Weathering

Term		Abbreviation		Definition
Residual Soil		RS		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered		XW		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered	Distinctly Weathered (Note 1)	HW	DW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered		MW		The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered		SW		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh		FR		Rock shows no sign of decomposition of individual minerals or colour changes.

NOTE 1: The term 'Distinctly Weathered' is used where it is not practicable to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock. 'Distinctly Weathered' is defined as follows: *'Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores'*. There is some change in rock strength.

Rock Material Strength Classification

Term	Abbreviation	Uniaxial Compressive Strength (MPa)	Guide to Strength	
			Point Load Strength Index $Is_{(50)}$ (MPa)	Field Assessment
Very Low Strength	VL	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30mm thick can be broken by finger pressure.
Low Strength	L	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium Strength	M	6 to 20	0.3 to 1	Scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High Strength	H	20 to 60	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High Strength	VH	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High Strength	EH	> 200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Appendix C: Activity Specific AMP

REPORT TO

NSW DEPARTMENT OF EDUCATION

ON

ACTIVITY SPECIFIC ASBESTOS MANAGEMENT PLAN

FOR

ENVIRONMENTAL INVESTIGATION (TEST PITTING)

AT

24B GLADSTONE STREET, KOGARAH, NSW

Date: 19 March 2025
Ref: E32976BT2rpt5-AMP

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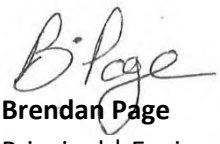

Brendan Page
Principal | Environmental Scientist

For and on behalf of
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NORTH RYDE BC NSW 1670

DOCUMENT REVISION RECORD

Report Reference	Report Status	Report Date
E32976BT2rpt5-AMP	Final Report	19 March 2025

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List of Tables

Attachments

Abbreviations

Asbestos Containing Material	**ACM**
Asbestos Fines/Fibrous Asbestos	**AF/FA**
Asbestos Management Plan	**AMP**
JK Environments	**JKE**
JK Geotechnics	**JKG**
National Association of Testing Authorities	**NATA**
Personal Protective Equipment	**PPE**
Protection of the Environment Operations	**POEO**
Work Health and Safety	**WHS**

Units

Fibres per millilitre	**Fibres/mL**
Kilogram	**kg**
Micron	**µm**

1 INTRODUCTION

NSW Department of Education ('the client') commissioned JK Environments (JKE) to carry out a supplementary environmental investigation for the proposed development works at Lot 4, 47-51 Waratah Street, Kirrawee, NSW ('the site'). This Activity Specific Asbestos Management Plan (AMP) has been prepared exclusively to manage asbestos-related risks during the intrusive supplementary investigation works. This AMP is not intended to be used for the day-to-day management of asbestos at the site during the typical site operations and is not be used in relation to any asbestos materials associated with the buildings or structures on site.

The proposed scope of intrusive field works at the site includes the excavation of test pits for environmental purposes. These intrusive works may disturb asbestos impacted fill at the site. This AMP includes management requirements for working, handling, temporary storage, removal, transportation and disposal procedures, and visual clearance inspections. The AMP has been prepared generally in accordance with the requirements of SafeWork NSW.

1.1 Aims and Objectives

The aim of the AMP is to outline the procedures to be implemented in order to effectively manage the asbestos-impacted material at the site during intrusive works, in accordance with relevant Codes of Practice and Work Health and Safety (WHS) legislation. The objectives of the AMP are to:

- Outline the applicability of the AMP and the various roles and responsibilities;
- Provide a protocol for managing the excavation works, including the identification of safe work procedures to minimise potential health effects to site workers/contractors and adjacent land users; and
- Document procedures for potential asbestos waste handling and transport.

1.2 Scope of Work

The scope of work includes preparation of the AMP which provides:

- Details of roles and responsibilities;
- Methodologies for protecting workers during intrusive field works, including personal protective equipment (PPE), decontamination and visual surface clearance requirements; and
- Procedures and protocols to manage the asbestos related risks, minimise potential asbestos exposure risks to personnel/workers involved in the field works, safe handling of asbestos containing materials and minimisation of potential asbestos exposure risks to the general public/site users in the vicinity of the proposed work areas on site.

The scope of work was undertaken with reference to the WHS Regulation 2017 and the SafeWork NSW Codes of Practice: How to Manage and Control Asbestos in the Workplace (2022)[1]; and How to Safely Remove Asbestos (2022)[2]. Other guidelines and legislation/regulations have been referenced throughout the AMP where applicable.

[1] Safe Work NSW (2022a). *Code of Practice How to Manage and Control Asbestos in the Workplace*. (referred to as CoP How to Manage and Control Asbestos in the Workplace) (December 2022)
[2] Safe Work NSW (2022b). *Code of Practice How to Safely Remove Asbestos*. (referred to as CoP How to Safely Remove Asbestos) (December 2022)

2 SITE INFORMATION

2.1 Site Identification

Table 2-1: Site Identification

Site Address:	24B Gladstone Street, Kogarah, NSW
Lot & Deposited Plan:	Lot 1 in DP179779, Lot A in DP391026, and part of Lot 1 in DP667959
Current Land Use:	Primary School (Kindergarten to Year 6)
Site Area (m^2) (approx.):	4,375
Geographical Location (decimal degrees) (approx. centre of site):	Latitude: -33.9618430 Longitude: 151.1370970
Site Plans:	Appendix A

JKE has previously undertaken a Phase 1 Desktop Assessment (desktop), a Phase 2 Preliminary Intrusive Investigation (intrusive investigation), and a Detailed Site Investigation (DSI) at the site. The following asbestos related finds were reported during the previous investigations:

- A single fragment of bonded asbestos containing material (ACM) on fill/soil during the site inspection in 2020. The source of the asbestos appeared to be a fibre cement board at the base of the neighbouring fence and was considered unlikely to be associated with on-site soils in that vicinity;
- A bag of fibre cement fragments (FCF)/suspected ACM (collected by others) was found on site during the DSI works in 2025. It was unclear if the material in the bag was associated with the demolition works recently undertaken at the site, or associated with surficial FCF/ACM identified on the exposed fill soils beneath these buildings (i.e. associated with imported fill); and
- Detection of asbestos [asbestos fines/fibrous asbestos (AF/FA)] in fill/soil material in one location (BH203, refer to Figure 2). The asbestos was in the friable form based on the laboratory identification of AF/FA and the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)[3] definitions. However, the occurrence of AF/FA appeared to be minor and not representative of the broader soil conditions as there were no detections elsewhere on site. The concentration of AF/FA in the fill soil sample from BH203 was very low and was below the respective Site Assessment Criterion (SAC) of 0.001%w/w presented in Schedule B1 of NEPM 2013. The source of asbestos in fill at this location was considered likely to either be associated with historical demolition activities, or imported fill material which was encountered to varying depths across the site. The asbestos was detected in fill soils beneath asphaltic concrete pavement.

Asbestos as AF/FA was not identified in any other samples collected from the site, therefore, the asbestos impact at BH203 was considered likely to be associated with bonded (non-friable) asbestos containing material (ACM) as sporadic occurrences of AF/FA can often be found co-located with ACM. The occurrence of demolition rubble inclusions in the fill supported this opinion.

[3] National Environment Protection Council (NEPC), (2013). *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013).* (referred to as NEPM 2013)

Based on the above, management provisions discussed in this AMP are on the basis that asbestos in soil is associated with bonded/non-friable ACM (i.e. 'fibro') in the vicinity of BH203.

3 ASBESTOS CONTAMINATION INFORMATION

The presence of asbestos in fill has only been confirmed at one location, BH203.

There is considered to be a potential for additional occurrences of asbestos in fill in other areas of the site as the fill contained demolition rubble inclusions which is often a precursor for asbestos. Notwithstanding, the investigations have not identified asbestos in fill/soil at any other location to date.

The exposure pathway for asbestos is via inhalation of airborne asbestos fibres. Exposure to asbestos fibres poses a potential risk to human health. The potential for release and transport of asbestos fibres via disturbance of soil containing asbestos has the potential to increase during the proposed excavation works. The human receptors most at risk of asbestos fibre release during field works and soil disturbance activities include the excavator operator, field engineer and nearby land users (e.g. site workers, contractors, land users beyond the site boundary, and visitors). Risks to these receptors will be mitigated under this AMP.

Asbestos fibres can range in size from 0.1 to 10 microns (µm) (one tenth the size of a grain of sand) and are a potential particulate respiratory hazard. The small fibres gain relatively easy access to the lung airways and air sacs. Damage to the respiratory tract generally tends to be time/dose dependent. An individual exposed to high doses of asbestos for long periods of time will have an increased risk of developing asbestos related diseases. In addition, the effects of asbestos related diseases are usually not detectable for 1 to 30 years after the initial exposure. This is called the latency period, and is a distinguishing feature of asbestos related diseases.

4 APPLICATION OF THE AMP AND RESPONSIBILITIES

4.1 Application of the AMP

This AMP shall apply from the commencement of soil/fill disturbance works at each test pit location, until disturbance of the fill ceases and the test pit is reinstated. The AMP is not intended to be a long-term management plan and as such it will cease to apply on completion of the field works.

4.2 Roles and Responsibilities

JKE is primarily responsible for the implementation of this AMP and will be responsible for securing the work area, arranging air monitoring during the works, implementing risk mitigation measures (as required) and managing any occurrences of asbestos encountered during test pitting.

Day to day works will be managed by the JKE field scientist, reporting to the project manager. The JKE field scientist is deemed to be a competent person and will be responsible for:

- Coordinating airborne asbestos monitoring (subcontracted to Clear Safe);
- Asbestos clearance inspections;
- Asbestos sampling and assessment;
- Review of results of any assessments;
- Advice and recommendations arising from monitoring and/or inspections during test pitting;
- Review and comment on WHS documentation with respect to asbestos assessment, management and control (as required); and
- Notification of field staff and the client if required, of any observed or documented non-compliance with this AMP.

JKE's Licensed Asbestos Assessor (LAA) is available to provide advice on WHS issues for asbestos-related works, as required, in the event suspected friable asbestos is observed. The LAA holds a NSW Asbestos Assessor Licence.

5 LEGISLATIVE REQUIREMENTS

5.1 Legislative Requirements and Regulations/Guidelines

All works must be undertaken with regards to (but not limited to) the following:

- Protection of the Environment Operations (POEO) Act 1997 (NSW);
- POEO (Waste) Regulation 2014 (NSW);
- Work Health and Safety Act 2011 (NSW);
- Work Health and Safety Regulation 2017 (NSW);
- Contaminated Land Management Act 1997 (NSW);
- CoP How to Manage and Control Asbestos in the Workplace;
- CoP How to Safely Remove Asbestos;
- National Occupational Health and Safety Commission (NOHSC), (2005). Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition (NOHSC:3003 [2005]);
- NOHSC, (2005). Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment 3rd Edition (NOHSC:3008 [1995]);
- AS/NZS 1715:2009 Selection, Use and Maintenance of Respiratory Protective Devices; and
- AS/NZS 1716:2012 Respiratory Protective Devices.

5.2 Non-Compliance with the AMP

Where a non-compliance with this AMP is identified, JKG's project Principal is to be notified. Where a non-compliance cannot be rectified, site works should cease, the AMP and asbestos controls reviewed, and revisions made as required.

5.3 SafeWork NSW Notification

Asbestos removal works triggering notification to SafeWork NSW is not proposed.

6 MANAGEMENT

This section outlines the requirements for managing the intrusive field works which we understand will broadly include:

1) Excavation of test pits using mechanical excavator;
2) Environmental soil sampling; and
3) On-site management of spoil and reinstatement of the test pit locations as agreed with the client.

We note that the site itself is fenced off and isolated from the wider school property. The following subsections outline the field work procedure to be implemented in the asbestos zone and also the remaining areas in the site that fall outside of this zone.

6.1 Areas of Site Outside the Asbestos Works Zone

6.1.1 PPE

As a minimum, all personnel on site will be required to wear the following PPE during intrusive works involving soil disturbance unless otherwise outlined in task specific documentation:

- Steel-capped boots (preferably lace-less);
- Hard hat meeting relevant standards;
- High visibility clothing;
- Gloves; and
- P2 rated disposable dust mask, or a half-face respirator fitted with an appropriate particulate filter in compliance with the relevant standards. Respiratory Protective Devices and be used in accordance with AS/NZS 1715:2009.

6.1.2 Field Work

For all areas of the site outside of the identified asbestos works zone (refer to Figure 2 in Appendix A), the following actions are to be implemented:

- The asphaltic concrete pavement can be removed as required at each test pit location and should be kept separate from the underlying material. This material will be reinstated in the test pit as appropriate. In test pits positioned beneath astir turf, the Astro turf will be cut and peeled back;
- To minimise the release of fugitive dust into the air the soil will be kept damp at all times (but not flooded). This will include the use of water sprays where necessary during excavation and sampling;
- On completion of sampling, the test pits will be backfilled to the surface with the spoil. A vibrating sled will be used to compact layers of spoil in the test pits. Excess spoil will be left on site in a skip bin. Where additional material is required to make up levels within the test pits, sand will be introduced and compacted;
- Test pits excavated in paved areas will be finished with cold mix levelled to match the surrounding ground surface. Test pits excavated in astro turf will be compacted to the surrounding ground level and the previously peeled back astro turf will be laid back over the top and pinned using u-nails;
- The JKE field scientist will inspect the ground surface following test pitting and reinstatement of the borehole to confirm there is not visible excess spoil material; and
- The air monitoring subcontractor (Clear Safe) will be conducting air monitoring throughout the works.

6.1.3 Unexpected Finds Contingency

In the event that ACM is encountered in the soil in areas outside of the asbestos works zone, or if the material is suspected of being friable asbestos, all works must cease and the procedures outlined under Section 6.2 Asbestos Works Zone (BH203) must be implemented.

6.2 Asbestos Works Zone (BH203 area)

6.2.1 Asbestos Specific PPE

In addition to the site specific PPE, as a minimum, all personnel on site will be required to wear the following asbestos specific PPE during works in asbestos work zones unless otherwise outlined in task specific documentation:

- P2 rated disposable dust mask, or a half-face respirator fitted with an appropriate particulate filter in compliance with the relevant standards. Respiratory Protective Devices and be used in accordance with AS/NZS 1715:2009;
- Disposable coveralls that prevent tearing and penetration of asbestos fibres (e.g. coveralls type 5, category 3 per EN ISO 13982–1 or equivalent); and
- Disposable boot covers made of a material consistent with the disposable coveralls or:
    - Gumboots may be worn in the asbestos removal area if they are decontaminated upon exiting the asbestos removal area; or
    - A separate set of work boot may be maintained in the asbestos work zone.

Care should be taken to ensure PPE compatibility and that a suitable degree of worker comfort is maintained. Regardless of the PPE adopted, asbestos removal workers must undertake appropriate personal decontamination upon leaving the asbestos work zone as outlined in the CoP How to Safely Remove Asbestos.

6.2.2 Field Work

The asbestos works zone is shown on Figure 2 in Appendix A. The following actions are to be implemented:

- Establish a defined asbestos work zone to limit access to the work area by installing bollards/witches' hats and warning signs so that the areas are not encroached upon by other site users (we note that other site users will be limited to the archaeological consultants undertaking their works concurrently). The zone will carry appropriate signage to indicate that asbestos disturbance/removal works are in progress. Where reasonably practicable to do so, the exclusion area will be established at a distance of 5-10m from the test pit/borehole using bollards or similar;
- The asphaltic concrete pavement will be removed as required at each test pit location and should be kept separate from the underlying material. This material will be disposed of accordingly;
- Prior to excavation of the fill, the surrounding areas will be covered with builder's plastic, or a similar material, to minimise the transfer of contaminated dust and/or soil to the surrounding areas;
- Works are to occur as required and any excavated material or spoil generated will be set aside on geofabric or builders' plastic, and managed on the assumption that it contains asbestos until or unless demonstrated otherwise;
- To minimise the release of fibres into the air the soil will be kept damp at all times (but not flooded). This will include the use of water sprays where necessary during excavation and sampling;

- On completion of sampling, the test pits will be backfilled to the surface with the spoil. A vibrating sled will be used to compact layers of spoil in the test pits. Excess spoil will be left on site in a skip bin. Where additional material is required to make up levels within the test pits, washed sand will be introduced and compacted;
- Test pits excavated in paved areas will be finished with cold mix levelled to match the surrounding ground surface. Test pits excavated in astro turf will be compacted to the surrounding ground level and the previously peeled back astro turf will be laid back over the top and pinned using u-nails;
- The JKE field scientist will inspect the ground surface following test pitting and reinstatement of the borehole to confirm there is not visible asbestos material; and
- The air monitoring subcontractor (Clear Safe) will be conducting air monitoring throughout the works.

6.3 Air Monitoring

During the intrusive field works, air monitoring will be undertaken by the subcontractor (Clear Safe) using calibrated portable air sampling pumps. Monitoring locations will be determined by Clear Safe, however, preliminary discussions have suggested two locations along the common boundary with residential areas and an additional three locations surrounding the work area each day. At the end of each day, the pumps and attached filters will be collected and analysed at a NATA-accredited laboratory.

Air monitoring works shall be conducted in accordance with NOHSC Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition (NOHSC:3003 [2005]). The results of air monitoring are to be provided to the JKE. The following action levels will be applied upon receipt of results:

- Reading of less than 0.01 fibres/mL – control measures implemented were appropriate and no action required; and
- Reading greater than 0.02 fibres/mL - control measures implemented may not have been appropriate, further action/site rectification may be required. SafeWork may need to be notified.

6.4 Isolation, Barricading and Signage

JKE is to take reasonable steps so the necessary measures are in place for the effective exclusion of unauthorised persons to asbestos work zones. The location, type and positioning of signs and labels must be decided, or authorised, by a competent person (i.e. the field scientist). Warning signs may include some of the following examples:

6.5 Restriction of Access to Asbestos Work Zone

Access to the asbestos- work area(s) will be restricted only to:

- Workers engaged for the intrusive field works, including JKE's field scientist and the excavator operator;
- Other persons associated with the intrusive field works such as the LAA (where required); and
- Anyone allowed under the WHS Regulation or another law to be in the asbestos works area.

6.6 Wet Methods

A low-pressure water spray is to be available and utilised as required for wetting down asbestos-impacted soils. This will be the primary control for dust generation and is considered adequate given the small-scale nature of the disturbance.

As a precautionary measure, this water spray will be utilised for wetting down all soils (including outside of the asbestos work zone), during the intrusive works.

6.7 Decontamination

A decontamination zone is to be established adjacent to a single entry/exit point to the asbestos work zone. Personal decontamination will include:

- Wiping down boots and coveralls with a wet rag and scraping off any soil clods; and
- Removing coveralls, gloves and then respirator/mask and placing in appropriate plastic asbestos waste bags within the provided disposal bin located at the entry/exit point.

Decontamination of the excavator/field equipment will include wiping down of the excavator bucket and any other equipment that comes into contact with the fill/soil.

6.8 Waste Management

6.8.1 Asbestos Waste (consumables and visible ACM)

Disposable items of PPE are to be bagged prior to being removed from the asbestos work zone. The bagged PPE will be deemed asbestos waste and will be bagged and placed in the designated asbestos waste bin onsite. Asbestos waste shall not be allowed to accumulate excessively within the work area and shall be bagged or placed in the skip bin as the work proceeds.

Sporadic fragments of ACM may be identified during the works and it is anticipated that this material will be sampled for further laboratory analysis.

6.8.2 Loading, Transport and Disposal of Asbestos Waste

Any asbestos waste from the works will be loaded directly into the designated asbestos waste bin onsite. The contents will be secured at the end of each working day (i.e. using a lockable lid or locating the skip in a secure area) to prevent unauthorised access.

The waste transporter is licenced for asbestos waste disposal and copies of asbestos waste disposal certificates/receipts will be obtained by JKE.

6.9 Clearance

The JKE field scientist will visually check the ground surface and clear any visible fibre cement/suspected ACM prior to moving to the next location. The result will be noted on the test pit logs and a clearance certificate will be issued.

7 DOCUMENTATION REQUIREMENTS

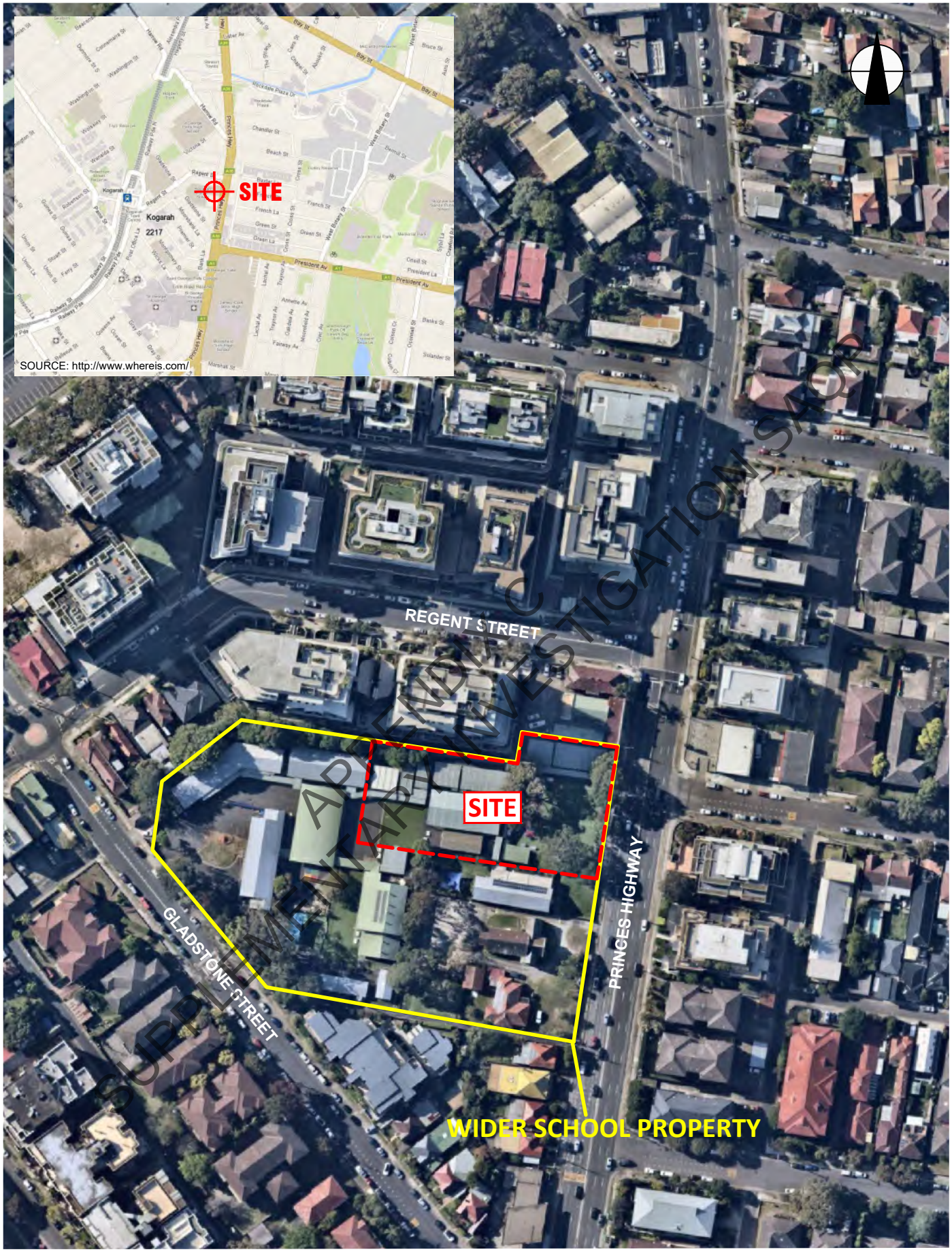
JKE will maintain records in relation to the works and implementation of the AMP. This will include but will not be necessarily limited to the following:

- Air monitoring reports and clearances;
- Waste disposal dockets (once received from the waste transporter); and
- Incident reports.

8 LIMITATIONS

- JKE accepts no responsibility for any unidentified contamination issues at the site. Any unexpected problems/subsurface features that may be encountered during future development or maintenance works should be inspected by an environmental consultant as soon as possible;
- Previous use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during future work;
- The preparation of this report has been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, JKE has not undertaken any verification process, except where specifically stated in the report;
- JKE has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination, except where specifically stated in the report;
- JKE have not and will not make any determination regarding finances associated with the site;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa; and
- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose.

Appendix A: Report Figures



AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the Environmental report.

Title:	**SITE LOCATION PLAN**
Location:	24B GLADSTONE STREET, KOGARAH, NSW
Project No:	E32976BT2
Figure No:	1

JKEnvironments

PLOT DATE: 4/03/2025 2:32:32 PM DWG FILE: K:\5C EIS JOBS\32000'S\E32976BT KOGARAH (KPS_JCHS)\CAD\E32976BT2.DWG

APPROXIMATE OUTLINE OF PROPOSED OSD TANK

APPROXIMATE OUTLINE OF PROPOSED BLOCK M

APPROXIMATE OUTLINE OF PROPOSED BLOCK L

ASBESTOS WORKS ZONE (orange highlighted area)

SUPPLEMENTARY INVESTIGATION SAQP APPENDIX C

TP301 TP302 TP303 TP304 TP305 TP306 TP307 TP308 TP309 TP310 TP311 TP312 TP313 TP314 TP315 TP316 TP317

BH107 (1.7) BH108 (0.2) BH109 (0.2) BH110 (0.3) BH201 (1.05) BH209 (0.95) BH210 (0.6) BH211 (0.35) BH212 (0.45) BH213 (0.7) BH214 (0.4) BH215 (0.5) BH216 (1.4) BH217 (0.6) BH218 (0.45) BH219 (1.0)

BH/MW203 (0.8) BH/MW207 (0.2) BH/MW208 (1.0)

FCF1

DP 1257669 DP 179777 DP 179779 DP 391026 DP 667959 DP 1037176

HIGHWAY PRINCES

LEGEND

APPROXIMATE SITE BOUNDARY	
APPROXIMATE WIDER PROPERTY BOUNDARY	
BH(Fill Depth)	JKE BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE INTRUSIVE INVESTIGATION, 2020)
BH202	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, DSI, 2025)
BH/MW203	BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, DSI 2025
FCF(Surface)	)FIBRE CEMENT FRAGMENT LOCATION, NUMBER AND DEPTH (Surface/m)
TP301	PROPOSED TEST PIT LOCATION AND NUMBER

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

0 3 6 9 12 15

SCALE 1:300 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **ASBESTOS WORKS ZONE**

Location: 24B GLADSTONE STREET, KOGARAH, NSW

Project No: E32976BT2

Figure No: 2

JKEnvironments

PLOT DATE: 5/03/2025 10:35:18 AM DWG FILE: K:\SC EIS JOBS\32000\SIE32976BT KOGARAH (KPS_JCHS)\CAD\EP71307PT.DWG

Appendix D: Report Explanatory Notes

QA/QC Definitions

The QA/QC terms used in this report are defined below. The definitions are in accordance with US EPA publication SW-846, entitled *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (1994)[20] methods and those described in *Environmental Sampling and Analysis, A Practical Guide,* (1991)[21]. The NEPM (2013) is consistent with these documents.

A. Practical Quantitation Limit (PQL), Limit of Reporting (LOR) & Estimated Quantitation Limit (EQL)

These terms all refer to the concentration above which results can be expressed with a minimum 95% confidence level. The laboratory reporting limits are generally set at ten times the standard deviation for the Method Detection Limit for each specific analyte. For the purposes of this report the LOR, PQL, and EQL are considered to be equivalent.

When assessing laboratory data it should be borne in mind that values at or near the PQL have two important limitations: *"The uncertainty of the measurement value can approach, and even equal, the reported value. Secondly, confirmation of the analytes reported is virtually impossible unless identification uses highly selective methods. These issues diminish when reliably measurable amounts of analytes are present. Accordingly, legal and regulatory actions should be limited to data at or above the reliable detection limit"* (Keith, 1991).

B. Precision

The degree to which data generated from repeated measurements differ from one another due to random errors. Precision is measured using the standard deviation or Relative Percent Difference (RPD).

C. Accuracy

Accuracy is a measure of the agreement between an experimental result and the true value of the parameter being measured (i.e. the proximity of an averaged result to the true value, where all random errors have been statistically removed). The assessment of accuracy for an analysis can be achieved through the analysis of known reference materials or assessed by the analysis of surrogates, field blanks, trip spikes and matrix spikes. Accuracy is typically reported as percent recovery.

D. Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is primarily dependent upon the design and implementation of the sampling program. Representativeness of the data is partially ensured by the avoidance of contamination, adherence to sample handing and analysis protocols and use of proper chain-of-custody and documentation procedures.

E. Completeness

Completeness is a measure of the number of valid measurements in a data set compared to the total number of measurements made and overall performance against DQIs. The following information is assessed for completeness:

- Chain-of-custody forms;
- Sample receipt form;
- All sample results reported;
- All blank data reported;

[20] US EPA, (1994). *SW-846: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* (US EPA SW-846)

[21] Keith., H, (1991). *Environmental Sampling and Analysis, A Practical Guide*

- All laboratory duplicate and RPDs calculated;
- All surrogate spike data reported;
- All matrix spike and lab control spike (LCS) data reported and RPDs calculated;
- Spike recovery acceptable limits reported; and
- NATA stamp on reports.

F. Comparability

Comparability is the evaluation of the similarity of conditions (e.g. sample depth, sample homogeneity) under which separate sets of data are produced. Data comparability checks include a bias assessment that may arise from the following sources:

- Collection and analysis of samples by different personnel; Use of different techniques;
- Collection and analysis by the same personnel using the same methods but at different times; and
- Spatial and temporal changes (due to environmental dynamics).

G. Blanks

The purpose of laboratory and field blanks is to check for artefacts and interferences that may arise during sampling, transport and analysis.

H. Matrix Spikes

Samples are spiked with laboratory grade standards to detect interactive effects between the sample matrix and the analytes being measured. Matrix Spikes are reported as a percent recovery and are prepared for 1 in every 20 samples. Sample batches that contain less than 20 samples may be reported with a Matrix Spike from another batch. The percent recovery is calculated using the formula below. Acceptable recovery limits are 70% to 130%.

$$\frac{\text{(Spike Sample Result – Sample Result) x 100}}{\text{Concentration of Spike Added}}$$

I. Surrogate Spikes

Samples are spiked with a known concentration of compounds that are chemically related to the analyte being investigated but unlikely to be detected in the environment. The purpose of the Surrogate Spikes is to check the accuracy of the analytical technique. Surrogate Spikes are reported as percent recovery.

J. Duplicates

Laboratory duplicates measure precision, expressed as Relative Percent Difference. Duplicates are prepared from a single field sample and analysed as two separate extraction procedures in the laboratory. The RPD is calculated using the formula where D1 is the sample concentration and D2 is the duplicate sample concentration:

$$\frac{\text{(D1 – D2) x 100}}{\{(D1 + D2)/2\}}$$

Appendix E: Guidelines and Reference Documents

Australian and New Zealand Governments (ANZG), (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia

Canadian Council of Ministers of the Environment, (1999). Canadian soil quality guidelines for the protection of environmental and human health: Benzo(a)Pyrene (1997)

CRC Care, (2011). Technical Report No. 10 – Health screening levels for hydrocarbons in soil and groundwater Part 1: Technical development document

Contaminated Land Management Act 1997 (NSW)

Department of Land and Water Conservation, (1997). 1:25,000 Acid Sulfate Soil Risk Map Series

Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land (1998)

National Health and Medical Research Council (NHMRC), (2021). National Water Quality Management Strategy, Australian Drinking Water Guidelines 2011

NSW Department of Environment and Conservation, (2007). Guidelines for the Assessment and Management of Groundwater Contamination

NSW EPA, (2014). Waste Classification Guidelines - Part 1: Classifying Waste

NSW EPA, (2015). Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997

NSW EPA, (2017). Guidelines for the NSW Site Auditor Scheme, 3rd Edition

NSW EPA, (2020). Consultants Reporting on Contaminated Land, Contaminated Land Guidelines

NSW EPA, (2022). *Sampling design part 1 - application*, Contaminated Land Guidelines

National Environment Protection Council (NEPC), (2013). National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)

Olszowy, H., Torr, P., and Imray, P., (1995). Trace Element Concentrations in Soils from Rural and Urban Areas of Australia. Contaminated Sites Monograph Series No. 4. Department of Human Services and Health, Environment Protection Agency, and South Australian Health Commission

Protection of the Environment Operations Act 1997 (NSW)

State Environmental Planning Policy (Resilience and Hazards) 2021 (NSW)

Western Australia Department of Health, (2021). Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia

Appendix D: Examples of Imported Materials and Waste Tracking Registers

Imported Materials Register

Supplier	Date	Docket/Invoice #	Product Type	Quantity (specify m3 or tonnes)	Area where Material was Placed

Exported (Waste) Materials Register

Load	Date	Material Type / Classification	Site Area where Waste was Generated	Waste Classification Report Reference	Disposal Facility	Tipping Receipt/Docket Number	Tracking Number (where relevant)	Tonnage

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The degree to which data generated from repeated measurements differ from one another due to random errors. Precision is measured using the standard deviation or Relative Percent Difference (RPD).

C. Accuracy

Accuracy is a measure of the agreement between an experimental result and the true value of the parameter being measured (i.e. the proximity of an averaged result to the true value, where all random errors have been statistically removed). The assessment of accuracy for an analysis can be achieved through the analysis of known reference materials or assessed by the analysis of surrogates, field blanks, trip spikes and matrix spikes. Accuracy is typically reported as percent recovery.

D. Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is primarily dependent upon the design and implementation of the sampling program. Representativeness of the data is partially ensured by the avoidance of contamination, adherence to sample handing and analysis protocols and use of proper chain-of-custody and documentation procedures.

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[19] Keith., H, (1991). *Environmental Sampling and Analysis, A Practical Guide*

- All blank data reported;
- All laboratory duplicate and RPDs calculated;
- All surrogate spike data reported;
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- Spike recovery acceptable limits reported; and
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Comparability is the evaluation of the similarity of conditions (e.g. sample depth, sample homogeneity) under which separate sets of data are produced. Data comparability checks include a bias assessment that may arise from the following sources:

- Collection and analysis of samples by different personnel; Use of different techniques;
- Collection and analysis by the same personnel using the same methods but at different times; and
- Spatial and temporal changes (due to environmental dynamics).

G. Blanks

The purpose of laboratory and field blanks is to check for artefacts and interferences that may arise during sampling, transport and analysis.

H. Matrix Spikes

Samples are spiked with laboratory grade standards to detect interactive effects between the sample matrix and the analytes being measured. Matrix Spikes are reported as a percent recovery and are prepared for 1 in every 20 samples. Sample batches that contain less than 20 samples may be reported with a Matrix Spike from another batch. The percent recovery is calculated using the formula below. Acceptable recovery limits are 70% to 130%.

$$\frac{\text{(Spike Sample Result – Sample Result) x 100}}{\text{Concentration of Spike Added}}$$

I. Surrogate Spikes

Samples are spiked with a known concentration of compounds that are chemically related to the analyte being investigated but unlikely to be detected in the environment. The purpose of the Surrogate Spikes is to check the accuracy of the analytical technique. Surrogate Spikes are reported as percent recovery.

J. Duplicates

Laboratory duplicates measure precision, expressed as Relative Percent Difference. Duplicates are prepared from a single field sample and analysed as two separate extraction procedures in the laboratory. The RPD is calculated using the formula where D1 is the sample concentration and D2 is the duplicate sample concentration:

$$\frac{(D1 - D2) \times 100}{\{(D1 + D2)/2\}}$$

Appendix F: Guidelines and Reference Documents

Contaminated Land Management Act 1997 (NSW)

Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land (1998)

NSW EPA, (2015). Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997

NSW EPA, (2017). Guidelines for the NSW Site Auditor Scheme, 3rd Edition

NSW EPA, (2020). Consultants Reporting on Contaminated Land, Contaminated Land Guidelines

NSW EPA, (2022). *Sampling design part 1 - application*, Contaminated Land Guidelines

National Environment Protection Council (NEPC), (2013). National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)

Protection of the Environment Operations Act 1997 (NSW)

State Environmental Planning Policy (Resilience and Hazards) 2021 (NSW)

Western Australia Department of Health, (2021). Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia