Douglas PARTNERS

GROUNDED EXPERTISE

Report on Supplementary Contamination Investigation

Proposed Multi-Purpose School Hall

Sutherland Public School
38-54 and 66 Eton Street, Sutherland NSW

Prepared for School Infrastructure NSW

Project 224456.00

13 January 2025

Douglas Partners Pty Ltd
ABN 75 053 980 117
douglaspartners.com.au
96 Hermitage Road, West Ryde, NSW 2114
(02) 9809 0666

Document History

Details

Project No.	224456.00
Document Title	Report on Supplementary Contamination Investigation
Site Address	Sutherland Public School 38-54 and 66 Eton Street, Sutherland NSW
Report Prepared For	School Infrastructure NSW
Filename	224456.00.R.003.Rev1

Status and Review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Setareh Pourkazemi	Paul Gorman	13 August 2024
Revision 1	Setareh Pourkazemi	Paul Gorman	13 January 2025

Distribution of Copies

Status	Issued to
Revision 0	School Infrastructure NSW
Revision 1	School Infrastructure NSW

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature	Date
Author	13 January 2025
Reviewer	13 January 2025

Table of Contents

Report on Supplementary Contamination Investigation Proposed Multi-Purpose School Hall, Sutherland Public School 38-54 and 66 Eton Street, Sutherland NSW

1. Introduction

Douglas Partners Pty Ltd (Douglas) has been engaged by School Infrastructure NSW (SINSW) to prepare this Supplementary Contamination Investigation report for the proposed multipurpose school hall to a portion of Sutherland Public School (SPS), located at 38-54 Eton Street, Sutherland NSW (the "school"). The investigation area is limited to the area of the proposal hall, as shown on Drawing 1, Appendix A (the "site").

The investigation was undertaken in accordance with Douglas' proposal 224456.01.P.001.Rev0 dated 8 July 2024 and in conjunction with a geotechnical investigation reported separately.

Douglas recently completed a detailed site (contamination) investigation (DSI) (ref: 224456.00.R.002.Rev1) for this project. At the time of undertaking the DSI, three options were being considered for the location of the hall (Options 1 to 3). This supplementary contamination investigation is being undertaken at the request of School Infrastructure NSW (SINSW) to provide additional sub-surface and contamination information related to Option 1. It is noted that the DSI report recommended remediation works in relation to Option 1, so the information presented in this report is to be used to further inform the remediation action plan (RAP) for the site.

This report must be read in conjunction with all appendices including the notes provided in Appendix B.

The following key guidelines were consulted in the preparation of this report:

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013); and
- NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020).

2. Proposed development

It is understood that the development of the site comprises the construction of a multi-purpose school hall on grade. Further details on the proposed hall were not known at the time of preparing of this report, however it is understood that it will likely house a stage, toilets and canteen. It will also likely be utilised by the general public as a community hall. No basement levels are proposed for the new building, however, small retaining walls may be required in some areas due to site topography.

3. Scope of work

The scope of work comprised:

- Review of the previous DSI and geotechnical reports prepared for the site and include relevant results in this report;
- Opportunistic sampling from five boreholes (BH101 to BH105) drilled in conjunction with the geotechnical investigation using a tight-access drilling rig fitted with 110 mm diameter solid flight augers to depths between 2.7 m to 4 m below ground level (bgl) to the top of weathered rock;
- Dispatched selected samples to a National Association of Testing Authorities (NATA) accredited laboratory plus quality assurance / quality control samples (QA / QC) for the analysis of:
    - Heavy metals (including arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc);
    - Total recoverable hydrocarbons (TRH);
    - Benzene, toluene, ethyl benzene, total xylenes (BTEX);
    - Polycyclic aromatic hydrocarbons (PAH);
    - Organochlorine pesticides (OCP);
    - Organophosphorus pesticides (OPP);
    - Polychlorinated biphenyls (PCB);
    - Asbestos (fibrous asbestos / asbestos fines – FA / AF);
- Quality samples were also collected and analysed, including replicate sample and trip spike and trip blank; and
- Preparation of this report.

4. Site information

Site address	Western portion of the SPS, part of 38-54 Eton Street, Sutherland38-54 and 66 Eton Street, Sutherland NSW
Legal description	Lots 1 to 10 in Deposited Plan 6600 Lots 5 to 10 in Deposited Plan 802
Site Area	Occupies approximately 800 m^2
Zoning (School)	Zone SP2 Infrastructure (Educational Establishment)
Local Council Area	Sutherland Shire Council
Current use	Primary school

Surrounding uses (i.e. proposed Option 1 location)	North – open car park area, multi-use hardstand open spaces and SPS campus's building East – Playground areas (including four tennis courts) as part the school South – turfed (natural and artificial) areas, multi-use hardstand open spaces followed by SPS building and West – landscaped garden beds, followed by Eton Street

Figure 1: Aerial image of the site overlain by 2 m surface contours to AHD

5. Environmental setting

5.1 Topography

Regional topography is generally elevated (>100 AHD), sloping downwards towards the northwest into Woronora River, and gently slopes in the south westerly direction towards Savilles Creek, that eventually flows into Hacking River.

Reference to the NSW 2 m elevation contour mapping indicates that the site is essentially flat, with the site slopes gently from about RL 113 m relative to Australian Height datum (AHD) in the north to RL 111 in the south, as shown in Figure 1.

5.2 Site geology

Reference to the Sydney 1:100 000 Geological Series Map indicates that the site is underlain by Hawkesbury Sandstone (shale lenses) of the Triassic period, which typically comprises fluvially deposited laminated mudstone, claystone, siltstone and sandstone.

5.3 Soil landscape

Reference to the Sydney 1:100 000 Soil Landscape Series map indicates that the site is underlain by a landscape group known as the Gymea soil landscape.

The Gymea soil landscape is an erosional soil landscape and is characterised by topography of undulating to rolling rises and low hills on Hawkesbury Sandstone, with local relief of 20 m to 80 m and slope gradients of 10% to 25%.

5.4 Acid sulfate soils

Reference to the 1:25 000 Acid Sulfate Soils (ASS) Risk map indicates that the site is in an area of no known occurrence of acid sulfate soils. The nearest mapped occurrences of ASS are close to the Woronora River, which is over 1 km away from the school. The high elevation and geology at the site suggest that the presence of acid sulphate soils is unlikely.

The Section 10.7 Planning Certificates also indicate that the site is not affected by the occurrence of acid sulfate soils.

5.5 Salinity

Dryland salinity risk and hazard mapping was undertaken in 2000 by the former NSW Government Departments of Land and Water Conservation to show the broad distribution of areas considered as having either a high salinity risk or a high salinity hazard.

The school site is not located within, or close to, mapped areas with high salinity risk or high salinity hazard. The nearest areas mapped as having high salinity risk / hazard are in Western Sydney.

5.6 Surface water and groundwater

The closest watercourse to the site is Savilles Creek, located approximately 600 m south of the site. The surface water from the site is expected to run in a south and south westerly direction towards Savilles Creek and be collected by the regional stormwater system.

A search of the Water NSW publicly available registered database was undertaken on 31 July 2024. The search results indicated (17) registered groundwater bores located within 500 m of the site. The five closest groundwater bores and their purposes are as summarised below in Table 1. The majority of the wells are associated with remediation and monitoring of the United Service Station.

Table 1: Summary of available information from nearby registered groundwater bores

Bore ID	Authorised purpose	Completion year	Status	Location relative to site	Final depth (m)	Standing water level (m bgl)
GW016096	Waste Disposal Bore	1958	Unknown	140 m north-west	76.5	2.70
GW110812	Monitoring bore	2009	Supply obtained	350 m north-west	6.00	3.64
GW110813	Monitoring bore	2009	Supply obtained	350 north-west	6.00	3.03
GW110814	Monitoring bore	2009	Supply obtained	355 m north-west	5.00	2.90
GW110815	Monitoring bore	2009	Supply obtained	356 north-west	5.60	3.70

Based on the regional topography, the anticipated flow direction of groundwater beneath the site is to the south or south-west. The likely receiving surface water body is Savilles Creek located to the south side of the site which eventually flows into Hacking River and Port Hacking.

Groundwater was not observed during the recent and previous field work for the investigations. The groundwater monitoring wells installed for Project 40773 showed water levels between 1 m and 5 m depth. This was considered to be perched seepage within the soil and weathered rock profile rather than the regional groundwater table.

6. Summary of asbestos register and asbestos management plan

During the DSI, Douglas has reviewed the asbestos register and asbestos management plan for the school. The reviewed of asbestos registered, indicated that asbestos containing material may be present in grounds as part of fill material. Asbestos was also detected in buildings in a few locations, including within the site. The proposed development would require the demolition of Building J (Pupil Facilities), which is built in 1984. In accordance with the asbestos register, chrysotile asbestos was detected, especially in the cement sheeting used for eaves, ceilings and vinyl floor tiles. As per the asbestos register, all instances of asbestos are in good condition and do not require immediate attention for remediation.

As per the Asbestos Management Plan (AMP) for NSW Government Schools, all asbestos removal and remediation must be administered by Department of Public Works and Services (DPWS) and the Department of Education (DoE). All removals are to be undertaken according to:

- NSW Work Health and Safety Act 2011;
- NSW Work Health and Safety Regulation 2011;
- How to Manage and Control Asbestos in the Workplace: Code of Practice 2011;

- How to Safely Remove Asbestos: Code of Practice 2011; and
- Other relevant documentation issued from time to time by WorkCover NSW or SafeWork Australia.

7. Summary of previous investigations

The following previous reports are relevant to the current investigation:

- Douglas *Report on Preliminary Site Investigation (Contamination) PSI, Proposed Multi-purpose School Hall, 38-54 and 66 Eton Street, Sutherland NSW*, dated 21 September 2023 (Report reference: 224456.00); and
- Douglas *Report on Detailed Site Investigation (Contamination), Proposed Multi-purpose School Hall, 38-54 and 66 Eton Street, Sutherland NSW*, dated 13 January 2025 (Report reference: 224456.00.R.002.Rev1).

7.1 Douglas (2023) – PSI

The PSI was undertaken for the whole of the school grounds and comprised a desktop review of site history and information (i.e. NSW EPA public records, historical aerial photographs, title deeds, geology, acid sulfate soil and hydrology) and environs, a site walkover and development of a conceptual site model (CSM). The objective of the PSI was to assess the potential for contamination at the site based on past and present land uses, to assess the suitability of the site for proposed development and to comment on the need for further investigation and / or management of contamination with regard to the proposed development.

The site history information suggests that the northern part of the site was developed into the school as early as 1888 (based on historical titles), with the central and southern portions also being developed into the school by 1950. The part of site to the south of President Ave had residential dwellings until 1977 and was redeveloped into a sports ground as part of the school in the 1989 aerial photograph. During the period from 1943 (first available aerial photograph) it is clear that some buildings have been constructed and demolished at various times, whilst a small number have remained at least since 1943.

A search of properties with EPA notices and licences and review of the Section 10.7 Planning Certificate did not identify the site to be notified to the EPA as contaminated, regulated under the CLM Act, hold a licence, or have received any EPA notices.

Potential sources of contamination identified from the site history information reviewed and the site walkover included fill (including potential impacts from previously demolished buildings), the degradation of hazardous building materials in the current site buildings, and the application of herbicides.

The PSI suggested intrusive investigations to target the three location options for the proposed multi-purpose hall development. The objective of those investigations was to assess the suitability for each option area to support the proposed development from a contamination perspective.

7.2 **Douglas (2025) – DSI**

The main objective of the DSI was to assess the potential contamination across the three proposed option areas and to assess the suitability for each option area to support the proposed development from a contamination perspective.

The scope of work conducted at the time of the DSI comprised a desktop review of the PSI, a review of desktop review of historical and mapping information applicable to the site and the drilling and sampling of 12 geotechnical boreholes (BH01 to BH12) across the three proposed option areas. Boreholes were positioned as follows:

- Boreholes BH01 to BH05 were drilled inside the proposed Option 1 area;
- Boreholes BH06 to BH09 were drilled inside the proposed Option 2 area; and
- Boreholes BH10 to BH12 were drilled inside the proposed Option 3 area.

The borehole locations adopted for Option 1 are shown on Drawing 1, Appendix A. The following generalised subsurface profile was encountered in the boreholes within Option 1:

- PAVEMENT: asphaltic concrete was present at BH01, BH02 and BH03 to depths of 0.1 m; overlying;
- FILL: Fill was encountered within all boreholes either from the ground surface or beneath the pavement to depths of between 0.2 m to 1.3 m. The fill included gravelly SAND, SAND, CLAY, Sandy SILT with varying proportions of igneous gravel, trace rootlets, ironstone gravel; overlying;
- RESIDUAL CLAY: medium to high plasticity clay, red-brown, pale grey, yellow-brown. The consistency of the residual clay was stiff; overlying; and
- WEATHERED SHALE / SANDSTONE: very low strength, highly weathered Hawkesbury Sandstone, dark grey and orange-brown from around 2.3 m.

No visual or olfactory evidence (e.g. staining, odours, free phase product) was observed during the investigations to suggest the presence of contamination within the soils at the site.

Groundwater was intersected at 2.4 m depth (RL 117.6 m AHD) during auger drilling at one borehole (BH02). Free groundwater was not observed during auger drilling in any of the other boreholes. The use of drilling fluid during coring at BH01 to BH04 prevented further observations with depth.

Soil samples were collected from the boreholes drilled for geotechnical investigation purpose directly from the drilling rig solid flight auger at regular depth intervals, or upon signs of contamination, and change of strata. Seventeen samples were selected and submitted to a NATA accredited laboratory for the analyses of heavy metals, total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and xylenes (BTEX), polyaromatic hydrocarbons (PAH), organochlorine pesticides (OCP), organophosphorus pesticides (OPP), polychlorinated biphenyls (PCB), phenols and asbestos.

All analytical results for all soil samples in Boreholes BH01 to BH05 (Option 1) were below the adopted site adopted criteria (SAC), with the following exceptions:

- Benzo(a)pyrene TEQ in samples BH01/0.5-0.6 and BD01 (duplicate sample of BH01) with concentrations of 9.5 mg/kg and 8.6 mg/kg respectively, exceeded HIL A criteria of 3 mg/kg;
- Benzo(a)pyrene (BaP) in samples BH01/0.4-0.5, BD01, BH03/0.4-0.5 m and BH05/0.4-0.5 m with concentrations of 7 mg/kg, 6.4 mg/kg, 1.4 mg/kg and 0.71 mg/kg exceeded the ecological criteria of 0.7 mg/kg; and
- TRH F3(>C10-C34) in samples BH01/0.4-0.5, BD01, BH02/0.1-0.2 m, BH03/0.4-0.5 and BH04/0-0.1 m with concentrations of 940 mg/kg, 390 mg/kg, 490 mg/kg and 330 mg/kg exceeded the ecological criteria.

The concentrations of PAH (including BaP) in fill samples from the Option 1 area may be reflective of the asphalt overlay, or possibly an ash component to the fill. The PAH is not leachable which is a characteristic of ash and asphalt. The reported TRH concentrations are also related to the PAH in the same samples. Should Option 1 be selected for the location of the proposed hall, it is likely that the asphalt and other pavement materials will be removed to facilitate construction. The report stated that the PAH impacts above HIL A criteria will also need to be chased out and removed to landfill, capped with the proposed building slab, or further assessed through a site specific Tier 2 risk assessment.

Based on the finding of the results, Douglas considered that Option 1 is suitable or can be made suitable for the proposed hall. In addition, the following recommendations were also made in relation to Option 1:

The asbestos register identifies asbestos in the buildings (as discussed in Section 6) within the Option 1 area. PAH and TRH have been found to exceed either human health or ecological criteria in a number of the fill samples in this area. It is considered likely that these concentrations are inherent in existing asphalt and / or ash in fill soils in this area, to depths typically of around 0.5 m bgl. The remaining analyte concentrations were below the adopted SAC in all samples. The Option 1 can be made suitable for the proposed hall development, subject to the following:

- *The removal of identified asbestos and other hazardous materials in buildings within this area;*
- *Clearance of the building by a qualified occupational hygienist following the removal of hazardous materials, and then of the ground surface post demolition;*
- *The removal of the asphalt pavement from the area subject to construction and validation; and*
- *The excavation, waste classification and off-site disposal of observed asphalt and / or ash impacted soils from the area subject to construction and validation; or*
- *Capping of the contaminated fill with the proposed building slab, noting that this option will need to be formally notified and included in a long term environmental management plan; or*
- *Further site specific risk assessment of the contaminants through potentially additional sampling and testing and assessment of likely exposure scenarios (note that the outcome may still be that a form of remediation is required); and*

- *Preparation of a remediation action plan (RAP) to document the above options and the preferred option; and*
- *Validation of the remedial works implemented, confirming that the area subject to validation is suitable for the land use from a contamination perspective.*

8. Preliminary conceptual site model

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

A CSM was presented in the DSI report and used to inform the soil sampling and testing plan reported as part of the DSI. The CSM has been updated on the basis of the results reported in the DSI report, as presented in the following Table 2.

Table 2: Summary of potential sources

Potential sources and associated CoPC
On-site sources
S1: Fill: Associated with levelling, potentially impacted by demolition of former buildings and hardstand on the site. Primary CoPC include metals, TRH, BTEX, PAH, and asbestos Secondary CoPC include PCB, OCP, phenols **S2:** Former and current buildings / structures containing hazardous building materials and potentially impacting surface soils in their vicinity CoPC include asbestos, synthetic mineral fibres (SMF), lead (in paint) and PCB

The following potential human and environmental receptors, along with relevant potential pathways, have been identified and summarised in Table 3.

Table 3: Summary of potential receptors and pathways

Potential human receptors
HR1: Current users [school workers, student and visitors] **HR2:** Construction and maintenance workers **HR3:** End users [school workers, student and visitors] **HR4:** Adjacent site users [education (as part of the school), commercial / residential

Potential environmental receptors
ER1: Surface water [Savilles Creek] **ER2:** Groundwater; and **ER3:** Terrestrial ecosystems.
Potential pathways to human receptors
HP1: Ingestion and dermal contact **HP2:** Inhalation of dust and / or vapours
Potential pathways to environmental receptors
EP1: Surface water run-off **EP2:** Leaching of contaminants and vertical migration into groundwater **EP3:** Lateral migration of groundwater providing base flow to water bodies **EP4:** Inhalation, ingestion and absorption

Summary of potentially complete exposure pathways

A 'source–pathway–receptor' approach has been used to assess the potential risks of harm being caused to human or environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways (potential complete pathways). The possible pathways between the above sources (S1 to S2) and receptors are provided in below Table 4.

Table 4: Summary of potentially complete exposure pathways

Source and CoPC	Exposure pathway	Receptor	Risk management action
S1: Fill: metals, TRH, BTEX, PAH, PCB, OCP, phenols and asbestos **S2:** Former buildings: asbestos, synthetic mineral fibres (SMF), lead (in paint) and PCB	**HP1:** Ingestion and dermal contact **HP2:** Inhalation of dust and / or vapours	**HR1:** Current users [school workers, student and visitors] **HR2:** Construction and maintenance workers **HR3:** End users [school workers, student and visitors]	The DSI found TRH, PAH and metal concentration above the site assessment criteria (SAC). The supplementary investigation is designed to further assess the contamination status based on the previous results, and to provide further
	HP2: Inhalation of dust and / or vapours	**HR4:** Adjacent site users [education (as part of the school), commercial / residential]	
	EP1: Surface water run-off **EP3:** Lateral migration of groundwater providing base flow to water bodies	**ER1:** Surface water [Savilles Creek]	

Source and CoPC	Exposure pathway	Receptor	Risk management action
	EP2: Leaching of contaminants and vertical migration into groundwater	**ER2:** Groundwater	information to inform the RAP. Hazardous building materials will need to be removed from buildings being demolished, in accordance with WHS legislation.
	EP4: Inhalation, ingestion and absorption	**ER3:** Terrestrial ecosystems	

9. Sampling plan

9.1 Data quality objectives

The supplementary contamination investigation was devised with reference to the seven-step data quality objectives (DQO) process which is provided in Appendix B Schedule B2, NEPC (2013). The data quality objective process is outlined in Appendix C.

9.2 Soil sampling and testing rationale and scope

The sampling plan was adopted at the request of SINSW.

A targeted sampling strategy was adopted for the site utilising the borehole locations (BH101 to BH105) as nominated by SINSW. The locations of boreholes were limited to the accessible areas utilising a tight-access drilling rig, as shown on Drawing 1, Appendix A.

Boreholes were drilled to depths between 2.7 m to 4 m bgl, using 110 mm diameter solid flight augers to the top of weathered rock. The boreholes were terminated due to practical refusal in inferred very low to low strength rock.

Soil samples were collected directly from auger from each borehole, at regular depth intervals, changes in lithology or signs of contamination (i.e. odours or staining).

Representative fill samples were analysed for the CoPCs based on the CSM, focussing predominantly on the primary CoPC.

The general sampling methods are described in the field work methodology, included in Appendix D.

10. Site assessment criteria

The site assessment criteria (SAC) applied in the current investigation are informed by the CSM (Section 8) which identified human and environmental receptors to potential contamination on the site. Analytical results are assessed (as a Tier 1 assessment) against the SAC comprising primarily the investigation and screening levels of Schedule B1 of NEPC (2013).

The investigation and screening levels applied in the current investigation comprise levels adopted for a generic residential / land use scenario which also captures children's day care centres, preschools and primary schools.

The derivation of the SAC is included in Appendix E and the adopted SAC are listed on the summary analytical results tables in Appendix F.

11. Results

11.1 Field work results

The borehole logs for this investigation are included in Appendix G. For reference, the borehole logs for BH01 to BH5 (part of the DSI) are also included in Appendix G. The general subsurface profile encountered at the combined borehole locations summarised as follows:

Pavement:	Asphaltic concrete pavement, with thickness of between 50 mm and 100 mm was encountered at all boreholes except BH103, which was located within grassed garden bed; overlying
Fill:	Sandy silt, silty sand and silty clay encountered to depths between 0.2 m to 1.3 m with varying proportion of other inclusions such as roots, wood fragments (BH103), ash (BH102); overlying
Residual CLAY:	Medium to high plasticity clay, with consistency ranging between stiff to hard. Residual clay was observed to depths of between 2.3 m and 2.8 m; overlying
Weathered Bedrock:	very low and low strength siltstone / shale bedrock

Free groundwater was not observed during auger drilling in any of the boreholes. The regional groundwater table is expected to be much deeper than shallow excavations that might occur during the proposed development at the site. Some minor seepage along the top of clay and bedrock and through joints and partings within the rock mass may occur and mostly after rainfall.

The following observations at specific borehole locations were also noted during the DSI (Option 1) and current field work:

- No building rubble and / or other anthropogenic inclusions were recorded in fill at any of the boreholes, apart from trace wood fragments and ash noted above;

- No asbestos containing material (PACM) was recorded on the exposed surface soil or within the boreholes; and
- No visual or olfactory evidence (e.g. staining, odours, free phase product) was observed during the investigations to suggest the presence of contamination within the soils or groundwater at the site.

11.2 Laboratory analytical results

The results of laboratory analysis are summarised in the following tables in Appendix F:

- Table F1: Summary of results of soil analysis (comprising current and DSI results); and
- Table F2: Summary of waste classification assessment (current and DSI results).

The laboratory certificate(s) of analysis together with the chain of custody and sample receipt information is / are provided in Appendix H.

12. Discussion

12.1 Site suitability assessment

The analytical results for contaminants tested in samples were below the SAC except for:

- Benzo(a)pyrene TEQ in samples BH01/0.5-0.6 m and BD01 (duplicate sample of BH01) with concentrations of 9.5 mg/kg and 8.6 mg/kg respectively, exceeded HIL A criteria of 3 mg/kg;
- Lead in sample BH103/0-0.1 m with a concentration of 350 mg/kg exceeded health investigation level (HIL A) criteria of 300 mg/kg;
- Benzo(a)pyrene (BaP) in samples BH01/0.4-0.5, BD01, BH03/0.4-0.5 m and BH05/0.4-0.5 m with concentrations of 7 mg/kg, 6.4 mg/kg, 1.4 mg/kg and 0.71 mg/kg exceeded the ecological criteria of 0.7 mg/kg;
- Zinc in sample BH103/0-0.1 m with a concentration of 390 mg/kg exceeded environmental investigation levels (EIL) criteria of 350 mg/kg; and
- TRH F3(>C10-C34) in samples BH01/0.4-0.5, BD01, BH02/0.1-0.2 m, BH03/0.4-0.5, BH04/0-0.1 m, and BH103/0-0.1, with concentrations of 940 mg/kg, 390 mg/kg, 490 mg/kg, 330 mg/kg and 340 mg/kg, exceeded the ecological criteria ESL of 300 mg/kg.

No asbestos was detected in any of samples analysed.

The concentrations of PAH (included BaP) in fill samples may be reflective of the asphalt overlay, or possibly an ash component to the fill (although only visually observed in one borehole). The reported TRH concentrations are also likely to be related to the PAH in the same samples. The PAH and lead impacts above HIL A criteria are subject to remediation, likely to comprise either chasing out and removal to landfill, capped with the proposed building slab, or further assessed through a site specific Tier 2 risk assessment.

The ecological based contaminant exceedances can be managed through the provision of hardstand and / or a suitable cover of clean fill which can be documented as part of the RAP.

12.2 Preliminary waste classification

The soil data from the borehole locations has been assessed against waste classification criteria in NSW EPA (2014) in order to provide a preliminary waste classification to assist in budgeting for the removal of surplus soils, and / or identified contaminated soils (if not retained) under the proposed development. the preliminary classification is for planning purposes only and does not provide a formal classification to inform off-site disposal of soils.

Table 5: Six step classification

Step	Comments	Rationale
1. Is the waste special waste?	No *	No asbestos-containing materials (ACM), clinical or related waste, or waste tyres were observed in the boreholes. * Asbestos was not observed in the boreholes or detected by the analytical laboratory. However, asbestos has been identified in the existing building within the site, and small diameter boreholes are not ideal for the detection of asbestos in soils. As such, there remains a potential for asbestos to be present in soils between sampled locations.
2. Is the waste liquid waste?	No	The fill comprised a soil matrix.
3. Is the waste "pre-classified"?	No	The fill is not pre-classified with reference to NSW EPA (2014).
4. Does the waste possess hazardous waste characteristics?	No	The fill was not observed to contain or considered at risk to contain explosives, gases, flammable solids, oxidising agents, organic peroxides, toxic substances, corrosive substances, coal tar, batteries, lead paint or dangerous goods containers.
5. Determining a wastes classification using chemical assessment	Conducted	Refer to Table F2, Appendix F).
6. Is the waste putrescible or non-putrescible?	Non-putrescible	The fill does not contain materials considered to be putrescible a.

Note: a wastes that are generally not classified as putrescible include soils, timber, garden trimmings, agricultural, forestry and crop materials, and natural fibrous organic and vegetative materials (NSW EPA, 2014).

As shown in the attached Table F2, all contaminant concentrations for the analysed fill samples were below the contaminant thresholds (CT1s) for general solid waste (GSW) with the exception of the following:

- Lead in sample BH05/0.4-0.5 m, and BH103/0-0.1 m, exceeded the CT1 criteria for GSW of 100 mg/kg. TCLP extract and analysis was conducted on one of the samples, and the result was within the SCC1 and TCLP1 thresholds for GSW; and

- Benzo(a)pyrene in samples BH01/BD01-0.5-0.6 and BH03/ 0.4-0.5, exceeded the CT1 criteria for GSW of 0.7 mg/kg. TCLP extract and analysis was conducted, and the results were within the SCC1 and TCLP1 thresholds for GSW.

The current results are therefore consistent with a GSW classification as defined in NSW EPA (2014), and the fill across the site is preliminary classified *in situ* as GSW (non putrescible).

Douglas analysed two natural samples as part of the preliminary waste classification reported in the DSI report. Benzo(a) pyrene exceeded the CT1 criteria for GSW of 0.7 mg/kg at BH03/0.4-0.5 m as shown in Table F2, Appendix F. Based on this, the natural soil at the BH03 may be impacted in the upper layers by the overlying fill.

Based on the site observations, and the limited test data, the natural soils and bedrock across the site is likely to classify as VENM, although this would need be verified *ex situ* at the time of excavation, and following the removal of the fill overburden.

Given the above, this preliminary classification is not a formal waste classification to inform off-site disposal. It is intended for planning purposes only. It is recommended that further *in situ* or *ex situ* investigation including visual and analytical processes using test pits, be conducted to confirm and formalise the preliminary waste classification, prior to off-site disposal.

12.3 Data quality assurance and quality control

The data quality assurance and quality control (QA / QC) results for this current investigation are included in Appendix I. A discussion on the data quality presented as part of the DSI is presented in that report.

Based on the results of the field QA and field and laboratory QC, and evaluation against the data quality indicators (DQI) it is concluded that the field and laboratory test data obtained are reliable and useable for this assessment.

13. Conclusions and recommendations

Based on the findings of this current supplementary and the DSI (for Option 1) it is considered that the site can be made suitable for the proposed multi-purpose school hall, subject to implementation of the following recommendations:

- The removal of identified asbestos and other hazardous materials in buildings within this area;
- Clearance of the building by a qualified occupational hygienist following the removal of hazardous materials, and then of the ground surface post demolition;
- The removal of the asphalt pavement from the area subject to construction and validation;
- Preparation of a remediation action plan (RAP) to document a remediation process in relation to the health-based exceedances (lead and PAH) and the ecological based exceedances (PAH, zinc and TRH); and
- Validation of the remedial works implemented, confirming that the site is suitable for the land use from a contamination perspective.

It is noted that the PAH, TRH and lead contaminated soils are currently present beneath asphalt surfacing or appropriately 0.5 m of soil overburden. As such, the contamination is not considered to pose a risk of exposure to students at the site. However, the presence of the contamination should be documented in the school's register of hazardous materials, such that any future intrusive works in these areas appropriately consider the exposure to the contaminants. This is particularly the case in the event that the proposed development does not proceed in this location.

14. References

CRC CARE. (2017). *Risk-based Management and Remediation Guidance for Benzo(a)pyrene*. Technical Report no. 39: Cooperative Research Centre for Contamination Assessment and Remediation of the Environment.

Douglas. (2023). *Report on Detailed Site Investigation (Contamination) - Proposed Multi-purpose Medium Hall, 38-54 and 66 Eton Street, Sutherland NSW*. (Reference 224456.00 dated 30 October 2023).

Douglas. (2023). *Report on Preliminary Site Investigation (Contamination) PSI - Proposed Multi-purpose Medium Hall, 38-54 and 66 Eton Street, Sutherland NSW*. (Reference 224456.00 dated 21 September 2023).

Douglas. (2024). *Report on Geotechnical Investigation, proposed Multi-purpose Medium Hall, 38-54 and 66 Eton Street, Sutherland NSW*. (Reference 224456.01).

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]*. Australian Government Publishing Services Canberra: National Environment Protection Council.

NSW EPA. (2014). *Waste Classification Guidelines, Part 1: Classifying Waste*. NSW Environment Protection Authority.

NSW EPA. (2020). *Guidelines for Consultants Reporting on Contaminated Land*. Contaminated Land Guidelines: NSW Environment Protection Authority.

NSW EPA. (2022). *Contaminated Sites, Sampling Design Guidelines*. NSW Environment Protection Authority.

15. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report (or services) for this project at 38-54 and 66 Eton Street, Sutherland NSW in line with Douglas' proposal 224456.01.P.001.Rev0 dated 8/07/2024 and acceptance received from Glenn Francis of School Infrastructure NSW. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of School Infrastructure NSW for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other

site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and / or their agents.

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

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

The assessment of atypical safety hazards arising from this advice is restricted to the (geotechnical / environmental / groundwater) components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

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

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

Appendix A

Drawings

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	12.08.2024	EC/MN

SCALE: 0 4 8 12 16 m — 1:350 @ A3

Douglas PARTNERS
OFFICE: SYDNEY
96-98 Hermitage Rd, West Ryde NSW 2114
(02)9809 0666

CLIENT: **School Infrastructure NSW**

NOTE:
1: Basemap from Metromap (Dated 26.05.2024)

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME: **Proposed Multi-Purpose Medium Hall**

PROJECT ADDRESS: **38-54 and 66 Eton Street, Sutherland**

DRAWING TITLE: **Test Location Plan**

PROJECT NO: **224456.01**

DRAWING NO: **1**

REVISION: **0**

Appendix B

About This Report

About this Report

November 2023

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

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

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole 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. They may not be the same at the time of construction as are indicated in the report; and
- 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 first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or 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 a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

continued next page

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

intentionally blank

intentionally blank

Appendix C

Data Quality Objectives

1. Data quality objectives

The supplementary contamination investigation has been devised broadly in accordance with the seven-step data quality objectives (DQO) process which is provided in Appendix B, Schedule B2 of NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013).

Table 1: Data quality objectives

Step	Summary
1: State the problem	The objective of the investigation is to obtain additional contamination status information for designated proposed Option 1 area, to assist in informing a remediation action plan (RAP). The report is being undertaken as the site is to be developed. A preliminary conceptual site model (CSM) has been prepared (Section 8) for the proposed development. The project team consisted of experienced environmental engineers and scientists working in the roles of Project Principal, Project Reviewer, Project Manager and field staff.
2: Identify the decisions / goal of the study	The site history and previous site contamination investigation has identified possible contaminating previous uses and features which are identified in the CSM (Section 8). The CSM identifies the associated contaminants of potential concern (CoPC) and the likely impacted media. The site assessment criteria (SAC) for each of the CoPC are detailed in Appendix E.
3: Identify the information inputs	Inputs to the investigation included site history information, site features and uses, field observations, sub surface and results of analysis of samples to measure the concentrations of COPC (identified in the CSM, Section 8) from NATA accredited laboratories and methods, where possible. The SAC for each of the CoPC are detailed in Appendix E.
4: Define the study boundaries	The lateral boundaries of the investigation area are shown on Drawing 1, Appendix A (approximate only). The vertical boundaries were to the maximum depth of boreholes drilled, generally ranging between 2.7 m to 4 m bgl. Constraints to the assessment are identified and discussed in the conclusions of the report, Section 13.
5: Develop the analytical approach (or decision rule)	The decision rule is to compare all analytical results with the SAC (Appendix E, based on NEPC (2013)). Where guideline values are absent, other sources of guideline values accepted by NEPC (2013) shall be adopted where possible. Where a sample result exceeds the adopted criterion, a further site-specific assessment will be made as to the risk posed by the presence of that contaminant(s). Quality control results are to be assessed according to their relative percent difference (RPD) values. For field duplicates, triplicates and laboratory results, RPD values should generally be below 30%; for field blanks and rinsates, results should be at or less than the limits of reporting (NEPC, 2013). The field and laboratory quality assurance assessment is included in Appendix I.

Step	Summary
6: Specify the performance or acceptance criteria	Baseline condition: Contaminants at the site and / or statistical analysis of data (in line with NEPC (2013)) exceed the human health and environmental SAC and pose a potentially unacceptable risk to receptors (null hypothesis). Alternative condition: Contaminants at the site and statistical analysis of data (in line with NEPC (2013)) comply with the human health and environmental SAC and as such, do not pose a potentially unacceptable risk to receptors (alternative hypothesis). Unless conclusive information from the collected data is sufficient to reject the null hypothesis, it is assumed that the baseline condition is true.
7: Optimise the design for obtaining data	As the purpose of the investigation is to assess the contamination status of the site, the sampling program is reliant on professional judgement to identify and sample the potentially affected areas. Further details regarding the proposed sampling plan are presented in Section 9.2.

2. References

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]*. Australian Government Publishing Services Canberra: National Environment Protection Council.

Appendix D

Field Work Methodology

1. Guidelines

The following key guidelines were consulted for the field work methodology:

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013).

2. Soil sampling

Soil sampling is carried out in accordance with Douglas' standard operating procedures. The general sampling and sample management procedures comprise:

- Collect soil samples directly from solid flight auger at regular depth;
- Place samples into laboratory-prepared glass jars with Teflon lined lids, capping immediately and minimising headspace within the sample jar;
- Collect ~500 ml samples in zip-lock bags for fibrous asbestos and asbestos fines (FA and AF) analysis;
- Wear a new disposable nitrile glove for each sample point thereby minimising potential for cross-contamination;
- Collect 10% replicate samples for quality control (QC) purposes;
- Label sample containers with individual and unique identification details, including project number, sample location and sample depth (where applicable);
- Place samples into a cooled, insulated and sealed container for transport to the laboratory; and
- Use chain of custody documentation.

3. References

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM].* Australian Government Publishing Services Canberra: National Environment Protection Council.

Appendix E

Site Assessment Criteria

1. Introduction

1.1 Guidelines

The following key guidelines were consulted for deriving the site assessment criteria (SAC):

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013); and
- CRC CARE *Health screening levels for petroleum hydrocarbons in soil and groundwater* (CRC CARE, 2011).

1.2 General

The SAC applied in the current investigation are informed by the CSM which identified human and environmental receptors to potential contamination at the site. Analytical results are assessed (as a Tier 1 assessment) against the SAC comprising primarily the investigation and screening levels of Schedule B1 of NEPC (2013).

The following inputs are relevant to the selection and/or derivation of the SAC:

The proposed development comprises construction of a multi-purpose medium hall including toilets and a canteen.

- Land use: residential:
  - Corresponding to land use category 'A', residential with garden / accessible soil (home grown produce <10% fruit and vegetable intake, (no poultry)), also includes children's day care centres, preschools and primary schools; and
- Soil type: The fill encountered across the three proposed Option 1 area consisted of CLAY and SAND overlaying by natural CLAY. For the purpose of this investigation SAND was selected as the soil type as it informs the most stringent criteria.

2. Soils

2.1 Health investigation and screening levels

The generic health investigation levels (HIL) and health screening levels (HSL) are considered to be appropriate for the assessment of human health risk via all relevant pathways of exposure associated with contamination at the site. The adopted soil HIL and HSL for the contaminants of concern are in Table 1 and Table 2.

Table 1: Health investigation levels (mg/kg)

Contaminant	HIL-A
Metals	
Arsenic	100
Cadmium	20

Contaminant	HIL-A
Chromium (VI)	100
Copper	6000
Lead	300
Mercury (inorganic)	40
Nickel	400
Zinc	7400
PAH	
B(a)P TEQ	3
Total PAH	300
Phenols	
Pentachlorophenol	100
OCP	
DDT+DDE+DDD	240
Aldrin and dieldrin	6
Chlordane	50
Endosulfan	270
Endrin	10
Heptachlor	6
HCB	10
Methoxychlor	300
OPP	
Chlorpyrifos	160
PCB	
PCB	1

Table 2: Health screening levels (mg/kg)

Contaminant	HSL-A&B	HSL-A&B	HSL-A&B
SAND	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4 m**
Benzene	0.5	0.5	0.5
Toluene	160	220	310
Ethylbenzene	55	NL	NL
Xylenes	40	60	95
Naphthalene	3	NL	NL

Contaminant	HSL-A&B	HSL-A&B	HSL-A&B
TRH F1	45	70	110
TRH F2	110	240	440

Notes: TRH F1 is TRH C_6-C_{10} minus BTEX
TRH F2 is TRH >C_{10}-C_{16} minus naphthalene
The soil saturation concentration (Csat) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds Csat, a soil vapour source concentration for a petroleum mixture could not exceed a level that would results in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'

Note that various depths to contamination are listed in Table 2. This is due to the potential depths between receptors (i.e. at ground or basement level) and the contaminant sources (e.g. fill and groundwater). Only the most conservative criteria are presented on the results tables in Appendix F.

The HSL for direct contact derived from CRC CARE (2011) are in Table 3.

Table 3: Health screening levels for direct contact (mg/kg)

Contaminant	DC HSL-A	DC HSL-IMW
Benzene	100	1100
Toluene	14 000	120 000
Ethylbenzene	4500	85 000
Xylenes	12 000	130 000
Naphthalene	1400	29 000
TRH F1	4400	82 000
TRH F2	3300	62 000
TRH F3	4500	85 000
TRH F4	6300	120 000

Notes: TRH F1 is TRH C_6-C_{10} minus BTEX
TRH F2 is TRH >C_{10}-C_{16} minus naphthalene

2.2 Asbestos in soil

The HSL for asbestos in soil are based on likely exposure levels for different scenarios published in NEPC (2013) for the following forms of asbestos:

- Bonded asbestos containing material (ACM); and
- Fibrous asbestos and asbestos fines (FA and AF).

The HSL are in Table 4.

Table 4: Health screening levels for asbestos

Form of asbestos	HSL-A
ACM	0.01%
FA and AF	0.001%
FA and AF and ACM	No visible asbestos for surface soil *

Notes: Surface soils defined as top 10 cm.
* Based on site observations at the sampling points and the analytical results of surface samples.

2.3 Ecological investigation levels

Ecological investigation levels (EIL) and added contaminant limits (ACL), where appropriate, have been derived in NEPC (2013) for arsenic, copper, chromium (III), nickel, lead, zinc, DDT and naphthalene. The adopted EIL, derived using the interactive (excel) calculation spreadsheet on the NEPM toolbox website are shown in Table 6, with inputs into their derivation shown in Table 5.

Table 5: Inputs to the derivation of the ecological investigation levels

Variable	Input	Rationale
Age of contaminants	"Aged"	Soils on site are > 2 years
pH	5.7	-
CEC	5.8 $cmol_c/kg$	-
Clay content	10%	Variable soil in some fill locations, conservative value of clay adopted
Traffic volumes	high	-
State / Territory	NSW	-

Table 6: Ecological investigation levels (mg/kg)

Contaminant	EIL-A-B-C
Metals	
Arsenic	100
Copper	140
Nickel	50
Chromium III	410
Lead	1100
Zinc	350
PAH	
Naphthalene	170
OCP	

Contaminant	EIL-A-B-C
DDT	180

EIL-A-B-C urban residential and public open space

2.4 Ecological screening levels

Ecological screening levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. The adopted ESL are shown in Table 7.

Table 7: Ecological screening levels (mg/kg)

Contaminant	Soil Type	ESL-A-B-C
Benzene	Coarse	50
Toluene	Coarse	85
Ethylbenzene	Coarse	70
Xylenes	Coarse	105
TRH F1	Coarse/ Fine	180*
TRH F2	Coarse/ Fine	120*
TRH F3	Coarse	300
TRH F4	Coarse	2800
B(a)P	Coarse	0.7

Notes: ESL are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability
TRH F1 is TRH C_6-C_{10} minus BTEX
TRH F2 is TRH >C_{10}-C_{16} including naphthalene
ESL-A-B-C urban residential and public open space

2.5 Management limits

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

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

The adopted management limits are in Table 8.

Table 8: Management limits (mg/kg)

Contaminant	Soil type	ML-A-B-C
TRH F1	Coarse	700
TRH F2	Coarse	1000
TRH F3	Coarse	2500
TRH F4	Coarse	10 000

Notes: TRH F1 is TRH C_6-C_{10} including BTEX
TRH F2 is TRH >C_{10}-C_{16} including naphthalene
ML-A-B-C residential, parkland and public open space

3. References

CRC CARE. (2011). *Health screening levels for petroleum hydrocarbons in soil and groundwater.* Parts 1 to 3, Technical Report No. 10: Cooperative Research Centre for Contamination Assessment and Remediation of the Environment.

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM].* Australian Government Publishing Services Canberra: National Environment Protection Council.

Appendix F

Table Summary Results

Table F1: Summary of Laboratory Results – Priority metals, PAH, TRH, BTEX, phenols, OCP, OCP, PCB, Asbestos (FA/AF)

				Priority metals								PAH				TRH					
				Total Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	Naphthalene [b]	Benzo(a)pyrene (B(a)P)	Benzo(a)pyrene TEQ (B(a)P TEQ)	Total PAH	TRH C6 - C10	TRH >C10-C16	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)
			PQL	4	0.4	1	1	1	0.1	1	1	1	0.05	0.5	0.05	25	50	25	50	100	100
Sample ID	Depth	FILL/ Natural	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Supplementary Contamination Investigation (Douglas, 2024)																					
BH101	0.4 - 0.5 m	FILL/ SAND	16/07/24	10	<0.4	18	9	15	<0.1	3	10	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	**260**	**370**
				100 100	20 -	100 410	6,000 140	300 1,100	40 -	400 50	7,400 350	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2,800
BH102	0.4 - 0.5 m	FILL / SANDY SILT	16/07/24	6	<0.4	13	27	50	<0.1	2	97	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100
				100 100	20 -	100 410	6,000 140	300 1,100	40 -	400 50	7,400 350	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2,800
BD1	0 m	FILL / SANDY SILT	16/07/24	6	<0.4	13	5	17	<0.1	2	17	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100
				100 100	20 -	100 410	6,000 140	300 1,100	40 -	400 50	7,400 350	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2,800
BH103	0 - 0.1 m	FILL / SANDY SILT	16/07/24	10	<0.4	17	40	**350**	0.2	9	**390**	<1	**0.53**	**0.7**	**4.5**	<25	<50	<25	<50	**340**	**360**
				100 100	20 -	100 410	6,000 140	300 1,100	40 -	400 50	7,400 350	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2,800
BH103	0.8 - 1 m	FILL /SILTY CLAY	16/07/24	20	<0.4	29	12	26	<0.1	2	13	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100
				100 100	20 -	100 410	6,000 140	300 1,100	40 -	400 50	7,400 350	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2,800
BH104	0.4 - 0.5 m	FILL / SANDY SILT	16/07/24	15	<0.4	30	4	20	<0.1	3	7	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100
				100 100	20 -	100 410	6,000 140	300 1,100	40 -	400 50	7,400 350	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2,800
BH105	0.4 - 0.5 m	FILL /SILTY CLAY	16/07/24	9	<0.4	20	10	20	<0.1	2	13	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100
				100 100	20 -	100 410	6,000 140	300 1,100	40 -	400 50	7,400 350	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2,800
Detailed Site Investigation (Douglas, 2023)																					
BH01	0.5 - 0.6 m	FILL/SAND	27/09/23	10	<0.4	33	22	23	0.1	17	150	<0.1	**7**	**9.5**	**64**	<25	<50	<25	<50	**940**	**600**
				100 100	20 -	100 410	6000 180	300 1100	40 -	400 100	7400 460	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2800
BD01/20230927	0.5 - 0.6 m	FILL/SAND	27/09/23	5	<0.4	18	30	19	<0.1	22	150	<0.1	**6.4**	**8.6**	**56**	<25	<50	<25	<50	**940**	**760**
				100 100	20 -	100 410	6000 180	300 1100	40 -	400 100	7400 460	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2800
BH02	0.1 - 0.2 m	FILL/CLAY	27/09/23	8	<0.4	15	29	23	<0.1	6	31	<0.1	0.1	<0.5	**1**	<25	<50	<25	<50	**390**	**580**
				100 100	20 -	100 410	6000 180	300 1100	40 -	400 100	7400 460	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2800
BH03	0.4 - 0.5 m	CLAY	27/09/23	10	<0.4	26	16	24	<0.1	9	37	<0.1	**1.4**	2	**14**	<25	<50	<25	<50	**490**	**460**
				100 100	20 -	100 410	6000 180	300 1100	40 -	400 100	7400 460	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2800
BH04	0 - 0.1 m	FILL/SANDY SILT	27/09/23	5	<0.4	10	29	53	<0.1	8	100	<0.1	0.2	<0.5	**2.1**	<25	<50	<25	<50	**330**	**460**
				100 100	20 -	100 410	6000 180	300 1100	40 -	400 100	7400 460	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2800
BH04	0.9 - 1 m	FILL/SANDY SILT	27/09/23	12	<0.4	30	23	77	0.1	6	88	<0.1	0.2	<0.5	1.8	<25	<50	<25	<50	**190**	**330**
				100 100	20 -	100 410	6000 180	300 1100	40 -	400 100	7400 460	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2800
BH05	0.4 - 0.5 m	FILL/SANDY SILT	27/09/23	8	<0.4	15	26	130	0.1	6	110	<0.1	**0.71**	**0.9**	**6.2**	<25	<50	<25	<50	**240**	**340**
				100 100	20 -	100 410	6000 180	300 1100	40 -	400 100	7400 460	3 170	- 0.7	3 -	300 -	- -	- 120	45 180	110 -	- 300	- 2800

Lab result

HIL/HSL value EIL/ESL/EGV value

HIL/HSL exceedance EIL/ESL exceedance HIL/HSL and EIL/ESL exceedance ML exceedance ML and HIL/HSL or EIL/ESL exceedance

Indicates that asbestos has been detected by the lab, refer to the lab report **Blue** = DC exceedance **Red** = EGV-indirect exceedance HSL 0-<1 Exceedance

Bold = Lab detections - = Not tested or No HIL/HSL/EIL/ESL (as applicable) or Not applicable NL = Not limiting NAD = No Asbestos detected

HIL = Health investigation level HSL = Health screening level (excluding DC) EIL = Ecological investigation level ESL = Ecological screening level EGV = Environmental Guideline Value ML = Management Limit DC = Direct Contact HSL

Notes:

a QA/QC replicate of sample listed directly below the primary sample

b Naphthalene reported as highest detection from the BTEXN or PAH suite, or if both results <PQL as lowest PQL

c EIL criteria applies to DDT only

Site Assessment Criteria (SAC):

SAC based on generic land use thresholds for Residential A with garden/accessible soil

Refer to the SAC section of report for information of SAC sources and rationale. Summary information as follows:

HIL	HIL-A (NEPC, 2013 or HEPA, 2020 (PFAS only))	EGV	EGV, all land uses, direct exposure (HEPA, 2020)
HSL (vapour intrusion)	HSL-A/B (NEPC, 2013)	ESL	Urban Residential and Public Open Space (NEPC, 2013)
DC	Direct contact HSL A Residential (Low density) (CRC CARE, 2011)	ML	Residential, Parkland and Public Open Space (NEPC, 2013)

Table F1: Summary of Laboratory Results – Priority metals, PAH, TRH, BTEX, phenols, OCP, OCP, PCB, Asbestos (FA/AF)

				BTEX				Phenols	Priority OCP									Priority OPP	PCB	Asbestos (FA/AF)		Asbestos, Other		
				Benzene	Toluene	Ethylbenzene	Total Xylenes	Total Phenolics	DDT+DDE+DDD c	Aldrin + Dieldrin	Total Chlordane	Total Endosulfan	Endrin	Heptachlor	Hexachlorobenzene	Methoxychlor	Mirex	Chlorpyriphos	Total PCB	Asb_Sample_mass	FA and AF Estimation	Asbestos ID in soil >0.1g/kg	Trace Analysis (NEPC)	Total Asbestos
			PQL	0.2	0.5	1	1	5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		0.001			0.1
Sample ID	Depth	FILL/ Natural	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	g	%(w/w)	-	-	g/kg
Supplementary Contamination Investigation (Douglas, 2024)																								
BH101	0.4 - 0.5 m	FILL/ SAND	16/07/24	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	695.94	<0.001	NAD	NAD	<0.1
				0.5 50	160 85	55 70	40 105	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	0.001 -			
BH102	0.4 - 0.5 m	FILL / SANDY SILT	16/07/24	<0.2	<0.5	<1	<1	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	430.29	<0.001	NAD	NAD	<0.1
				0.5 50	160 85	55 70	40 105	100 -	240 180	6 -	50 -	270 -	10 -	6 -	10 -	300 -	10 -	160 -	1 -	- -	0.001 -			
BD1	0 m	FILL / SANDY SILT	16/07/24	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				0.5 50	160 85	55 70	40 105	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -			
BH103	0 - 0.1 m	FILL / SANDY SILT	16/07/24	<0.2	<0.5	<1	<1	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	371.7	<0.001	NAD	NAD	<0.1
				0.5 50	160 85	55 70	40 105	100 -	240 180	6 -	50 -	270 -	10 -	6 -	10 -	300 -	10 -	160 -	1 -	- -	0.001 -			
BH103	0.8 - 1 m	FILL /SILTY CLAY	16/07/24	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	419.25	<0.001	NAD	NAD	<0.1
				0.5 50	160 85	55 70	40 105	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	0.001 -			
BH104	0.4 - 0.5 m	FILL / SANDY SILT	16/07/24	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	665.93	<0.001	NAD	NAD	<0.1
				0.5 50	160 85	55 70	40 105	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	0.001 -			
BH105	0.4 - 0.5 m	FILL /SILTY CLAY	16/07/24	<0.2	<0.5	<1	<1	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	438.35	<0.001	NAD	NAD	<0.1
				0.5 50	160 85	55 70	40 105	100 -	240 180	6 -	50 -	270 -	10 -	6 -	10 -	300 -	10 -	160 -	1 -	- -	0.001 -			
Detailed Site Investigation (Douglas, 2023)																								
BH01	0.5 - 0.6 m	FILL/SAND	27/09/23	<0.2	<0.5	<1	<1	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	NAD	-	-
				0.5 50	160 85	55 70	40 105	100 -	240 180	6 -	50 -	270 -	10 -	6 -	10 -	300 -	10 -	160 -	1 -					
BD01/20230927	0.5 - 0.6 m	FILL/SAND	27/09/23	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				0.5 50	160 85	55 70	40 105	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -					
BH02	0.1 - 0.2 m	FILL/CLAY	27/09/23	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD	-	-
				0.5 50	160 85	55 70	40 105	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -					
BH03	0.4 - 0.5 m	CLAY	27/09/23	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD	-	-
				0.5 50	160 85	55 70	40 105	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -					
BH04	0 - 0.1 m	FILL/SANDY SILT	27/09/23	<0.2	<0.5	<1	<1	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	NAD	-	-
				0.5 50	160 85	55 70	40 105	100 -	240 180	6 -	50 -	270 -	10 -	6 -	10 -	300 -	10 -	160 -	1 -					
BH04	0.9 - 1 m	FILL/SANDY SILT	27/09/23	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD	-	-
				0.5 50	160 85	55 70	40 105	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -					
BH05	0.4 - 0.5 m	FILL/SANDY SILT	27/09/23	<0.2	<0.5	<1	<1	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	NAD	-	-
				0.5 50	160 85	55 70	40 105	100 -	240 180	6 -	50 -	270 -	10 -	6 -	10 -	300 -	10 -	160 -	1 -					

Lab result

HIL/HSL value EIL/ESL/EGV value

HIL/HSL exceedance EIL/ESL exceedance HIL/HSL and EIL/ESL exceedance ML exceedance ML and HIL/HSL or EIL/ESL exceedance

Indicates that asbestos has been detected by the lab, refer to the lab report **Blue** = DC exceedance **Red** = EGV-indirect exceedance HSL 0-<1 Exceedance

Bold = Lab detections - = Not tested or No HIL/HSL/EIL/ESL (as applicable) or Not applicable NL = Not limiting NAD = No Asbestos detected

HIL = Health investigation level HSL = Health screening level (excluding DC) EIL = Ecological investigation level ESL = Ecological screening level EGV = Environmental Guideline Value ML = Management Limit DC = Direct Contact HSL

Notes:

a QA/QC replicate of sample listed directly below the primary sample

b Naphthalene reported as highest detection from the BTEXN or PAH suite, or if both results <PQL as lowest PQL

c EIL criteria applies to DDT only

Site Assessment Criteria (SAC):

SAC based on generic land use thresholds for Residential A with garden/accessible soil

Refer to the SAC section of report for information of SAC sources and rationale. Summary information as follows:

HIL	HIL-A (NEPC, 2013 or HEPA, 2020 (PFAS only))	EGV	EGV, all land uses, direct exposure (HEPA, 2020)
HSL (vapour intrusion)	HSL-A/B (NEPC, 2013)	ESL	Urban Residential and Public Open Space (NEPC, 2013)
DC	Direct contact HSL A Residential (Low density) (CRC CARE, 2011)	ML	Residential, Parkland and Public Open Space (NEPC, 2013)

Table F2 : Summary of Laboratory Results – Metals, TRH, BTEX, PAH, Phenols, OCP, OPP, PCB, Asbestos

				Metals							TRH		BTEX				PAH				Phenols	OCP		OPP	PCB	Asbestos	
				Total Arsenic	Cadmium	Total Chromium	Lead	TCLP Lead	Mercury (inorganic)	Nickel	TRH C6 - C9	TRH C10-C36	Benzene	Toluene	Ethylbenzene	Total Xylenes	Benzo(a)pyrene (B(a)P)	TCLP Benzo(a)pyrene (B(a)P)	Total PAH	TCLP Total PAH	Total Phenolics	Total Endosulfan	Total Analysed OCP	Total Analysed OPP	Total PCB	Asbestos ID in soil >0.1g/kg	FA and AF Estimation
			PQL	4	0.4	1	1	0.03	0.1	1	25	50	0.2	0.5	1	1	0.05	0.0001	0.05		5	0.1	0.1	0.1	0.1		0.001
Sample ID	Depth	Fill / Natural	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	-	%(w/w)
Supplementary Contamination Investigation (Douglas, 2024)																											
BH101	0.4 - 0.5 m	FILL / SAND	16/07/24	10	<0.4	18	15	-	<0.1	3	<25	300	<0.2	<0.5	<1	<1	<0.05	-	<0.05	-	-	-	-	-	-	NAD	<0.001
BH102	0.4 - 0.5 m	FILL / SANDY SILT	16/07/24	6	<0.4	13	50	-	<0.1	2	<25	<50	<0.2	<0.5	<1	<1	<0.05	-	<0.05	-	<5	<0.1	<0.1	<0.1	<0.1	NAD	<0.001
BD1	0 m	FILL / SANDY SILT	16/07/24	6	<0.4	13	17	-	<0.1	2	<25	<50	<0.2	<0.5	<1	<1	<0.05	-	<0.05	-	-	-	-	-	-	-	-
BH103	0 - 0.1 m	FILL / SANDY SILT	16/07/24	10	<0.4	17	350	-	0.2	9	<25	470	<0.2	<0.5	<1	<1	0.53	-	4.5	-	<5	<0.1	<0.1	<0.1	<0.1	NAD	<0.001
BH103	0.8 - 1 m	FILL / SILTY CLAY	16/07/24	20	<0.4	29	26	-	<0.1	2	<25	<50	<0.2	<0.5	<1	<1	<0.05	-	<0.05	-	-	-	-	-	-	NAD	<0.001
BH104	0.4 - 0.5 m	FLL/ SANDY SILT	16/07/24	15	<0.4	30	20	-	<0.1	3	<25	<50	<0.2	<0.5	<1	<1	<0.05	-	<0.05	-	-	-	-	-	-	NAD	<0.001
BH105	0.4 - 0.5 m	FILL/ SILTY CLAY	16/07/24	9	<0.4	20	20	-	<0.1	2	<25	<50	<0.2	<0.5	<1	<1	<0.05	-	<0.05	-	<5	<0.1	<0.1	<0.1	<0.1	NAD	<0.001
BH102 - [TRIPLICATE]	0.4 - 0.5 m	FILL/ SANDY SILT	16/07/24	5	<0.4	12	41	-	<0.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Detailed Site Investigation (Douglas, 2023)																											
BH01	0.5 - 0.6 m	FILL / SAND	27/09/23	10	<0.4	33	23	-	0.1	17	<25	1200	<0.2	<0.5	<1	<1	7	<0.0001	64	0.002	<5	<0.1	<0.1	<0.1	<0.1	NAD	–
BD01/20230927	0.5 - 0.6 m	FILL / SAND	27/09/23	5	<0.4	18	19	-	<0.1	22	<25	1200	<0.2	<0.5	<1	<1	6.4	<0.0001	56	0.0024	-	-	-	-	-	–	–
BH02	0.1 - 0.2 m	FILL / CLAY	27/09/23	8	<0.4	15	23	-	<0.1	6	<25	560	<0.2	<0.5	<1	<1	0.1	-	1	-	-	-	-	-	-	NAD	–
BH03	0.4 - 0.5 m	CLAY	27/09/23	10	<0.4	26	24	-	<0.1	9	<25	650	<0.2	<0.5	<1	<1	1.4	<0.0001	14	0.0004	-	-	-	-	-	NAD	–
BH04	0 - 0.1 m	FILL / SANDY SILT	27/09/23	5	<0.4	10	53	-	<0.1	8	<25	500	<0.2	<0.5	<1	<1	0.2	-	2.1	-	<5	<0.1	<0.1	<0.1	<0.1	NAD	–
BH04	0.9 - 1 m	FILL / SANDY SILT	27/09/23	12	<0.4	30	77	-	0.1	6	<25	220	<0.2	<0.5	<1	<1	0.2	-	1.8	-	-	-	-	-	-	NAD	–
BH05	0.4 - 0.5 m	FILL / SANDY SILT	27/09/23	8	<0.4	15	130	0.06	0.1	6	<25	370	<0.2	<0.5	<1	<1	0.71	-	6.2	-	<5	<0.1	<0.1	<0.1	<0.1	NAD	–
Waste Classification Criteria																											
CT1				100	20	100	100	-	4	40	650	10,000	10	288	600	1000	0.8	-	200	-	288	60	-	4	<50	NAD	-
SCC1				500	100	1,900	1,500	-	50	1,050	650	10,000	18	518	1,080	1,800	10	-	200	-	518	108	-	7.5	<50	NAD	-
TCLP1				-	-	-	-	5	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-	-	-	-	-	-
CT2				400	80	400	400	-	16	160	2,600	40,000	40	1,152	2,400	4,000	3.2	-	800	-	1,152	240	-	16	<50	NAD	-
SCC2				2,000	400	7,600	6,000	-	200	4,200	2,600	40,000	72	2,073	4,320	7,200	23	-	800	-	2,073	432	-	30	<50	NAD	-
TCLP2				-	-	-	-	20	-	-	-	-	-	-	-	-	-	0.16	-	-	-	-	-	-	-	-	-

CT1 exceedance TCLP1 and/or SCC1 exceedance CT2 exceedance TCLP2 and/or SCC2 exceedance Asbestos detection

- = Not tested, no criteria or not applicable NAD = no asbestos detected

Notes:

a QA/QC replicate of sample listed directly below the primary sample

b Total chromium used as initial screen for chromium(VI).

c Total recoverable hydrocarbons (TRH) used as an initial screen for total petroleum hydrocarbons (TPH)

d Criteria for scheduled chemicals used as an initial screen

e Criteria for Chlorpyrifos used as initial screen

f NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste

PQL Practical quantitation limit

CT1 Maximum values of specific contaminant concentration (SCC) for classification without TCLP: General solid waste

SCC1 Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: General solid waste

TCLP1 Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: General solid waste

CT2 Maximum values of specific contaminant concentration (SCC) for classification without TCLP: Restricted solid waste

SCC2 Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: Restricted solid waste

TCLP2 Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: Restricted solid waste

Appendix G

Borehole Logs

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland

SURFACE LEVEL: 112.4 AHD
EASTING: 320800.2
NORTHING: 6232529.2
DIP/AZIMUTH: 90°/--

BORE No: BH01
PROJECT No: 224456.00
DATE: 27/9/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
112	0.1	ASPHALTIC CONCRETE			0.1				
		FILL/ Gravelly SAND: fine to coarse, grey to dark grey, fine to medium angular igneous gravel, dry, apparently well compacted		E	0.2				
	0.35	FILL/ SAND: fine to medium, dark grey, with clay nodules, moist		E*	0.5				
	0.6	CLAY CI-CH: medium to high plasticity, red-brown and pale grey, w<PL, stiff, residual			0.6				
				E	0.9				
	1	Below 1.0m: very stiff			1.0				1
111				S			3,7,10 N = 17		
					1.45				
	2								2
110	2.4	SHALE: dark grey and orange-brown, very low strength, highly weathered, Hawkesbury Sandstone			2.5				
		Below 2.6m: low strength		S			10,25/100 refusal		
	2.75	Bore discontinued at 2.75m Refusal			2.75				
	3								3
109									
	4								4
108									

RIG: Comacchio 205 **DRILLER:** DB **LOGGED:** TM **CASING:** Uncased
TYPE OF BORING: Solid flight auger to 2.5m
WATER OBSERVATIONS: No free groundwater observed
REMARKS: *BD01/20230927TM Taken from 0.5-0.6m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland

SURFACE LEVEL: 112.8 AHD
EASTING: 320819
NORTHING: 6232525.6
DIP/AZIMUTH: 90°/--

BORE No: BH02
PROJECT No: 224456.00
DATE: 27/9/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	ASPHALTIC CONCRETE			0.1				
	0.2	FILL/ CLAY: medium plasticity, red-brown and brown, trace fine to medium angular igneous gravel, w<PL		E	0.2				
		CLAY CI-CH: medium to high plasticity, red-brown and pale grey, w<PL, stiff, residual							
				E	0.5				
					0.6				
112									
				E	0.9				
	1	Below 1.0m: very stiff to hard			1.0				1
				S			6,12,15 N = 27		
					1.45				
111									
	2								2
	2.3	SHALE: dark grey and orange-brown, very low strength, highly weathered, Hawkesbury Sandstone							
					2.5				
		Below 2.7m: low strength		S			12,25,20/100 refusal		
110	2.9				2.9				
		Bore discontinued at 2.9m Refusal							
	3								3
109									
	4								4
108									

RIG: Comacchio 205 **DRILLER:** DB **LOGGED:** TM **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 2.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland

SURFACE LEVEL: 112.3 AHD
EASTING: 320805.7
NORTHING: 6232519.7
DIP/AZIMUTH: 90°/--

BORE No: BH03
PROJECT No: 224456.00
DATE: 27/9/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
112	0.1	ASPHALTIC CONCRETE			0.1				
		FILL/ Gravelly SAND: fine to medium, dark grey, fine to medium angular igneous gravel, dry, apparently well compacted		E	0.2				
	0.3	CLAY CI-CH: medium to high plasticity, red-brown and pale grey, w<PL, stiff, residual		E	0.4				
				U	0.5				
					0.7				
				E	0.9				
	1	Below 1.0m: very stiff to hard			1.0				1
111				S			6,14,16 N = 30		
					1.45				
	2								2
110	2.3	SHALE: dark grey and orange-brown, very low strength, highly weathered, Hawkesbury Sandstone							
	2.55	Below 2.5m: low strength		S	2.5 2.55		10/50 refusal		
		Bore discontinued at 2.55m Refusal							
	3								3
109									
	4								4
108									

RIG: Comacchio 205 **DRILLER:** DB **LOGGED:** TM **CASING:** Uncased
TYPE OF BORING: Solid flight auger to 2.5m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland

SURFACE LEVEL: 111.6 AHD
EASTING: 320795.6
NORTHING: 6232498.8
DIP/AZIMUTH: 90°/--

BORE No: BH04
PROJECT No: 224456.00
DATE: 27/9/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
111	0	FILL/ Sandy SILT: low plasticity, brow to dark grey, trace rootlets							
				E	0.1				
					0.2				
				E	0.4				
					0.5				
				E*	0.9				
	1				1.0				1
				S			2,2,6 N = 8		
	1.3	CLAY CI-CH: medium to high plasticity, red-brown and pale grey, w<PL, stiff to very stiff, residual							
					1.45				
110				E	1.5				
					1.6				
				E	1.9				
	2				2.0				2
					2.5				
109				S			11,20,25/100 refusal		
	2.8	SHALE: dark grey and orange-brown, low strength, highly weathered, Hawkesbury Sandstone							
	2.9	Bore discontinued at 2.9m Refusal			2.9				
	3								3
108									
	4								4
107									

RIG: Comacchio 205 **DRILLER:** DB **LOGGED:** TM **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 2.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD02/20230927TM Taken from 0.9-1.0m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland

SURFACE LEVEL: 111.7 AHD
EASTING: 320807.2
NORTHING: 6232493.5
DIP/AZIMUTH: 90°/--

BORE No: BH05
PROJECT No: 224456.00
DATE: 27/9/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
111	0.0	FILL/ Sandy SILT: low plasticity, brown to dark grey, trace rootlets		E	0.0–0.1				
				E	0.4–0.5				
	0.6	CLAY CI-CH: medium to high plasticity, red-brown and pale grey, w<PL, very stiff, residual		E	0.9–1.0				
	1			S	1.45		6,8,10 N = 18		
110	2								
	2.5	SHALE: dark grey and orange-brown, low strength, highly weathered, Hawkesbury Sandstone		S	2.5–2.55		10/50 refusal		
109	2.55	Bore discontinued at 2.55m Refusal							
	3								
108	4								
107									

RIG: Comacchio 205 **DRILLER:** DB **LOGGED:** TM **CASING:** Uncased
TYPE OF BORING: Solid flight auger to 2.5m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland

SURFACE LEVEL: 110.7 AHD
EASTING: 320826.7
NORTHING: 6232448.5
DIP/AZIMUTH: 90°/--

BORE No: BH06
PROJECT No: 224456.00
DATE: 27/9/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
110	0.0	FILL/ SAND: medium, grey-brown, with clay, trace tile fragments, moist		E	0.0–0.1				
	0.2	CLAY CI-CH: medium to high plasticity, red-brown and pale grey, w<PL, stiff, residual		E	0.4–0.5				
	1	Below 1.0m: very stiff		E	0.9–1.0				
				S	1.0–1.45		7,10,15 N = 25		
109	2								
	2.3	SHALE: dark grey and orange-brown, very low strength, highly weathered, Hawkesbury Sandstone		S	2.5		10,27,10/50 refusal		
108		Below 2.7m: low strength							
	2.85	Bore discontinued at 2.85m Refusal			2.85				
107	3								
	4								
106									

RIG: Comacchio 205 **DRILLER:** DB **LOGGED:** TM **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 2.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland

SURFACE LEVEL: 111.5 AHD
EASTING: 320845.5
NORTHING: 6232450.5
DIP/AZIMUTH: 90°/--

BORE No: BH07
PROJECT No: 224456.00
DATE: 28/9/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
111	0.0			E	0.0–0.1				
	0.15	FILL/ SAND: fine to medium, brown, trace silt and rootlets, moist							
		FILL/ CLAY: medium plasticity, brown, trace fine igneous gravel, w<PL		E*	0.4–0.5				
	0.7	CLAY CI-CH: medium to high plasticity, red-brown and pale grey, w<PL, stiff, residual		E	0.9–1.0				
110	1			U	1.4				
		Below 1.4m: very stiff							
	2								
	2.3	SHALE: dark grey and orange-brown, very low strength, highly weathered, Hawkesbury Sandstone		S	2.5		11,30 refusal		
109		Below 2.7m: low strength							
	2.8	Bore discontinued at 2.8m Refusal			2.8				
	3								
108									
	4								
107									

RIG: Explora **DRILLER:** DB **LOGGED:** TM **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 2.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD03/20230928TM Taken from 0.4-0.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland

SURFACE LEVEL: 109.7 AHD
EASTING: 320824.1
NORTHING: 6232431.9
DIP/AZIMUTH: 90°/--

BORE No: BH08
PROJECT No: 224456.00
DATE: 27/9/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
109	0.0	FILL/ Gravelly SAND: fine to medium, grey to dark grey, fine to medium angular to sub-angular igneous gravel, dry		E	0.0 0.1				
	0.4	CLAY CI-CH: medium to high plasticity, red-brown and pale grey, w<PL, stiff, residual		E	0.4 0.5				
				U	0.6				
				E	0.9				
	1	Below 1.0m: very stiff to hard		S	1.0 1.45		10,12,19 N = 31		
108	2								
	2.5	SHALE: dark grey and orange-brown, low strength, highly weathered, Hawkesbury Sandstone		S	2.5		20/100 refusal		
107	2.6	Bore discontinued at 2.6m Refusal			2.6				
	3								
106	4								
105									

RIG: Comacchio 205 **DRILLER:** DB **LOGGED:** TM **CASING:** Uncased
TYPE OF BORING: Solid flight auger to 2.5m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland

SURFACE LEVEL: 109.5 AHD
EASTING: 320838.9
NORTHING: 6232418.2
DIP/AZIMUTH: 90°/--

BORE No: BH09
PROJECT No: 224456.00
DATE: 27/9/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
109	0.0	FILL/ Sandy SILT: low plasticity, dark grey-brown, fine to medium sand, w<PL		E	0.0 0.1				
	0.4	FILL/ CLAY: medium plasticity, red-brown and brown, trace fine igneous and ironstone gravel, w<PL, generally in a firm condition, possibly reworked natural		E U E	0.4 0.5 0.9				
108	1			S	1.0 1.45		1,3,2 N = 5		1
107	1.9	CLAY CI-CH: medium to high plasticity, red-brown and pale grey, w<PL, very stiff to hard, residual		E S	1.9 2.0 2.5		10,12,17 N = 29		2 3
106	3.8	SHALE: dark grey and orange-brown, low strength, highly weathered, Hawkesbury Sandstone			2.95				
105	4.0	Bore discontinued at 4.0m Refusal							4

RIG: Comacchio 205 **DRILLER:** DB **LOGGED:** TM **CASING:** Uncased
TYPE OF BORING: Solid flight auger to 4.0m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland

SURFACE LEVEL: 103.9 AHD
EASTING: 320793.3
NORTHING: 6232318.8
DIP/AZIMUTH: 90°/--

BORE No: BH10
PROJECT No: 224456.00
DATE: 28/9/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
103	0.0	FILL/ CLAY: low plasticity, brown, trace silt, ironstone gravel and rootlets, w<PL		E	0.0–0.1				
				E	0.4–0.5				
				U					
	0.8	CLAY CI-CH: medium to high plasticity, red-brown and pale grey, w<PL, stiff to very stiff, residual			0.8				
	1			E	0.9–1.0				1
				S			4,5,9 N = 14		
					1.45				
102	2								2
	2.1	SHALE: dark grey and orange-brown, very low strength with low strength iron indurated bands, highly weathered, Hawkesbury Sandstone							
	2.35	Below 2.3m: low to medium strength Bore discontinued at 2.35m Refusal							
101	3								3
100	4								4
99									

RIG: Explora **DRILLER:** DB **LOGGED:** TM **CASING:** Uncased
TYPE OF BORING: Solid flight auger to 2.35m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland

SURFACE LEVEL: 103.6 AHD
EASTING: 320821.7
NORTHING: 6232315
DIP/AZIMUTH: 90°/--

BORE No: BH11
PROJECT No: 224456.00
DATE: 28/9/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
103	0.0	FILL/ CLAY: low plasticity, brown, trace silt, ironstone gravel and rootlets, w<PL		E	0.0				
					0.1				
	0.2	CLAY CI-CH: medium to high plasticity, yellow-brown and red-brown, w<PL, stiff, residual		E	0.4				
					0.5				
					0.9				
	1	Below 1.0m: very stiff		E	1.0				1
102				S			6,10,12 N = 22		
					1.45				
	2								2
	2.3	SHALE: dark grey and orange-brown, very low strength with low strength iron indurated bands, highly weathered, Hawkesbury Sandstone							
101				S	2.5		14,15/80 refusal		
					2.77				
		Below 2.9m: low strength							
	3								3
	3.1	Bore discontinued at 3.1m Refusal		A	3.0 3.1				
100									
	4								4
99									

RIG: Explora **DRILLER:** DB **LOGGED:** TM **CASING:** Uncased
TYPE OF BORING: Solid flight auger to 3.1m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland

SURFACE LEVEL: 102.7 AHD
EASTING: 320786.2
NORTHING: 6232288
DIP/AZIMUTH: 90°/--

BORE No: BH12
PROJECT No: 224456.00
DATE: 28/9/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
102	0.0	FILL/ CLAY: low plasticity, brown, trace silt, ironstone gravel and rootlets, w<PL		E	0.0				
					0.1				
	0.35	CLAY CI-CH: medium to high plasticity, yellow-brown, w<PL, stiff, residual		E	0.4				
					0.5				
	1	Below 1.0m: very stiff		E	0.9				1
					1.0				
				S			2,7,16 N = 23		
	1.5	SHALE: dark grey with pale grey fine grained sandstone bands, very low strength with low strength iron indurated bands, highly weathered, Hawkesbury Sandstone			1.45				
101									
	2	Below 1.9m: low strength		A	1.9				2
	2.1	Bore discontinued at 2.1m Refusal			2.1				
100	3								3
99	4								4
98									

RIG: Explora **DRILLER:** DB **LOGGED:** TM **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 2.1m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland, NSW 2232

SURFACE LEVEL: 112.2 AHD
COORDINATE: E:320810.7, N:6232518.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH101
PROJECT No: 224456.01
DATE: 16/07/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	112	0.10	ASPHALTIC CONCRETE: 100 mm			NA	NA				0.10		
			FILL / Sandy SILT: brown; low plasticity; fine to medium sand.		FILL	ND	w>PL		ES		0.20		
									A/ES		0.40		
											0.50		
									ES		0.80		
		1.00	Silty CLAY (CH), with gravel: pale grey mottled red-brown; high plasticity; fine to medium, angular to sub-angular, ironstone gravel.		RS	VSt	w<PL				1.00		
	111								SPT			SPT	8,10,15 N=25
											1.45		
									ES		1.80		
	110	2									2.00		
		2.60	SILTSTONE: dark grey; inferred very low to low strength with extremely weathered and ironstone bands. Hawkesbury Sandstone			NA	NA				2.50		
			Borehole discontinued at 2.70m depth. Target depth reached.						SPT		2.70	SPT	16,25/50 (HB)
	109	3											
	108	4											

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Bobcat
METHOD: AD/T to 2.7 m
REMARKS: No free groundwater observed

OPERATOR: Ground Test (C.S.)

LOGGED: CSY
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland, NSW 2232

SURFACE LEVEL: 112.2 AHD
COORDINATE: E:320798.3, N:6232511.5
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH102
PROJECT No: 224456.01
DATE: 16/07/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	112	0.10	ASPHALTIC CONCRETE: 100 mm			NA	NA				0.10		
			FILL / Sandy SILT, trace gravel: brown and grey; low plasticity; fine to medium sand; fine to medium, ironstone gravel; trace rootlets and ash.		FILL	ND	w>PL		A/ES		0.20		
									A		0.40		
		0.70									0.50		
			Silty CLAY (CI), trace gravel: red-brown mottled brown; medium plasticity; fine, ironstone gravel; trace roots.			St - VSt	w>PL		ES		0.80		
	111	1									1.00		
									SPT			SPT	3,5,9 N=14 400kPa
			1.30m: becoming pale grey		RS								600kPa
											1.45	PP	
						VSt	w=PL to w<PL					PP	
	110	2							ES		1.80		
											2.00		
		2.50									2.50		
			SILTSTONE: dark grey; inferred very low to low strength with extremely weathered and ironstone bands. Hawkesbury Sandstone			NA	NA		SPT			SPT	9,15,25/100 (HB)
											2.90		
	109	3	Borehole discontinued at 2.90m depth. Target depth reached.										
	108	4											

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Bobcat
METHOD: AD/T to 2.9 m
REMARKS: No free groundwater observed

OPERATOR: Ground Test (C.S.)

LOGGED: CSY
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland, NSW 2232

SURFACE LEVEL: 111.9 AHD
COORDINATE: E:320792.9, N:6232501.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH103
PROJECT No: 224456.01
DATE: 16/07/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.00	FILL / Sandy SILT, trace gravel: dark brown; low plasticity; fine to medium sand; fine, sandstone gravel; with wood fragment and rootlets.		FILL	ND	w>PL		ES		0.10		
									ES		0.40 0.50		
		0.70	FILL / Silty CLAY, trace gravel: red-brown mottled brown; medium to high plasticity; fine, ironstone gravel; trace rootlets.		FILL possibly RS	ND	w>PL		ES		0.80 1.00		
	111	1											
		1.20	Silty CLAY (CH), trace gravel: pale grey mottled red-brown; high plasticity; fine, ironstone gravel; trace rootlets.		RS	St - VSt	w=PL		SPT		1.45	SPT	4,6,6 N=12 540-580kPa
												PP	
	110	2							A		1.80 2.00		
		2.40			XWM	H	w<PL		SPT		2.50	SPT	12,19,24 N=43
	109	3.00	SILTSTONE: dark grey; inferred very low strength with extremely weathered and ironstone bands. Hawkesbury Sandstone			NA	NA				2.95		
	108	4											
			Borehole discontinued at 4.00m depth. Target depth reached.										
	107												

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Bobcat
METHOD: AD/T to 4.0 m
REMARKS: No free groundwater observed

OPERATOR: Ground Test (C.S.)

LOGGED: CSY
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland, NSW 2232

SURFACE LEVEL: 112.1 AHD
COORDINATE: E:320805.6, N:6232503.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH104
PROJECT No: 224456.01
DATE: 16/07/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
						NA	NA						
	112	0.05	ASHPALTIC CONCRETE: 50 mm								0.05		
			FILL / Sandy SILT, trace gravel: brown; low plasticity; fine to medium sand; fine, ironstone gravel; trace rootlets.		FILL	ND	w>PL		A/ES		0.20		
											0.40		
									ES		0.50		
		0.60	Silty CLAY (CH), trace gravel: red-brown; high plasticity; fine, ironstone gravel; trace rootlets.										
		1									1.00		
	111						w=PL		SPT			SPT	5,6,10 N=16
													600-kPa
											1.45	PP	
					RS	St - VSt			ES		1.50		
		2	2.00m: becoming pale grey								2.00		
	110								ES		2.20		
							w<PL						
											2.50		
									SPT			SPT	9,15,21 N=36
		2.80	SILTSTONE: dark grey; inferred very low strength with extremely weathered and ironstone bands. Hawkesbury Sandstone			NA	NA				2.95		
		3	Borehole discontinued at 3.00m depth. Target depth reached.										
	109												
		4											
	108												

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Bobcat
METHOD: AD/T to 3.0 m
REMARKS: No free groundwater observed

OPERATOR: Ground Test (C.S.)

LOGGED: CSY
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Proposed Multi-Purpose Medium Hall
LOCATION: 38-54 and 66 Eton Street, Sutherland, NSW 2232

SURFACE LEVEL: 112.1 AHD
COORDINATE: E:320808.7, N:6232503.2
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH105
PROJECT No: 224456.01
DATE: 16/07/24
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	TESTING AND REMARKS: RESULTS AND REMARKS
	112	0.10	ASPHALTIC CONCRETE: 100 mm			NA	NA				0.10		
			FILL / Silty SAND, trace gravel: brown; fine to medium; low plasticity silt; fine, ironstone gravel; trace plaster and root fibers.		FILL				ES		0.20		
		0.30	FILL / Silty CLAY, with sand, trace gravel: brown and red-brown; low to medium plasticity; fine to medium sand; fine to medium, igneous and ironstone gravel; trace root fibers, possibly reworked natural.		FILL possibly RS	ND	M		ES		0.40		
		0.60	Silty CLAY (CH), trace gravel: red-brown; high plasticity; fine, ironstone gravel; trace roots.								0.50		
									A/ES		0.80		
	111	1	1.20m: becoming pale grey		RS	VSt - H	w=PL				1.00		
									SPT			SPT	5,9,9 N=18
											1.45	PP	500-kPa
		1.70	Silty Gravelly CLAY (CI): pale grey mottled red-brown; medium plasticity; fine to medium, siltstone and ironstone gravel.						A		1.80		
	110	2			XWM		w<PL				2.00		
											2.50		
		2.70	SILTSTONE: dark grey; inferred very low to low strength with extremely weathered and ironstone bands. Hawkesbury Sandstone						SPT			SPT	6,17,18/100 (HB)
											2.90		
	109	3				NA	NA		A		3.00		
											3.20		
		4											
	108		Borehole discontinued at 4.00m depth. Target depth reached.										

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Bobcat
METHOD: AD/T to 4.0 m
REMARKS: No free groundwater observed

OPERATOR: Ground Test (C.S.)

LOGGED: CSY
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

Terminology, Symbols and Abbreviations

November 2023

Introduction to Terminology, Symbols and Abbreviations

Douglas Partners' reports, investigation logs, and other correspondence may use terminology which has quantitative or qualitative connotations. To remove ambiguity or uncertainty surrounding the use of such terms, the following sets of notes pages may be attached Douglas Partners' reports, depending on the work performed and conditions encountered:

- Soil Descriptions;
- Rock Descriptions; and
- Sampling, insitu testing, and drilling methodologies

In addition to these pages, the following notes generally apply to most documents.

Abbreviation Codes

Site conditions may also be presented in a number of different formats, such as investigation logs, field mapping, or as a written summary. In some of these formats textual or symbolic terminology may be presented using textual abbreviation codes or graphic symbols, and, where commonly used, these are listed alongside the terminology definition. For ease of identification in these note pages, textual codes are presented in these notes in the following style XW. Code usage conforms with the following guidelines:

- Textual codes are case insensitive, although herein they are generally presented in upper case; and
- Textual codes are contextual (i.e. the same or similar combinations of characters may be used in different contexts with different meanings (for example `PL` is used for plastic limit in the context of soil moisture condition, as well as in `PL(A)` for point load test result in the testing results column)).

Data Integrity Codes

Subsurface investigation data recorded by Douglas Partners is generally managed in a highly structured database environment, where records "span" between a top and bottom depth interval. Depth interval "gaps" between records are considered to introduce ambiguity, and, where appropriate, our practice guidelines may require contiguous data sets. Recording meaningful data is not always appropriate (for example assigning a "strength" to a concrete pavement) and the following codes may be used to maintain contiguity in such circumstances.

Term	Description	Abbreviation Code
Core loss	No core recovery	KL
Unknown	Information was not available to allow classification of the property. For example, when auguring in loose, saturated sand auger cuttings may not be returned.	UK
No data	Information required to allow classification of the property was not available. For example if drilling is commenced from the base of a hole predrilled by others	ND
Not Applicable	Derivation of the properties not appropriate or beyond the scope of the investigation. For example providing a description of the strength of a concrete pavement	NA

Graphic Symbols

Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has been provided in these notes.

intentionally blank

Soil Descriptions

Terminology
Symbols
Abbreviations

March 2024

Introduction

All materials which are not considered to be "in-situ rock" are described in general accordance with the soil description model of AS 1726-2017 Part 6.1.3, and can be broken down into the following description structure:

The "classification" comprises a two character "group symbol" providing a general summary of dominant soil characteristics. The "name" summarises the particle sizes within the soil which most influence its behaviour. The detailed description presents more information about composition, condition, structure, and origin of the soil.

Classification, naming and description of soils require the relative proportion of particles of different sizes within the whole soil mixture to be considered.

Particle size designation and Behaviour Model

Solid particles within a soil are differentiated on the basis of size.

The engineering behaviour properties of a soil can subsequently be modelled to be either "fine grained" (also known as "cohesive" behaviour) or "coarse grained" ("non cohesive" behaviour), depending on the relative proportion of fine or coarse fractions in the soil mixture.

Particle Size Designation	Particle Size (mm)	Behaviour Model	
		Behaviour	Approximate Dry Mass
Boulder	>200	Excluded from particle behaviour model as "oversize"	
Cobble	63 - 200		
Gravel[1]	2.36 - 63	Coarse	>65%
Sand[1]	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

[1] – refer grain size subdivision descriptions below

The behaviour model boundaries defined above are not precise, and the material behaviour should be assumed from the name given to the material (which considers the particle fraction which dominates the behaviour, refer "component proportions" below), rather than strict observance of the proportions of particle sizes. For example, if a material is named a "Sandy CLAY", this is indicative that the material exhibits fine grained behaviour, even if the dry mass of coarse grained material may exceed 65%.

Component proportions

The relative proportion of the dry mass of each particle size fraction is assessed to be a "primary", "secondary", or "minor" component of the soil mixture, depending on its influence over the soil behaviour.

Component Proportion Designation	Definition[1]	Relative Proportion	
		In Fine Grained Soil	In Coarse Grained Soil
Primary	The component (particle size designation, refer above) which dominates the engineering behaviour of the soil	The clay/silt component with the greater proportion	The sand/gravel component with the greater proportion
Secondary	Any component which is not the primary, but is significant to the engineering properties of the soil	Any component with greater than 30% proportion	Any granular component with greater than 30%; or Any fine component with greater than 12%
Minor[2]	Present in the soil, but not significant to its engineering properties	All other components	All other components

[1] As defined in AS1726-2017 6.1.4.4

[2] In the detailed material description, minor components are split into two further sub-categories. Refer "identification of minor components" below.

Composite Materials

In certain situations, a lithology description may describe more than one material, for example, collectively describing a layer of interbedded sand and clay. In such a scenario, the two materials would be described independently, with the names preceded or followed by a statement describing the arrangement by which the materials co-exist. For example, "INTERBEDDED Silty CLAY AND SAND".

Soil Descriptions

Classification

The soil classification comprises a two character group symbol. The first character identifies the primary component. The second character identifies either the grading or presence of fines in a coarse grained soil, or the plasticity in a fine grained soil. Refer AS1726-2017 6.1.6 for further clarification.

Soil Name

For most soils, the name is derived with the primary component included as the noun (in upper case), preceded by any secondary components stated in an adjective form. In this way, the soil name also describes the general composition and indicates the dominant behaviour of the material.

Component [1]	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

[1] – for determination of component proportions, refer component proportions on previous page

For materials which cannot be disaggregated, or which are not comprised of rock or mineral fragments, the names "ORGANIC MATTER" or "ARTIFICIAL MATERIAL" may be used, in accordance with AS1726-2017 Table 14.

Commercial or colloquial names are not used for the soil name where a component derived name is possible (for example "Gravelly SAND" rather than "CRACKER DUST").

Materials of "fill" or "topsoil" origin are generally assigned a name derived from the primary/secondary component (where appropriate). In log descriptions this is preceded by uppercase "FILL" or "TOPSOIL". Origin uncertainty is indicated in the description by the characters (?), with the degree of uncertainty described (using the terms "probably" or "possibly" in the origin column, or at the end of the description).

Identification of minor components

Minor components are identified in the soil description immediately following the soil name. The minor component fraction is usually preceded with a term indicating the relative proportion of the component.

Minor Component Proportion Term	Relative Proportion	
	In Fine Grained Soil	In Coarse Grained Soil
With	All fractions: 15-30%	Clay/silt: 5-12% sand/gravel: 15-30%
Trace	All fractions: 0-15%	Clay/silt: 0-5% sand/gravel: 0-15%

The terms "with" and "trace" generally apply only to gravel or fine particle fractions. Where cobbles/boulders are encountered in minor proportions (generally less than about 12%) the term "occasional" may be used. This term describes the sporadic distribution of the material within the confines of the investigation excavation only, and there may be considerable variation in proportion over a wider area which is difficult to factually characterise due to the relative size of the particles and the investigation methods.

Soil Composition

Plasticity

Descriptive Term	Laboratory liquid limit range	
	Silt	Clay
Non-plastic materials	Not applicable	Not applicable
Low plasticity	≤50	≤35
Medium plasticity	Not applicable	>35 and ≤50
High plasticity	>50	>50

Note, Plasticity descriptions generally describe the plasticity behaviour of the whole of the fine grained soil, not individual fine grained fractions.

Grain Size

Type		Particle size (mm)
Gravel	Coarse	19 - 63
	Medium	6.7 - 19
	Fine	2.36 – 6.7
Sand	Coarse	0.6 - 2.36
	Medium	0.21 - 0.6
	Fine	0.075 - 0.21

Grading

Grading Term	Particle size (mm)
Well	A good representation of all particle sizes
Poorly	An excess or deficiency of particular sizes within the specified range
Uniformly	Essentially of one size
Gap	A deficiency of a particular size or size range within the total range

Note, AS1726-2017 provides terminology for additional attributes not listed here.

Soil Condition

Moisture

The moisture condition of soils is assessed relative to the plastic limit for fine grained soils, while for coarse grained soils it is assessed based on the appearance and feel of the material. The moisture condition of a material is considered to be independent of stratigraphy (although commonly these are related), and this data is presented in its own column on logs.

Applicability	Term	Tactile Assessment	Abbreviation code
Fine	Dry of plastic limit	Hard and friable or powdery	w<PL
	Near plastic limit	Can be moulded	w=PL
	Wet of plastic limit	Water residue remains on hands when handling	w>PL
	Near liquid limit	"oozes" when agitated	w=LL
	Wet of liquid limit	"oozes"	w>LL
Coarse	Dry	Non-cohesive and free running	D
	Moist	Feels cool, darkened in colour, particles may stick together	M
	Wet	Feels cool, darkened in colour, particles may stick together, free water forms when handling	W

The abbreviation code NDF, meaning "not-assessable due to drilling fluid use" may also be used.

Note, observations relating to free ground water or drilling fluids are provided independent of soil moisture condition.

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

These concepts give an indication of how the material may respond to applied forces (when considered in conjunction with other attributes of the soil). This behaviour can vary independent of the composition of the material, and on logs these are described in an independent column and are generally mutually exclusive (i.e it is inappropriate to describe both consistency and compaction at the same time). The method by which the behaviour is described depends on the behaviour model and other characteristics of the soil as follows:

- In fine grained soils, the "consistency" describes the ease with which the soil can be remoulded, and is generally correlated against the materials undrained shear strength;
- In granular materials, the relative density describes how tightly packed the particles are, and is generally correlated against the density index;
- In anthropogenically modified materials, the compaction of the material is described qualitatively;
- In cemented soils (both natural and anthropogenic), the cemented "strength" is described qualitatively, relative to the difficulty with which the material is disaggregated; and
- In soils of extremely weathered material origin, the engineering behaviour may be governed by relic rock features, and expected behaviour needs to be assessed based the overall material description.

Quantitative engineering performance of these materials may be determined by laboratory testing or estimated by correlated field tests (for example penetration or shear vane testing). In some cases, performance may be assessed by tactile or other subjective methods, in which case investigation logs will show the estimated value enclosed in round brackets, for example (VS).

Consistency (fine grained soils)

Consistency Term	Tactile Assessment	Undrained Shear Strength (kPa)	Abbreviation Code
Very soft	Extrudes between fingers when squeezed	<12	VS
Soft	Mouldable with light finger pressure	>12 - ≤25	S
Firm	Mouldable with strong finger pressure	>25 - ≤50	F
Stiff	Cannot be moulded by fingers	>50 - ≤100	St
Very stiff	Indented by thumbnail	>100 - ≤200	VSt
Hard	Indented by thumbnail with difficulty	>200	H
Friable	Easily crumbled or broken into small pieces by hand	-	Fr

Relative Density (coarse grained soils)

Relative Density Term	Density Index	Abbreviation Code
Very loose	<15	VL
Loose	>15 - ≤35	L
Medium dense	>35 - ≤65	MD
Dense	>65 - ≤85	D
Very dense	>85	VD

Note, tactile assessment of relative density is difficult, and generally requires penetration testing, hence a tactile assessment guide is not provided.

Compaction (anthropogenically modified soil)

Compaction Term	Abbreviation Code
Well compacted	WC
Poorly compacted	PC
Moderately compacted	MC
Variably compacted	VC

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

AS1726-2017 considers weathered material to be soil if the unconfined compressive strength is less than 0.6 MPa (i.e. less than very low strength rock). These materials may be identified as "extremely weathered material" in reports and by the abbreviation code XWM on log sheets. This identification is not correlated to any specific qualitative or quantitative behaviour, and the engineering properties of this material must therefore be assessed according to engineering principles with reference to any relic rock structure, fabric, or texture described in the description.

Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	RS
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than 'very low' as per as1726 but retains the structure or fabric of the parent rock.	XWM
Alluvial	Deposited by streams and rivers	ALV
Fluvial	Deposited by channel fill and overbank (natural levee, crevasse splay or flood basin)	FLV
Estuarine	Deposited in coastal estuaries	EST
Marine	Deposited in a marine environment	MAR
Lacustrine	Deposited in freshwater lakes	LAC
Aeolian	Carried and deposited by wind	AEO
Colluvial	Soil and rock debris transported down slopes by gravity	COL
Slopewash	Thin layers of soil and rock debris gradually and slowly deposited by gravity and possibly water	SW
Topsoil	Mantle of surface soil, often with high levels of organic material	TOP
Fill	Any material which has been moved by man	FILL
Littoral	Deposited on the lake or seashore	LIT
Unidentifiable	Not able to be identified	UID

Cobbles and Boulders

The presence of particles considered to be "oversize" may be described using one of the following strategies:

- Oversize encountered in a minor proportion (when considered relative to the wider area) are noted in the soil description; or
- Where a significant proportion of oversize is encountered, the cobbles/boulders are described independent of the soil description, in a similar manner to composite soils (described above) but qualified with "MIXTURE OF".

intentionally blank

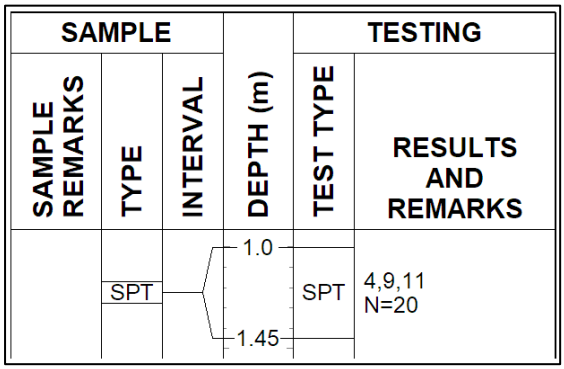
Sampling, Testing and Excavation Methodology

Terminology
Symbols
Abbreviations

March 2024

Sampling and Testing

A record of samples retained, and field testing performed is usually shown on a Douglas Partners' log with samples appearing to the left of a depth scale, and selected field and laboratory testing (including results, where relevant) appearing to the right of the scale, as illustrated below:



Sampling

The type or intended purpose for which a sample was taken is indicated by the following abbreviation codes.

Sample Type	Code
Auger sample	A
Acid Sulfate sample	ASS
Bulk sample	B
Core sample	C
Disturbed sample	D
Environmental sample	ES
Gas sample	G
Piston sample	P
Sample from SPT test	SPT
Undisturbed tube sample	U[1]
Water sample	W
Material Sample	MT
Core sample for unconfined compressive strength testing	UCS

[1] – numeric suffixes indicate tube diameter/width in mm

The above codes only indicate that a sample was retained, and not that testing was scheduled or performed.

Field and Laboratory Testing

A record that field and laboratory testing was performed is indicated by the following abbreviation codes.

Test Type	Code
Pocket penetrometer (kPa)	PP
Photo ionisation detector (ppm)	PID
Standard Penetration Test x/y =x blows for y mm penetration HB = hammer bouncing HW = fell under weight of hammer	SPT
Shear vane (kPa)	V
Unconfined compressive strength, (MPa)	UCS

Field and laboratory testing (continued)

Test Type	Code
Point load test, (MPa), axial (A), diametric (D), irregular (I)	PLT(_)
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150

Groundwater Observations

▷	seepage/inflow
▽	standing or observed water level
NFGWO	no free groundwater observed
OBS	observations obscured by drilling fluids

Drilling or Excavation Methods/Tools

The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

Method	Abbreviation Code
Direct Push	DP
Solid flight auger. Suffixes: /T = tungsten carbide tip, /V = v-shaped tip	AD[1]
Air Track	AT
Diatube	DT[1]
Hand auger	HA[1]
Hand tools (unspecified)	HAND
Existing exposure	X
Hollow flight auger	HSA[1]
HQ coring	HQ3
HMLC series coring	HMLC
NMLC series coring	NMLC
NQ coring	NQ3
PQ coring	PQ3
Predrilled	PD
Push tube	PT[1]
Ripping tyne/ripper	R
Rock roller	RR[1]
Rock breaker/hydraulic hammer	EH
Sonic drilling	SON[1]
Mud/blade bucket	MB[1]
Toothed bucket	TB[1]
Vibrocore	VC[1]
Vacuum excavation	VE
Wash bore (unspecified bit type)	WB[1]

[1] – numeric suffixes indicate tool diameter/width in mm

Douglas PARTNERS

Appendix H

Laboratory Analysis Certificates

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 357021

Client Details

Client	Douglas Partners Pty Ltd
Attention	Paul Gorman
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**224456.00 Sutherland**
Number of Samples	9 Soil
Date samples received	19/07/2024
Date completed instructions received	19/07/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	26/07/2024
Date of Issue	26/07/2024

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Asbestos Approved By
Analysed by Asbestos Approved Analyst: Lucy Zhu
Authorised by Asbestos Approved Signatory: Lucy Zhu

Results Approved By
Diego Bigolin, Inorganics Supervisor
Dragana Tomas, Senior Chemist
Giovanni Agosti, Group Technical Manager
Lucy Zhu, Asbestos Supervisor
Timothy Toll, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		357021-1	357021-2	357021-3	357021-4	357021-5
Your Reference	UNITS	BH101	BH102	BH103	BH103	BH104
Depth		0.4-0.5	0.4-0.5	0-0.1	0.8-1	0.4-0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	22/07/2024	22/07/2024	22/07/2024	22/07/2024	22/07/2024
Date analysed	-	23/07/2024	23/07/2024	26/07/2024	23/07/2024	23/07/2024
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTRH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
Naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	68	88	107	120	87

vTRH(C6-C10)/BTEXN in Soil					
Our Reference		357021-6	357021-7	357021-8	357021-9
Your Reference	UNITS	BH105	BD1	TS	TB
Depth		0.4-0.5	-	-	-
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	22/07/2024	22/07/2024	22/07/2024	22/07/2024
Date analysed	-	23/07/2024	23/07/2024	23/07/2024	23/07/2024
TRH C_6 - C_9	mg/kg	<25	<25	[NA]	[NA]
TRH C_6 - C_{10}	mg/kg	<25	<25	[NA]	[NA]
vTRH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	[NA]	[NA]
Benzene	mg/kg	<0.2	<0.2	113%	<0.2
Toluene	mg/kg	<0.5	<0.5	113%	<0.5
Ethylbenzene	mg/kg	<1	<1	113%	<1
m+p-xylene	mg/kg	<2	<2	113%	<2
o-Xylene	mg/kg	<1	<1	113%	<1
Naphthalene	mg/kg	<1	<1	[NA]	[NA]
Total +ve Xylenes	mg/kg	<1	<1	[NA]	[NA]
Surrogate aaa-Trifluorotoluene	%	116	88	112	94

svTRH (C10-C40) in Soil						
Our Reference		357021-1	357021-2	357021-3	357021-4	357021-5
Your Reference	UNITS	BH101	BH102	BH103	BH103	BH104
Depth		0.4-0.5	0.4-0.5	0-0.1	0.8-1	0.4-0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	22/07/2024	22/07/2024	22/07/2024	22/07/2024	22/07/2024
Date analysed	-	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	130	<100	<100
TRH C_{29} - C_{36}	mg/kg	300	<100	340	<100	<100
Total +ve TRH (C10-C36)	mg/kg	300	<50	470	<50	<50
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} -C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	260	<100	340	<100	<100
TRH >C_{34} -C_{40}	mg/kg	370	<100	360	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	640	<50	700	<50	<50
Surrogate o-Terphenyl	%	83	84	80	82	80

svTRH (C10-C40) in Soil			
Our Reference		357021-6	357021-7
Your Reference	UNITS	BH105	BD1
Depth		0.4-0.5	-
Date Sampled		16/07/2024	16/07/2024
Type of sample		Soil	Soil
Date extracted	-	22/07/2024	22/07/2024
Date analysed	-	23/07/2024	23/07/2024
TRH C_{10} - C_{14}	mg/kg	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100
Total +ve TRH (C10-C36)	mg/kg	<50	<50
TRH >C_{10} -C_{16}	mg/kg	<50	<50
TRH >C_{10} -C_{16} less Naphthalene (F2)	mg/kg	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50
Surrogate o-Terphenyl	%	84	80

PAHs in Soil						
Our Reference		357021-1	357021-2	357021-3	357021-4	357021-5
Your Reference	UNITS	BH101	BH102	BH103	BH103	BH104
Depth		0.4-0.5	0.4-0.5	0-0.1	0.8-1	0.4-0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	22/07/2024	22/07/2024	22/07/2024	22/07/2024	22/07/2024
Date analysed	-	22/07/2024	23/07/2024	23/07/2024	22/07/2024	22/07/2024
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	0.6	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	0.7	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	0.5	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	0.4	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	0.9	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	0.53	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	0.3	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	0.4	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	4.5	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	0.7	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	0.8	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	0.8	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	121	84	77	126	108

PAHs in Soil			
Our Reference		357021-6	357021-7
Your Reference	UNITS	BH105	BD1
Depth		0.4-0.5	-
Date Sampled		16/07/2024	16/07/2024
Type of sample		Soil	Soil
Date extracted	-	22/07/2024	22/07/2024
Date analysed	-	22/07/2024	22/07/2024
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	120	117

Organochlorine Pesticides in soil				
Our Reference		357021-2	357021-3	357021-6
Your Reference	UNITS	BH102	BH103	BH105
Depth		0.4-0.5	0-0.1	0.4-0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil
Date extracted	-	22/07/2024	22/07/2024	22/07/2024
Date analysed	-	23/07/2024	23/07/2024	22/07/2024
alpha-BHC	mg/kg	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1
Mirex	mg/kg	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1
Surrogate 4-Chloro-3-NBTF	%	88	91	79

Organophosphorus Pesticides in Soil				
Our Reference		357021-2	357021-3	357021-6
Your Reference	UNITS	BH102	BH103	BH105
Depth		0.4-0.5	0-0.1	0.4-0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil
Date extracted	-	22/07/2024	22/07/2024	22/07/2024
Date analysed	-	23/07/2024	23/07/2024	22/07/2024
Dichlorvos	mg/kg	<0.1	<0.1	<0.1
Mevinphos	mg/kg	<0.1	<0.1	<0.1
Phorate	mg/kg	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1
Disulfoton	mg/kg	<0.1	<0.1	<0.1
Chlorpyrifos-methyl	mg/kg	<0.1	<0.1	<0.1
Parathion-Methyl	mg/kg	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1
Fenthion	mg/kg	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1
Methidathion	mg/kg	<0.1	<0.1	<0.1
Fenamiphos	mg/kg	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1
Phosalone	mg/kg	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1
Coumaphos	mg/kg	<0.1	<0.1	<0.1
Surrogate 4-Chloro-3-NBTF	%	88	91	79

PCBs in Soil				
Our Reference		357021-2	357021-3	357021-6
Your Reference	UNITS	BH102	BH103	BH105
Depth		0.4-0.5	0-0.1	0.4-0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil
Date extracted	-	22/07/2024	22/07/2024	22/07/2024
Date analysed	-	23/07/2024	23/07/2024	22/07/2024
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1
Surrogate 2-Fluorobiphenyl	%	80	82	77

Misc Soil - Inorg				
Our Reference		357021-2	357021-3	357021-6
Your Reference	UNITS	BH102	BH103	BH105
Depth		0.4-0.5	0-0.1	0.4-0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil
Date prepared	-	25/07/2024	25/07/2024	25/07/2024
Date analysed	-	25/07/2024	25/07/2024	25/07/2024
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5

Acid Extractable metals in soil						
Our Reference		357021-1	357021-2	357021-3	357021-4	357021-5
Your Reference	UNITS	BH101	BH102	BH103	BH103	BH104
Depth		0.4-0.5	0.4-0.5	0-0.1	0.8-1	0.4-0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/07/2024	22/07/2024	22/07/2024	22/07/2024	22/07/2024
Date analysed	-	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Arsenic	mg/kg	10	6	10	20	15
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	18	13	17	29	30
Copper	mg/kg	9	27	40	12	4
Lead	mg/kg	15	50	350	26	20
Mercury	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Nickel	mg/kg	3	2	9	2	3
Zinc	mg/kg	10	97	390	13	7

Acid Extractable metals in soil				
Our Reference		357021-6	357021-7	357021-10
Your Reference	UNITS	BH105	BD1	BH102 - [TRIPLICATE]
Depth		0.4-0.5	-	0.4-0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil
Date prepared	-	22/07/2024	22/07/2024	22/07/2024
Date analysed	-	23/07/2024	23/07/2024	23/07/2024
Arsenic	mg/kg	9	6	5
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	20	13	12
Copper	mg/kg	10	5	90
Lead	mg/kg	20	17	41
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	2	2	2
Zinc	mg/kg	13	17	90

Moisture						
Our Reference		357021-1	357021-2	357021-3	357021-4	357021-5
Your Reference	UNITS	BH101	BH102	BH103	BH103	BH104
Depth		0.4-0.5	0.4-0.5	0-0.1	0.8-1	0.4-0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/07/2024	22/07/2024	22/07/2024	22/07/2024	22/07/2024
Date analysed	-	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Moisture	%	13	19	16	25	13

Moisture			
Our Reference		357021-6	357021-7
Your Reference	UNITS	BH105	BD1
Depth		0.4-0.5	-
Date Sampled		16/07/2024	16/07/2024
Type of sample		Soil	Soil
Date prepared	-	22/07/2024	22/07/2024
Date analysed	-	23/07/2024	23/07/2024
Moisture	%	20	16

Asbestos ID - soils NEPM						
Our Reference		357021-1	357021-2	357021-3	357021-4	357021-5
Your Reference	UNITS	BH101	BH102	BH103	BH103	BH104
Depth		0.4-0.5	0.4-0.5	0-0.1	0.8-1	0.4-0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	25/07/2024	25/07/2024	25/07/2024	25/07/2024	25/07/2024
Sample mass tested	g	695.94	430.29	371.7	419.25	665.93
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–	–	–	–
FA and AF Estimation*	g	–	–	–	–	–
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos comments	-	Nil	Nil	Nil	Nil	Nil

Asbestos ID - soils NEPM		
Our Reference		357021-6
Your Reference	UNITS	BH105
Depth		0.4-0.5
Date Sampled		16/07/2024
Type of sample		Soil
Date analysed	-	25/07/2024
Sample mass tested	g	438.35
Sample Description	-	Brown coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected
ACM >7mm Estimation*	g	–
FA and AF Estimation*	g	–
FA and AF Estimation*#2	%(w/w)	<0.001
Asbestos comments	-	Nil

Misc Inorg - Soil		
Our Reference		357021-2
Your Reference	UNITS	BH102
Depth		0.4-0.5
Date Sampled		16/07/2024
Type of sample		Soil
Date prepared	-	24/07/2024
Date analysed	-	24/07/2024
pH 1:5 soil:water	pH Units	5.7

CEC		
Our Reference		357021-2
Your Reference	UNITS	BH102
Depth		0.4-0.5
Date Sampled		16/07/2024
Type of sample		Soil
Date prepared	-	23/07/2024
Date analysed	-	23/07/2024
Exchangeable Ca	meq/100g	3.9
Exchangeable K	meq/100g	<0.1
Exchangeable Mg	meq/100g	1.3
Exchangeable Na	meq/100g	0.5
Cation Exchange Capacity	meq/100g	5.8

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. NOTE#1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF relative to the sample mass tested) NOTE#2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-020	Determination of various metals by ICP-AES.
Metals-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-OES analytical finish.
Metals-021	Determination of Mercury by Cold Vapour AAS.

Method ID	Methodology Summary
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-021/022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD and/or GC-MS/GC-MSMS. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS/GC-MSMS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

Method ID	Methodology Summary
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	357021-3
Date extracted	-			22/07/2024	2	22/07/2024	22/07/2024		22/07/2024	22/07/2024
Date analysed	-			23/07/2024	2	23/07/2024	23/07/2024		23/07/2024	23/07/2024
TRH C_6 - C_9	mg/kg	25	Org-023	<25	2	<25	<25	0	98	76
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	2	<25	<25	0	98	76
Benzene	mg/kg	0.2	Org-023	<0.2	2	<0.2	<0.2	0	96	69
Toluene	mg/kg	0.5	Org-023	<0.5	2	<0.5	<0.5	0	89	76
Ethylbenzene	mg/kg	1	Org-023	<1	2	<1	<1	0	97	76
m+p-xylene	mg/kg	2	Org-023	<2	2	<2	<2	0	104	79
o-Xylene	mg/kg	1	Org-023	<1	2	<1	<1	0	94	79
Naphthalene	mg/kg	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	120	2	88	106	19	94	91

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	357021-3
Date extracted	-			22/07/2024	2	22/07/2024	22/07/2024		22/07/2024	22/07/2024
Date analysed	-			23/07/2024	2	23/07/2024	23/07/2024		23/07/2024	23/07/2024
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	2	<50	<50	0	111	113
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	2	<100	<100	0	108	118
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	2	<100	<100	0	100	#
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	2	<50	<50	0	111	113
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	2	<100	<100	0	108	118
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	2	<100	<100	0	100	#
Surrogate o-Terphenyl	%		Org-020	83	2	84	86	2	84	79

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	357021-3
Date extracted	-			22/07/2024	2	22/07/2024	22/07/2024		22/07/2024	22/07/2024
Date analysed	-			23/07/2024	2	23/07/2024	23/07/2024		23/07/2024	23/07/2024
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	116	72
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	120	80
Fluorene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	114	78
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	124	82
Anthracene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	114	95
Pyrene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	126	102
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	110	83
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	2	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	2	<0.05	<0.05	0	116	99
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	81	2	84	83	1	129	76

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	357021-3
Date extracted	-			22/07/2024	2	22/07/2024	22/07/2024		22/07/2024	22/07/2024
Date analysed	-			23/07/2024	2	23/07/2024	23/07/2024		23/07/2024	23/07/2024
alpha-BHC	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	80	84
HCB	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	76	82
gamma-BHC	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	84	80
delta-BHC	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	90	84
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	94	94
gamma-Chlordane	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	84	78
Dieldrin	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	100	87
Endrin	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	108	90
Endosulfan II	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	88	92
Endrin Aldehyde	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	82	82
Methoxychlor	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Mirex	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	88	2	88	90	2	93	88

QUALITY CONTROL: Organophosphorus Pesticides in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	357021-3
Date extracted	-			22/07/2024	2	22/07/2024	22/07/2024		22/07/2024	22/07/2024
Date analysed	-			23/07/2024	2	23/07/2024	23/07/2024		23/07/2024	23/07/2024
Dichlorvos	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	84	88
Mevinphos	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Phorate	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Dimethoate	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Disulfoton	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Chlorpyrifos-methyl	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Parathion-Methyl	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	72	72
Fenitrothion	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	88	106
Malathion	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	84	88
Chlorpyriphos	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	72	82
Fenthion	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Parathion	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	76	92
Bromophos-ethyl	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Methidathion	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Fenamiphos	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	70	88
Phosalone	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Coumaphos	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	88	2	88	90	2	93	88

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	357021-3
Date extracted	-			22/07/2024	2	22/07/2024	22/07/2024		22/07/2024	22/07/2024
Date analysed	-			23/07/2024	2	23/07/2024	23/07/2024		23/07/2024	23/07/2024
Aroclor 1016	mg/kg	0.1	Org-021/022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021/022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021/022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021/022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021/022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021/022/025	<0.1	2	<0.1	<0.1	0	92	100
Aroclor 1260	mg/kg	0.1	Org-021/022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate 2-Fluorobiphenyl	%		Org-021/022/025	79	2	80	85	6	83	80

QUALITY CONTROL: Misc Soil - Inorg						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	[NT]
Date prepared	-			25/07/2024	2	25/07/2024	25/07/2024		25/07/2024	[NT]
Date analysed	-			25/07/2024	2	25/07/2024	25/07/2024		25/07/2024	[NT]
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	2	<5	<5	0	99	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	357021-3
Date prepared	-			22/07/2024	2	22/07/2024	22/07/2024		22/07/2024	22/07/2024
Date analysed	-			23/07/2024	2	23/07/2024	23/07/2024		23/07/2024	23/07/2024
Arsenic	mg/kg	4	Metals-020	<4	2	6	6	0	108	93
Cadmium	mg/kg	0.4	Metals-020	<0.4	2	<0.4	<0.4	0	100	89
Chromium	mg/kg	1	Metals-020	<1	2	13	16	21	99	93
Copper	mg/kg	1	Metals-020	<1	2	27	53	65	96	96
Lead	mg/kg	1	Metals-020	<1	2	50	73	37	97	102
Mercury	mg/kg	0.1	Metals-021	<0.1	2	<0.1	<0.1	0	88	82
Nickel	mg/kg	1	Metals-020	<1	2	2	2	0	97	89
Zinc	mg/kg	1	Metals-020	<1	2	97	100	3	99	129

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	[NT]
Date prepared	-			24/07/2024	[NT]	[NT]	[NT]	[NT]	24/07/2024	[NT]
Date analysed	-			24/07/2024	[NT]	[NT]	[NT]	[NT]	24/07/2024	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]

QUALITY CONTROL: CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/07/2024	[NT]	[NT]	[NT]	[NT]	23/07/2024	[NT]
Date analysed	-			23/07/2024	[NT]	[NT]	[NT]	[NT]	23/07/2024	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	87	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

TRH Soil C10-C40 NEPM - # Percent recovery for the matrix spike is not possible to report as the high concentration of analytes in sample 357021-2ms have caused interference.

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteria has been exceeded for 357021-2 for Cu. Therefore a triplicate result has been issued as laboratory sample number 357021-10.

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

Note: All samples analysed as received. However, sample 357021-3 was below the minimum recommended 500mL sample volume as per National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	224456.00	**Suburb:**	Sutherland	**To:**	Envirolab Services
Project Manager:	Paul Gorman	**Order Number:**		**Sampler:** CSY	12 Ashley St, Chatswood NSW 2067
Email:	paul.gorman@douglaspartners.com.au			**Attn:**	Sample Receipt
Turnaround time:	☑ Standard ☐ 72 hour ☐ 48 hour ☐ 24 hour ☐ Same day				(02) 9910 6200 samplereceipt@envirolab.com.au
Prior Storage:	☑ Fridge ☐ Freezer ☑ Esky ☐ Shelf	**Do samples contain 'potential' HBM?**	☐ No ☑ Yes	(If YES, then handle, transport and store in accordance with FPM HAZID)	

Lab ID	Sample ID: Location / Other ID	Depth From	Depth To	Date Sampled	Sample Type: S - soil W - water M - Material	Container Type: G - glass P - plastic	Analytes: Combo 8a NEPM	Combo 3a NEPM	Combo 3	pH	CEC	BTEX	Asbestos					Notes/ Preservation/ Additional Requirements
1	BH101	0.4	0.5	16.7.24	S	G/P		x										
2	BH102	0.4	0.5	16.7.24	S	G/P	x			x	x							
3	BH103	0	0.1	16.7.24	S	G/P	x											
4	BH103	0.8	1	16.7.24	S	G/P		x										
5	BH104	0.4	0.5	16.7.24	S	G/P		x										
6	BH105	0.4	0.5	16.7.24	S	G/P	x											
7	BD1			16.7.24	S	G/P			x									
8	TS											x						
9	TB											x						

ENVIROLAB GROUP
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 357021

Date Received: 19/7/24
Time Received: 1435
Received By: VW
Temp: Cool/Ambient
Cooling: Ice/Icepack 10°C
Security: Intact/Broken/None

Metals to analyse:

Number of samples in container:		**Transported to laboratory by:**	
Send results to:	Douglas Partners Pty Ltd		
Address:	96 Hermitage Road, West Ryde NSW 211	**Phone:** (02) 9809 0666	
Relinquished by:		**Date:**	**Signed:**

LAB RECEIPT

Lab Ref. No:	357021
Received by:	Katy Wayne
Date & Time:	19/7/24 1435
Signed:	

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Pty Ltd
Attention	Paul Gorman

Sample Login Details

Your reference	224456.00 Sutherland
Envirolab Reference	357021
Date Sample Received	19/07/2024
Date Instructions Received	19/07/2024
Date Results Expected to be Reported	26/07/2024

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	9 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	10
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticides in soil	Organophosphorus Pesticides in Soil	PCBs in Soil	Misc Soil - Inorg	Acid Extractable metalsin soil	Asbestos ID - soils NEPM	Misc Inorg - Soil	CEC
BH101-0.4-0.5	✓	✓	✓					✓	✓		
BH102-0.4-0.5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BH103-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH103-0.8-1	✓	✓	✓					✓	✓		
BH104-0.4-0.5	✓	✓	✓					✓	✓		
BH105-0.4-0.5	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BD1	✓	✓	✓					✓			
TS	✓										
TB	✓										

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Appendix I

Data Quality Assurance and Data Quality Control

1. Field and laboratory data quality assurance and quality control

The field and laboratory data quality assurance and quality control (QA / QC) procedures and results are summarised in the following Table 1. Reference should be made to the field work methodology and the laboratory results / certificates of analysis for further details. The relative percentage difference (RPD) results, along with the other field QC samples are included in the summary results tables OR at the end of this appendix.

Table 1: Field and laboratory quality control

Item	Evaluation / acceptance criteria	Compliance
Analytical laboratories used	NATA accreditation	C
Holding times	Various, based on type of analysis	C
Intra-laboratory replicates	10% of primary soil samples	C
	<30% RPD	PC
Inter-laboratory replicates	10% of primary soil samples	C
	<30% RPD	C
Trip spikes	1 per sampling event	C
	60-140% recovery	C
Trip blanks	1 per sampling event	C
	<PQL	C
Laboratory / reagent blanks	1 per batch; <PQL	C
Laboratory duplicate	1 per lab batch; As laboratory certificate	C
Matrix spikes	1 per lab batch; 70-130% recovery (inorganics); 60-140% recovery (organics)	C
Surrogate spikes	All organics analysis; 70-130% recovery (inorganics); 60-140% recovery (organics)	C
Control samples	1 per lab batch; 70-130% recovery (inorganics); 60-140% recovery (organics)	C
Standard operating procedures (SOP)	Adopting SOP for all aspects of the sampling field work	C

Notes:
C = compliance; PC = partial compliance; NC = non-compliance

The RPD results were all within the acceptable range, with the exception of copper, lead and zinc indicated in Table QA1 (results in bold). The exceedances are not, however, considered to be of concern given that:

- The actual differences in the concentrations of the replicate pairs where RPD exceedances occurred were typically low;
- The replicate pairs were collected from fill soils which by its nature are heterogeneous;
- Replicates, rather than homogenised duplicates, were used to minimise risk of volatile loss, hence greater analytical variability between replicate pairs can be expected;
- Most of the recorded concentrations were relatively close to the PQL;
- The majority of RPD results from a replicate pair were within the acceptable limits; and
- All other QA / QC parameters met the data quality indicators.

A trip spike and trip blank were taken into the field during the soil sampling. No analytes were recorded above the PQL in the trip blank samples analysed (Table QA2, at the end of this appendix). All results in the trip spike samples were within the acceptable range of recovery (Table QA3, at the end of this Appendix).

No rinsate sample was collected during the limited investigation. Where possible soil samples were collected from recovered materials which had not been in direct contact with drilling equipment. However, all other QA procedures were met and given the results of field trip spike and trip blank and recorded concentrations of analysed samples, it is considered that the non compliance does not impact the reliability of the results.

In summary, the QC data is determined to be of sufficient quality to be considered acceptable for the assessment.

2. Data quality indicators

The reliability of field procedures and analytical results was assessed against the following data quality indicators (DQI) as outlined in NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013):

- Completeness: a measure of the amount of usable data from a data collection activity;
- Comparability: the confidence (qualitative) that data may be considered to be equivalent for each sampling and analytical event;
- Representativeness: the confidence (qualitative) of data representativeness of media present on-site;
- Precision: a measure of variability or reproducibility of data; and
- Accuracy: a measure of closeness of the data to the 'true' value.

Table 2: Data quality indicators

Data quality indicator	Method(s) of achievement
Completeness	Systematic and selected target locations sampled.
	Preparation of borehole logs, sample location plan and chain of custody records.
	Preparation of field groundwater sampling sheets.
	Laboratory sample receipt information received confirming receipt of samples intact and appropriateness of the chain of custody.
	Samples analysed for contaminants of potential concern (COPC) identified in the conceptual site model (CSM).
	Completion of chain of custody (COC) documentation.
	NATA accredited laboratory results certificates provided by the laboratory.
	Satisfactory frequency and results for field and laboratory quality control (QC) samples as discussed in Section 1.
Comparability	Using appropriate techniques for sample recovery, storage and transportation, which were the same for the duration of the project.
	Experienced sampler(s) used.
	Use of NATA registered laboratories, with test methods the same or similar between laboratories.
	Satisfactory results for field and laboratory QC samples.
Representativeness	Target media sampled.
	Sample numbers recovered and analysed are considered to be representative of the target media and complying with DQO.
	Samples were extracted and analysed within holding times.
	Samples were analysed in accordance with the COC.
Precision	Field staff followed standard operating procedures.
	Acceptable RPD between original samples and replicates.
	Satisfactory results for all other field and laboratory QC samples.
Accuracy	Field staff followed standard operating procedures.
	Satisfactory results for all field and laboratory QC samples. • The laboratory RPD acceptance criteria has been exceeded at BH102/0.4-0.5, for cu. Therefore, a triplicate result has been issued as laboratory sample number Triplicate.

Based on the above, it is considered that the DQI have been generally complied with.

3. Conclusion

Based on the results of the field QA and field and laboratory QC, and evaluation against the DQI it is concluded that the field and laboratory test data obtained are reliable and useable for this assessment.

4. References

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]*. Australian Government Publishing Services Canberra: National Environment Protection Council.

Table QA1: Relative Percentage Difference Results – Soil

Lab Report No	Sample ID	Depth	Sample Date	Sample Type	Units	Priority metals								PAH	Priority TRH				BTEX			
						Total Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	Total PAH	TRH C6 - C10	TRH >C10-C16	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	Total Xylenes
357021	BH102	0.4 - 0.5 m	16/07/24	Soil	mg/kg	6	<0.4	13	27	50	<0.1	2	97	<0.05	<25	<50	<100	<100	<0.2	<0.5	<1	<1
357021	BD1	0 m	16/07/24	Soil	mg/kg	6	<0.4	13	5	17	<0.1	2	17	<0.05	<25	<50	<100	<100	<0.2	<0.5	<1	<1
			Difference		mg/kg	0	0	0	22	33	0	0	80	0	0	0	0	0	0	0	0	0
			RPD		%	0%	0%	0%	**138%**	**99%**	0%	0%	**140%**	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table QA2: Trip Blank Results

Sample ID	Sample Date	Media Being Sampled	Sample Type	Units	BTEX					Lab Report No
					Benzene	Toluene	Ethylbenzene	o-Xylene	Total Xylenes	
TB	16/04/2024	Soil	Soil	mg/kg	<0.2	<0.5	<1	<1	<1	357021

Table QA3: Trip Spike Results (% Recovery)

Sample ID	Sample Date	Media Being Sampled	Sample Type	BTEX					Lab Report No
				Benzene	Toluene	Ethylbenzene	o-Xylene	Total Xylenes	
TS	16/04/2024	Soil	Soil	113	113	113	113	113	357021