Douglas PARTNERS

GROUNDED EXPERTISE

Remediation Action Plan

Proposed Mixed Use Residential Development

601 Pacific Highway, St Leonards NSW

Prepared for Stockland Development Pty Limited

Project 86230.03

18 March 2026

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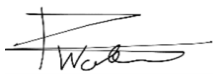
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Douglas Partners acknowledges Australia's First Peoples as the Traditional Owners of the Land and Sea on which we operate. We pay our respects to Elders past and present and to all Aboriginal and Torres Strait Islander peoples across the many communities in which we live, visit and work. We recognise and respect their ongoing cultural and spiritual connection to Country.

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Remediation Action Plan
Proposed Mixed Use Residential Development
601 Pacific Highway, St Leonards NSW

1. Introduction

Douglas Partners Pty Ltd (Douglas) has prepared this remediation action plan (RAP) for a proposed mixed use residential development at 601 Pacific Highway, St Leonards NSW. The RAP was commissioned by Hee-Jung Yoon of Stockland Development Pty Limited and was undertaken in accordance with Douglas' proposal by Aconex dated 22 October 2025. This RAP has been prepared by Douglas and is submitted to the Department of Planning, Housing and Infrastructure (DPHI) in support of the SSDA (SSD-85848713) and concurrent rezoning proposal for a new mixed-use development at 601 Pacific Highway, St Leonards (the site). Further details on the proposed development are provided in Section 2.

Stockland Development (Stockland) submitted an EOI for an SSDA and concurrent rezoning proposal on 17 January 2025 through the Housing Delivery Authority Pathway (HDA). At its Briefing on 19 February 2025, the HDA recommended to the Minister that the applicant's project be declared SSD, for the reason that it sufficiently satisfied the objectives and criteria of the HDA. The project was declared as SSD in the State Significant Development Declaration Order 2025 (No 2) (26 February 2025).

A request for SEARs was lodged on the 6th of June 2025 with SEARS received on the 4th of July 2025.

This report has been prepared to address the following relevant Secretary's Environmental Assessment Requirements (SEARs) set out in the Table 1 below.

Table 1: Secretary's Environmental Assessment Requirements relevant to this report

SEARs	Report Reference (how addressed)
13. Contamination and Remediation In accordance with Chapter 4 of the State Environmental Planning Policy (Resilience and Hazards) 2021, assess and quantify and soil and groundwater contamination and demonstrate that the site is suitable (or will be made suitable after remediation) for the development.	Report as a whole presents the remediation action plan (RAP) which demonstrates that the site can be made suitable for the development following completion of remediation, specifically the following: Section 6: Summary of previous investigations / contamination status and risks; Section 7: Conceptual site model of contamination risks; Section 11: Remediation methodology to address contamination risks. This RAP also references and summarised a preliminary site investigation (PSI) report. A detailed site investigation (DSI) report has been prepared by Douglas to address the data gaps identified in this RAP. No long term management plan is considered to be required.

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);
- NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020); and
- CRC CARE *Remediation Action Plan: Development - Guideline on Establishing Remediation Objectives* (CRC CARE, 2019a).

The remediation objectives, devised in accordance with CRC (2019a), are to:

- Address potentially unacceptable risks to relevant environmental values from contamination; and
- Render the site suitable, from a contamination perspective, for the proposed development.

This RAP provides details of the work that will be required at the site to meet the remediation objectives.

This RAP presents the procedures and plans which provide the means by which site remediation can be achieved. The Remediation Contractor must base their detailed work methodologies around the requirements of this RAP.

This report must be read in conjunction with all appendices.

2. Proposed development

The proposal seeks consent for the following:

- An amendment to the North Sydney Local Environmental Plan 2013 (NSLEP 2013) to rezone the site from E2 Commercial Centre to MU1 Mixed Use and to amend the minimum non-residential floor space ratio development standard under Clause 4.4A from 20:1 to 1:1.
- Demolition of the existing 14 storey commercial office building that is currently on the site.
- Site excavation, remediation and other preparatory works.
- Construction and operation of a new 52 storey (RL264.50) mixed use shop top housing development, with a FSR of 20:1 (maximum GFA of 56,880m2), comprising:
  - 538 dwellings including 508 Build-to-Sell apartments and 30 Affordable Housing apartments across a mix of apartment typologies.
  - A contribution of 5% of the residential GFA toward Affordable Housing.
  - Retail and commercial land uses at the ground and podium levels.
  - Internal and external residential amenities provided throughout the building.
  - Six levels of basement carparking, comprising a total of 300 car spaces, bicycle parking, loading bays, waste areas, plant, and back of house.
- Vehicular access to the basement via Atchison Street.
- Landscaping and Public Domain works.

- Reticulation of site services and infrastructure (electricity, telecommunication, water, and sewer connections).

3. Scope of work

The scope of work for the RAP comprised:

- Summarise the findings of previous investigations used to inform the status of contamination and contamination risk at the site;
- Present a conceptual site model (CSM) to list potential and likely contamination source, pathway and receptor linkages to address potentially unacceptable risks to human health and relevant environmental values from contamination;
- Define the anticipated extent of remediation;
- Assess potentially suitable remediation options to render the site suitable for its proposed use, and which will minimise potentially unacceptable risk to human health and/or the environment, and which includes the consideration of the principles of ecologically sustainable development;
- Identify the preferred remediation option;
- Establish the remediation acceptance criteria (RAC) to be adopted for validation of remediation;
- Identify how successful implementation of the RAP will be demonstrated / validated;
- Outline waste classification, handling and tracking requirements;
- Outline environmental safeguards required to complete the remediation works; and
- Include contingency plans and an unexpected finds protocol.

4. Site description

Site address	601 Pacific Highway, St Leonards NSW
Legal description	Lot 71 in DP749690
Area	2,844 m^2
Zoning	E2 – Commercial Centre
Local council area	North Sydney Council
Current use	The site is occupied by a 14-storey commercial building in the eastern portion of the site, and single level mixed-use retail in the western portion.

Surrounding uses	North – Beyond Aitchson Street to the north is mixed use buildings with residential zoning roughly 200m to the north and beyond. East – Mitchell Street and beyond is mixed use zoning. Residential zoning can be seen roughly 200m to the east and beyond. South – The SP2 zoned Pacific Highway is situated directly south, with Mixed use and commercia centre zoning beyond. West – bounded by a 7-storey commercial building to the west with SP2 zoning on Christie Street and mixed-use zoning beyond.

The site is located on Cammeraygal country at 601 Pacific Highway, St Leonards within North Sydney (LGA). The site is legally described as Lot 71 in DP749690 and has a total area of 2,844 m^2. The site is 4.5 km north of the Sydney CBD, 3 km from the North Sydney CBD, and within proximity to the centres of St Leonards, Chatswood, and Macquarie Park. The site is located 350 metres (walking distance) from St Leonards train station and approximately 400 m (walking distance) from the Crows Nest Metro station.

The site is zoned as E2 – Commercial Centre. The surrounding landscape has combination of commercial E2, MU1 mixed use and both R2 low density and R4 high density residential zoning.

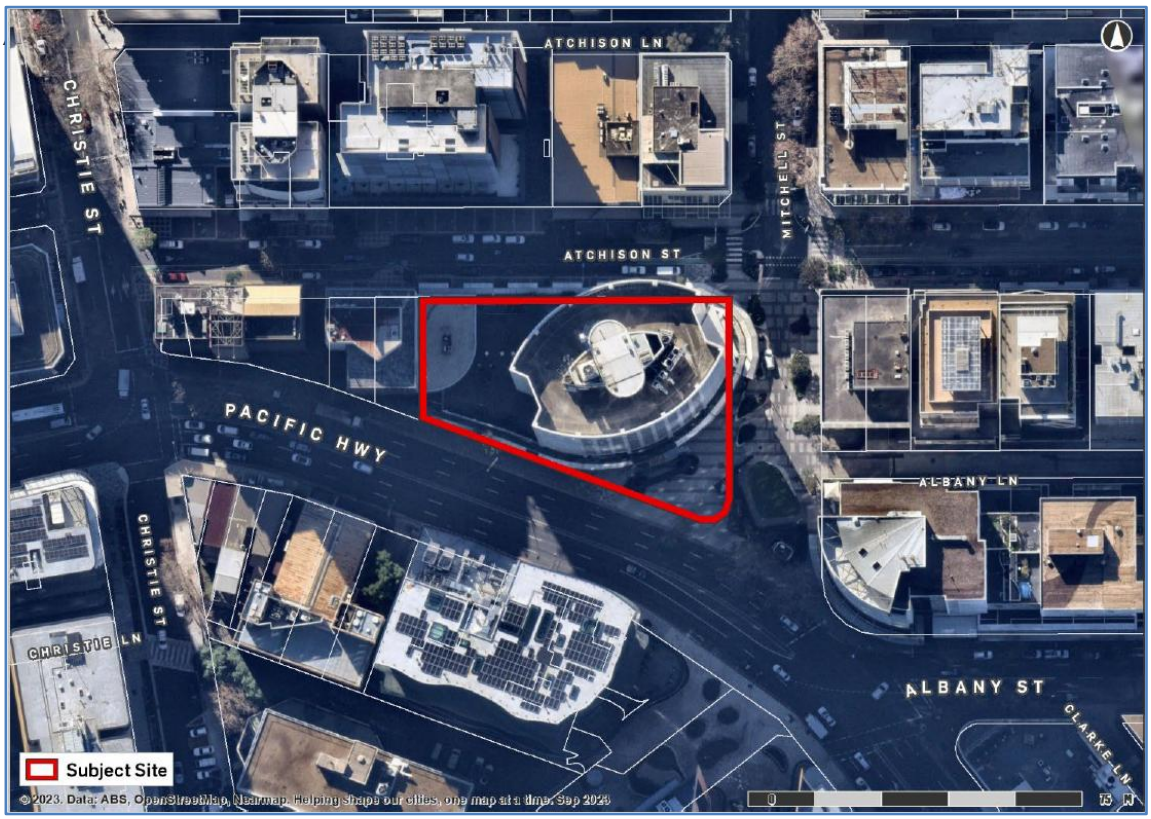


Figure 1. Site Location and Boundary

5. Environmental setting

Regional topography	The site is located on the western side of a ridge that peaks at roughly RL 92 m (Australian Height Datum, AHD). The topography surrounding the site slopes down to the south-west towards Smoothey Park and Berry's Creek which is a tributary of the Parramatta River.
Site topography	Based on the available 'NSW 2 m Elevation Contours'; the site topography generally slopes down towards the west, with surface levels of approximately RL 93 m in the east, falling to RL 88 m in the west, relative to Australian Height Datum.
Soil landscape	Reference to the Sydney 1:100,000 Soils Landscape Sheet indicates that the site is underlain by the Blacktown soil landscape which is characterised by gently undulating rises on Wianamatta Group shales and Hawkesbury shale. Local relief to 30 m, slopes are usually <5%, but up to 10%. Broad rounded crests and ridges with gently inclined slopes. Soils are a residual soil comprising yellow podzolic soils and slolths (150-300 m) on lower slopes and in areas of poor drainage; shallow to moderately deep (<100 m) red and brown podzolic soils on crests, upper slopes and well drained areas. The limitations associated with this classification are moderately reactive highly plastic subsoil with low fertility, and poor soil drainage.
Geology	Reference to the Sydney 1:100 000 Seamless Geology Sheet indicates that the site is underlain by the Ashfield Shale of the Wianamatta Group, described as black to dark-grey shale and laminite. Below the Ashfield Shale is the Hawkesbury Sandstone which typically comprises medium to coarse grained quartz sandstone with some shale and laminite bands or lenses. The Mittagong Formation is a transitional unit often found between the Ashfield Shale and Hawkesbury Sandstone and typically includes laminite and fine-grained sandstone of variable strength, ranging in thickness from about 2 m to 10 m.
Acid sulfate soils	Reference to the published national Acid Sulfate Soil (ASS) mapping and regional ASS Risk map, indicates the site is mapped as an area with 'Extremely Low Probability of Occurrence' of ASS.

Surface water	Surface water is anticipated to follow the general regional topography and drain into the local stormwater system which is likely to discharge adjacent to Greenwich at the Parramatta River located approximately 1.3 km south-west of the site.
Groundwater	One Water NSW registered groundwater bore with a current license is located approximately 420 m north of the site with a recorded standing groundwater level of 35 m depth or RL 37 m, referring to the available 'NSW 2 m Elevation Contours'. Shallower perched seepage may occur along the clay and rock surface and at strata boundaries and in defects in the rock mass. It should be noted that groundwater levels may vary over time due to climatic and human influences and will temporarily rise following periods of prolonged rainfall.

6. Summary of previous investigations

6.1 Previous reports

The following previous reports are relevant to this RAP.

6.1.1 Golder (2021)

This investigation encompasses a non-intrusive Preliminary Site Investigation (PSI) undertaken to gain a better understanding of the potential environmental risk at the site, with a focus on the potential for ground contamination to support the Planning Proposal.

The PSI involved the following key tasks:

- Review readily available on-line records held by the NSW Environmental Protection Authority (EPA);
- A search of the SafeWork NSW files for records relating to historical storage of hazardous chemicals at the site;
- Review of published maps and databases with Site coverage to establish likely surface and subsurface conditions (including geology, hydrogeology, soil landscape, topography and likelihood of acid sulfate soils);
- Review of historical certificates of title (COT) for the site;
- A review of historical aerial photographs;
- A summary of a third party (Lotsearch) report on various searches; and
- A site walkover and interview with relevant Stockland and/or Stockland management agent completed on 6 March 2017.

No intrusive investigation works were completed as part of the PSI.

The site walkover identified that the site has been used for professional services since the current building opened with tenants such as IBM occupying multiple floors. The site formerly had a café located in a separate building on the western portion of the site. A grease trap was reported to be present however this was not sighted during the inspection. In the lowest basement level an underground storage tank (UST) was identified which was used to store diesel fuel for the backup power generator. The UST was located within a separate room and the tank was accessed via two concrete floor panels. The UST was not sighted during the 2017 inspection.

The pipework for this UST was visible within the lower basement room and at ground level where the fill point is located. The UST is refuelled by gravity via above ground pipework. There was no evidence of staining on the concrete hardstand at the fill point nor in the UST lower basement room at the time of the site inspection, however, it was noted that there was no form of secondary containment located at the fill point.

The UST failed an integrity test (Premo 2017) where it was concluded that a leak (via nitrogen decay) existed in the return line weld. The risk of contamination from this leak is elevated however from a review of photographs within the integrity test report (Premo 2017) it appeared that the weld where the leak exists is above ground and that any leaks would migrate onto the concrete hardstand within the UST access room. In addition, the condition of the UST was classified as fair by SGA in 2013 and water ingress into the UST chamber was observed. The results of a subsequent integrity test (Premo 2019) indicated that the leak had been rectified. Historical leakage had the potential, albeit low, to migrate into the surrounding bedrock and present a risk to groundwater and a vapour intrusion risk. Given that the UST passed a more recent integrity test (Premo 2019) it was considered there is a lower potential for hydrocarbons to migrate to surrounding bedrock and pose a risk to groundwater or vapour intrusion risk to site occupants. As such, the ongoing risk from the UST was assessed as low.

Groundwater underlying the site was considered to flow in a south to south-westerly direction towards Sydney Harbour based on the topography of the area, however this was not confirmed.

The NSW EPA's register for contaminated land notices under the Contaminated Land Management Act 1997 (the CLM Act) performed in 2017 and 2021 did not identify any premises within 500 m of the site as being subject to current or prior notices.

The NSW EPA maintains a "List of NSW contaminated sites notified to the EPA" under Section 60 of the CLM Act. The searches performed in 2017 and 2021 indicated that there are no premises within 500 m of the site that have been identified as a contaminated site.

The NSW EPA maintains a public register of premises subject to an Environment Protection Licence (EPL) under the Protection of the Environment Operations Act 1997 (the POEO Act). The searches performed in 2017 and 2021 indicated that there was one premise currently operating under an EPL within 500 m of the site, being the North Shore rail line which was not considered to present a contamination risk to the site.

A search of the SafeWork NSW files for records relating to historical storage of hazardous chemicals at the site was requested by Golder. The results of this search indicate SafeWork NSW did not locate records of hazardous chemicals being stored at the site.

The report presented a preliminary conceptual site model (PCSM) which documented potential contamination sources comprising the UST, a former Shell service station use in part of the site (prior to existing basement excavation), diesel day tanks storage, historical demolition (including fill), and various surrounding historical commercial and industrial activities.

The report considered that the site is suitable for ongoing commercial land use. However, there was considered to be a potential that the consent authority for the proposed redevelopment may request a detailed site investigation (DSI) to confirm site suitability for the intended mixed use residential land uses. The report also states that the proposed redevelopment of the site includes excavation of additional basement levels. The UST below the lowest basement slab should be decommissioned in accordance with regulatory requirements prior to future development in accordance with the Planning Proposal.

The report mentions that as the proposed redevelopment includes enlarging the basement, the development and implementation of an unexpected finds protocol (UFP) would facilitate the management of the potential contamination sources.

6.1.2 **Douglas (2025)**

Douglas prepared a due diligence contamination testing report which documented the observations and results of opportunistic soil and groundwater testing from six boreholes constructed across the site for geotechnical investigation purposes. The results were presented in Douglas (2025).

The scope of work comprised:

- Recovery of soil samples from the drilling augers at each of the six boreholes (BH01 to BH06, refer Drawing 2, Appendix A) constructed below the lower basement concrete slab, and at regular depth intervals until fill penetration and/or auger refusal; and
- PID screening of soil samples for potential volatiles.
- Analysis of soil samples at a National Association of Testing Authorities (NATA) accredited laboratory for a combination of commonly encountered contaminants, including:
    - Eight priority heavy metals (arsenic, cadmium, chromium, copper, lead, nickel and zinc);
    - Polycyclic aromatic hydrocarbons (PAH);
    - Total recoverable hydrocarbons (TRH);
    - Benzene, toluene, ethylbenzene and xylenes (BTEX);
    - Total phenols;
    - Organochlorine pesticides (OCP);
    - Organophosphorus pesticides (OPP);
    - Polychlorinated biphenyls (PCB);
    - Asbestos identification; and
    - Toxicity characteristic leaching procedure (TCLP) testing for metals for preliminary waste classification purposes.

- Sampling of groundwater from three groundwater monitoring wells installed in Boreholes BH01, BH03 and BH06 using low-flow minimal drawdown sampling methods following collection of stabilised field parameters for pH, temperature, redox, electrical conductivity (EC) and turbidity;
- Analysis of groundwater samples at a NATA accredited laboratory for heavy metals, TRH, BTEX, PAH, OCP, OPP, PCB and VOC testing. QA/QC testing included an intra-laboratory replicate, trip spike and blank; and
- Comparison of the analytical data against the applicable assessment criteria published in the national guidelines NEPC (2013), plus any other relevant guidelines. The site assessment criteria (SAC) adopted applied to a residential land use with minimal soil access opportunities.

The investigation and screening levels applied comprise levels adopted for a generic Residential B land use scenario (as an initial conservative screen), notwithstanding that the proposed development is a mixed use with multiple basement levels. The adopted SAC are listed on the summary analytical results tables in Appendix B.

The borehole logs for BH01 to BH06 are included in Appendix B. The logs recorded the following general sub-surface soil profile.

Pavement:	BH01 and BH02 comprised of a double concrete slab, 250mm and 180mm deep respectively with binding sand separating the layers. BH03-BH06 comprised of a single 150mm thick concrete slab.
Fill:	Fill materials comprised of gravels / sand to maximum depths between 0.25 m and 1.0 m bgl. Sandy clays are observed below this layer maximum depth of between 0.7 m and 2.60 m bgl. BH04 contained no clay layer and consisted of solely gravels / sands to a depth of 0.6 m bgl.
Residual soils:	No residual soil observed.
Ashfield Shale:	Typically, very low to low strength, highly weathered siltstone encountered at depths between 0.6 m and 4.8 m; overlying
Mittagong Formation:	Interbedded and interlaminated siltstone and fine-grained sandstone, of very low to high strength, at depths between 4.05 m and 14.6 m; overlying
Hawkesbury Sandstone:	Medium to coarse grained Hawkesbury Sandstone, encountered at depths of between 12.0 m and 31.5 m, typically medium to high strength. No Hawkesbury sandstone was encountered in BH03, BH05 and BH06.

Visual anthropogenic inclusions were noted in BH05 as “trace PVC fragments”. No olfactory evidence of potential contamination was observed during the drilling.

During groundwater sampling (after well development), groundwater levels were measured at 10.83 m below slab level (bsl) for BH01, 6.73 m bsl for BH03 and 3.4 m bsl for BH06 (82.4 m AHD, 82.4 m AHD and 81.3 m AHD respectively). It should be noted that groundwater levels are affected by climatic conditions and soil permeability and will therefore vary with time.

Based on the field and testing results presented in the report, the following comments were made:

- The soils within the site, at the tested locations (boreholes) do not exceed the SAC applicable to a Residential B land use;
- The testing focussed on fill soils at the borehole locations. The test results suggest that the fill at the boreholes preliminarily classifies as general solid waste (non putrescible) under the NSW EPA (2014) waste classification guidelines; and
- Groundwater below the site is not considered to present a risk of harm or exposure to occupants and workers at the site. However, given the marginally elevated metals, nutrients, anion and cation concentrations, it was considered likely that some form of pre-treatment will be required to reduce these concentrations prior to disposal of water collected through a dewatering scheme. It was envisaged that would be captured in a dewatering management plan. reference should also be made to the Douglas *Groundwater Impact Assessment* report.

7. Conceptual site model

The data collected during previous investigations, as summarised in Section 6, generally confirmed that for certain potential contaminant sources outlined in the PCSM in (Golder, 2021), potentially complete exposure pathways to the identified receptors exist, whereas for others, they do not. No other sources of contamination have been identified as a result of the testing reported in Douglas (2025), noting however that the report does not constitute a DSI.

The source (and associated contaminants of potential concern (CoPC)), pathway and receptor linkages are summarised in the following Tables 2, 3 and 4.

Table2: Summary of potential sources

Potential sources and associated CoPC
On-site sources
S1: Fill: fill of unknown origin was found in all six boreholes as part of Douglas (2025). All test results were below SAC, however additional sampling and testing is proposed to fill data gaps in the borehole numbers and layout: CoPC include heavy metals, TRH, BTEX, PAH, PCB, OCP, OPP, phenols and asbestos **S2:** Current buildings (noting that a previous hazardous materials management plan identified asbestos in lift friction pads, synthetic mineral fibres (SMF) in in some building materials, and PCB in light fittings: CoPC include asbestos, SMF, lead (in paint) and PCB **S3:** Below ground UST and associated infrastructure: CoPC include heavy metals, TRH, BTEX and PAH

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

Table3: Summary of potential receptors and pathways

Potential human receptors
HR1: Current users [office workers, retail staff, residents and customers] **HR2:** Construction and maintenance workers **HR3:** End users [residents, retail staff and customers] **HR4**: Adjacent users [residents, retail staff and customers]
Potential environmental receptors
ER1: Surface water **ER2:** Groundwater
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

A summary of the potentially complete exposure pathways for the proposed land use is shown in Table 4 below.

Table 4: Summary of potentially complete exposure pathways (proposed land use)

Source and CoPC	Exposure pathway	Receptor	Recommended action
S1: Fill beneath the slab	**HP1:** Ingestion and dermal contact **HP2:** Inhalation of dust and/or vapours	**HR2:** Construction and maintenance workers	Current test results show concentrations below SAC. Data gap investigation recommended to complete fill testing to the NSW EPA (2022) sampling guidelines. All fill to be removed for planned basement excavation works, so formal waste classification to be undertaken to inform off-site disposal.
	EP1: Surface water run-off. **EP3:** Lateral migration of groundwater providing base flow to water bodies.	**ER1:** Surface water **HR2**: Construction and maintenance workers	
	EP2: Leaching of contaminants and vertical migration into groundwater.	**ER2:** Groundwater **HR2**: Construction and maintenance workers **HR3:** End users	

Source and CoPC	Exposure pathway	Receptor	Recommended action
S2: Hazardous building materials	**HP1:** Ingestion and dermal contact **HP2:** Inhalation of dust and/or vapours	**HR1:** Current site users **HR2**: Construction and maintenance workers	All hazardous building materials to be removed and a building clearance by a qualified occupational hygienist issued prior to bulk demolition. Ground surface clearance by occupational hygienist post building demolition.
S3: UST and associated infrastructure	**HP1:** Ingestion and dermal contact **HP2:** Inhalation of dust and/or vapours	**HR1:** Current site users **HR2**: Construction and maintenance workers **HR3:** End users	UST and associated infrastructure to be removed and validated in accordance with this RAP
	EP1: Surface water run-off. **EP3:** Lateral migration of groundwater providing base flow to water bodies.	**ER1:** Surface water **HR2**: Construction and maintenance workers	
	EP2: Leaching of contaminants and vertical migration into groundwater.	**ER2:** Groundwater **HR2**: Construction and maintenance workers **HR3:** End users	

8. Data gap assessment

Douglas (2025) comprised opportunistic soil and groundwater sampling from six (6) boreholes drilled in the lower basement for geotechnical investigation purposes. The sampling and testing did not identify contaminants in soil or groundwater warranting specific remediation. However, these boreholes were not positioned to target specific contamination risks (i.e. UST) listed in the Golder PSI report, nor adequate site coverage.

The NSW EPA (2022) sampling design guidelines recommend for a site area of 2,844 m^2 a minimum of eight (8) sampling locations for characterisation assuming no point sources of contamination. Given the presence of the UST, however noting limited opportunity for pre-removal nearby intrusive investigations, the data gap assessment will comprise an additional

three (3) boreholes strategically positioned for site coverage and to target proximate to the UST (where possible).

The scope of the data gap assessment is as follows:

- Review and incorporation of the scope and outcomes of Golder (2021) and Douglas (2025);
- The existing concrete slab will be cored at three (3) strategically positioned borehole locations;
- Progressing the borehole at each of the three locations using hand tools, through the fill into natural soils or refusal;
- Recovery of soil samples at regular depth intervals until full fill penetration and/or auger refusal;
- PID screening for potential volatiles;
- Analysis of recovered soil samples for a range of contaminants of concern based on Golder (2021) and Douglas (2025), including metals, TRH, BTEX, PAH, OCP, OPP, PCB, phenols, asbestos and VOC;
- Inclusion of quality control samples comprising replicate samples, trip spike and trip blank samples;
- Comparison of the analytical data against the adopted SAC; and
- Preparation of a DSI report with reference to the NSW EPA (2020) reporting guidelines.

A detailed site investigation (DSI) has been undertaken and reported by Douglas to address these data gaps. The DSI report will be submitted as part of the application.

9. Remediation extent

The extent of remediation based on current data comprises:

- Remediation Area 1: The UST (located underneath the lowest basement level at the site) is to be decommissioned, removed and validated. The extent of excavation to be confirmed upon removal. Any identified contaminated soils around the UST are to be waste classified to inform off-site disposal.

10. Remediation options assessment

Given that the site is proposed for deeper excavation to accommodate additional basement levels, the only viable remediation option for the UST is decommissioning and removal from site. As such, an assessment of the suitability of other remediation options has not been undertaken.

11. Remediation methodology

11.1 Sequence of remediation

The general sequence of remediation shall be determined by the Remediation Contractor with the aim of minimising the potential for cross contamination of 'clean' areas / soils with contaminated soils. This should include avoiding, wherever possible transporting or placing contaminated soil over 'clean' areas separating stockpiles of different origin / contamination profile and validating the complete removal of any contaminated material placed / potentially impacting 'clean' areas.

The general sequence of remediation will consider the following recommended sequence:

- Decommissioning of the UST (including disposal of contents);
- Excavation of UST backfill soils, stockpiling for waste classification;
- Excavation, removal and disposal of the UST and associated infrastructure (collectively the underground petroleum storage system – UPSS);
- Further excavation of any hydrocarbon impacted soils or bedrock within the planned basement excavation as determined by the Environmental Consultant, with such material waste classified for off-site disposal; and
- Validation of completion of remediation prior to bulk excavation around the location.

Roles and responsibilities are outlined in the site management plan (Appendix C).

11.2 Regulations and guidance

UPSS removal works should be conducted with reference to the following:

- NSW *State Environmental Planning Policy (Resilience and Hazards) 2021* (the 'SEPP').
- NSW *Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019* (UPSS Regulation).
- EPA *Underground Petroleum Storage Systems Guidelines for Implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019* (EPA, 2020) (UPSS Guidelines).
- EPA *Decommissioning an underground petroleum storage tank or system*, Fact Sheet, September 2021 (EPA, 2021).
- EPA *Sampling Design, Part 1: Application* and *Part 2: Interpretation,* August 2022 (EPA, 2022).
- EPA *Contamination Assessment of Service Station Sites, Minimum Sampling Requirements*, July 2023. (EPA, 2023).
- SafeWork NSW *Notifications for Schedule 11 Hazardous Chemicals and Abandoned Tanks – Guidance Material*, Catalogue No. SW08219 (SafeWork SW08219).
- SafeWork NSW safety alert WC01188, *Potential risks when removing underground storage tanks*.
- Standards Australia *Safety in welding and allied processes - Fire precautions (*AS 1674.1) [Standard], 1997. (AS 1674.1).

- Standards Australia *The Storage and Handling of Flammable and Combustible Liquids* (AS 1940–2017) [Standard], 2017. (AS 1940–2017).
- Standards Australia *The Removal and Disposal of Underground Petroleum Storage Tanks* (AS 4976–2008) [Standard], 2008. (AS 4976–2008).

11.3 Consent and notifications prior to decommissioning

The following consent / notifications are required prior to decommissioning:

- Notification of Council and SafeWork NSW.
- The UPSS Guidelines recommend that consultation be undertaken with the local council for any requirements and/or approvals necessary for the proposed UPSS removal and/or remediation works. The below standard requirements apply for remediation work, and should apply to the works at the site:
    - The UPSS Regulation requires the person responsible for the storage system to advise the relevant local council at least 30 days prior to the proposed decommissioning of the UPSS.
    - The SEPP provides requirements for consent or notification of Category 1 and Category 2 remediation. The remediation category should be confirmed by an appropriately qualified planner in accordance with Chapter 4 of the SEPP. In brief:
        - Category 1: A person must not carry out Category 1 remediation work except with the consent of the consent authority.
        - Category 2: A person may carry out Category 2 remediation work without the consent of the consent authority. Notification must be provided at least 30 days before the commencement of the work.

11.4 Work health and safety (WHS)

Any residual flammable vapour in a tank can be ignited resulting in fire and explosion. Contaminants can present a risk to people through inhalation, ingestion, or dermal contact. This is in addition to general construction / demolition hazards associated with the physical removal works.

To manage these risks the following controls must be implemented:

- The contactor must be suitably qualified and experienced in UPSS removal. They must hold an unrestricted demolition licence with chemical demolition authorisation as per (SafeWork, SW08219). The person holding the unrestricted licence must be on-site supervising during the removal work.
- The Contractor is to develop appropriate safety controls, including safe work method statements (SWMS), or similar.
- The works area is to be controlled to prevent unauthorised access during removal works.
- All workers are to be inducted and made aware of the WHS controls.
- Management and monitoring of explosive gas concentrations in accordance with AS 4976–2008.

- Management of the stability of the excavation and its backfilling (if required), including protection of adjacent structures. Engineering advice should be sought as required.
- No smoking on the site.
- No food consumption is to occur at the site. Drink containers should be stored appropriately to prevent their contact with potentially contaminated soil or liquids.
- No-one is to enter the tank; potentially unstable excavations or any excavation greater than 1.5 m deep.
- Appropriate personal protective equipment (PPE) must be worn. This should include clothing and gloves to minimise physical contact with potentially contaminated soils and water.
- All potentially contaminated soils and water should be managed to prevent its off-site migration, which could result in exposure to people and the environment off the site.

11.5 **UPSS decommissioning and removal**

Decommissioning of the UPSS by a suitably qualified Contractor by the following process:

- Review by the Contractor of any relevant drawings showing location of the UPSS, including the UST and associated pipework (if these become available).
- Undertake site investigation by the Contractor to identify the location and extent of the UPSS (including pipework) and potential underground services within the excavation area as required to assist in planning for the works.
- Pumping out of all fluids from the tank and disposal to an appropriately licensed liquid waste facility.
- Purging vapours from the UPSS in accordance with AS 4976–2008, for example by the water displacement method or eduction with an inert gas such as nitrogen until readings with a calibrated gas meter are less than 5% of the lower explosive limit (LEL).
- Continue monitoring for flammable gases during any cutting or removal of the tank, air monitoring should be undertaken to assess whether any potential flammable / explosive vapours are within or near to the tank. Work is to cease if gas is recorded at or above 5% of the LEL, and is only to recommence when appropriate action has been undertaken to reduce gas levels to below this level.
- Removal of UPSS pipework and other infrastructure, this should be removed prior to the tank being removed unless there is certainty that it can be reached after tank removal.
- Planning for safe removal of the tank. Given the access restrictions it may not be possible for the tank to be removed in one piece, in which case it will require cutting prior to removal. Considerations at planning stage include:
    - If the UST is to be cut, the method to be used, and the need for a hot works permit (e.g. if the cutting method presents a potential spark risk). Note AS 1940 specified information required in a work permit.
    - If the tank is proposed to be removed in one piece, checking to ensure it can withstand lifting / transport prior to removal.
- Removal of the tank (e.g. using chains or lifting lugs), destruction and appropriate off-site disposal with reference to AS 4976 (2008).

- Inspection and photographing of the tank and pipework to record their condition.
- If the tank is to be cut and/or cleaned on-site all removed solids and liquids must be captured for off-site disposal.
- A competent person should scrap the tank and issue a tank scrapping certificate (tank cannot be set to a metal recyclers).

11.6 Excavation and validation testing of tank pit

The following steps are to be undertaken for the excavation of soils and validation of the tank pit:

- Inspection by the Environmental Consultant of all UPSS infrastructure.
- Excavation by the Contractor of backfill from the tank pit, which typically comprises a sandy fill used to support the tank. Placement of excavated spoil onto the concrete slab, into a skip or a designated, plastic lined stockpile area with appropriate erosion controls.
- Assessment for apparent signs of gross contamination (such as free product, strong odours or soil / rock with high photoionization detector (PID) results) by the Environmental Consultant comprising:
    - Inspection by the Environmental Consultant of the tank pit and the collection of samples from the base, various depths on the walls and below the pipework recovered with the assistance of the Contractor's plant.
    - Screening of soil samples collected from various locations in the excavation by the Environmental Consultant using a calibrated PID to assess for potential gross impact.
    - The Environmental Consultant should advise the Contractor of any signs of gross contamination which may trigger additional excavation prior to validation sampling.
- Further excavation of materials with apparent signs of gross contamination by the Contractor if considered necessary and practicable.

If signs of gross contamination, such as free product, strong odours, or soil / rock with high PID results are recorded, further excavation and stockpiling of the impacted materials should be considered. The Contractor should assess their ability to conduct the further excavation based on site restrictions and discuss with the Environmental Consultant and Principal's representative:

- If water with signs of gross contamination is present in the tank pit it should be sampled by the Environmental Consultant and then pumped out by the Contractor and disposed of to an appropriately licensed liquid waste facility.
- Collection and analysis of validation samples by the Environmental Consultant in accordance with Section 13 with the assistance of the Contractor (note sample(s) collected as part of the assessment for signs of gross contamination above may be used for this purpose subject to them meeting the validation sampling requirements and no further excavation having occurred at their source location).
- Assessment by the Environmental Consultant of laboratory results relative to the SAC, and advising their client of the results.
- If practicable, excavation of soil / rock in which contamination is recorded above the SAC, either immediately or following backfill of the excavation.

- Continue validation sampling, and if necessary, excavation of the tank pit until either all results are less than the SAC, or the target waste classification criteria, or limits of excavation are reached.
- Sampling and analysis of the stockpiled (or if preferred in situ) soil / rock by the Environmental Consultant as follows:
  - Sampling frequency: generally one sample per 25 m^3 of spoil, or in accordance with the NSW EPA (2022) sampling guidelines.
  - Analytes: metals, TRH, BTEX, PAH, VOC.
  - Quality control (QC): replicate samples as required to provide the overall frequency in accordance with Section 13.
- Preparation of a formal waste classification report to facilitate disposal of the excavated spoil.
- Disposal to a nominated landfill under the waste classification designated.

12. Assessment criteria

12.1 Remediation and excavation works

The remediation works are to be validated by the Environmental Consultant by means of visual inspection, field screening, recovery and analysis of samples and review of any available plans as set out in this report.

All fill / soil tested as part of the validation process is proposed to be excavated and disposed off-site to accommodate the proposed basement deepening. Therefore, all testing of fill and other soils will be to facilitate off-site disposal. The following table provides a summary of the criteria against which test data will be assessed.

Table 2: Assessment Criteria

Item	Assessment criteria
Existing fill or identified contaminated soils (such as backfill around the UST), sampled in situ or in stockpile form.	Waste classification criteria as per the NSW EPA (2014) waste classification guidelines.
Existing natural soils and bedrock, not considered impacted with contaminants, sampled in situ or in stockpile form.	Assessed against the POEO Act (VENM definition) and typical background concentrations for a VENM classification. Alternatively, assessment against an applicable NSW EPA Resource Recovery Order (RRO).

12.2 Site assessment criteria

The SAC will apply to the assessment of analytical results for the data gap investigation.

The SAC to be applied are informed by the proposed land use and development intentions 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 to be applied comprise levels adopted for a generic Residential B land use scenario (as an initial conservative screen), notwithstanding that the proposed development is a mixed use with multiple basement levels. The derivation of the SAC is in Appendix D, and these are consistent with the SAC adopted in Douglas (2025).

13. Validation plan

13.1 Data quality objectives

The data quality objectives (DQO) for the validation plan are included in Appendix E.

13.2 Validation assessment requirements

The following site validation work will be required:

- Field assessment by the Environmental Consultant comprising:
  - Visual inspection, including taking photographs for record purposes;
  - Collecting validation samples from excavations resulting from the removal of contaminated soils, including contaminated soil stockpile footprints (if relevant); and
  - Collecting validation / characterisation samples from the tank pit.
- Laboratory analysis of validation samples at a NATA accredited laboratory for:
  - The CoPC relevant to the remediation area; and
  - Quality control (QC) samples.
- Comparison by the Environmental Consultant of the laboratory results with the SAC and/or other assessment criteria as discussed in Section 12; and
- Preparation by the Environmental Consultant of a validation report detailing the methods and results of the remediation works and validation assessment.

13.3 Visual inspections

All areas to be assessed and validated will first be subject to a visual inspection by the Environmental Consultant.

13.4 Validation / VENM sampling

The sampling frequency will depend on the volume or area to be assessed and the previous results. The following approximate sampling frequencies will be adopted but may be modified by the Environmental Consultant to consider previous results, where applicable, and findings from the visual inspections.

Small to medium excavations (base <500 m^2) (i.e. the UST excavation):

- Base of excavation: one sample per 25 m^2 or part thereof, with a minimum of three samples where the base of the excavation is fill rather than natural soils;
- Sides of excavation: one sample per 10 m to 20 m length or part thereof with a minimum of one sample per wall. Additional samples will be collected at depths of concern where there is more than one depth of concern, with a minimum of one sample per 1.5 m depth in fill; and
- Fuel lines associated with the UST: one sample per 5 m (linear).

For other contaminated materials encountered and managed under the unexpected finds protocol (Section 16.3) the frequency can be modified, as considered appropriate by the Environmental Consultant.

Where contaminated soils are stored or treated on bare soils, the footprint of the stockpile will require validation following removal of the contaminated soils.

Validation samples will be analysed by a NATA accredited laboratory for the relevant CoPC relevant to the remediation area.

Validation sample test results will be compared to the assessment criteria discussed in Section 12. Where the criteria are considered to have not been met, the remediation excavation(s) may be expanded to 'chase-out' impacted material, as advised by the Environmental Consultant, with the validation sampling then continuing into the extended excavation.

It is envisaged that at the completion of fill, UST and associated infrastructure removal, and validation results meeting the SAC, the natural bedrock can be assessed against virgin excavated natural material (VENM) criteria defined by the NSW EPA. The validation sampling can be utilised as part of the assessment process, supplemented with additional sampling and testing where needed. Once a VENM classification is reported, all deeper excavated materials are considered to be covered by the VENM classification report.

In the event that contamination extends beyond site boundaries or in areas that can't be practically chased out (e.g. under buildings), validation samples will be taken at the limit of excavation. Notwithstanding that there may be residual contamination present. Advice may need to be obtained from a qualified geotechnical or structural engineer regarding excavation and/or structure stability if excavations approach site boundaries and/or existing structures.

14. **Waste disposal**

Disposal of waste must be to an appropriately licensed waste facility, as per *Protection of the Environment Operations Act 1997* NSW (POEO Act) and the *Protection of the Environment (Waste) Regulation 2014* NSW. For the purpose of this RAP, waste comprises all excavated soils and bedrock that do not meet the definition of VENM.

Any waste disposed off-site must be initially classified by the Environmental Consultant in accordance with:

- NSW EPA *Waste Classification Guidelines, Part 1: Classifying Waste* (NSW EPA, 2014a);
- NSW EPA *Waste Classification Guidelines, Part 2: Immobilisation of Waste* (NSW EPA, 2014b);
- NSW EPA *Waste Classification Guidelines, Part 4: Acid Sulfate Soils* (NSW EPA, 2014c); and
- NSW EPA *Addendum to the Waste Classification Guidelines (2014) - Part 1: Classifying Waste* (NSW EPA, 2016) [addendum for per- and poly-fluoroalkyl substances (PFAS)].

Samples will be collected from stockpiles / in situ fill at various depths to characterise the full depth of the material. The frequency is to be determined by the Environmental Consultant based on the risk of contamination and heterogeneity of the material.

For stockpiles comprising similar materials and a:

- Volume up to 200 m^3: a recommended minimum frequency of one sample per 25 m^3, with a minimum of three per stockpile (NSW EPA, 2022); or
- Volume greater than 200 m^3: a recommended minimum frequency of one sample per 25 m^3, with a minimum of 12 samples OR a minimum of 10 samples and calculation of the 95% upper confidence limit of the arithmetic mean for all applicable analytes (NSW EPA, 2022). Note that this does not apply to stockpiles impacted, or potentially impacted, by asbestos. For stockpiles greater than 200 m^3 which are impacted, or potentially impacted, by asbestos the Environmental Consultant shall provide guidance in accordance with NSW EPA (2022).

It may be possible to classify excavated soil / fill for reuse on another site under a relevant NSW EPA resource recovery order (RRO) so that it can be used on other sites under the requirements of the corresponding NSW EPA resource recovery exemption (RRE). For this option, the frequency of sampling should be in accordance with the relevant RRO and the contaminants to be analysed will be determined by the Environmental Consultant. The Environmental Consult will provide a report confirming the suitability of the spoil for reuse under a RRO, or otherwise.

All waste must be tracked by the Remediation Contractor from 'cradle to grave'. Copies of all consignment notes / disposal dockets (or similar) and environment protection licences for receipt and disposal of the materials must be maintained by the Remediation Contractor as part of the site log and must be provided to the Environmental Consultant for inclusion in the validation report.

15. Quality assurance and quality control

Field quality assurance and quality control (QA/QC) testing will include the following:

- 10 % sample intra-laboratory analysis, analysed for the same suite as primary sample;
- Rinsate samples (where re-useable sampling equipment is used), analysed for the suite of analytes analysed by the majority of the primary samples; and
- Trip spike and trip blank samples (analysed for BTEX) (approximately one per batch of samples where volatile contaminants are CoPC).

The laboratory will undertake analysis in accordance with its NATA accreditation, including in-house QA/QC procedures:

- The QC analytical results will be assessed using the following criteria:
  - Sampling location rationale met the sampling objective;
  - Standard operating procedures (SOP) are followed;
  - Appropriate QA/QC samples are collected / prepared and analysed;
  - Samples are stored under secure, temperature-controlled conditions;
  - Chain of custody documentation is employed for the handling, transport and delivery of samples to the selected laboratory;
  - Conformance with specified holding times;
  - Accuracy of spiked samples within the laboratory's acceptable range (typically 70-130% for inorganic contaminants and greater for some organic contaminants);
  - Field and laboratory duplicate, and replicate samples will have a precision average of +/- 30% relative percentage difference (RPD); and
  - Rinsate samples will show that the sampling equipment (if used) is free of introduced contaminants, i.e. the analytes show that the rinsate sample is within the normal range for deionised water.

16. Management and responsibilities

16.1 Site management plan

A general site management plan for the operational phase of site remediation is included in Appendix CD. The management plan includes soil, noise, dust, work health safety (WHS), remediation schedule, hours of operation and incident response. The Remediation Contractor is to implement the general site management plan for the duration of remediation works by incorporating the plan into their over-arching construction environmental management plan (CEMP).

16.2 Site responsibilities

The site management plan (Appendix C) provides a summary of the general program management and associated responsibilities. Contact details for key utilities are also included in the event of needing to respond to any incidents.

16.3 Contingency plan and unexpected finds protocol

Plans for contingency situations (e.g. encountering asbestos in fill), along with an unexpected finds protocol for dealing with unexpected finds during remediation work / earthworks, are included in Appendix F.

17. Validation reporting

17.1 Documentation

The following documents will need to be collated and reviewed by the Environmental Consultant as part of the validation assessment (including those items that are prepared by the Environmental Consultant):

- Any licences and approvals required for the remediation works (Remediation Contractor);
- Waste classification report(s) (Environmental Consultant);
- Transportation Record: comprising a record of all truckloads of soil (including aggregate) entering the site, including truck identification (e.g. registration number), date, time, source site, load characteristics (e.g. type of material, i.e. quarried aggregate, etc.), approximate volume, use (e.g. general site raising, service trenches, etc.) (Remediation Contractor);
- Disposal dockets: for any soil disposed off-site including transportation records, spoil source, spoil disposal location, receipt provided by the receiving waste facility / site (Remediation Contractor). Note: A record of the building materials disposed off-site is also to be kept and provided to the Principal, on request;
- Records relating to any unexpected finds and contingency plans implemented (Remediation Contractor);
- Laboratory certificates and chain-of-custody documentation;
- Inspections records from the Environmental Consultant; and
- Photographic records by all contractors and consultants of the works undertaken within their purview of responsibilities (Remediation Contractor).

17.2 Reporting

A validation assessment report will be prepared by the Environmental Consultant in accordance with NSW EPA (2020).

The validation report shall describe the remediation approach adopted, methodology, results and conclusion of the assessment and make a statement regarding the suitability of the site for the proposed mixed-use commercial and residential development.

18. Discussion

In support of the pending SSDA and pursuant to recent discussions, preparation of a Detailed Site Investigation (DSI) report is recommended, incorporating the scope of the data gap investigation outlined herein. As stated herein a DSI is currently being undertaken by Douglas.

19. Conclusions

As stated in Sections 6 and 7, Douglas has demonstrated that the site is not significantly impacted by soil contamination and there is no evidence of groundwater contamination. As a result, it is considered that the site can be made suitable for the proposed mixed-use residential development subject to implementation of this RAP.

On the basis of the information presented in this report and the DSI report, Douglas considers that a long-term environmental management plan is not required for the site, as any identified contamination associated with the sources identified in the CSM will be removed as part of proposed basement excavation.

20. References

CRC CARE. (2019a). *Remediation Action Plan: Development - Guideline on Establishing Remediation Objectives*. National Remediation Framework: CRC for Contamination Assessment and Remediation of the Environment.

CRC CARE. (2019b). *Remediation Action Plan: Development - Guideline on Performing Remediation Options Assessment*. National Remediation Framework: CRC for Contamination Assessment and Remediation of the Environment.

Douglas. (2025). *Report on Contamination Testing - 601 Pacific Highway, St Leonards, NSW*. Reference 86230.01.R.002.Rev1 Dated 24 October 2025.

Douglas. (2025). *Report on Geotechnical Investigation - 601 Pacific Highway, St Leonards, NSW*. Reference 86230.01.R.001.Rev1 Dated 24 October 2025.

EPA. (2014). *Waste Classification Guidelines*. NSW Environment Protection Authority.

EPA. (2021). *Decommissioning an underground petroleum storage tank or system, Fact Sheet*. September 2021: NSW Environment Protection Authority.

EPA. (2022). *Sampling Design, Part 1: Application; Part 2: Interpretation*. NSW Environment Protection Authority.

EPA. (2023). *Contamination Assessment of Service Station Sites, Minimum Sampling Requirements*. NSW Environment Protection Authority.

Golder. (2021). *Preliminary Site Investigation - 601 Pacific Highway, St Leonards, NSW*. Reference 1792109-002-R-Rev1 Dated 24 June 2021.

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

NSW EPA. (2014b). *Waste Classification Guidelines, Part 2: Immobilisation of Waste*. NSW Environment Protection Authority.

NSW EPA. (2014c). *Waste Classification Guidelines, Part 4: Acid Sulfate Soils*. NSW Environment Protection Authority.

NSW EPA. (2014d). *Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014, The excavated natural material order 2014*. NSW Environment Protection Authority.

NSW EPA. (2016). *Addendum to the Waste Classification Guidelines (2014) - 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). *Sampling Design, Part 1: Application; Part 2: Interpretation*. NSW Environment Protection Authority.

Standards Australia. (2008). *The removal and disposal of underground petroleum storage tanks*. (AS 4976) [Standard].

Sydney Metro. (2021). *Sydney Metro Underground Corridor Protection Technical Guideline*. April 2021.

21. **Limitations**

Douglas Partners Pty Ltd (Douglas) has prepared this report (or services) for this project at 601 Pacific Highway, St Leonards NSW in line with Douglas' proposal dated 22/10/2025 and acceptance received from Hee-Jung Yoon of Stockland Development Pty Limited dated 22/10/2025. The work was carried out as A variation has been procured under Douglas Partners' main Geotechnical contract. This report is provided for the exclusive use of Stockland Development Pty Limited 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.

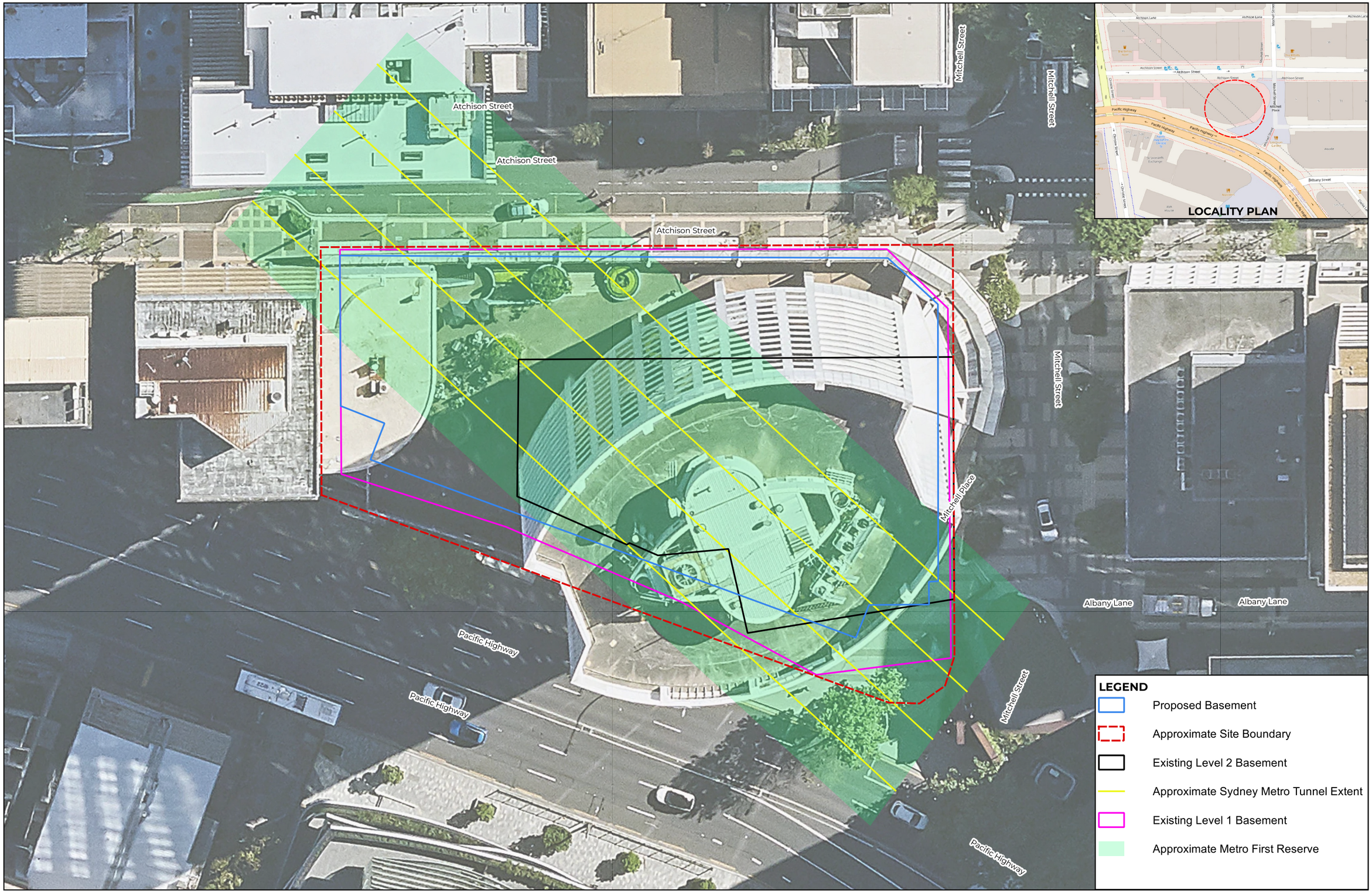
This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation,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

About this Report



REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	28.10.2025	PW

SCALE: 0 4 8 12 16 20 m — 1:400 @ A3

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

CLIENT:
Stockland Development Pty Limited

NOTE:
1: Basemap from Metromap (Dated 13.03.2025)

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME:
Proposed Mixed Use Residential Building

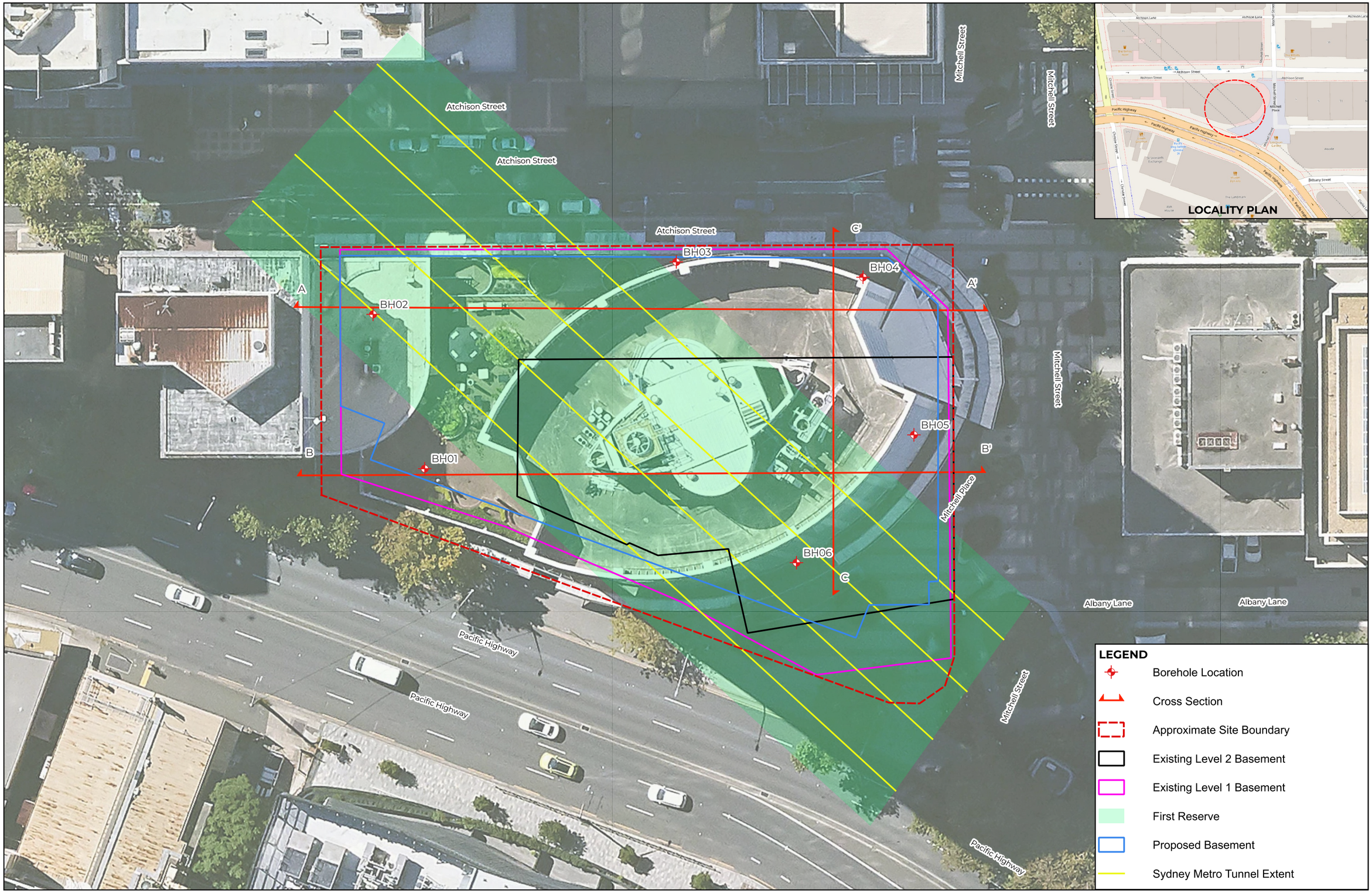
PROJECT ADDRESS:
601 Pacific Highway, St Leonards NSW

DRAWING TITLE:
Site Layout

PROJECT NO: **86230.03**

DRAWING NO: **1**

REVISION: **0**



REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	15.04.2025	EC

SCALE: 0 4 8 12 16 20 m
1:400 @ A3

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

CLIENT:
Stockland Commercial Property

NOTE:
1: Basemap from Metromap (Dated 13.03.2025)

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME:
Residential Development

PROJECT ADDRESS:
601 Pacific Highway, St Leonards

DRAWING TITLE:
Test Location Plan

PROJECT NO: **86230.01**
DRAWING NO: 2
REVISION: **0**

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

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

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.

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Appendix B

Previous Investigation Information

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333081.1, N:6255981.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 86230.01
DATE: 25/03/25
SHEET: 1 of 3

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	BACKFILL	WELL PIPE
25/03/25 No free groundwater observed whilst augering	82	0.25	CONCRETE; reinforcement 8mm, 2 slabs 130mm thick and 90mm thick (low), second slab has no reinforcement observable, 10mm blinding sand separating slabs.		FILL	NA	NA		D	0.40 – 0.50					
		0.35	FILL / GRAVEL: dark grey; fine to medium, angular, igneous.						D						
	81	1	FILL / CLAY trace sand: dark grey; low to medium plasticity; fine sand.		FILL	PC	w<PL		D	0.90 – 1.00					
			2.00m: very poor compaction						D	1.40 – 1.50				Bentonite	
	80	2							D	1.90 – 2.00				Gravel	
		2.60	Continued as rock log												
	79	3									3				
	78	4									4				
	77	5									5				
	76	6									6				
	75	7									7				
	74	8									8				
	73	9									9				

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: DTS 700
METHOD: DT to 0.25m, AD/T to 2.6m, NMLC to 14.80m
REMARKS: Unable to perform SPTs due to height restriction

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 2m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333081.1, N:6255981.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 86230.01
DATE: 25/03/25
SHEET: 2 of 3

CONDITIONS ENCOUNTERED | **SAMPLE** | **TESTING**

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, DW [HW, MW, SW], FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
25/03/25 No free groundwater observed whilst augering	82	0	Continued from soil log												0			Bentonite	
	81	1													1				
	80	2													2				
		2.60	SILTSTONE: dark grey, indistinct, bedded; (horizontal). Ashfield Shale.			2.60		100	100		2.87m: JT, 70°, PR, CN, SM 3.23m: JT, 70°, PR, CN, SM,				3	PLT	PL(A)=0.62MPa		
	79	3						100	100		3.00m: Very minimal water loss				3	PLT	PL(A)=0.78MPa		
		4					M	100	100		3.72m: JT, 70°, PR, CN, SM,				4	PLT	PL(A)=0.65MPa		
	78	4.54													4	PLT	PL(A)=0.62MPa		
		4.54	SANDSTONE: grey, fine to medium grained, indistinct bedding; siltstone ~5 - 10%. Mittagong Formation.		FR						4.09m: JT, 30°, PR, CN, SM,					PLT	PL(A)=0.98MPa		
		5				5.00	L	100	100		4.70m: Water loss ~20%				5	PLT	PL(A)=0.28MPa		
	77					5.60													
		6					H	95	100		5.70m: Water loss ~30-40%				6	PLT	PL(A)=1.1MPa		
	76	6.65														PLT	PL(A)=1.2MPa	Gravel	
		6.70				6.70													
		7					L	100	90		7.30m: Water loss 80-100% recovering to ~40%				7	PLT	PL(A)=1.1MPa		
	75					7.65					7.55-7.65m: B, 5°, PR, CN, RF, x3								
		8					H	100	93		8.03m: B, 10°, PR, CN, RF 8.25m: B, 10°, PR, CN, RF 8.40m: B, 10°, PR, CN, RF				8	PLT	PL(A)=1.6MPa		
	74				FR	8.60					8.62-8.70m: B, 0°, PR, RF, x4								
						8.65													
		9					M	100	100		8.90m: Water loss 60-90% 9.10m: Water loss ~10-20%				9	PLT	PL(A)=0.73MPa		
	73							100	100										

NOTES: [a] Soil origin is "probable" unless otherwise stated.

Generated with CORE-GS by Geroc - Split Soil-Rock Log

PLANT: DTS 700
METHOD: DT to 0.25m, AD/T to 2.6m, NMLC to 14.80m
REMARKS: Unable to perform SPTs due to height restriction

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 2m

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333081.1, N:6255981.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 86230.01
DATE: 25/03/25
SHEET: 3 of 3

CONDITIONS ENCOUNTERED														SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, HW, MW, SW, FR; DW)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.03, 0.06, 0.2, 0.6, 2.0)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	72	11					M	100	100		10.80m: Water loss ~20-30%				11	PLT	PL(A)=0.76MPa	Gravel	
	71					11.50		100	100							PLT	PL(A)=0.74MPa		
		12.00	SANDSTONE: grey, medium to coarse grained, indistinct bedding. Hawkesbury Sandstone.		FR										12				
	70						H	100	100							PLT	PL(A)=1.1MPa		
	69	13													13	PLT	PL(A)=1.1MPa		
	68	14				14.20		100	100						14				
						14.25	H - VH									PLT	PL(A)=3.1MPa		
	67	15	Borehole discontinued at 14.80m depth. Target depth reached.																
	66	16																	
	65	17																	
	64	18																	
	63	19																	

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
METHOD: DT to 0.25m, AD/T to 2.6m, NMLC to 14.80m
REMARKS: Unable to perform SPTs due to height restriction

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 2m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333081.1, N:6255981.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 86230.01
DATE: 25/03/25
SHEET: 1 of 2



2.60-7.00 m depth



7.00-12.00 m depth

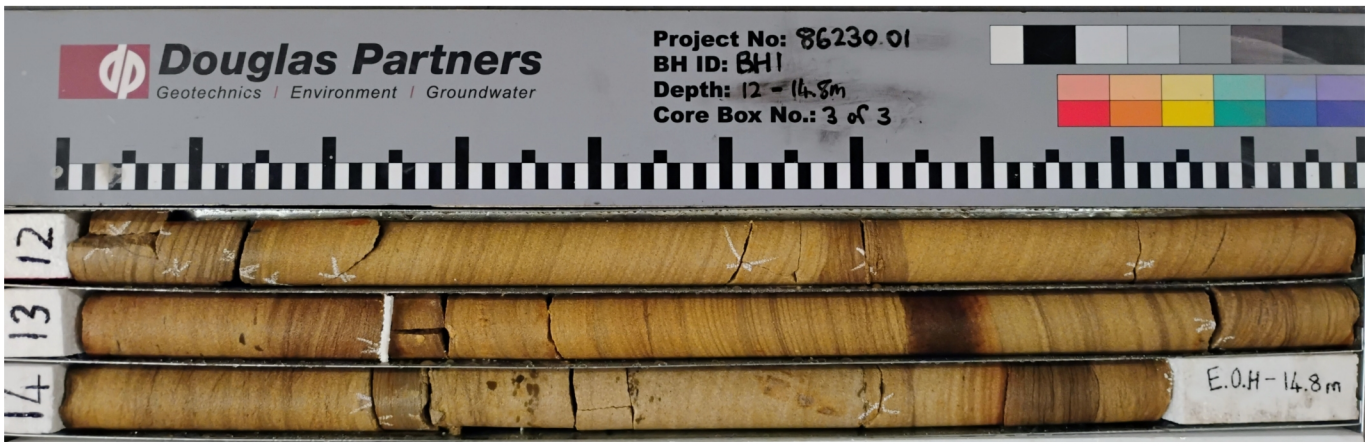
Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333081.1, N:6255981.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 86230.01
DATE: 25/03/25
SHEET: 2 of 2



12.00-14.80 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333075.4, N:6255998.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 86230.01
DATE: 28/03/25
SHEET: 1 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.18	CONCRETE; 2 layers reinforcement 8mm and 4mm.			NA	NA						
	82	0.40	FILL / Gravelly SAND with clay: brownish-grey; fine to medium; medium, sub-angular, igneous gravel.		FILL	ND	M						
		0.90	FILL / Clayey SAND trace gravel: dark grey; fine to medium; low to medium plasticity clay; fine to medium, angular, igneous gravel.		FILL		D						
		1.10	FILL / CLAY trace sand trace gravel: dark grey; low to medium plasticity.		FILL		w<PL						
	81		Continued as rock log								1		
	80										2		
	79										3		
	78										4		
	77										5		
	76										6		
	75										7		
	74										8		
	73										9		

28/03/25 No free groundwater observed whilst augering

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: DTS 700
METHOD: DT to 0.13m, AD/T to 1.10m, NMLC to 14.10m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 1m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333075.4, N:6255998.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 86230.01
DATE: 28/03/25
SHEET: 2 of 3

CONDITIONS ENCOUNTERED | **SAMPLE** | **TESTING**

GROUNDWATER: 28/03/25 No free groundwater observed whilst augering

RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
82	0	Continued from soil log												0				
	1	SILTSTONE: dark grey, indistinct bedding. Ashfield Shale.		FR	1.10	L	100	100		1.33m: JT, 40°, PR, CN, SM				1	PLT	PL(A)=0.12MPa		
81	2				2.00		100	100						2	PLT	PL(A)=0.14MPa		
	2.50														PLT	PL(A)=0.32MPa		
80	2.63				2.63					2.50m - 3.60m: Water loss <10%					PLT	PL(A)=0.60MPa		
	3			SW		M	88	100		3.27m: JT, 45°, PR, CN, SM				3	PLT	PL(A)=0.66MPa		
79	4						100	100		3.90m: CZ, 0°, PR, Clay, SM, ~5mm 4.25m: CZ, 0°, PR, Clay, SM, ~5mm 4.62-4.67m: CZ, 5°, PR, Clay				4	PLT	PL(A)=0.87MPa PL(A)=0.54MPa		
78	4.72	SANDSTONE: grey, fine and medium grained; with siltstone laminations and bedding. Mittagong Formation. 5.50m-5.80m: rip up clasts			5.30										PLT	PL(A)=0.48MPa		
77	5			FR										5	PLT	PL(A)=0.37MPa		
	6				6.00	H	100	100						6	PLT	PL(A)=1.2MPa		
76	7				7.60	M	100	100						7	PLT	PL(A)=1.3MPa		
75	8				8.05					8.56m: CZ, 20mm				8	PLT	PL(A)=1.4MPa		
74	9					H	100	90						9	PLT	PL(A)=1.1MPa		
73							100	100										

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
METHOD: DT to 0.13m, AD/T to 1.10m, NMLC to 14.10m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 1m

Generated with CORE-GS by Geroc - Split Soil-Rock Log

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333075.4, N:6255998.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 86230.01
DATE: 28/03/25
SHEET: 3 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, HW, DW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.03, 0.06, 0.20, 0.60, 2.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	72		[CONT] SANDSTONE: grey, fine and medium grained; with siltstone laminations and bedding. Mittagong Formation.			10.00	M												
		11				10.40		100	100		10.60m CZ, 20mm				11				
	71										11.10m - 14.10m: Water loss <10%					PLT	PL(A)=0.49MPa		
		12			FR			100	100						12	PLT	PL(A)=1.4MPa		
	70						H									PLT	PL(A)=1.8MPa		
		13													13				
	69	13.37	SANDSTONE: pale grey, medium to coarse grained; cross-bedded. Hawkesbury Sandstone.					87	87							PLT	PL(A)=1.1MPa		
		13.90													14				
	68		Borehole discontinued at 14.10m depth. Target depth reached.																
		15																	
	67																		
		16																	
	66																		
		17																	
	65																		
		18																	
	64																		
		19																	
	63																		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
METHOD: DT to 0.13m, AD/T to 1.10m, NMLC to 14.10m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 1m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333075.4, N:6255998.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 86230.01
DATE: 28/03/25
SHEET: 1 of 2



1.10-5.00 m depth



5.00-10.00 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333075.4, N:6255998.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 86230.01
DATE: 28/03/25
SHEET: 2 of 2



10.00-14.10 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333109.1, N:6256004.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 86230.01
DATE: 01/04/25
SHEET: 1 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
01/04/25 No free groundwater observed whilst augering	82	0.15	CONCRETE; 150mm thick.			NA			D		0.15			Bentonite	
		0.25	FILL / Gravelly SAND: yellow and grey; medium; fine to coarse, igneous, concrete gravel.		FILL	ND	w<PL		D		0.20				
		0.70	FILL / Sandy CLAY trace gravel: dark grey; low to medium plasticity; fine to coarse sand; fine gravel; shale.								0.40				
	81	1	Continued as rock log								0.50				
	80	2									1				
	79	3									2				
	78	4									3				
	77	5									4			Sand	
	76	6									5				
	75	7									6				
	74	8									7				
	73	9									8				
											9				

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: DTS 700
METHOD: DT to 0.15m, AD/T to 0.70m, NMLC to 12.10m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 0.5m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333109.1, N:6256004.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 86230.01
DATE: 01/04/25
SHEET: 2 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
01/04/25 No free groundwater observed whilst augering	82	0	Continued from soil log																
	81	1	SILTSTONE: dark grey, indistinct, bedded. Ashfield Shale.		SW	0.70 1.00		100	100		0.75m: JT, 35°, PR, SN Fe 0.92m: JT, 85°, PR, SN Fe 0.70m - 1.80m: Water loss <10%				1	PLT	PL(A)=1.3MPa		
	80	2						100	100						2	PLT	PL(A)=0.80MPa		
	79	3						100	100						3	PLT	PL(A)=0.61MPa		
	78	4					M H	100	100		3.30m - 4.00m: Water loss ~10% 4.13-4.15m: CZ, 0°, PR, SN Clay		SPT		3.30	PLT	PL(A)=0.91MPa		
	77	4.80 5	SANDSTONE: grey and pale grey, fine to medium grained, distinct, laminated; siltstone laminations and bedding. Mittagong Formation.		FR			100	100						3.75	PLT	PL(A)=0.70MPa		
	76	6						100	100		6.08m: B, ~5°, PR, CN, RF 6.49m: JT, 15°, PR, CN, RF				4	PLT	PL(A)=0.67MPa		
	75	7				7.00	H	100	90		7.28m: B, 10°, PR, RF 7.30m: B, 5°, PR, HE 7.35m: B, 50°, PR Clay 6 mm 7.41m: B, ~20°, UN, RF 7.50m: JT, 70°, PR, HE 7.62m: JT, 85°, UN, HE 7.75m: JT, 20°, UN, Clay, ~5mm				4.75	PLT	PL(A)=0.67MPa		
	74	8						100	100		8.46m: B, 5°, ST, Clay, ~2 mm 8.79m: JT, 70°, PR, CN, RF				5 5.20	PLT	PL(A)=0.86MPa	Sand	
	73	9				9.40	M	100	84		9.45m: JT, 80-90°, CU, Clay, 1-3mm 9.60m: B, ~50°, PR, Clay, PO, 1-2mm				6	PLT	PL(A)=1.1MPa		
															7	PLT	PL(A)=0.77MPa		
															8	PLT	PL(A)=2.4MPa		
															9	PLT	PL(A)=1.5MPa		
																PLT	PL(A)=0.37MPa		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
METHOD: DT to 0.15m, AD/T to 0.70m, NMLC to 12.10m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 0.5m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333109.1, N:6256004.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 86230.01
DATE: 01/04/25
SHEET: 3 of 3

CONDITIONS ENCOUNTERED													SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (DW: PS, XW, HW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.03, 0.06, 0.20, 0.60, >2.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	72	11	[CONT] SANDSTONE: grey and pale grey, fine to medium grained, distinct, laminated; siltstone laminations and bedding. Mittagong Formation.		FR		M	100	84						11	PLT	PL(A)=0.92MPa	Sand	
	71							100	100		11.55m: JT, 40°, PR, VNR Clay, RF 11.63m: CS, 30mm					PLT	PL(A)=0.84MPa		
		12									12.06m: JT, 80°, PR, CN, SM				12				
	70		Borehole discontinued at 12.10m depth. Target depth reached.																
	69	13																	
	68	14																	
	67	15																	
	66	16																	
	65	17																	
	64	18																	
	63	19																	

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
METHOD: DT to 0.15m, AD/T to 0.70m, NMLC to 12.10m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 0.5m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333109.1, N:6256004.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 86230.01
DATE: 01/04/25
SHEET: 1 of 2



0.70-5.00 m depth



5.00-10.00 m depth

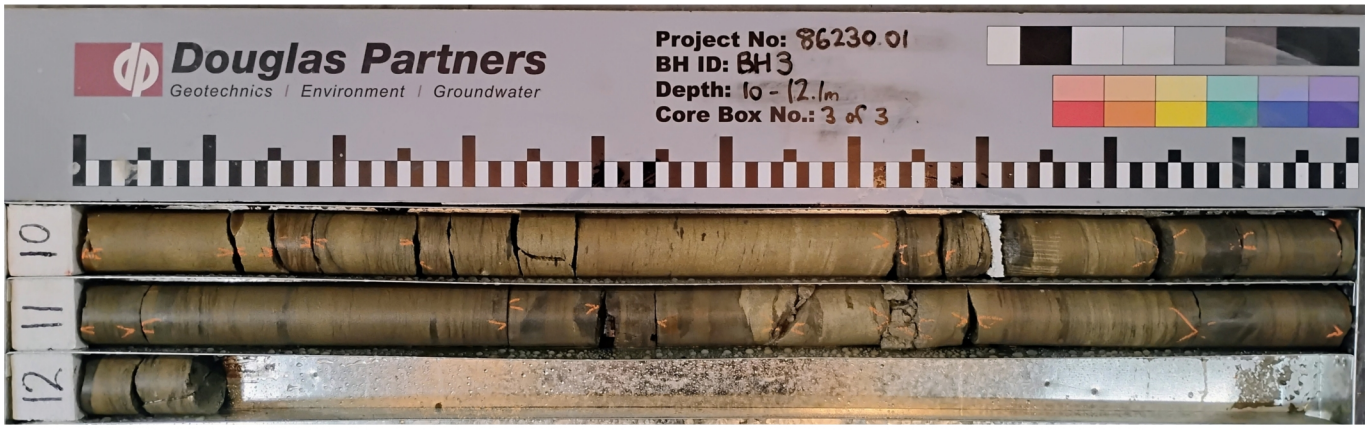
Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333109.1, N:6256004.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 86230.01
DATE: 01/04/25
SHEET: 2 of 2



10.00-12.10 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 1 of 5

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
07/04/25 Water level measured at 25.2m BGL.	82	0.15	CONCRETE; 150mm thick; one layer bidirectional reinforcement (SL82).			NA	NA		D	0.15 - 0.20	0.15		
		0.23	FILL / SAND: grey; medium.		FILL	ND	M				0.20		
		0.60	FILL / Sandy GRAVEL: dark grey; fine to medium, sub-angular, igneous; fine to coarse sand.		FILL		M / W		D	0.40 - 0.50	0.40		
			Continued as rock log								0.50		
	81	1									1		
	80	2									2		
	79	3									3		
	78	4									4		
	77	5									5		
	76	6									6		
	75	7									7		
	74	8									8		
	73	9									9		

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: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.60m, NMLC to 31.50m
CASING: HW to 0.5m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 2 of 5

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
07/04/25 Water level measured at 25.2m BGL.	82	0	Continued from soil log												0	PLT	PL(A)=1.1MPa		
			SILTSTONE: dark grey, indistinct, bedded. Ashfield Shale.			0.60		100	100							PLT	PL(A)=1.0MPa		
	81	1													1				
		2					H	100	100		1.91m: JT, 50°, PR, CN, SM				2	PLT	PL(A)=1.2MPa		
	80															PLT	PL(A)=0.68MPa		
		3									2.86m: JT, 60°, PR, CN, SM				3	PLT	PL(A)=0.75MPa		
						3.40		100	100							PLT	PL(A)=1.3MPa		
	79	4					M				3.70m: Water loss 10-20%				4	PLT	PL(A)=0.56MPa		
	4.15		SANDSTONE: grey and pale grey, fine to medium grained, distinct, bedded; siltstone laminae ~5-15%. Mittagong Formation.			4.10	L				4.15m: JT, ~70°, PR, CN, RF					PLT	PL(A)=0.22MPa		
						4.20		100	100		4.20m: Water loss <10%					PLT	PL(A)=0.85MPa		
	78	5													5				
					FR		H	100	100							PLT	PL(A)=1.2MPa		
	77	6													6				
								100	99		6.70m - 8.20m: Water loss 10%					PLT	PL(A)=1.7MPa		
	76	7				7.50	L				7.60m: JT, 70°, CU, CN, RF				7				
						7.90	M				7.66m: B, 0°, PR, RF 7.68m: B, 0°, PR, RF					PLT	PL(A)=0.13MPa		
	75	8				8.10									8				
							H									PLT	PL(A)=2.2MPa		
	74	9				9.00		100	87		8.72-8.92m: B, 0-10°, PR, RF, 7x				9				
							M				9.00-9.70m: JT, 85°, CU, CN, RF								
	73					9.90		100	100							PLT	PL(A)=0.73MPa		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.60m, NMLC to 31.50m
CASING: HW to 0.5m
REMARKS:

Generated with CORE-GS by Geroc - Split Soil-Rock Log

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 3 of 5

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	72	10.00	SANDSTONE: grey, pale grey, and pale brown, fine to medium grained, distinct, bedded; siltstone laminae ~5-15%. Mittagong Formation.					100	100						11	PLT	PL(A)=1.1MPa		
	71	11						100	100						12	PLT	PL(A)=0.99MPa		
	70	12						100	100						13	PLT	PL(A)=0.83MPa		
	69	13					M - H	100	100						14	PLT	PL(A)=0.89MPa		
	68	13.05	SANDSTONE: pale grey and pale brown, medium to coarse grained; cross-bedded. Hawkesbury Sandstone.					100	100		13.81m: B, 5-10°, PR, VNR Clay, RF				15	PLT	PL(A)=0.80MPa		
	67	14	From 14.30m: pale grey		FR			100	92		15.54m: B, 0°, PR, VNR Clay, RF 15.67m: B, 10°, PR, VNR, RF				16	PLT	PL(A)=0.73MPa		
	66	15						100	100						17	PLT	PL(A)=1.1MPa		
	65	16				17.00		100	100						18	PLT	PL(A)=1.3MPa		
	64	17					H	100	100		19.57m: B, 10°, PR, RF, iron clay 19.80m: Water loss ~20%				19	PLT	PL(A)=1.0MPa		
	63	18						100	100							PLT	PL(A)=1.1MPa		
		19																	

NOTES: [H] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
METHOD: DT (200mm) to 0.15m, AD/T to 0.60m, NMLC to 31.50m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HW to 0.5m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 4 of 5

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	62	20	[CONT] SANDSTONE: pale grey and pale brown, medium to coarse grained; cross-bedded. Hawkesbury Sandstone.					100	100		20.77m: CS, 10mm				20	PLT	PL(A)=1.0MPa		
	61	21									21.20m: B, ~5°, PR, Clay 2mm, RF				21	PLT	PL(A)=1.3MPa		
											21.40m: Water loss ~10%								
	60	22						100	100						22	PLT	PL(A)=1.1MPa		
	59	23					H	100	100						23	PLT	PL(A)=1.6MPa		
	58	24						100	100						24	PLT	PL(A)=1.5MPa		
	57	25			FR			100	100						25	PLT	PL(A)=1.7MPa		
	56	26				26.50	L	100	92		26.12m: JT, 90°, UN, CN, RF 26.20m: B, 5-10°, PR, Clay, RF, 3-4mm 26.26m: B, 0°, PR, Clay, RF, 1-2mm 26.57m: B, 15°, PR, Clay 1mm, RF 26.70m: B, 0°, PR, Clay 5mm, RF 26.75m: B, 0°, PR, Clay, RF, 1-2mm				26	PLT	PL(A)=0.34MPa		
	55	27				26.90					26.00m - 27.40m: Water loss 25%				27	PLT	PL(A)=0.59MPa		
	54	28					M	100	90		27.75m: CS, 10°, PR, Clay 40mm, RF 28.08m: CS, Clay 15mm 28.20m: JT, 20°, PR, Clay 4mm, RF 28.25m: B, 0°, PR, Clay, RF, 2-4mm				28	PLT	PL(A)=0.32MPa		
	53	29				29.50	M	100	76		28.70m: JT, 15°, PR, Clay 4mm, RF 28.94m: JT, 20°, PR, VNR Clay, RF 29.04-29.30m: B, 5°, PR, VNR, RF 29.36m: JT, 70°, PR, CN, RF 29.40m: JT, 15°, PR, VNR, RF 29.57-29.67m: CZ, 10°, PR 29.82m: JT, 5°, UN, VNR				29	PLT	PL(A)=0.43MPa		
																PLT	PL(A)=0.29MPa		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
METHOD: DT (200mm) to 0.15m, AD/T to 0.60m, NMLC to 31.50m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HW to 0.5m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 5 of 5

CONDITIONS ENCOUNTERED													SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, HW, DW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.06, 0.20, 0.60, 2.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	52	30	[CONT] SANDSTONE: pale grey and pale brown, medium to coarse grained; cross-bedded. Hawkesbury Sandstone.		FR	30.00	H	100	90		Clay, RF, 29.92m: JT, 25°, PR, Clay 6mm, RF 29.98m: JT, 15°, PR, Clay, RF, ~2mm 30.10m: Water loss 25% 30.29m: B, 5°, PR, Clay, RF, 2-4mm 30.34-30.39m: B, ~10°, UN, Clay, RF, 4-6mm 30.45m: B, 15°, UN, Clay, RF, ~2mm 30.48m: B, 10°, PR, Clay, RF, ~3mm				31	PLT	PL(A)=0.95MPa PL(A)=1.2MPa		
	51	31	Borehole discontinued at 31.50m depth.																	
	50	32																		
	49	33																		
	48	34																		
	47	35																		
	46	36																		
	45	37																		
	44	38																		
	43	39																		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.60m, NMLC to 31.50m
CASING: HW to 0.5m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 1 of 4



0.60-5.00 m depth



5.00-10.00 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 2 of 4



10.00-15.00 m depth



15.00-20.00 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 3 of 4



20.00-25.00 m depth



25.00-30.00 m depth

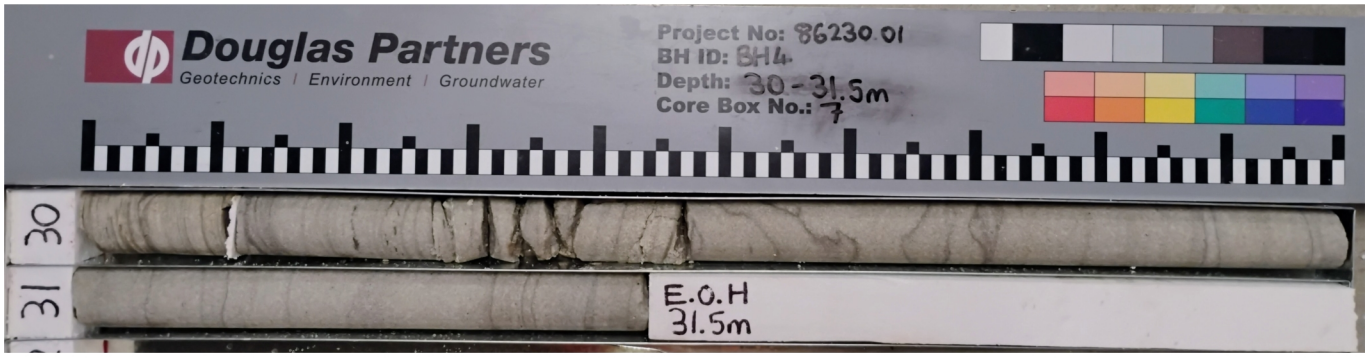
Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 4 of 4



30.00-31.50 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.2 AHD
COORDINATE: E:333135.6, N:6255984.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 1 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] DENSITY.[*]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
08/04/25 No free groundwater observed whilst augering	82	0.15	CONCRETE; 150mm thick; one layer reinforcement 8mm (SL82).			NA	NA		D	0.15 - 0.20	0.15		
		0.25			FILL						0.20		
		0.30	FILL / SAND: yellow-grey; medium.						D	0.40 - 0.50	0.40		
			FILL / GRAVEL: grey; fine to medium, sub-angular, igneous.		FILL	ND	M				0.50		
	81	1							D	0.90 - 1.00	0.90		
		1.10	FILL / Sandy CLAY trace gravel: grey; low to medium plasticity; fine sand; fine, angular, siltstone gravel; trace PVC fragments.								1.00		
			Continued as rock log										
	80	2									2		
	79	3									3		
	78	4									4		
	77	5									5		
	76	6									6		
	75	7									7		
	74	8									8		
	73	9									9		

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: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 1.10m, NMLC to 14.60m
CASING: HWT to 1m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.2 AHD
COORDINATE: E:333135.6, N:6255984.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 2 of 3

CONDITIONS ENCOUNTERED | **SAMPLE** | **TESTING**

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (DW, PS, XW, HW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.03, 0.06, 0.20, 0.60, 2.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
08/04/25 No free groundwater observed whilst augering	82	0													0				
	81	1	Continued from soil log			1.10									1				
		1.25	SILTSTONE: dark grey, indistinct, bedded. Ashfield Shale.			1.25	M	81	81		1.80m: JT, 70°, PR, VNR M, SM,					PLT	PL(A)=0.77MPa		
	80	2				2.20	VL	100	80		1.90m - 3.00m: Water loss ~10%				2	PLT	PL(A)=1.5MPa		
						2.30	M - H				2.20-2.30m: CZ, M, fine to medium					PLT	PL(A)=2.3MPa		
	79	3				3.43	VL	100	60		2.76m: JT, 50-60°, PR, VNR M, SM 2.83m: JT, 50-60°, PR, VNR M, SM 2.88m: JT, 50-60°, PR, VNR M, SM 3.05-3.10m: CZ, M, medium 3.36m: B, PR, M, SM, fine to course				3	PLT	PL(A)=0.35MPa		
						3.65	L - M				3.43-3.65m: CZ, M, fine to course					PLT	PL(A)=0.16MPa		
						3.90	VL				3.75-3.78m: CZ, M, fine to course gravel					PLT	PL(A)=0.66MPa		
	78	4				4.00	L - M				4.30m - 5.90m: Water loss <10%				4	PLT	PL(A)=0.39MPa		
		4.75	SANDSTONE: grey and pale grey, fine to medium grained, distinct, bedded; with siltstone laminations and bedding ~5%. Mittagong Formation.			4.71					3.90-4.00m: CZ, 6°, M, fine to medium					PLT	PL(A)=0.13MPa		
	77	5						100	86		4.09m: B, 0°, PR, M, 4mm 4.45m: JT, 35°, PR, VNR M, SM 4.53m: B, 0°, PR, M, SM, 1-2mm 4.67m: B, PR, M, SM, ~2mm 4.71m: B, PR, M, SM, ~2mm				5	PLT	PL(A)=1.0MPa		
				FR							5.90m - 7.50m: Water loss ~10%								
	76	6						100	100		4.74m: B, PR, M, SM, ~2mm 4.77m: B, PR, M, SM, ~2mm 5.33m: B, 5°, PR, SM 6.30m: JT, 70°, PR, CN, RF 6.56m: JT, 70°, PR, CN, RF 6.60m: B, 0°, PR, SM 6.82m: JT, 70°, PR, CN, RF 6.94m: B, 10°, PR, SM				6	PLT	PL(A)=0.69MPa		
	75	7					M - H				7.40m: B, 10°, PR, SM				7	PLT	PL(A)=1.4MPa		
	74	8						100	100						8	PLT	PL(A)=1.6MPa		
	73	9						100	100		9.23m: B, 5°, PR, SM				9	PLT	PL(A)=0.90MPa		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
METHOD: DT (200mm) to 0.15m, AD/T to 1.10m, NMLC to 14.60m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 1m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.2 AHD
COORDINATE: E:333135.6, N:6255984.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 3 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	72	11	[CONT] SANDSTONE: grey and pale grey, fine to medium grained, distinct, bedded; with siltstone laminations and bedding ~5%. Mittagong Formation.		FR	12.20	M-H	100	100		10.30m: No drilling muds, water loss ~20%				11	PLT	PL(A)=1.9MPa		
	71							100	92		10.55-1059m: CZ, Clay, coating, infill 6mm 10.66m: B, 15°, PR, Clay 10mm, SM					PLT	PL(A)=0.95MPa		
	70	12									11.57m: B, 10°, PR, M, SM				12				
	69	13				13.20	M	100	100						13	PLT	PL(A)=0.40MPa		
	68	14					H	100	95		13.40m: B, 5°, PR, Clay 1mm, SM 13.45m: JT, 80°, ST, CN, RF				14	PLT	PL(A)=1.0MPa		
											14.55m: B, PR, Clay 11mm					PLT	PL(A)=1.1MPa		
	67	15	Borehole discontinued at 14.60m depth. Target depth reached.																
	66	16																	
	65	17																	
	64	18																	
	63	19																	

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 1.10m, NMLC to 14.60m
CASING: HWT to 1m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

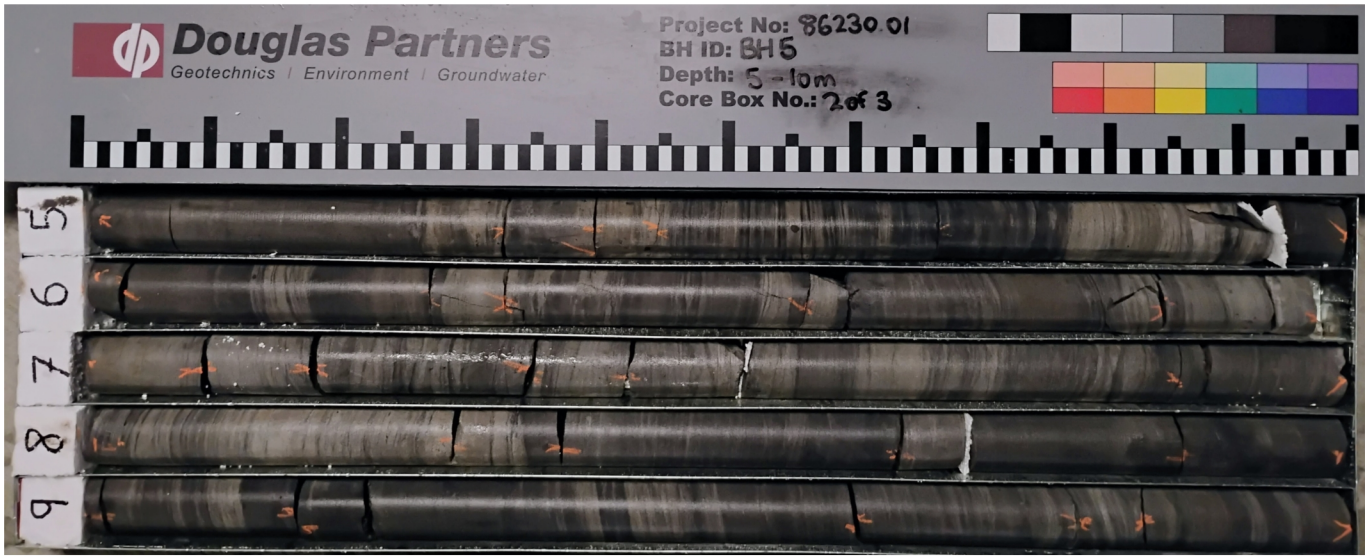
CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.2 AHD
COORDINATE: E:333135.6, N:6255984.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 1 of 2



1.10-5.00 m depth



5.00-10.00 m depth

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CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.2 AHD
COORDINATE: E:333135.6, N:6255984.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 2 of 2



10.00-14.60 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 81.3 AHD
COORDINATE: E:333122.5, N:6255970.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH06
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 1 of 3

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	BACKFILL	WELL PIPE
08/04/25 No free groundwater observed whilst augering	81	0.15	CONCRETE; 150m thick; one layer reinforcement (SL82).			NA	NA				0.15				
		0.25	FILL / SAND: grey-brown; medium.		FILL	ND	M		D		0.25				
		0.50	FILL / Sandy CLAY with gravel: dark grey; low to medium plasticity; fine to coarse sand; fine, siltstone gravel.		FILL		w=PL		D		0.40				
		0.65	SILTSTONE: dark grey. Ashfield Shale.								0.50				
	80	1	Continued as rock log								1			Bentonite	
	79	2									2				
	78	3									3				
	77	4									4				
	76	5									5				
	75	6									6			Sand	
	74	7									7				
	73	8									8				
	72	9									9				

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: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.50m, WB to 0.65m, NMLC to 11.05m
CASING: HWT to 0.5m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 81.3 AHD
COORDINATE: E:333122.5, N:6255970.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH06
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 2 of 3

CONDITIONS ENCOUNTERED | **SAMPLE** | **TESTING**

GROUNDWATER: 08/04/25 No free groundwater observed whilst augering

RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS
81	0	Continued from soil log								
		SILTSTONE: dark grey, indistinct, bedded. Ashfield Shale.			0.65		100	76		0.85m: B, 0°, PR, 1mm, SM, fines 1.15m: JT, 30°, PR, VNR, SM, fines 1.33m: JT, 30°, PR, VNR, SM, fines 1.35m: JT, 70°, PR, CN, SM 1.42m: CZ, 40mm 1.70m: Water loss <10%. no drilling mud added.
80	1						100	100		
79	2					M				
78	3						100	95		3.00m: CZ, 40mm 3.75m: CZ, 20mm 3.98m: CZ, 20mm
77	4				4.50					
	4.05	SANDSTONE: grey and pale grey, fine to medium grained, indistinct, bedded; siltstone laminations and bedding. Mittagong Formation.		FR			100	100		
76	5									
75	6						100	93		6.21m: CZ, 20mm 6.31m: CZ, 20mm
74	7					H				
73	8						100	100		
72	9						100	91		

SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
			0	PLT	PL(A)=0.94MPa	Bentonite	
			1	PLT	PL(A)=1.8MPa		
				PLT	PL(A)=0.72MPa		
			2	PLT	PL(A)=0.95MPa		
				PLT	PL(A)=0.80MPa		
			3	PLT	PL(A)=0.75MPa		
				PLT	PL(A)=0.88MPa		
			4	PLT	PL(A)=0.70MPa		
				PLT	PL(A)=0.93MPa		
			5	PLT	PL(A)=1.0MPa		
						Sand	
			6	PLT	PL(A)=2.0MPa		
				PLT	PL(A)=2.3MPa		
			7	PLT	PL(A)=1.4MPa		
			8				
			9	PLT	PL(A)=1.5MPa		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.50m, WB to 0.65m, NMLC to 11.05m
CASING: HWT to 0.5m
REMARKS:

Generated with CORE-GS by Geroc - Split Soil-Rock Log

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 81.3 AHD
COORDINATE: E:333122.5, N:6255970.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH06
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 3 of 3

CONDITIONS ENCOUNTERED														SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, DW, HW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	71	11	[CONT] SANDSTONE: grey and pale grey, fine to medium grained, indistinct, bedded; siltstone laminations and bedding. Mittagong Formation.		FR		H	100	91		9.97m: CZ, 80mm 10.10m: B, 10°, PR, Clay 10mm, RF				11	PLT	PL(A)=1.3MPa	Sand	
	70	12	Borehole discontinued at 11.05m depth. Target depth reached.					100	100										
	69	13																	
	68	14																	
	67	15																	
	66	16																	
	65	17																	
	64	18																	
	63	19																	
	62																		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.50m, WB to 0.65m, NMLC to 11.05m
CASING: HWT to 0.5m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 81.3 AHD
COORDINATE: E:333122.5, N:6255970.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH06
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 1 of 1



0.50-5.00 m depth



5.00-11.05 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

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.

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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

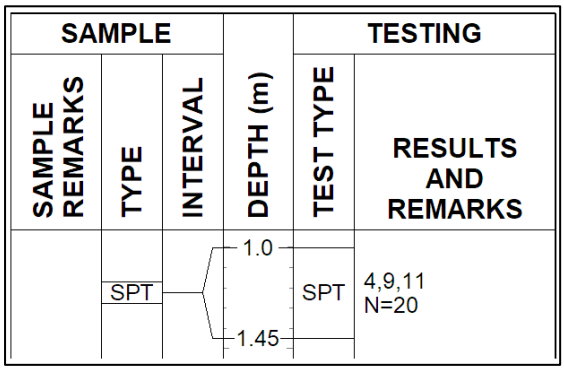
The presence of particles considered to be "oversize" may be described using one of the following strategies:

- 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".

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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
Driven Tube sample	DT
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
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)	DCP9/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150
Dynamic probe super heavy, followed by blow count penetration increment in mm	DPSH/100

Groundwater Observations

	water seepage/inflow
	water seepage/outflow
	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

Table E1: Summary of Laboratory Results – Priority metals, Priority PAH, Priority TRH, BTEX

			Priority metals								Priority PAH				Priority TRH						BTEX			
			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)	Benzene	Toluene	Ethylbenzene	Total Xylenes
		PQL	4	0.4	1	1	1	0.1	1	1	1	0.05	0.5	0.05	25	50	25	50	100	100	0.2	0.5	1	1
Sample ID	Depth	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
BH01	0.5 - 0.6 m	25/03/25	**6**	**0.9**	**6**	**41**	**18**	<0.1	**45**	**370**	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	3 -	- -	4 -	400 -	- -	- -	45 -	110 -	- -	- -	0.5 -	160 -	55 -	40 -
BD1/20250325	0 m	25/03/25	**5**	**0.6**	**7**	**41**	**15**	<0.1	**51**	**260**	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	3 -	- -	4 -	400 -	- -	- -	45 -	110 -	- -	- -	0.5 -	160 -	55 -	40 -
BH01	1.4 - 1.5 m	25/03/25	**11**	**0.5**	**4**	**37**	**20**	<0.1	**55**	**260**	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	NL -	- -	4 -	400 -	- -	- -	70 -	240 -	- -	- -	0.5 -	220 -	NL -	60 -
BH02	0.13 - 0.2 m	25/03/25	<4	<0.4	**4**	**15**	**3**	<0.1	**27**	**18**	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	3 -	- -	4 -	400 -	- -	- -	45 -	110 -	- -	- -	0.5 -	160 -	55 -	40 -
BH02	0.4 - 0.5 m	25/03/25	<4	<0.4	**5**	**24**	**2**	<0.1	**62**	**27**	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	3 -	- -	4 -	400 -	- -	- -	45 -	110 -	- -	- -	0.5 -	160 -	55 -	40 -
BH03	0.4 - 0.5 m	25/03/25	**11**	<0.4	**9**	**38**	**22**	<0.1	**36**	**190**	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	**120**	<100	<0.2	<0.5	<1	<1
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	3 -	- -	4 -	400 -	- -	- -	45 -	110 -	- -	- -	0.5 -	160 -	55 -	40 -
BH04	0.4 - 0.5 m	25/03/25	**4**	<0.4	**13**	**40**	**11**	<0.1	**47**	**130**	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	3 -	- -	4 -	400 -	- -	- -	45 -	110 -	- -	- -	0.5 -	160 -	55 -	40 -
BH05	0.15 - 0.2 m	25/03/25	<4	<0.4	**2**	**5**	**2**	<0.1	**1**	**3**	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	3 -	- -	4 -	400 -	- -	- -	45 -	110 -	- -	- -	0.5 -	160 -	55 -	40 -
BH05	0.4 - 0.5 m	25/03/25	<4	<0.4	**9**	**27**	**16**	<0.1	**25**	**78**	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	3 -	- -	4 -	400 -	- -	- -	45 -	110 -	- -	- -	0.5 -	160 -	55 -	40 -
BH05	0.9 - 1 m	25/03/25	**5**	<0.4	**8**	**41**	**22**	<0.1	**28**	**110**	<1	<0.05	<0.5	<0.05	<25	**56**	<25	**56**	**130**	<100	<0.2	<0.5	<1	<1
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	3 -	- -	4 -	400 -	- -	- -	45 -	110 -	- -	- -	0.5 -	160 -	55 -	40 -
BH05-FC	1.1 m	25/03/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
BH06	0.4 - 0.5 m	25/03/25	**170**	<0.4	**6**	**25**	**30**	**0.2**	**63**	**62**	<1	<0.05	<0.5	<0.05	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	3 -	- -	4 -	400 -	- -	- -	45 -	110 -	- -	- -	0.5 -	160 -	55 -	40 -
BH02 - [TRIPLICATE]	0.4 - 0.5 m	25/03/25	<4	<0.4	**5**	**46**	**4**	<0.1	**59**	**49**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
BH06 - [TRIPLICATE]	0.4 - 0.5 m	25/03/25	**100**	<0.4	**6**	**23**	**17**	**0.1**	**45**	**60**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			500 -	150 -	500 -	30,000 -	1,200 -	120 -	1,200 -	60,000 -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

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 B with minimal opportunities for soil access

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

HIL	HIL-B (NEPC, 2013 or HEPA, 2025 (PFAS only))	ML	Residential, Parkland and Public Open Space (NEPC, 2013)
HSL (vapour intrusion)	HSL-A/B (NEPC, 2013)		
DC	Direct contact HSL B Residential (High density) (CRC CARE, 2011)		

Table E2: Summary of Laboratory Results – Metals, TRH, BTEX, PAH, OCP, OPP, PCB, VOC (excluding BTEX), Nutrients, Anions & Cations

		Metals								Metals - Dissolved								TRH				BTEX					
		Total Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	Total Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	o-Xylene	m+p-Xylene	Total Xylenes
	PQL	1	0.1	1	1	1	0.05	1	1	1	0.1	1	1	1	0.05	1	1	10	50	100	100	1	1	1	1	2	1
ANZG (2018) 95% LOP Fresh		13	0.2	1	1.4	3.4	**0.06**	11	8	13	0.2	1	1.4	3.4	**0.06**	11	8					950	180	80	350	75	
NEPC (2013) HSL 2-4m																		1000	1000			800	NL	NL			NL
Sample ID	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH01	17/04/25	**3**	<0.1	<1	**13**	**2**	<0.05	**130**	**270**	<1	<0.1	<1	**3**	<1	<0.05	**100**	**120**	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1
BH03	17/04/25	**6**	<0.1	**2**	**24**	**2**	<0.05	**22**	**59**	**2**	<0.1	<1	<1	<1	<0.05	**17**	**28**	**30**	<50	<100	<100	<1	<1	<1	<1	<2	<1
BH06	17/04/25	**5**	<0.1	**9**	**36**	**8**	<0.05	**28**	**110**	<1	<0.1	<1	**3**	<1	<0.05	**15**	**41**	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1
BD1/250417	17/04/25	**6**	<0.1	**11**	**33**	**10**	<0.05	**33**	**100**	-	-	-	-	-	-	-	-	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1

Notes:

- No criterion / not defined / not tested / not applicable
- * QA/QC replicate of sample listed directly below the primary sample
- NL Not limiting
- PQL Practical quantitation limit

Shaded cell is exceedance of guideline value

Where one or more guideline value is exceeded, the cell is shaded to the colour of the highest guideline value exceeded

NEPC (2013) National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013), health screening level Sand 2-4m

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 95% level of protection of species for Fresh aquatic ecosystems [NB: 99% level of protection adopted for bioaccumulative chemicals]

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, orange text is 'unknown' level of protection

Underlining of ANZG (2018) criteria indicates a criteria with an 'unknown' level of protection.

ANZG (2018) DGV adopted for most conservative species of following analytes: DGV for xylene (m) adopted for xylene (m+p); DGV for CrVI adopted for total chromium; DGV for AsV adopted for total arsenic

ANZG (2018) DGV adopted for aluminium in freshwater is for receiving waters with pH >6.5. For receiving waters with pH <6.5 suitability of the more conservative, low reliability DGV of unknown LOP should be considered

ANZG (2018) Ammonia DGV is pH and temperature dependant. DGV for a pH of 8 provided in table.

Table E2: Summary of Laboratory Results – Metals, TRH, BTEX, PAH, OCP, OPP, PCB, VOC (excluding BTEX), Nutrients, Anions & Cations

		PAH																									
		Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Naphthalene	Benzo(a)pyrene (BaP)	Benzo(b+j+k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	Sum of detected PAH	DDE	DDT	DDD	Aldrin	Dieldrin	Aldrin + Dieldrin (calculated)	alpha-chlordane	gamma-Chlordane	Endosulfan I	Endosulfan II
	PQL	0.1	0.1	0.1	0.1	1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
ANZG (2018) 95% LOP Fresh				**0.01**		16	**0.1**					**1**			**0.6**				**0.006**		**<u>0.001</u>**	**<u>0.01</u>**					
NEPC (2013) HSL 2-4m						NL																					
Sample ID	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH01	17/04/25	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BH03	17/04/25	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BH06	17/04/25	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BD1/250417	17/04/25	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Notes:

- No criterion / not defined / not tested / not applicable
- * QA/QC replicate of sample listed directly below the primary sample
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ANZG (2018) Ammonia DGV is pH and temperature dependant. DGV for a pH of 8 provided in table.

Table E2: Summary of Laboratory Results – Metals, TRH, BTEX, PAH, OCP, OPP, PCB, VOC (excluding BTEX), Nutrients, Anions & Cations

		OCP													OPP																	
		Endosulfan Sulphate	Endrin	Endrin Aldehyde	Heptachlor	Heptachlor Epoxide	Hexachlorobenzene	Methoxychlor	Mirex	alpha-BHC	beta-BHC	delta-BHC	Lindane	Sum of detected OCP	Azinphos methyl (Guthion)	Bromophos-ethyl	Chlorpyriphos	Chlorpyriphos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Ronnel (fenchlorphos)	Fenitrothion	Fenthion	Malathion	Parathion	Parathion-methyl	Methidathion	Fenamiphos	Sum of detected OPP
	PQL	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
ANZG (2018) 95% LOP Fresh			**0.01**		**0.01**		0.1	**0.005**	**0.04**				0.2		0.02		**0.00004**		0.01		0.15			0.2		0.05	0.004				
NEPC (2013) HSL 2-4m																																
Sample ID	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH01	17/04/25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BH03	17/04/25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BH06	17/04/25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BD1/250417	17/04/25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Notes:

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Table E2: Summary of Laboratory Results – Metals, TRH, BTEX, PAH, OCP, OPP, PCB, VOC (excluding BTEX), Nutrients, Anions & Cations

		PCB																																
		Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arodor 1260	Sum of detected PCB	1,1,1,2-tetrachloroethane	1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	tetrachloroethene	1,1,2-trichloroethane	1,1,2-trichloroethylene	1,1-dichloroethane	1,1-Dichloroethene	1,2-dichloropropane	1,2,3-trichlorobenzene	1,2,3-trichloropropane	1,2,4-trichlorobenzene	1,2,4-trimethyl benzene	1,2-dibromo-3-chloropropane	1,2-dichlorobenzene	1,2-dichloroethane	1,2-dichloropropane	1,3,5-trimethyl benzene	1,3-dichlorobenzene	1,3-dichloropropane	1,4-dichlorobenzene	2,2-dichloropropane	2-chlorotoluene
	PQL	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ANZG (2018) 95% LOP Fresh					**0.3**		**0.01**				270	400	70	6,500	330		700		**3**		**85**			160	1,900	900		260	1,100	60		
NEPC (2013) HSL 2-4m																																		
Sample ID	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH01	17/04/25	<2	<2	<2	<2	<2	<2	<2	<2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH03	17/04/25	<2	<2	<2	<2	<2	<2	<2	<2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH06	17/04/25	<2	<2	<2	<2	<2	<2	<2	<2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BD1/250417	17/04/25	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

- No criterion / not defined / not tested / not applicable
- * QA/QC replicate of sample listed directly below the primary sample
- NL Not limiting
- PQL Practical quantitation limit

Shaded cell is exceedance of guideline value

Where one or more guideline value is exceeded, the cell is shaded to the colour of the highest guideline value exceeded

NEPC (2013) National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013), health screening level Sand 2-4m

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 95% level of protection of species for Fresh aquatic ecosystems [NB: 99% level of protection adopted for bioaccumulative chemicals]

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, orange text is 'unknown' level of protection

Underlining of ANZG (2018) criteria indicates a criteria with an 'unknown' level of protection.

ANZG (2018) DGV adopted for most conservative species of following analytes: DGV for xylene (m) adopted for xylene (m+p); DGV for CrVI adopted for total chromium; DGV for AsV adopted for total arsenic

ANZG (2018) DGV adopted for aluminium in freshwater is for receiving waters with pH >6.5. For receiving waters with pH <6.5 suitability of the more conservative, low reliability DGV of unknown LOP should be considered

ANZG (2018) Ammonia DGV is pH and temperature dependant. DGV for a pH of 8 provided in table.

Table E2: Summary of Laboratory Results – Metals, TRH, BTEX, PAH, OCP, OPP, PCB, VOC (excluding BTEX), Nutrients, Anions & Cations

		VOC (excluding BTEX)																														
		4-chlorotoluene	4-isopropyl toluene	Bromobenzene	Bromochloromethane	Bromodichloroethane	Bromoform	carbon tetrachloride	Chloroethane	Vinyl Chloride	Chloroform	Chloromethane	cis-1,2-dichloroethene	cis-1,3-dichloropropene	Isopropylbenzene (cumene)	Cyclohexane	dibromochloroethane	Dibromomethane	Dichlorodifluoromethane	1,2-dibromoethane	hexachlorobutadiene	Bromomethane	Monochlorobenzene	n-butyl benzene	n-propyl benzene	sec-butyl benzene	Styrene (vinylbenzene)	Tert-butyl benzene	trans-1,2-dichloroethene	trans-1,3-dichloropropene	Trichlorofluoromethane	Sum of detected VOC
	PQL	1	1	1	1	1	1	1	10	10	1	10	1	1	1	1	1	1	10	1	1	10	1	1	1	1	1	1	1	1	10	1
ANZG (2018) 95% LOP Fresh								240		100	770				30								55									
NEPC (2013) HSL 2-4m																																
Sample ID	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH01	17/04/25	<1	<1	<1	<1	<1	<1	<1	<10	<10	**3**	<10	<1	<1	<1	<1	<1	<1	<10	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<10	**3**
BH03	17/04/25	<1	<1	<1	<1	**5**	<1	<1	<10	<10	**32**	<10	<1	<1	<1	<1	<1	**1**	<1	<10	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<10	**38**
BH06	17/04/25	<1	<1	<1	<1	<1	<1	<1	<10	<10	<1	<10	<1	<1	<1	<1	<1	<1	<10	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<10	<1
BD1/250417	17/04/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

- No criterion / not defined / not tested / not applicable
- * QA/QC replicate of sample listed directly below the primary sample
- NL Not limiting
- PQL Practical quantitation limit

Shaded cell is exceedance of guideline value

Where one or more guideline value is exceeded, the cell is shaded to the colour of the highest guideline value exceeded

NEPC (2013) National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013), health screening level Sand 2-4m

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 95% level of protection of species for Fresh aquatic ecosystems [NB: 99% level of protection adopted for bioaccumulative chemicals]

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Underlining of ANZG (2018) criteria indicates a criteria with an 'unknown' level of protection.

ANZG (2018) DGV adopted for most conservative species of following analytes: DGV for xylene (m) adopted for xylene (m+p); DGV for CrVI adopted for total chromium; DGV for AsV adopted for total arsenic

ANZG (2018) DGV adopted for aluminium in freshwater is for receiving waters with pH >6.5. For receiving waters with pH <6.5 suitability of the more conservative, low reliability DGV of unknown LOP should be considered

ANZG (2018) Ammonia DGV is pH and temperature dependant. DGV for a pH of 8 provided in table.

Table E2: Summary of Laboratory Results – Metals, TRH, BTEX, PAH, OCP, OPP, PCB, VOC (excluding BTEX), Nutrients, Anions & Cations

		Nutrients								Anions & Cations	
		Nitrogen	Ammonia as N	TKN in water	Nitrate as N	Nitrite as N	NOx as N	Organic Nitrogen as N	Phosphorous	Chloride	Sulphate
	PQL	100	5	100	5	5	5	200	50	1000	1000
ANZG (2018) 95% LOP Fresh			900		1,100						
NEPC (2013) HSL 2-4m											
Sample ID	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH01	17/04/25	**100**	**12**	**100**	<5	<5	<5	<200	<50	**250,000**	**120,000**
BH03	17/04/25	**300**	<5	**300**	<5	<5	<5	**300**	**60**	**56,000**	**55,000**
BH06	17/04/25	**100**	**12**	**100**	<5	<5	<5	<200	**2,900**	**66,000**	**71,000**
BD1/250417	17/04/25	-	-	-	-	-	-	-	-	-	-

Notes:

-	No criterion / not defined / not tested / not applicable
*	QA/QC replicate of sample listed directly below the primary sample
NL	Not limiting
PQL	Practical quantitation limit
	Shaded cell is exceedance of guideline value
	Where one or more guideline value is exceeded, the cell is shaded to the colour of the highest guideline value exceeded
	NEPC (2013) National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013), health screening level Sand 2-4m
	ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 95% level of protection of species for Fresh aquatic ecosystems [NB: 99% level of protection adopted for bioaccumulative chemicals]
	ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, orange text is 'unknown' level of protection
	Underlining of ANZG (2018) criteria indicates a criteria with an 'unknown' level of protection.
	ANZG (2018) DGV adopted for most conservative species of following analytes: DGV for xylene (m) adopted for xylene (m+p); DGV for CrVI adopted for total chromium; DGV for AsV adopted for total arsenic
	ANZG (2018) DGV adopted for aluminium in freshwater is for receiving waters with pH >6.5. For receiving waters with pH <6.5 suitability of the more conservative, low reliability DGV of unknown LOP should be considered
	ANZG (2018) Ammonia DGV is pH and temperature dependant. DGV for a pH of 8 provided in table.

Table E3: Summary of Laboratory Results – Waste Classification

			Metals								TRH		BTEX				PAH		Phenols	OCP				
			Total Arsenic	TCLP Total Arsenic	Cadmium	Total Chromium	Lead	Mercury (inorganic)	Nickel	TCLP Nickel	TRH C6 - C9	TRH C10-C36	Benzene	Toluene	Ethylbenzene	Total Xylenes	Benzo(a)pyrene (B(a)P)	Total PAH	Total Phenolics	Scheduled Chemical Waste (standard)	Chlordane	Total Endosulfan	Total Analysed OCP	Mirex
		PQL	4	0.05	0.4	1	1	0.1	1	0.02	25	50	0.2	0.5	1	1	0.05	0.05	5	0.1	0.1	0.1	0.1	0.1
Sample ID	Depth	Sample Date	mg/kg	mg/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/L	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
BH01	0.5 - 0.6 m	25/03/25	**6**	-	**0.9**	**6**	**18**	<0.1	**45**	-	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	<5	<0.1	<0.1	<0.1	<0.1	<0.1
BD1/20250325	0 m	25/03/25	**5**	-	**0.6**	**7**	**15**	<0.1	**51**	-	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	-	-	-	-
BH01	1.4 - 1.5 m	25/03/25	**11**	-	**0.5**	**4**	**20**	<0.1	**55**	-	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	-	-	-	-
BH02	0.13 - 0.2 m	25/03/25	<4	-	<0.4	**4**	**3**	<0.1	**27**	-	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	-	-	-	-
BH02	0.4 - 0.5 m	25/03/25	<4	-	<0.4	**5**	**2**	<0.1	**62**	**0.07**	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	<5	<0.1	<0.1	<0.1	<0.1	<0.1
BH03	0.4 - 0.5 m	25/03/25	**11**	-	<0.4	**9**	**22**	<0.1	**36**	-	<25	**110**	<0.2	<0.5	<1	<1	<0.05	<0.05	<5	<0.1	<0.1	<0.1	<0.1	<0.1
BH04	0.4 - 0.5 m	25/03/25	**4**	-	<0.4	**13**	**11**	<0.1	**47**	-	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	<5	<0.1	<0.1	<0.1	<0.1	<0.1
BH05	0.15 - 0.2 m	25/03/25	<4	-	<0.4	**2**	**2**	<0.1	**1**	-	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	-	-	-	-
BH05	0.4 - 0.5 m	25/03/25	<4	-	<0.4	**9**	**16**	<0.1	**25**	-	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	<5	<0.1	<0.1	<0.1	<0.1	<0.1
BH05	0.9 - 1 m	25/03/25	**5**	-	<0.4	**8**	**22**	<0.1	**28**	-	<25	**140**	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	-	-	-	-
BH05-FC	1.1 m	25/03/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH06	0.4 - 0.5 m	25/03/25	**170**	<0.05	<0.4	**6**	**30**	**0.2**	**63**	**0.2**	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	<5	<0.1	<0.1	<0.1	<0.1	<0.1
BH02 - [TRIPLICATE]	0.4 - 0.5 m	25/03/25	<4	-	<0.4	**5**	**4**	<0.1	**59**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH06 - [TRIPLICATE]	0.4 - 0.5 m	25/03/25	**100**	-	<0.4	**6**	**17**	**0.1**	**45**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Summary Statistics																								
Min			4	0.05	0.4	2	2	0.1	1	0.07	25	50	0.2	0.5	1	1	0.05	0.05	5	0.1	0.1	0.1	0.1	0.1
Max			170	0.05	0.9	13	30	0.2	63	0.2	25	140	88	87	88	177	0.05	0.05	5	0.1	0.1	0.1	0.1	0.1
Mean			26	0.05	0.5	6	14	0.1	42	0.14	25	64	7	7.2	8	15	0.05	0.05	5	0.1	0.1	0.1	0.1	0.1
Waste Classification Criteria [f]																								
CT1			100	-	20	100	100	4	40	-	-	10,000	10	288	600	1000	0.8	200	288	<50	-	60	-	-
SCC1			500	-	100	1,900	1,500	50	1,050	-	-	10,000	18	518	1,080	1,800	10	200	518	<50	-	108	-	-
TCLP1			-	5	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT2			400	-	80	400	400	16	160	-	-	40,000	40	1,152	2,400	4,000	3.2	800	1,152	<50	-	240	-	-
SCC2			2,000	-	400	7,600	6,000	200	4,200	-	-	40,000	72	2,073	4,320	7,200	23	800	2,073	<50	-	432	-	-
TCLP2			-	20	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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

Table E3: Summary of Laboratory Results – Waste Classification

			OPP	PCB	VOC														Asbestos				
			Total Analysed OPP	Total PCB	Tetrachloromethane (carbon tetrachloride / CT)	Monochlorobenzene	Trichloromethane (chloroform / TCM)	1,2-dichlorobenzene	1,4-dichlorobenzene	1,2-dichloroethane	1,1-Dichloroethene	Styrene (vinylbenzene)	1,1,1,2-tetrachloroethane	1,1,2,2-tetrachloroethane	tetrachloroethene (PCE)	1,1,1-trichloroethane	1,1,2-trichloroethane	Trichloroethene (TCE)	Chloroethene (vinyl chloride / VC)	Asbestos ID in materials	Asbestos ID in soil >0.1g/kg	Trace Analysis (AS)	Asbestos Comment	Asbestos Summary
		PQL	0.1	0.1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					
Sample ID	Depth	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	-	-	-	-	
BH01	0.5 - 0.6 m	25/03/25	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD	NAD	Nil	-
BD1/20250325	0 m	25/03/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH01	1.4 - 1.5 m	25/03/25	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	NAD	NAD	Nil	-
BH02	0.13 - 0.2 m	25/03/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD	NAD	Nil	-
BH02	0.4 - 0.5 m	25/03/25	<0.1	<0.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	NAD	NAD	Nil	-
BH03	0.4 - 0.5 m	25/03/25	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD	NAD	Nil	-
BH04	0.4 - 0.5 m	25/03/25	<0.1	<0.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	NAD	NAD	Nil	-
BH05	0.15 - 0.2 m	25/03/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD	NAD	Nil	-
BH05	0.4 - 0.5 m	25/03/25	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD	NAD	Nil	-
BH05	0.9 - 1 m	25/03/25	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	NAD	NAD	Nil	-
BH05-FC	1.1 m	25/03/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD	-	NAD	-	-
BH06	0.4 - 0.5 m	25/03/25	<0.1	<0.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	NAD	NAD	Nil	-
BH02 - [TRIPLICATE]	0.4 - 0.5 m	25/03/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH06 - [TRIPLICATE]	0.4 - 0.5 m	25/03/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Summary Statistics																								
Min			0.1	0.1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-	-	-	-
Max			0.1	0.1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-	-	-	-
Mean			0.1	0.1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-	-	-	-
Waste Classification Criteria [f]																								
CT1			4	<50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCC1			7.5	<50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TCLP1			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT2			16	<50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCC2			30	<50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TCLP2			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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 C

Site Management Plan

1. Introduction

This general site management plan (SMP) has been developed to minimise potentially adverse impacts on the environment, and worker and public health as a result of the proposed remediation works.

The Remediation Contractor must have in place a construction environmental management plan (CEMP) (or similar) which is specific to the equipment used for the remediation and the proposed methods to be adopted by the Remediation Contractor. This SMP has been prepared to augment the Remediation Contractor's CEMP and contains general details for aspects of the work, as per reporting requirements for a remediation action plan (RAP) under NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020).

Apart from the management principles outlined in this SMP, the Remediation Contractor must also ensure compliance with all relevant environmental legislation and regulations, including (but not limited to) the following:

- Contaminated Land Management Act 1997 NSW (CLM Act);
- Protection of the Environment Operations Act 1997 NSW (POEO Act);
- Protection of the Environment Legislation Amendment Act 2011 NSW;
- Protection of the Environment Operations Amendment (Scheduled Activities and Waste) Regulation 2008 NSW;
- Environmentally Hazardous Chemicals Act 1985 NSW;
- Environmental Offences and Penalties Act 1989 NSW;
- Pesticide Act 1999 NSW and Pesticides Regulation 2017; and
- Work Health and Safety Act 2017 NSW (WHS Act) and Work Health and Safety Regulations 2017 NSW.

2. Roles and responsibilities

2.1 Principal

The Principal is responsible for the environmental performance of the proposed remediation works, including implementation of acceptable environmental controls during remediation works. The Principal will retain the overall responsibility for ensuring this RAP is appropriately implemented. The Principal is to nominate a representative (the Principal's Representative), who is responsible for overseeing the implementation of this RAP. The actual implementation of the RAP will, however, be conducted by the Remediation Contractor on behalf of the Principal.

The Principal is responsible for providing appropriate information to the Remediation Contractor to allow them to safely plan the required works. This includes the asbestos register for the site and this RAP.

The Principal is also responsible for implementing an appropriate communications plan.

2.2 **Remediation contractor**

The Remediation Contractor will be the party responsible for daily implementation of this RAP and shall fulfil the responsibilities of the Remediation Contractor as defined by SafeWork NSW. It is noted that the Remediation Contractor may appoint appropriately qualified sub-contractors or sub-consultants to assist in fulfilling the requirements of the procedures. The Remediation Contractor will appoint a Site Manager.

In addition to the implementation of the RAP it will be the Remediation Contractors responsibility to:

- Obtain / ensure relevant sub-contractors obtain specific related approvals as necessary to implement the earthworks including permits for removal of asbestos-containing material, SafeWork NSW notification etc.;
- Develop or request and review any site plans to manage the works to be conducted; and
- Ensure that all remediation works and other related activities are undertaken in accordance with this RAP.
- Maintain all site records related to the implementation of this RAP including but not limited to:
    - Tracking of all movement of soil within the site, on to site and off-site from cradle to grave;
    - Transportation Record: comprising a record of all truckloads of soil (including aggregate) entering the site, including truck identification (e.g. registration number), date, time, source site, load characteristics (e.g. type of material, i.e. quarried aggregate, etc.), approximate volume, use (e.g. general site raising, service trenches, etc.);
    - Disposal dockets: for any soil disposed off-site including transportation records, spoil source, spoil disposal location, receipt provided by the receiving waste facility / site;
    - Imported materials records: records for any soil imported onto the site, including source site, classification reports, inspection records of soil upon receipt at site and transportation records;
    - Records relating to any unexpected finds and contingency plans implemented; and
    - Photographic records by all contractors and consultants of the works undertaken within their purview of responsibilities.
- Ensure sufficient information is provided to engage or direct all required parties, including sub-contractors, to implement the requirements of the RAP other than those that are the direct responsibility of the Remediation Contractor;
- Manage the implementation of any recommendation made by those parties in relation to work undertaken in accordance with the RAP;
- Inform, if appropriate, the relevant regulatory authorities of any non-conformances with the procedures and requirements of the RAP in accordance with the procedures outlined in this document;
- Retain records of any contingency actions;
- On completion of the project, to review the RAP records for completeness and update as necessary; and

- Recommend any modification to general documentation which would further improve the environmental outcomes of this RAP.

2.3 Sub-contractors

All sub-contractors will be inducted onto the site, informed of their responsibilities in relation to this RAP and sign their agreement to abide by the RAP requirements. Where necessary, sub-contractors will also be trained in accordance with the requirements of this document. All sub-contractors must conduct their operations in accordance with the RAP as well as all applicable regulatory requirements.

2.4 Environmental consultant

The Environmental Consultant will provide advice on implementing the RAP. The Environmental Consultant will be responsible for:

- Undertake any required assessments where applicable (e.g. waste classification, validation);
- Provide advice and recommendations arising from monitoring and/or inspections, including unexpected finds; and
- Notify the Client with any results of assessments, and any observed non-conformances.

2.5 Site workers

All workers on the site are responsible for observing the requirements of this RAP and other management plans. These responsibilities include the following:

- Being inducted on the site and advised of the general nature of the remediation / environmental issues at the site;
- Being aware of the requirements of this plan;
- Wearing appropriate personal protective equipment (PPE) as required by this plan;
- Only entering restricted areas when permitted; and
- Requesting clarification when unclear of requirements of this or any other plans (e.g. safe work method statements (SWMS)).

3. Water management

3.1 Stormwater

Stormwater must be managed during the remediation works such that potential adverse impacts from surface runoff (e.g. cross contamination, mobilisation of contaminants in soil particles, etc.) are appropriately mitigated. Accordingly, the Remediation Contractor will take appropriate measures which may include:

- Construction, where necessary, of stormwater diversion channels, bunding and linear drainage sumps with catch pits in and around the remediation areas to divert stormwater from the contaminated areas;
- Provision of appropriately located sediment traps including geotextiles; and

- Discharge of excess water in excavations / low points on a regular basis to limit the potential for flooding.

3.2 Dewatering of excavations

Management of dewatering effluent must be in accordance with the project dewatering management plan (DMP) which Douglas is preparing. Long-term groundwater level monitoring is ongoing and a DMP will be required for the proposed excavation following completion of the long-term monitoring.

4. Soil management plan

The Remediation Contractor will develop a plan to mitigate cross contamination as part of the CEMP to be implemented throughout the works.

4.1 Stockpiling of contaminated material

Contaminated material shall be excavated and stockpiled at a suitably segregated location(s) away from sensitive areas (e.g. water bodies, drainage lines, stormwater pits, etc.) and ongoing excavations, and in a manner that will not cause nuisance to the neighbouring properties. Soil stockpiles are to be managed as follows:

- An impermeable membrane such as plastic sheeting should be provided at the surface by the Remediation Contractor prior to stockpiling. Plastic sheeting should be taped at joins, as necessary;
- All stockpiles of contaminated material shall be surrounded by star pickets and marking tape or other suitable material to clearly delineate their boundaries;
- Stockpiles shall be lightly conditioned by sprinkler or covered by geotextile or similar cover to prevent dust generation (if remaining overnight);
- Stockpiles impacted, or potentially impacted, with asbestos must be covered by geotextile or similar cover to prevent dust generation;
- Measures should be taken by the Remediation Contractor to prevent the migration of stockpile materials (i.e. perimeter bunds, hay bales, silt fences, etc.); and
- A record of stockpile locations (stockpile register), dimensions, descriptions, environmental controls, etc. should be maintained by the Remediation Contractor.

All movement of soil within the site is to be tracked by the Remediation Contractor, from cradle to grave. Copies of tracking records must be provided to the Environmental Consultant.

4.2 Stockpiling imported material

Imported material (if any) shall be stockpiled at a suitably segregated location(s) away from sensitive areas (e.g. water bodies, drainage lines, stormwater pits, etc.) and ongoing excavations, and in a manner that will not cause nuisance to the neighbouring properties. Soil stockpiles are to be managed as follows:

- Imported material should not be stockpiled within un-remediated areas of the site. If this is unavoidable an impermeable membrane such as plastic sheeting should be provided at the

surface by the Remediation Contractor prior to stockpiling. Plastic sheeting should be taped at joins, as necessary;

- All stockpiles shall be surrounded by star pickets and marking tape or other suitable material to clearly delineate their boundaries;
- Stockpiles shall be lightly conditioned by sprinkler or covered by geotextile or similar cover to prevent dust generation (if remaining overnight); and
- A record of stockpile locations (stockpile register), dimensions, descriptions, environmental controls, etc. should be maintained by the Remediation Contractor.

All movement of soil within the site is to be tracked by the Remediation Contractor, from cradle to grave. Copies of tracking records must be provided to the Environmental Consultant.

4.3 Transport of material off-site and on to site

Transport of contaminated material from the site and imported material to the site (if any) shall be via a clearly delineated haul route(s) and this route shall be used exclusively for entry and egress of vehicles used to transport contaminated materials within and away from the site, and onto and within the site. The proposed transport route(s) (to be determined by the Remediation Contractor) will be notified to Council and truck dispatch shall be logged and recorded by the Remediation Contractor for each load leaving or arriving the site. A record of the truck dispatch will be provided to the Environmental Consultant.

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

- Comply with all road traffic rules;
- Minimise noise, vibration and dust to adjacent premises; and
- Use State roads and minimise use of local roads as far as practicable.

The remediation work will be conducted such that all vehicles:

- Conduct deliveries of soil, materials, equipment or machinery only during the specified hours of remediation;
- Have securely covered loads to prevent any dust or odour emissions during transportation; and
- Exit the site in a forward direction.

In addition, measures will be implemented to ensure no contaminated material is spilled onto public roadways or tracked off-site on vehicle wheels. Roadways will be kept clean throughout the remediation works and will be broomed, if necessary, to achieve a clean environment.

All loads will be securely covered and may be lightly wetted, if required, to ensure that no materials or dust are dropped or deposited outside or within the site. Prior to exiting the site each truck should be inspected by Remediation Contractor personnel and either noted as clean (wheels and chassis) or broomed prior to leaving the site. Any soil spilled onto surrounding streets will be cleaned by mechanical or hand methods, on a daily basis.

Removal of waste materials from the site shall only be carried out contractors holding the appropriate license(s), consent or approvals to dispose the waste materials according to the waste classification and with the appropriate approvals obtained from the EPA, were required.

Materials imported onto the site shall only be carried out contractors holding the appropriate license(s), consent or approvals to transport the materials with the appropriate approvals obtained from the EPA, were required.

All movement of soil within the site is to be tracked by the Remediation Contractor, from cradle to grave. Copies of tracking records must be provided to the Environmental Consultant.

5. Noise and vibration control plan

All equipment and machinery should be operated in an efficient manner to minimise the emission of noise. The use of any plant and/or machinery should not cause unacceptable vibrations to nearby properties and should meet Council requirements.

6. Dust control plan

Dust emissions must be confined within the site boundary as far as is practicable. The following example dust control procedures could be employed to comply with this requirement, as necessary:

- Erection of dust screens around the perimeter of the site (as applicable);
- Securely covering all loads entering or exiting the site;
- Use of water sprays across the site to suppress dust;
- Stockpiles shall be lightly conditioned by sprinkler or covered by geotextile or similar cover to prevent dust generation (if remaining overnight);
- Stockpiles impacted, or potentially impacted, with asbestos must be covered by geotextile or similar cover to prevent dust generation;
- Include wheel wash (if applicable); and
- Keeping excavation and stockpile surfaces moist.

Regular checking of the fugitive dust issues is to be undertaken. Remedial measures are to be undertaken to rectify any cases of excessive dust.

7. Odour control plan

No odours should be detected at any boundary of the site during remediation works by an authorised Council Officer relying solely on sense of smell. The following example procedures could be employed to comply with this requirement as necessary:

- Use of appropriate covering techniques such as plastic sheeting, polythene or geotextile membranes to cover excavation faces or stockpiles;

- Fine spray of water and/or hydrocarbon mitigating agent on impacted areas / stockpiles or loads to lightly condition the material;
- If required, restrict uncovered stockpiles to appropriate sizes to minimise odour generation;
- Ceasing works during periods of inclement weather such as high winds or heavy rain;
- Regular checking of the fugitive dust and odour issues to ensure compliance. Undertake immediate remediation measures to rectify any cases of excessive dust or odour (e.g. use of misting sprays or odour masking agent); and
- Adequate maintenance of equipment and machinery to minimise exhaust emissions.

8. Work health and safety plan

8.1 General

It is the Remediation Contractor's responsibility to devise a SWMS[1] (or series thereof, for various respective tasks) and to implement proper controls that enable the personnel undertaking the remediation to work in a safe environment. This RAP and SMP does not relieve the Remediation Contractor or other contractors of their ultimate responsibility for occupational health and safety of their workforce and to prevent contamination of areas outside the 'remediation' workspace. This RAP and SMP sets out general procedures and the minimum standards and guidelines for remediation that will need to be used in preparing the safe work method statement.

This work health safety plan (WHSP) has been prepared with refence to CRC CARE *Remediation Action Plan: Implementation - Guideline on Health and Safety* (CRC CARE, 2019). The requirements of this WHSP must be incorporated into the Remediation Contractor's SWMS.

All site work must be undertaken in a controlled and safe manner with due regard to potential hazards, training and safe work practices. To attain this the SWMS developed by the Remediation Contractor must comply with policies specified in the Work Health and Safety Regulation 2011.

All appropriate permits, licences and notifications required for the remediation activities must be obtained prior to the commencement of remediation works.

8.2 Site access

Appropriate fencing and signage must be installed around and within the site to prevent unauthorised access and restrict access to remediation areas and/or deep excavations. Access restrictions and administrative arrangements for management of entry of workers or related personnel on site is the responsibility of the Remediation Contractor.

Any existing pits or unstable areas on site that may generate potential safety, or operational risk should be demarcated and taped off, with appropriate rectification action undertaken (e.g. backfilling of pits).

[1] Either a SWMS or construction environmental management plan (CEMP), or other equivalent document incorporating health and safety aspects of the proposed remedial works.

8.3 Personnel and responsibilities

Before undertaking works on site, all personnel will be made aware of the officer responsible for implementing WHS procedures. All personnel must read and understand this WHSP and over-arching SWMS prior to commencing site works and sign a statement to that effect. Contractors employed at the site will be responsible for ensuring that their employees are aware of, and comply with, the requirements of this WHSP and Remediation Contractor's SWMS.

8.4 Chemical contamination hazards

Chemical compounds or substances that may be present in the soils at the site include the key CoPC heavy metals, TRH, BTEX, PAH and phenols. There is also a lower probability of other contaminants being present.

The risks associated with the identified contaminants to site personnel and workers involved in the remediation are considered to be low due to the concentrations within groundwater and soil vapour and limited exposure durations. These risks are associated with:

- Ingestion of contaminated soil and/or water;
- Dermal contact with contaminated soil and/or water; and
- Inhalation of dusts or vapours of the CoPC.

If asbestos is encountered in fill, this risk evaluation should be revised.

Personnel will endeavour, wherever possible, to avoid direct contact with potentially contaminated material. Workers must avoid the potential exposures listed above as far as is practicable. Appropriate personal protective equipment (PPE) must be used to mitigate potential risks.

8.5 Physical hazards

The following physical hazards are associated with conditions that may be created during remediation works:

- Heat exposure;
- Excavations;
- Buried services;
- Noise;
- Dust;
- Electrical equipment;
- Heavy equipment and truck operation; and
- Asbestos.

Safe work practices must be employed to manage the physical risks identified above. For the most part these risks can be managed through appropriate demarcation, access controls and the use of appropriate PPE.

8.6 Safe work practices

The appropriate safe work practices should be clearly defined by the Remediation Contractor in their SWMS. As a minimum, all personnel on site will be required to wear the following PPE:

- Steel-capped boots (mandatory);
- High visibility clothing / vest (mandatory);
- Safety glasses or safety goggles with side shields requirements (as necessary);
- Hard hat (as necessary);
- Appropriate respiratory and protective equipment for any works involving asbestos (as necessary); and
- Hearing protection when working in the vicinity of machinery or plant equipment if noise levels exceed exposure standards (as necessary).

Each item of PPE should meet the corresponding relevant Australian Standard(s).

Specific safe work practices will be adopted when working with asbestos (if any), in accordance with (but not limited to) the following codes of practice:

- SafeWork NSW *Code of Practice, How to Manage and Control Asbestos in the Workplace* (SafeWork NSW, 2019a);
- SafeWork *NSW Code of Practice, How to Safely Remove Asbestos* (SafeWork NSW, 2019b);
- WorkCover *NSW Managing Asbestos in or on Soil* (WorkCover NSW, 2014); and
- NOHSC *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Ed* (NOHSC, 2005).

9. Remediation schedule and hours of operation

The remediation works will be conducted within the days and hours specified in the development consent.

10. Response to incidents

The key to effective management of incidents is the timely action taken before any situation reaches a reportable or critical level. Therefore, surveillance activities are extremely important and should be conducted for the measures prescribed herein and any other measures prescribed in any additional environmental management plan developed subsequently. During construction activities on the site, the following inspection or preventative actions should be performed by the Remediation Contractor:

- Regular inspection of works;
- Completion of routine environmental checklists and follow-up of non-compliance situations;
- Maintenance and supervision on-site; and

- An induction process for site personnel involved in the remediation works that includes relevant information on the contamination status of the site, the remediation works being undertaken, worker health and environmental protection requirements and ensures that all site personnel are familiar with the site emergency procedures.

An emergency response plan will be in place for all aspects of site works. Any emergency will be reported immediately to the site office and/or the Site Manager (and Safety Officer), and the appropriate emergency assistance should be sought. The Site Manager should be responsible for initiating an immediate emergency response using the resources available on the site. Where external assistance is required, the relevant emergency services should be contacted. A table such as that below, containing contact details for key personnel who may be involved in an environmental emergency response should be completed and be readily available to personnel at all times. The table should be completed, and thereafter amended, as required.

The Remediation Contractor will be responsible for ensuring that site personnel are aware of the emergency services available and the appropriate contact details. A site Safety Officer should be contactable, or available, on-site during remediation and development works.

Contact details for key utilities are included in the event of needing to respond to incidents. Blank cells are 'to be confirmed' and should be completed prior to works commencing when all entities are confirmed.

Table 1: Summary of roles and contact details

Role	Personnel / contact	Phone contact details
Principal		
Principal's Representative		
Site Manager		
Remediation Contractor and Builder		
Site Office		
Environmental Consultant		
Consent Authority	NSW Planning Commission	
Regulator	NSW EPA (pollution line and general enquiries)	131 555
Utility Provider	Water (Sydney Water Corporation)	13 20 92
Utility Provider	Power (Ausgrid)	13 13 88
Utility Provider	Gas (Jemena Limited)	131 909
Utility Provider	Telecommunications (Telstra Corporation Limited)	13 22 03
Utility Provider	Telecommunications (Optus)	1800 505 777
Utility Provider	Telecommunications (NBN Co Limited)	1800 687 626

11. References

ANZG. (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Canberra, ACT: Australian and New Zealand Governments and Australian state and territory governments.

CRC CARE. (2019). *Remediation Action Plan: Implementation - Guideline on Health and Safety*. National Remediation Framework: CRC for Contamination Assessment and Remediation of the Environment.

NOHSC. (2005). *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Ed*. Canberra, April 2005, NOHSC:3003: National Occupational Health and Safety Commission, Commonwealth of Australia.

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

SafeWork NSW. (2019a). *Code of Practice, How to Manage and Control Asbestos in the Workplace*. August 2019.

SafeWork NSW. (2019b). *Code of Practice, How to Safely Remove Asbestos*. August 2019: SafeWork NSW, NSW Government.

WorkCover NSW. (2014). *Managing Asbestos in or on Soil*. March 2014: WorkCover NSW, NSW Government.

Appendix D

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).
- CRC CARE *Health screening levels for petroleum hydrocarbons in soil and groundwater* (CRC CARE, 2011).
- ANZG *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018).
- ANZECC *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000).

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:

- Land use: residential.
    - Corresponding to land use category 'B', residential with minimal opportunities for soil access includes dwellings with fully and permanently paved yard space such as high-rise buildings and flats.
- Soil type: sand (sand has been adopted as a screening tool due to more conservative criteria however on-site soils present multiple fill layers ranging from coarse to fine soils).

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-B
Metals	
Arsenic	500

Contaminant	HIL-B
Cadmium	150
Chromium (VI)	500
Copper	30 000
Lead	1200
Mercury (inorganic)	120
Nickel	1200
Zinc	60 000
PAH	
B(a)P TEQ	4
Total PAH	400
Phenols	
Phenol	45 000
Pentachlorophenol	130
OCP	
DDT+DDE+DDD	600
Aldrin and dieldrin	10
Chlordane	90
Endosulfan	400
Endrin	20
Heptachlor	10
HCB	15
Methoxychlor	500
OPP	
Chlorpyrifos	340
PCB	
PCB	1

Table 2: Health screening levels (mg/kg)

Contaminant	HSL-A&B	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**	**4 m+**
Benzene	0.5	0.5	0.5	0.5
Toluene	160	220	310	540
Ethylbenzene	55	NL	NL	NL

Contaminant	HSL-A&B	HSL-A&B	HSL-A&B	HSL-A&B
Xylenes	40	60	95	170
Naphthalene	3	NL	NL	NL
TRH F1	45	70	110	200
TRH F2	110	240	440	NL

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'
scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'

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-B	DC HSL-IMW
Benzene	140	1100
Toluene	21 000	120 000
Ethylbenzene	5900	85 000
Xylenes	17 000	130 000
Naphthalene	2200	29 000
TRH F1	5600	82 000
TRH F2	4200	62 000
TRH F3	5800	85 000
TRH F4	8100	120 000

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

2.2 Asbestos in soil

Based on the CSM and/or current site access limitations, a detailed asbestos assessment was not considered to be warranted at this stage. However, due to the history of widespread use of ACM products across Australia, ACM can be encountered unexpectedly and sporadically at a site. Therefore, the presence or absence of asbestos at a limit of reporting of 0.1 g/kg (AS:4964) has been adopted for this investigation / assessment as an initial screen.

2.3 Ecological investigation levels

Ecological investigation levels (EIL) and added contaminant limits (ACL), have not been evaluated due to the construction of four basement levels at the site. There are not considered to be any environmental receptors as a result.

2.4 Ecological screening levels

The ESL's have not been evaluated due to the construction of four basement levels at the site. There are not considered to be any environmental receptors as a result.

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;
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services.

The adopted management limits are in Table 4.

Table 4: 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
TRH F1	Fine	800
TRH F2	Fine	1000
TRH F3	Fine	3500
TRH F4	Fine	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. Groundwater

3.1 Introduction

The groundwater investigation levels (GIL) used for interpretation of the groundwater data (as a Tier 1 assessment) have been selected for the purposes of a preliminary screening tool, the most conservative criteria for Residential B Land use has been adopted.

Table 5: Groundwater investigation level rationale

Receptor / beneficial use	GIL	Source	Comments / rationale
Aquatic ecosystem	DGV	ANZG (2018)	Freshwater 99% LOP for bioaccumulative contaminants

Receptor / beneficial use	GIL	Source	Comments / rationale
			95% LOP for non-bioaccumulative contaminants
Building occupants (vapour intrusion)	HSL	NEPC (2013)	2 m to <4 m, 4-8 m, and >8m based on measured depths to groundwater. Note that the four level basement is likely to sit within groundwater, and therefore the HSL do not apply. If concentrations exceed the laboratory PQL the report will recommend a site specific assessment of groundwater seepage risk into the new basement.

Notes: DGV default guideline value
% LOP percentage level of protection of species
HSL health screening level
GV guideline value
LTV long term value (up to 100 years)
STV short term value (up to 20 years)

3.2 Groundwater investigation levels for aquatic ecosystems

The DGV for the protection of aquatic ecosystems derived from ANZG (2018) are in Table 6.

Table 6: Groundwater investigation levels for protection of aquatic ecosystems (µg/L)

Contaminant	Freshwater DGV 95% LOP	Notes
Metals / metalloids		
Arsenic	24 / 13	Levels provided for As III / As IV respectively. Moderate reliability.
Cadmium	0.2	Very high reliability.
Chromium (VI)	1	Chromium VI levels adopted as initial screen for total chromium. Very high reliability.
Copper	1.4	Very high reliability.
Lead	3.4	Moderate reliability.
Mercury (inorganic)	0.06	99% LOP adopted as recommended due to potential for bioaccumulation. Moderate reliability.
Nickel	11	Low reliability.
Zinc	8	Very high reliability.
BTEX		
Benzene	950	Moderate reliability.
Ethylbenzene	80	Unknown reliability.
m-Xylene	75	Unknown reliability.
o-xylene	350	Low reliability.
p-Xylene	200	Low reliability.

Contaminant	Freshwater DGV 95% LOP	Notes
Toluene	180	Unknown reliability.
PAH		
Anthracene	0.01	99% LOP adopted as recommended due to potential for bioaccumulation. Unknown reliability.
Benzo(a)pyrene	0.1	99% LOP adopted as recommended due to potential for bioaccumulation. Unknown reliability.
Fluoranthene	1	99% LOP adopted as recommended due to potential for bioaccumulation. Unknown reliability.
Naphthalene	16	Low reliability.
Phenanthrene	0.6	99% LOP adopted as recommended due to potential for bioaccumulation. Unknown reliability.
OCP		
Aldrin	0.001	Unknown reliability and LOP.
Chlordane	0.03	99% LOP adopted as recommended due to potential for bioaccumulation. Moderate reliability.
DDT	0.006	99% LOP adopted as recommended due to potential for bioaccumulation. Moderate reliability.
Dieldrin	0.01	Unknown reliability and LOP.
Endosulfan	0.03	99% LOP adopted as recommended due to potential for bioaccumulation. Moderate reliability.
Endrin	0.01	99% LOP adopted as recommended due to potential for bioaccumulation. Moderate reliability.
Heptachlor	0.01	99% LOP adopted as recommended due to potential for bioaccumulation. Moderate reliability.
Methoxychlor	0.005	Unknown reliability and LOP.
OPP		
Chlorpyrifos	0.01	Moderate reliability.
Diazinon	0.01	Moderate reliability.
Dimethoate	0.15	Low reliability.
Fenitrothion	0.2	Moderate reliability.
Malathion	0.05	Moderate reliability.
Parathion	0.004	Moderate reliability.
PCB		
Aroclor 1242	0.3	99% LOP adopted as recommended due to potential for bioaccumulation. Low reliability.

Contaminant	Freshwater DGV 95% LOP	Notes
Aroclor 1254	0.01	99% LOP adopted as recommended due to potential for bioaccumulation. Moderate reliability.
VOC		
Tetrachloroethene (PCE)	70	Unknown reliability.
Trichloroethene (TCE)	330	Unknown reliability.
1,1-dichloroethene (DCE)	700	Unknown reliability.
Chloroethene (vinyl chloride / VC)	100	Unknown reliability.
Tetrachloromethane (carbon tetrachloride / CT)	240	Unknown reliability.
Trichloromethane (chloroform / TCM)	370	99% LOP adopted as recommended to protect key species from chronic toxicity. Unknown reliability.
Inorganics		
Ammonia	900	Very high reliability.

Notes: 95% LOP for non-bioaccumulative contaminants
99% LOP for bioaccumulative contaminants

3.3 Health screening levels for vapour intrusion

The HSL to evaluate potential vapour intrusion risks derived from NEPC (2013) are in Table 7. There are no generic HSL for groundwater within 2 m of the ground (or basement) level.

Table 7: Groundwater health screening levels for vapour intrusion (µg/L)

Contaminant	HSL-A&B	HSL-A&B	HSL-A&B	Solubility limit
SAND	**2 m to <4 m**	**4 m to <8 m**	**8 m+**	**-**
Benzene	800	800	900	59 000
Toluene	NL	NL	NL	61 000
Ethylbenzene	NL	NL	NL	3900
Xylenes	NL	NL	NL	21 000
Naphthalene	NL	NL	NL	170
TRH F1	1000	1000	1000	9000
TRH F2	1000	1000	1000	3000

Notes: TRH F1 is TRH C_6-C_{10} minus BTEX
TRH F2 is TRH >C_{10}-C_{16} minus naphthalene
The solubility limit is defined as the groundwater concentration at which the water cannot dissolve any more of an individual chemical based on a petroleum mixture. The soil vapour that is in equilibrium with the groundwater will be at its maximum. If the derived groundwater HSL exceeds the water solubility limit, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result 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'.

4. References

ANZECC. (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australia and New Zealand Environment and Conservation Council.

ANZG. (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Canberra, ACT: Australian and New Zealand Governments and Australian state and territory governments.

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.

NHMRC, NRMMC. (2022). *Australian Drinking Water Guidelines 6 2011, Version 3.7*. Canberra: National Health and Medical Research Council, National Resource Management Ministerial Council.

Appendix E

Data Quality Objectives

1. Introduction

The objective of the validation plan is to assess to assess the results of validation testing against the remediation acceptance criteria (RAC) stated within Section 11, assess the resultant suitability of the site for the intended land use, and to provide information on any environmental impacts which may have resulted from the works.

The validation assessment will be conducted with reference to the seven step data quality objectives process (DQO) as outlined in NEPC (2013), described below.

2. Data quality objectives

Table 1: Data quality objectives

Step	Summary
1: State the problem	The site requires remediation and validation of remediation in order to render it suitable for a mixed-use residential re-development (commercial / industrial land use category). The objective of the validation plan is to confirm the successful implementation of this remediation action plan. A conceptual site model (CSM) for the proposed development has been prepared (Section 7).
2: Identify the decisions / goal of the study	The CSM identifies the contaminants of potential concern (CoPC) and the likely impacted media. The key CoPC impacting the site are: • The UST, CoPC include TRH, BTEX and PAH. The validation sampling results will be compared against the RAC. The preferred remediation strategy outlined in the RAP is excavation, removal and validation of the UST excavation. The success of the remediation and subsequent validation will be based on a comparison of the analytical results for all CoPC to the adopted RAC.
3: Identify the information inputs	Relevant inputs to the decision include: • The CSM identifying CoPC and affected media; • Results analysed for the relevant CoPC using NATA accredited laboratories and methods, where possible; • Field and laboratory QA/QC data to assess the suitability of the environmental data for the validation assessment; and • Results compared with the RAC.
4: Define the study boundaries	The lateral boundaries of the site are shown on Drawing 1, Appendix A. The vertical boundaries are to the extent of contamination impact as determined from the site history assessment, site observations and previous investigations used to inform the RAP.
5: Develop the analytical approach (or decision rule)	The decision rule is to compare all analytical results with RAC (i.e. as basement excavation progresses, the VENM and non-VENM soil / rock in the vicinity of the UST need to be segregated facilitating off-site disposal).

Step	Summary
6: Specify the performance or acceptance criteria	Complete removal of the UST and any hydrocarbon impacted fill / soil / rock. Appropriate classification of fill / soil / rock adjacent to the UST to facilitate off-site disposal.
7: Optimise the design for obtaining data	Sampling design as per Section 12.4.

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 F

Contingency Plan and Unexpected Finds Protocol

1. General

Where the site conditions are found to be different than that anticipated during the remediation works, the proposed remediation approach may not be appropriate for the contamination encountered. In such cases the Environmental Consultant is to re-assess the contamination and remediation approach. Where necessary the Environmental Consultant will prepare an addendum to, or revision of, this RAP.

2. Contingency plan

This contingency plan has been developed to provide guidance on processes to follow if contamination (or indicators of contamination), other than that included in the remediation strategy, (Section 10) is encountered during the remediation works. Any such finds shall be surveyed and the location documented.

Although the site has been subject to previous investigation(s), there remains a potential for soil contamination to be present between sampled locations. In the event that signs of soil contamination, other than that included in the remediation strategy, are encountered during remediation e.g. petroleum which wasn't previously identified, the following protocols will apply:

- The Site Manager is to be notified, and the affected area closed off by the use of barrier tape and warning signs;
- The Environmental Consultant is to be notified to inspect the area and assess the significance of the potential contamination and determine extent of remediation works (if deemed necessary) to be undertaken. An assessment report and management plan detailing this information will be compiled by the Environmental Consultant and provided to the Principal's Representative;
- The assessment results together with a suitable management plan shall be provided by the Principal's Representative to the Consent Authority (if required by the development consent);
- The agreed management / remedial strategy, based on the RAP and relevant guidelines (e.g. WA DoH (2021), for asbestos issues), shall be implemented; and
- All details of the assessment and remedial works are to be included in the site validation report.

3. Unexpected finds protocol

This unexpected finds protocol (UFP) has been developed to provide guidance on processes to follow if any unexpected find is encountered during the remediation or future civil and construction works. Any unexpected finds should be surveyed and the location documented.

All site personnel are to be inducted into their responsibilities under this (UFP), which should be included or referenced in the Remediation Contractors Environmental Management Plan.

All site personnel are required to report unexpected signs of environmental concern to the Site Manager if observed during the course of their works e.g. presence of potential unexploded ordinance, unnatural staining, potential contamination sources (such as buried drums or tanks) or chemical spills.

Should signs of concern be observed, the Site Manager, as soon as practical, will:

- Stop work in the affected area and ensure the area is barricaded to prevent unauthorised access;
- Notify authorities needed to obtain emergency response for any health or environmental concerns (e.g. fire brigade);
- Notify the Principal's Representative of the occurrence;
- Notify any of the authorities that the Remediation Contractor is legally / contractually required to notify (e.g. EPA, Council); and
- Notify the Environmental Consultant.

The Principal's Representative is to notify any of the authorities which the Principal is legally / contractually required to notify (e.g. EPA, Council). Where appropriate, the Principals Representative will also implement appropriate community consultation in accordance with the Communications Plan.

The Environmental Consultant will assess the extent and significance of the find and develop an investigation, remediation or management approach using (where possible) the principles and procedures already outlined in the RAP. Where a Site Auditor is involved, the proposed approach will be discussed and agreed with the Site Auditor prior to implementation.

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.

WA DoH. (2021). *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.* WA Department of Health.