Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Remediation Action Plan

Proposed Commercial Development
2-8a Lee Street, Haymarket

Prepared for
Toga Development and Construction Pty Ltd

Project 86884.05
July 2022

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	86884.05	Document No.	R.003.Rev0
Document title	Remediation Action Plan Proposed Commercial Development		
Site address	2-8a Lee Street, Haymarket		
Report prepared for	Toga Development and Construction Pty Ltd		
File name	86884.05.R.003.Rev0		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Wen-Fei Yuan	Paul Gorman	15 July 2022

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 0	1	-	David Springford of Toga Development and Construction Pty Ltd

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

	Signature	Date
Author	Wen-fei yuan	15 July 2022
Reviewer	P. Gorman	15 July 2022

bsi. ISO 9001 Quality Management
FS 604853

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666

Executive Summary

This Remediation Action Plan (RAP) has been prepared by Douglas Partners Pty Ltd (DP) to accompany a detailed State significant development (SSD) development application (DA) for the mixed-use (commercial/retail/hotel) redevelopment proposal at TOGA Central, located at 2 & 8A Lee Street, Haymarket (the site). The site is legally described as Lot 30 in Deposited Plan 880518, Lot 13 in Deposited Plan 1062447 and part of Lot 14 in Deposited Plan 1062447. The site is also described as 'Site C' within the Western Gateway sub-precinct at the Central Precinct.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the SSD DA (SSD 33258337).

The RAP was commissioned by Toga Development and Construction Pty Ltd (Toga) and was undertaken in accordance with the variation work carried out under an amended Toga Major Consultancy Services agreement (contract number CSC-01, dated 10 March 2021) and DP email proposal dated 26 May 2022 (Proposal ref: 86884.05.P.001.Rev0).

The proposed development is to include:

- The excavation of a four-level basement and access tunnels beneath the current Adina Hotel and Henry Deane Plaza, with localised deeper excavation for lift shafts and building cores.
- Deepest excavation is expected to be RL 1 m, in the area of the Henry Deane Plaza (currently RL 17.6 m).
- The construction of a multi-story commercial (hotel/office) tower above the basement levels.

The RAP has been informed by the results of previous environmental and geotechnical investigations as listed and summarised in Section 6. The primary objectives of the RAP are to establish the following:

- Data gap investigations in previously identified (and current) inaccessible areas of the site and following demolition of building and other underground site structures;
- Appropriate remedial options to render the site suitable, from a site contamination perspective, for the proposed commercial development;
- Requirements to carry out suitable validation and waste classification of soils; and
- New and Unexpected Finds Protocol (UFP) to be implemented during basement excavation such that any finds of suspected (but as yet not found) and unexpected contamination are appropriately investigated and managed.

The RAP also addresses the following measures to be implemented during the remediation work:

- The validation assessment criteria to be adopted for the remediation of the site;
- Appropriate environmental safeguards required to complete the remediation work in an environmentally acceptable manner; and
- Appropriate occupational, health and safety procedures required to complete the remediation work in a manner that would not pose a risk to the health of site workers or users.

Identified areas of environmental concern (AECs) from previous contamination investigations include:

- Lead and PAH exceedances of the adopted site assessment criteria (SAC) identified in the footprint of a contaminated soil containment cell as per ERM (2001) report, refer Section 6.5 of this RAP;
- Lead and PAH waste class exceedances were detected in boreholes BH1003, BH1004, BH1005 and BH1007 within or in proximity of the containment cell; and
- Friable asbestos was identified in borehole BH1007 at a depth of 2.0-2.1 in proximity to the containment cell.

Summary of remediation work associated with the above AECs includes:

- **Data Gap Investigation:** assess the nature and extent of lead, PAH and asbestos contamination within/near the footprint of the containment cell and to expand on the general coverage of the site.
- **Post demolition:** validate removal of hazardous building materials identified on surficial fill/soil following demolition;
- **Remediation:** validate removal of lead, PAH and asbestos contamination within/near the footprint of the containment cell following basement excavation;
- **New or Unexpected Contamination:** address such finds, as might be encountered during the redevelopment works and which may require addenda or amendment to this RAP; and
- **Reinstatement of the Cell, as required:** repair and reinstate the walls of the containment cell, as required, to ensure that the integrity of the cell is maintained.

The RAP concludes that the proposed mixed-use (commercial/retail/hotel) redevelopment is suitable and warrants approval subject to the implementation of the above work.

Significant contamination identified during the data gap analysis and/or addressing unexpected finds may warrant an amendment or addendum to this RAP such that appropriate actions are managed and documented.

Note: this RAP does not form a detailed specification for the proposed site remediation works, but rather represents a planning document which outlines the means by which site remediation can be achieved.

Table of Contents

Page

Remediation Action Plan
Proposed Commercial Development
2-8a Lee Street, Haymarket

1. Introduction

Douglas Partners Pty Ltd (DP) has prepared this remediation action plan (RAP) for the proposed commercial development at 2-8a Lee Street, Haymarket, otherwise known as 'TOGA Central' or the Site. The RAP was commissioned by Toga Development and Construction Pty Ltd (Toga) under an amended Toga Major Consultancy Services agreement (contract number CSC-01, dated 10 March 2021) and DP's email proposal dated 26 May 2022 (Proposal ref: 86884.05.P.001.Rev0).

The key objectives of the RAP are to establish the following:

- Data gap investigations in previously identified (and current) inaccessible areas of the site and following demolition of building and other underground site structures;
- Appropriate remedial options to render the site suitable, from a site contamination perspective, for the proposed commercial development;
- Requirements to carry out suitable validation and waste classification of soils; and
- New and Unexpected Finds Protocol (UFP) to be implemented during basement excavation such that any finds of suspected (but as yet not found) and unexpected contamination are appropriately investigated and managed.

The RAP is required to support a state significant development (SSD) application (SSD 33258337) for a mixed-use (retail/commercial/hotel) redevelopment proposal at TOGA Central. The Site is shown on Drawing 1 in Appendix B.

[1]*The purpose of the SSD DA is to complete the restoration of the heritage-listed building on the site, delivery of new commercial floorspace and public realm improvements that will contribute to the realisation of the Government's vision for an iconic technology precinct and transport gateway. The application seeks consent for the conservation, refurbishment and adaptive re-use of the Adina Hotel building (also referred to as the former Parcel Post building (fPPb)), construction of a 45-storey tower above and adjacent to the existing building and delivery of significant public domain improvements at street level, lower ground level and within Henry Deane Plaza. Specifically, the SSD DA seeks development consent for:*

- *Site establishment and removal of landscaping within Henry Deane Plaza.*
- *Demolition of contemporary additions to the fPPb and public domain elements within Henry Deane Plaza.*

[1] Text in italic is sourced from Urbis Pty Ltd Memo on: *TOGA Central SSD DA Consultant Reports – Mandatory Inclusions*, Revision 6, 12 July 2022 (Urbis 2022).

- *Conservation work and alterations to the fPPb for retail premises, commercial premises, and hotel and motel accommodation. The adaptive reuse of the building will seek to accommodate:*
  - *Commercial lobby and hotel concierge facilities,*
  - *Retail tenancies including food and drink tenancies and convenience retail with back of house areas,*
  - *4 levels of co-working space,*
  - *Function and conference area with access to level 7 outdoor rooftop space, and*
  - *Reinstatement of the original fPPb roof pitch form in a contemporary terracotta materiality.*
- *Provision of retail floor space including a supermarket tenancy, smaller retail tenancies, and back of house areas below Henry Deane Plaza (at basement level 1 (RL12.10) and lower ground (RL 16)).*
- *Construction of a 45-storey hotel and commercial office tower above and adjacent to the fPPb. The tower will have a maximum building height of RL 202.28m, and comprise:*
  - *10 levels of hotel facilities between level 10 – level 19 of the tower including 204 hotel keys and 2 levels of amenities including a pool, gymnasium and day spa to operate ancillary to the hotel premises. A glazed atrium and hotel arrival is accommodated adjacent to the fPPb, accessible from Lee Street.*
  - *22 levels of commercial office space between level 23 – level 44 of the tower accommodated within a connected floor plate with a consolidated side core.*
  - *Rooftop plant, lift overrun, servicing and BMU.*
- *Provision of vehicular access into the site via a shared basement, with connection points provided to both Block A (at RL 5) and Block B (at RL5.5) basements. Primary access will be accommodated from the adjacent Atlassian site at 8-10 Lee Street, Haymarket, into 4 basement levels in a split-level arrangement. The basement will accommodate:*
  - *Car parking for 106 vehicles, 4 car share spaces and 5 loading bays.*
  - *Hotel, commercial and retail and waste storage areas.*
  - *Plant, utilities and servicing.*
- *Provision of end of trip facilities and 165 employee bicycle spaces within the fPPb basement, and an additional 72 visitor bicycle spaces within the public realm.*
- *Delivery of a revitalised public realm across the site that is coordinated with adjacent development, including an improved public plaza linking Railway Square (Lee Street), and Block B (known as 'Central Place Sydney'). The proposal includes the delivery of a significant area of new publicly accessible open space at street level, lower ground level, and at Henry Deane Plaza, including the following proposed elements:*
  - *Provision of equitable access within Henry Deane Plaza including stairways and a publicly accessible lift.*
  - *Construction of raised planters and terraced seating within Henry Deane Plaza.*
  - *Landscaping works within Henry Deane Plaza.*
- *Utilities and service provision.*
- *Realignment of lot boundaries.*

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 17 December 2021 and issued for the SSD DA. Specifically, this report has been prepared to respond to the SEARs requirement issued below.

Specifically, this report has been prepared to respond to the SEARs requirement issued below.

Table 1: SEARs with Reference to Reports

SEARs	Report Reference
18. Contamination and Remediation: *In accordance with SEPP 55, assess and quantify any soil and groundwater contamination and demonstrate that the site is suitable (or will be suitable, after remediation) for the development.*	• Preliminary Site Investigation (summarised in Section 6.1 of this RAP); • Detailed Site Investigation (summarised in Section 6.3 of this RAP); • Remedial Action Plan (this document); and • Preliminary Long-term Environmental Management Plan (not required at this stage; subject to the final design of the basement levels).

The assessment process, including approval of this RAP, is subject to a Site Audit by an EPA accredited Site Auditor, Mr Rod Harwood of Harwood Environmental Consultants Pty Ltd, under part 4 of the *Contaminated Land Management (CLM) Act* 1997).

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, 2020a); and
- CRC CARE *Remediation Action Plan: Development - Guideline on Establishing Remediation Objectives* (CRC CARE, 2019a).

Notes: this RAP does not form a detailed specification for the proposed site remediation works, but rather represents a planning document which outlines the means by which site remediation can be achieved. This document must be read in conjunction with all appendices including the notes provided in Appendix A.

2. Proposed Development

Specifications of the proposed development are outlined in the introduction (Section 1) of this RAP as per Urbis' requirement.

It is understood that continuous refinement on the details of the proposed development plans[2] will progress.

[2] Bates Smart Pty Ltd, SSDA Drawings, Project No. S12550

3. Scope of Work and Objective of the Remediation Action Plan

The overarching objective of the RAP is to provide a mechanism by which the Site can be remediated in an acceptable manner, with minimal environmental impact, and to a condition suitable for the proposed land-use.

The scope of works to achieve the objective is as follows:

- Summarising the findings of previous investigations used to inform the status of contamination and contamination risk at the site;
- Presenting a conceptual site model (CSM) to list potential and likely contamination source, pathway and receptor linkages;
- Defining the anticipated extent of remediation;
- Setting contamination management and remediation objectives so that the Site will be suitable for its proposed use, and which will result in no potentially unacceptable risk to human health or the environment;
- Assessing, selecting and justifying a preferred approach to management and / or remediation, which includes the consideration of the principles of ecologically sustainable development;
- Establishing the environmental safeguards required to complete the remediation works;
- Including contingency plans and an unexpected finds protocol;
- Outlining waste classification, handling and tracking requirements;
- Identifying how successful implementation of the RAP will be demonstrated / validated; and
- Identifying the need for, and nature of, any long-term management and/or monitoring following the completion of management / remediation and, if required, provide an outline of an environmental management plan.

4. Site Identification and Description

Site Address	2-8a Lee Street, Haymarket
Legal Description	• Lot 13, Deposited Plan 1062447 (8a Lee Street, Haymarket); • Lot 30, Deposited Plan 877478 (2 Lee Street Haymarket); and • A portion of Lot 14 in DP1062447
Area	Approximately 4200 m^2
Zoning	B8 Metropolitan Centre
Local Council Area	City of Sydney

Surrounding Uses	• North: Ramp driveway to YHA hostel, Ambulance Avenue, bus bay, an open space area, Pitt Street and commercial (office) buildings; • East: YHA hostel, Central Station; • South: retail spaces in Henry Deane Plaza and three adjoining commercial buildings; and • West: Lee Street, Railway Square, George Street, commercial buildings.

[3]*The site is located within the City of Sydney Local Government Area (LGA). The site is situated 1.5km south of the Sydney CBD and 6.9km north-east of the Sydney International Airport within the suburb of Haymarket.*

The site is located within the Western Gateway sub-precinct, an area of approximately 1.65ha that is located immediately west of Central Station within Haymarket on the southern fringe of the Sydney CBD. Immediately north of Central Station is Belmore Park, to the west is Haymarket (including the University of Technology, Sydney and Chinatown), to the south and east is rail lines and services and Prince Alfred Park and to the east is Elizabeth Street and Surry Hills.

Central Station is a public landmark, heritage building, and the largest transport interchange in NSW. With regional and suburban train services, connections to light rail, bus networks and to Sydney Airport, the area around Central Station is one of the most-connected destinations in Australia.

The site is located at 2 & 8A Lee Street, Haymarket and is legally described as Lot 30 in Deposited Plan 880518, Lot 13 in Deposited Plan 1062447 and part of Lot 14 in Deposited Plan 1062447.

*The land that comprises the site under the Proponent's control (either wholly or limited in either height or depth) comprises a total area of approximately **4,159sqm**.*

*The location of the TOGA Central site is illustrated in **Figure 1**.*

[3]Text in italic is sourced from Urbis Pty Ltd Memo on: *TOGA Central SSD DA Consultant Reports – Mandatory Inclusions*, Revision 6, 12 July 2022 (Urbis 2022).

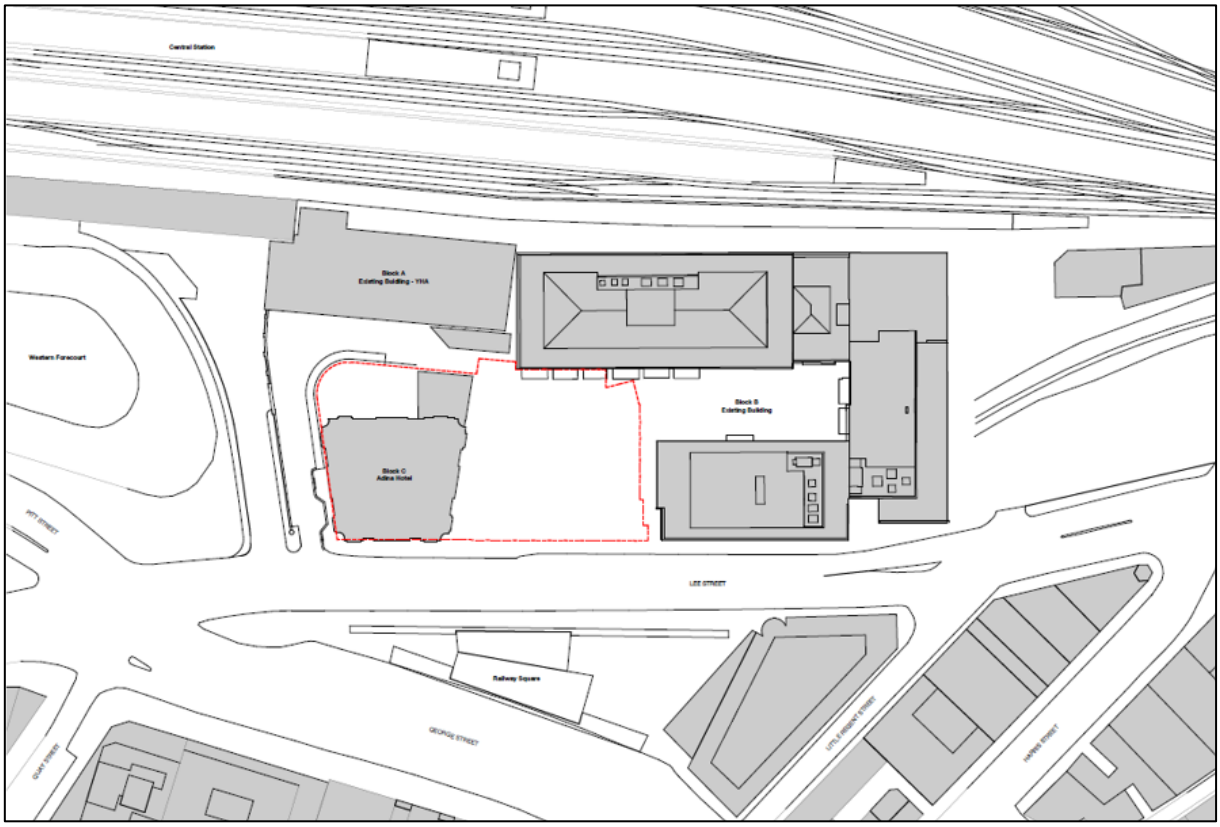


Figure 1: Site Identification Plan (sourced from Bates Smart)

The site currently comprises the following existing development:

- *Lot 30 in Deposited Plan 880518 (Adina Hotel building): the north-western lot within the Western Gateway sub-precinct accommodates a heritage-listed building which was originally developed as the Parcels Post Office building. The building has been adaptively re-used and is currently occupied by the Adina Hotel Sydney Central. The eight-storey building provides 98 short-stay visitor apartments and studio rooms with ancillary facilities including a swimming pool and outdoor seating at the rear of the site.*
- *Lot 13 in Deposited Plan 1062447 and part of Lot 14 in Deposited Plan 1062447 (Henry Deane Plaza): the central lot within the Western Gateway sub-precinct adjoins Lot 30 to the south. It accommodates 22 specialty food and beverage, convenience retail and commercial service tenancies. The lot also includes publicly accessible space which is used for pop-up events and a pedestrian thoroughfare from Central Station via the Devonshire Street Tunnel. At the entrance to Devonshire Street Tunnel is a large public sculpture and a glazed structure covers the walkway leading into Railway Square. This area forms part of the busy pedestrian connection from Central Station to Railway Square and on to George and Pitt Streets, and pedestrian subways.*

The site is listed as an item of local significance under Schedule 5 of the Sydney Local Environmental Plan 2012 'Former Parcels Post Office including retaining wall, early lamp post and building interior', Item 855.

The site is also included within the Central Railway Station State heritage listing. This is listed on the State Heritage Register 'Sydney Terminal and Central Railway Station Group', Item SHR 01255, and in

Schedule 5 of the Sydney Local Environmental Plan 2012 'Central Railway Station group including buildings, station yard, viaducts and building interiors' Item 824.

The site is not however listed independently on the State Heritage Register. There is an array of built forms that constitute Central Station, however the Main Terminal Building (particularly the western frontage) and associated clocktower constitute key components in the visual setting of the Parcel Post building.

5. Environmental Setting

Regional Topography	The overall regional topography appears to slope down towards north and west of the Site.
Site Topography	The Site topography varies from 14 m relative to the Australian height datum (AHD) to 20 m AHD as shown on published 2 m elevation contours.
Soil Landscape	Reference to the Sydney 1:100 000 Soils Landscape Sheet indicates the Site is underlain by the Blacktown soil landscape (mapping unit bt), characterised by gently undulating rises on Wianamatta Group shales and Hawkesbury shale, with local relief to 30 m and slopes usually less than 5%. The natural undeveloped landscape is typically represented by broad rounded crests and ridges with gently inclined slopes. Soils range from shallow (<1 m) red-brown podzolic soils - comprising mostly clayey soils on crests and upper slopes - to deep (1.5 - 3 m) yellow-brown clay soils on lower slopes and areas of poor drainage. These soils are typically moderately reactive with low fertility, poor soil drainage and highly plastic subsoil.
Geology	Reference to the Sydney 1:100 000 Geological Series Sheet indicates that the Site is underlain by Triassic age Ashfield Shale overlying Hawkesbury Sandstone, and that the Site is located near Quaternary age alluvial sediments, including transgressive dune sands. Although not specifically shown on the geological map, the Mittagong Formation is likely to be present at the transition between the Ashfield Shale and Hawkesbury Sandstone geological units. The Quaternary sediments typically comprise medium to fine grained sand. The Ashfield Shale typically comprises black to dark grey shales and laminite. The Mittagong Formation consists of interbedded shale, laminite and fine grained quartz sandstone, and the underlying Hawkesbury Sandstone typically comprises horizontally bedded and vertically jointed, massive and cross-bedded, medium grained quartz sandstone with a few shale interbeds. A former creek is shown on a plan from the year 1855 from the City of Sydney Archives. The Devonshire Street Pedestrian Tunnel is inferred to

	be aligned sub-parallel to and either co-incident with or adjacent to the former creek. The geological map indicates the possible presence of igneous dykes near to and north of the Site, striking in a north-westerly direction. These dykes are commonly steeply dipping (often near-vertical) slabs of igneous rock which intrude through the bedrock, with measured widths in the Greater Sydney Region ranging between a centimetre or less to about 6 m (Ref. 3). These dykes could be associated with zones of closely spaced fractures within high strength rock. Although no evidence of dykes was found in the previous investigations there is a possibility that a dyke could cross the Site. Previous Site investigations encountered alluvial and residual soils, and sandstone bedrock consistent with the Mittagong Formation and Hawkesbury Sandstone.
Acid Sulfate Soils	Reference to the published Acid Sulfate Soils Mapping indicates that the Site lies in a "Class B" area, where there is a low probability of occurrence of acid sulfate soils. Furthermore, given that the Site lies at an elevation of approximately 14 to 20 m AHD, the probability of ASS being present on site is considered extremely unlikely. Further assessment of acid sulphate soil is not considered to be required.
Surface Water	Surface water is anticipated to drain to the local stormwater system and follow the general regional topography.
Groundwater	Groundwater is expected to flow in a north north-westerly direction towards Blackwattle Bay and Darling Harbour which is located approximately 1.1 km northwest of the Site. Inferred groundwater flow direction is shown on Drawing M1 in Appendix B. DP note that groundwater located in a shale profile can be saline in nature with elevated total dissolved solids. Review of the groundwater bore database maintained by the Department of Primary Industry (DPI) indicates that there were 43 registered groundwater bores located to the southwest, within 500 m of the Site, however, standing water level (SWL) data only available for GW109500, GW109501, GW109502 and GW109503 with SWL at approximately 2.2 m to 2.3 m. The authorised purpose of the bores were reported to be for groundwater monitoring. Relevant groundwater wells installed near the site boundary in the adjacent site indicated similar groundwater levels as per DPI database, ranging between 2.3 m and 3 m (RL 13.0 m and 13.4 m AHD). The site's groundwater levels varied, ranging between 2,8 m and 16.4 m (RL -3.0 m and 11.5 m AHD) predominately due to site's variable elevation i.e. tunnel and basement level

6. Review of Relevant Reports

The following relevant reports were available for review:

The Site:

- DP *Report on Preliminary Site (Contamination) Investigation, Proposed Multistorey Building Redevelopment, 2 & 8A Lee Street, Haymarket*, Reference: 86884.01.R.001.Rev1, dated February 2020 (DP 2020);
- DP *Report on Geotechnical Investigation, Proposed Commercial Development, 2-8a Lee Street, Haymarket*, Reference: 86884.02.R.001.Rev1, dated July 2021 (DP 2021).
- DP *Factual Summary Report on Contamination Testing, Proposed Commercial Development, 2-8a Lee Street, Haymarket*, Reference: 86884.02.R.002.Rev0, dated April 2021 (DP 2021a); and
- DP *Preliminary In Situ Waste Classification, 2-8a Lee Street, Haymarket*, Reference: 86884.02.R.003.Rev0, dated April 2021 (DP 2021b);
- DP *Sampling and Analysis Quality Plan*, *2-8a Lee Street, Haymarket*, Reference: 86884.05.R.001.Rev0, dated 23 June 2022 (DP 2022);
- Harwood Environmental Consultants Pty Ltd, *Interim Advice 02*[4]*: Review of Environmental Management Plan (EMP) and Sampling and Analysis Quality Plan (SAQP)*, dated 1 July 2022 (HEC 2022); and
- DP *Detailed Site Investigation (Contamination), 2-8a Lee Street, Haymarket*, Reference: 86884.05.R.002.Rev0, dated 6 July 2022 (DP 2022a).

DP (2021), DP (2021a) and DP (2021b) investigations were undertaken concurrently.

DP used the soil and groundwater data obtained from DP (2021a) and DP (2021b) investigations to form the detailed site investigation (contamination), DSI. As such, the DSI report [DP (2022a)] supersedes both DP (2021a) and DP (2021b) reports; and is summarised in the subsection below.

Nearby Sites:

- *Environmental Resources Management Pty Ltd (ERM)*, Environmental Management Plan (EMP), Henry Deane Park, Lee Street, Sydney, Reference: 98252RP9-EMP (ERM 2001);
- *JBS&G Australia Pty Ltd, Data Gap Investigation, 14 to 30 Lee Street, Haymarket,* Reference: 59064 – 129805 (Rev1) (JBS&G 2021);
- *Arup Pty Ltd, Geotechnical Statement - DA Report, Central Place, Sydney,* Reference: CEN-ARP-REP-GE-0002, Version 1, March 2021 (Arup 2021);
- DP *Report on Detailed Site (Contamination) Investigation, Proposed Commercial Development, 8-10 Lee Street, Haymarket,* Reference: 86767.01.R.001.Rev0, 2022 (DP 2022b); and
- DP *Report on Supplementary (Contamination) Site Investigation, Proposed Commercial Development, 8-10 Lee Street, Haymarket*, Reference: 86767.06.R.001.Rev2, 2021 (DP 2021c).

[4] Please note HEC's Interim Advice 01 was not submitted to DP for review.

JBS&G (2021) report included review of JBS&G (2019)[5] investigation, discussed in Section 6.6.

DP (2021c) report incorporated review of DP (2022b) report, discussed in Section 6.8.

It is understood that a data-sharing agreement is in place among the site neighbours and Toga with the shared information.

The relevant borehole or test pit locations referenced in this section are shown on Drawing 2 in Appendix B.

6.1 DP (2020)

Preliminary site (contamination) investigation, PSI, DP (2020) included a review of site history information, a site walkover, and development of a preliminary conceptual site model (PCSM).

The site and surrounds had been used largely for commercial land use since the 1800s based on the site history information. The site was occupied by Benevolent Asylum, likely from the early 1800s until the building was demolished in 1901 - the year that construction works commenced on Central Station, located to the east of the site. The Carriage Shed, formerly located within the southern portion of the Site, and likely constructed in the early 1900s was also subsequently demolished. It was considered possible that hazardous building materials were used in the buildings. The demolition of the structures could therefore impact the area, especially if the demolition practices were poorly controlled.

In around 1911 to 1912, construction of the Parcels Post Office commenced, the heritage-listed building that currently occupies the north-western portion of the Site. The building is currently (2022) in use as the Adina hotel. Given the current use as a hotel and the laundry / cleaning activities undertaken in the basement level, along with the retail stores that occupy Henry Deane Plaza, the current site uses were considered a potential source of contamination, primarily through the groundwater pathway.

Based on review of the borehole logs in the vicinity of the site (DP 2021) report, it was considered likely that fill has been placed on the site, used for historical levelling purposes. Furthermore, it was considered possible that material excavated from Central Station during the construction stage, was used as fill at the Site. Off-site contamination from Central Station, located up-gradient to the Site was also considered to be a potential source of contamination to the Site, primarily though the groundwater pathway.

Four potential contamination sources were identified during the PSI. These are summarised in Table 4, Section 7 of this RAP.

The identified contaminants of potential concern (COPC) at the site comprised:

- Heavy metals (including As, Cd, Cr, Cu, Pb, Hg, Ni, Zn);
- Total recoverable hydrocarbons (TRH);
- Benzene, toluene, ethylbenzene and xylenes (BTEX);

[5] *JBS&G Targeted Detailed Site Investigation – 14-18, 20-24 and 26-30 Lee Street, Haymarket, NSW*. Reference: 125138, November 2019 (JBS&G 2019). This report was not supplied to DP for review.

- Polycyclic aromatic hydrocarbons (PAH);
- Organochlorine pesticides (OCP);
- Organophosphorus pesticides (OPP);
- Polychlorinated biphenyls (PCB);
- Volatile organic compounds (VOC)[6];
- Phenols;
- Asbestos; and
- Synthetic mineral fibres (SMF).

Overall, based on the site history information, the Site was considered to pose a moderate risk of contamination, however, a pre-demolition hazardous building material survey, and intrusive soil and groundwater investigation was recommended to confirm this conclusion.

6.2 DP (2021)

The field work for the investigation was completed in two stages:

- First stage: completed within both the Adina Hotel basement and Henry Deane Plaza during March 2021; and
- Second stage: completed within a retail tenancy area on the southern side of the Adina Hotel footprint during June 2021.

The two stages of work included the drilling of twelve boreholes at the locations shown on Drawing 2 in Appendix B (Boreholes BH1001-BH1007, BH1003A, BH1004A, BH2001-BH2002, and BH2001A), and installation of three standpipes in boreholes BH1002, BH1003A and BH1007.

In conjunction with groundwater sampling activities for contamination assessment purposes, water levels were measured in the new standpipes during March and June 2021, and also in a selection of existing standpipes near the eastern and northern site boundaries (i.e., boreholes BH8, BH107A, BH107Band BH202, refer to Drawing 2 in Appendix B). Rising head tests were also carried out within boreholes BH1002, BH1003A, BH1007 and BH202. Extended groundwater monitoring of water levels within standpipes was concluded following the completion of drilling in June 2021.

The subsurface conditions encountered in the boreholes within the site can be summarised as:

STONE TILE (Henry Deane Plaza only):	Stone tiles (20-40 mm thick) laid over a layer of sand and cement 0.05-0.08 m thick; over
CONCRETE:	Single concrete slab (steel reinforcement not observed in Boreholes BH1001, BH1002, BH2001, BH2001A and BH2002), thickness ranging between 0.08-0.24 m; over

[6] Screening contaminant for volatile chlorinated hydrocarbon (VCH)

FILL:	Gravel or gravel and bricks (110 mm thick: Boreholes BH1001 and BH1002 only), or layers of clayey sand, sand, silt, or sandy clay, with either silty clay and gravel, cobble or boulder-sized fragments of sandstone, siltstone, igneous rock (railway ballast), concrete and brick rubble, or other anthropogenic materials (e.g., plastic bottles), trace ash and slag. The boreholes within the Henry Deane Plaza included one or more layers of building rubble in a clayey sand matrix, to depths ranging between 1.2 m and 3.5 m (refusal to Boreholes BH1003, BH1004 and BH1006 within these materials); over
ALLUVIAL SAND:	Medium dense to very dense alluvial sand (absent in Boreholes BH1001, BH1002 and BH2001A), typically wet, 1.0-3.7 m thick, including a thin layer (0.8 m thick) of stiff to very stiff silty clay in BH1007; over
ALLUVIAL SILTY CLAY:	Very soft to very stiff alluvial silty clay (Boreholes BH1004A and BH1005 only), 1.0-1.6 m thick, with traces of either charcoal and fine gravel; over
RESIDUAL CLAY:	Firm to very stiff residual silty clay or sandy clay (absent in Borehole BH1004A), 0.18-1.8 m thick, with traces of fine sand and / or gravel; over
RESIDUAL CLAYEY SAND or SANDY CLAY:	Medium dense to very dense residual clayey sand with occasional thin clay bands or very stiff to hard sandy clay (present in Boreholes BH1003, BH1005, BH1007 and BH2002 only), with relict rock texture (extremely weathered sandstone); over
SANDSTONE (MEDIUM GRAINED):	Very low to medium strength, medium grained sandstone, with both clay seams and iron-cemented bands of up to medium to high strength (absent in Boreholes BH1005 and BH1007); over
SANDSTONE (MEDIUM TO COARSE GRAINED):	Medium or high strength, medium to coarse grained sandstone, typically with widely spaced extremely low or very low strength bands.

The medium grained sandstone is interpreted to be part of the Mittagong Formation, and the underlying medium to coarse grained sandstone is interpreted to be Hawkesbury Sandstone.

The range of maximum water levels for the available standpipes, screened in the following materials, were:

- Alluvial soils: between elevations of RL11.9 m and RL13.5 m;
- Mittagong Formation: between elevations of RL13.7 m and RL13.9 m; and
- Hawkesbury Sandstone: between elevations of RL-2.8 m and RL13.5 m.

The variation in water level elevations ranged between 0.4-0.7 m for standpipes screened within rock (for both Mittagong Formation, Hawkesbury Sandstone, or both), and 0.6-0.9 m for standpipes screened

within alluvial soil. The measured levels in the sandstone formations indicated confined or semi-confined aquifers.

6.3 DP (2022a)

The DSI report incorporated soil and groundwater contamination data from eleven boreholes including three abandoned soil boreholes and three groundwater wells. The field investigation was carried out in conjunction with DP (2021) geotechnical investigation. The boreholes generally targeted the area of the proposed commercial building.

Eleven boreholes were drilled in the following locations:

- Existing Adina Hotel basement (BH1001 and BH1002); and
- Existing open-air portion of the Henry Deane Plaza between a retail tenancy (e.g., 'Priceline') and the southern side of a pedestrian ramp leading down into the Lee Street tunnel (BH 2001A, BH2002, BH1003, BH1003A, BH1004, BH1004A, BH1005, BH1006 and BH1007). Note: Boreholes BH1003, BH1004 and BH1006 were the three abandoned soil boreholes due to refusal on underground services/building rubble. Groundwater wells were installed in boreholes: BH1002, BH1003A and BH1007.

The above borehole locations are shown on Drawing 2 in Appendix B.

The subsurface conditions encountered in the boreholes within the Site are summarised in Section 6.2.

Soil samples selected for analysis included at least one fill sample from each borehole. Additional fill samples were selected from boreholes with large amounts of anthropogenic material and / or where several layers of fill were observed.

The PID screening recorded readings of less than 1 ppm for all samples with the exception of samples BH1007/2.5-2.95 and BH1007/4-4.45 which recorded values of 60 ppm and 16 ppm, respectively.

Three groundwater monitoring wells (BH1002, BH1003A and BH1007) installed for the geotechnical investigation along with three monitoring wells installed for previous DP investigations were used for groundwater sampling.

Groundwater was observed to be clear-yellow (BH107A), clear-grey (BH107B) and clear-brown (BH202, BH1002, BH1003A and 1007). No light non-aqueous phase liquid LNAPL was observed whilst sampling.

A total of twenty-four (24) soil samples (fill/natural) was submitted to a NATA-accredited laboratory for the analysis of heavy metals, PAH, TRH, BTEX, phenols, OCP, OPP, PCB, VOC and asbestos. Six groundwater samples were analysed for heavy metals (dissolved and total) PAH, TRH, BTEX, OCP, OPP, VOC, dissolved ions and cyanide.

Concentrations of BTEX, phenol, OCP, OPP and VOC were below the laboratory reporting limit and, hence, within the adopted site assessment criteria for a commercial land use. Concentrations of heavy metals, PAH, TRH and PCB were above the PQL but all within the adopted SAC.

Friable chrysotile asbestos was detected in sample BH1007/2.0-2.1. Building rubble (such as brick and concrete) was observed in the fill across the site and it was stated that asbestos containing material (ACM) can be associated with the building rubble in fill.

Concentrations of contaminants for the analysed soil samples in the Henry Dean Plaza area were within the contaminant thresholds (CT1) for General Solid Waste (GSW) as listed in the NSW EPA (2014) waste classification guidelines with the exception of:

- Lead in BH1005/1.55-1.65, with a concentration of 210 mg/kg, exceeding the CT1 of 100 mg/kg;
- Benzo(a)pyrene (B(a)P) in BH1003/0.25-0.3, BH1004/0.3-0.4, BH1004/ 0.6-0.7, BH1005/0.22-0.3, BH1005/0.5-0.6, BH1005/1.55-1.65 and BH1007/2.0-2.1. Exceedances ranged from 0.94 mg/kg to 8.4 mg/kg, exceeding the CT1 of 0.8 mg/kg; and
- Asbestos, which was detected in BH1007/2.0-2.1.

Toxicity characteristic leaching procedure (TCLP) analysis was undertaken on five samples with the highest B(a)P and lead contaminant concentrations to determine the leachability characteristics of the contamination. All concentrations were within specific contaminant concentration (SCC1) and TCLP1 for GSW. Furthermore, samples with the highest concentrations of PAH, including B(a)P, and lead were observed to contain ash and slag, possibly the source of the contamination.

The NSW EPA Immobilisation of Contaminants in Waste 1999/05 is a general immobilisation approval for ash / coal-contaminated materials, whilst the NSW EPA Immobilisation of Contaminants in Waste 2009/07 is a general immobilisation for metallurgical furnace slag. These immobilisations allow waste classification for such materials based on their leachability concentration (TCLP) value alone. Given the low leachability of B(a)P and PAH in the samples analysed, it is considered the appropriate immobilisation approvals could be applied in the final waste classification to materials containing concentrations of B(a)P which exceed the GSW criteria where ash, clinker and / or slag are observed.

Sample BH1007/2.0-2.1 recorded a concentration of 0.0016% w/w of chrysotile asbestos. Given that results, and the observation of significant quantities of building rubble in the boreholes BH1003-BH1007, the fill within the Henry Dean Plaza area was given a preliminary waste classification of general solid waste **(non-putrescible) -** Special Waste (Asbestos).

The materials in the Adina Hotel basement footprint recorded lower concentrations of the contaminants in the fill soils than the Henry Deane Plaza footprint, with all analysed soil samples within the contaminant thresholds (CT1) for GSW. Therefore, the fill within the Adina Hotel basement footprint has been given a preliminary waste classification of GSW (non-putrescible). It should be noted that brick was observed in BH1002 which (along with other building demolition materials) can be an indicator for the potential presence of asbestos, hence it was noted that this should be considered for future waste classification investigations of the fill in this area.

Table 2: Preliminary Waste Classification Summary - Fill

Item	Description
Based on the observations at the time of sampling and the reported analytical results, the fill described as:	Layers of clayey sand, sand, silt, or sandy clay with gravel and cobble size fragments of sandstone, igneous rock (railway ballast), concrete, brick, building rubble, ash, slag and other anthropogenic materials (e.g., plastic bottles), with one or more layers of building rubble in a clayey sand matrix, to depths ranging between 1.2 m and 3.5 m in the Henry Dean Plaza area. Gravel and brick fill to a depth of 0.35 m in Adina Hotel footprint.
Within the Adina Hotel basement footprint area:	General Solid Waste (Non-Putrescible)
Within the Henry Dean Plaza area:	General Solid Waste (Non-Putrescible); Special Waste (Asbestos).
The form of asbestos identified within the material was:	Chrysotile - Asbestos Fines / Friable Asbestos.

Concentrations of metals for the analysed natural soil samples were within the published allowable maximum and average concentrations in NSW EPA *The Excavated Natural Material Order 2014* except TRH (C10-C36) in BH1004A/3.1-3.55. However, some contaminants, including B(a)P, were detected above the laboratory practical quantitation limit (PQL) in some natural samples. It was therefore considered that the shallow natural soils directly beneath the fill may be impacted by the overlying materials and will be provisionally classified as GSW. It was recommended that for project planning the top 0.5 m of the natural soil profile is assumed to be GSW (non-putrescible), particularly in the Henry Dean Plaza area.

Table 3: Preliminary Waste Classification Summary - Natural Soils

Item	Description
The natural soils and bedrock described as:	Alluvial sand, alluvial silty clay, residual clay, residual clayey sand and sandstone.
Within the SIte is preliminarily classified as:	GSW (upper 0.5 m of natural soil) VENM (assume from below the upper 0.5 m of the natural soil profile).

It was noted that the provisional waste class information provided did not constitute a final waste classification for off-site disposal purposes. Should excavated soils require off-site disposal during development further testing and a final waste classification assessment was stated to be required.

From all groundwater samples tested, all reported concentrations of contaminants including VOC were below the PQL, and hence below the adopted SAC with the exception of some total and dissolved heavy metals. Elevated levels of total cadmium, chromium, copper, lead, nickel and zinc; and dissolved copper and zinc were identified in a number of groundwater samples. The elevated concentrations were considered to be within the normal range of background levels in heavily urbanised areas of Sydney and especially adjacent to Central Station railway.

Given that dewatering is required at the Site, it was stated that further groundwater sampling is likely to be requested by the City of Sydney Council to assess for the quality and suitability of groundwater prior to stormwater discharge. Alternatively, it was stated that groundwater can be discharged into sewer subject to approval from Sydney Water, or disposed to a licensed liquid waste facility.

In addition, soil contamination data (BH8, BH110, BH107B, BH202, HA02 and HA03, refer to Drawing 2 in Appendix B) and groundwater contamination data (BH8, BH202, BH107A and BH107B) available for adjacent sites (and on or in close proximity to the Site) indicated that concentrations of contaminants of concern were below the SAC adopted for the Site and proposed development, apart from metals (copper and zinc) concentrations in groundwater. The metal levels were considered typical background levels of localised groundwater. The locations of the adjacent boreholes are depicted on Drawing 2 in Appendix B.

6.4 DP (2022) and HEC (2022)

The sampling analysis and quality plan (SAQP) incorporated a review of relevant reports including soil and groundwater contamination data obtained from adjacent sites. In addition, the SAQP outlined a detailed scope of a data gap investigation to be carried out following vacancy of the existing tenants.

The data gap investigation proposed twenty-one (21) additional sampling locations as follow:

- Four (4) within the mapped containment cell;
  - Including the shallow groundwater well for perched water in the cell.
- Six (6) near to the boundary of the mapped containment cell;
- Three (3) locations along the Devonshire Street tunnel; and
- Eight (8) locations in and surrounding the Adina Hotel.

The Site Auditor, Rod Harwood, indicated that some of the above proposed boreholes were excessive for the data gap colure and planning for the site; and requested DP to reduce the locations beneath the Adina Hotel, the Devonshire Street tunnel and the central portion of the Site, either for the reason of proximity to a previous sample location or unnecessary density of sampling locations. In addition, the Site Auditor requested for additional groundwater wells to be implemented up gradient (south) and down gradient (north) of the Site.

DP comments on HEC (2022) are outlined below and are subject to endorsement of the Site Auditor:

DP concurs with the Site Auditor on the reduction of sampling locations in the northern half of the Site. However, groundwater data in the down gradient location of the Site is already available in BH1002. In addition, there is also groundwater data available from groundwater well BH8 located near the north-eastern boundary at the adjacent site. DP considers that additional groundwater wells are not required in the down gradient locations of the Site.

DP has revised the proposed test locations, and considers thirteen (13) boreholes to be sufficient as per Drawing 2 in Appendix B:

- Four (4) within the mapped containment cell;
  - Including the shallow groundwater well for perched water in the cell.

- Three (3) near to the boundary of the mapped containment cell;
  - Including the deep groundwater well (to a minimum of 12 m; targeting the sandstone profile) in the up gradient (south);
- One (1) location along the Devonshire Street tunnel; and
- Five (5) locations in and surrounding the Adina Hotel.

Soil and groundwater samples will be analysed for various combinations of in line with the Site Auditor's comments regarding sampling locations and / or depth.

- Heavy metals (including As, Cd, Cr, Cu, Pb, Hg, Ni, Zn) - higher percentage of soil (at various depth of the fill profile) and groundwater samples distributed to samples recovered within the footprint of the cell;
- Total recoverable hydrocarbons (TRH);
- Benzene, toluene, ethylbenzene and xylenes (BTEX);
- Polycyclic aromatic hydrocarbons (PAH) – higher percentage of soil (at various depth of the fill profile) and groundwater samples distributed to samples recovered within the footprint of the cell;
- Organochlorine pesticides (OCP);
- Organophosphorus pesticides (OPP);
- Volatile organic compounds (VOC);
- Cyanide - soil and groundwater samples within the footprint of the cell;
- PFAS;
- Asbestos - soil sample only in fill with building rubble; and
- Hardness, pH and ions - groundwater sample only.

6.5 ERM (2001)

ERM (2001) was prepared for the Henry Deane Park site (HDP site) which is located on Lee Street in Sydney (to the south-west of the Site). The findings reported in ERP (2001) are considered relevant to the current RAP in that the containment cell referenced in this RAP is defined. The containment cell crosses into the site boundary as shown on Drawing 2, Appendix B.

The HDP site was part of the Central Station Complex which consisted of the former railway yards and a maintenance shed. In the past, the HDP site and surrounding area was extensively filled and levelled to enable construction of Station platforms in 1880 and sheds in 1908. The main use of the HDP site was for the cleaning of railway carriages between 1855 and the 1960s.

CMPS&F and ERM prepared a series of contamination reports for the HDP site. The contaminants of concern analysed included: heavy metals, TRH, BTEX, VOC and OCP. Lead and PAH concentrations were detected in all soil samples from the borehole locations, several of these samples exceeded the HIL (1996) criteria[7] for PAH.

[7] Superseded by *NEPC National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended 2013) (NEPC, 2013);

A cap and contain method for the containment of PAH and lead impacted soils was adopted at the time. The containment cell comprised of sandstone bedrock with stiff impermeable clay walls and base. The upper seal was the concrete slab of the development at the time. Below the slab is understood to be a marker horizon of sand several hundred mm thick. The boundary of the containment cell is depicted on Drawing 2 in Appendix B.

The vertical extent of the cell is anticipated to be between 2.6 m and 4 m thick with clay barrier walls and base and a sand marker layer (several hundred mm thick) below the concrete slab.

In the case of a partial breach in the clay barrier wall, ERM states that this should be repaired with clay of similar composition and properties. If the concrete slab is breached ERM states that it should be replaced and the sand marker layer below it reinstated.

The Specific Management Plan (SMP) documented in ERM (2001) is summarised below:

Excavation within cell:

- Reinstatement: Any materials to be reinstated in the cell should be subject to 98% compaction and moisture content tests. The restoration of the marker layer should occur before resealing the area.
- Disposal: Waste classification sampling is required and a Waste Classification Certificate produced.
- Dust suppression is required during any excavation activities.

Excavation of cell wall:

- Integrity must not be compromised. Where possible, disturbance to the clay wall should be avoided.
- If the wall is breached, the material should be repaired and replaced with material of similar composition and subject to 98% compaction and moisture testing.

Building demolition works:

No breach of the cell wall and concrete cap

- If the concrete cap and cell walls are not breached, no further action is required.

Partial breach of the cell wall and concrete cap

- A partial breach of the cell wall should be repaired as soon as practicable.
- If the concrete cap is breached, the concrete should be replaced and the sand marker layer reinstated.
- The cell should be subject to compaction and moisture testing.

Complete Demolition of the Containment Cell

- An Environmental Site Assessment of the area is required to be undertaken.
- All materials from within the cell and materials which have come in contact must be segregated from 'clean' materials.
- Dust suppression, silt traps and all movements of materials tracked.

- A Waste Classification Investigation should be undertaken on the material for offsite disposal.

If material is to be replaced in a cell, then a new cell design should be incorporated into the new development.

6.6 JBS&G (2021)

JBS&G prepared a data gap (contamination) investigation at 14-30 Lee Street, Haymarket (to the south-west of the Site). The scope of JBS&G (2021) investigation included collection and analysis of soil samples from 9 (nine) targeted boreholes across the neighbouring site. Two of the boreholes were converted into two groundwater wells. The investigation has relevance to the characterisation of the Site as some of the sample locations fall within the Site boundary.

The soil samples were analysed for: heavy metals, PAH, TRH, BTEX, TOC, VOC, PCB, PFAS and asbestos. The groundwater samples were analysed for: heavy metals, PAH, TRH, BTEX, VOC and PFAS.

The soil, groundwater and soil vapour investigations (including JBS&G 2019[8]) investigation did not identify any contamination at concentrations which would pose an unacceptable risk to human health or the ecology under a commercial / industrial land use scenario. The neighbouring site was considered suitable for the proposed development without remediation and site management subject to decommissioning of the known underground storage tanks (USTs).

Two of the boreholes (HA01 and HA02) were positioned within the Site boundary and were hand drilled during JBS&G (2019) investigation. The soil results of boreholes HA01 and HA02 are discussed further in Section 6.4,as they relate to the assessment of the contamination status of the Site.

Marginal copper and zinc exceedances were detected in groundwater sample (upgradient well), these reported concentrations were, however, considered to be typical background levels of localised groundwater. Groundwater was considered likely to be suitable for discharge to stormwater subject to treatment of groundwater for turbidity and pH.

Fill materials across the neighbouring site (including within the containment cell) were classified as general solid waste (non-putrescible). Natural soil materials in proximity of the USTs may contain hydrocarbon impacts, and the report recommended that further sampling/analysis will be required.

An unexpected finds protocol (UFP) was recommended for the site to guide appropriate actions during development in the event of unexpected finds of contamination.

6.7 Arup (2021)

Arup (2021) report was a desktop review of previous geotechnical and contamination investigations for the neighbouring site at 14-30 Lee Street, Haymarket.

Uncontrolled fill material at the adjacent site contained various inclusions such as sand, clay, gravel, ash, bricks, ballast, rubble and metal. The depth of fill various across the neighbouring site from 0.1 m to 8.1 m thick. Deep fill could be associated with infilling the historical creek. Review of the historical map in Arup (2021) report indicated the subject site is not impacted by the historical creek.

Arup (2021) report showed a site photograph of the containment cell noted in ERM (2001) report, as shown in Figure 2 below.

Figure 2: Photograph of the Containment Cell dated April 1999 (extracted from Arup (2021) report)

6.8 DP (2021c)

A total of twenty-six (26)[9] boreholes were drilled in the adjacent Atlassian site (to the east and north-east of the Site). This report has relevance to the Site due to the proximity of the boreholes and groundwater wells near the subject site and data sharing agreement between Atlassian and Toga.

Ten (10) of the boreholes were converted into groundwater wells. The soil samples were selected for analysis of the following contaminants of concern: heavy metals, PAH, TRH, BTEX, phenols, OCP, OPP, VOC, PCB and asbestos. The groundwater samples were analysed for: heavy metals, PAH, TRH, BTEX, OCP, OPP, PCB, phenols, VOC and cyanide.

Fill material was encountered at the adjacent Atlassian site. The fill material contains various anthropogenic inclusions such as coal, ceramic tile fragments, ash, slag, glass and brick. The depth of fill various across the neighbouring site from 0.0 m to 8.0 m thick. Deep fill could be associated with the infilling of the former railway platform adjacent to Central Station platform.

TRH and PAH in soil samples were detected at concentrations above the adopted site assessment criteria for commercial uses. In groundwater, copper and zinc were detected at concentrations above the adopted groundwater investigation levels, these reported concentrations were, however, considered to be typical background levels of localised groundwater.

Delineation of PAH contamination was recommended in three test locations for waste classification purposes. Further soil and groundwater investigation was recommended for data gap testing within the footprints of the existing buildings following demolition and for dewatering purposes. A remediation action plan was devised to address these issues.

7. Conceptual Site Model

The data collected during previous investigations generally confirmed that for certain potential contaminant sources outlined in the CSM in DP (2022) and DP (2022a) reports potentially complete 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 results to date.

The source [and associated contaminants(s) of potential concern (CoPC)], from DP (2022a) and DP (2022b) reports, are summarised in Table 4.

Table 4: Summary of Identified Potential Areas of Environmental Concern

Potential Source	Description of Potential Contaminating Activity	Contaminants of Potential Concern
Fill and surficial soil (S1)	It is likely that fill was placed at the site to achieve the design levels. As the source of fill is unknown, there is potential for contaminants to be present in the fill.	Heavy metals, TPH, BTEX, PAH, PCB, OCP, OPP, phenols and asbestos.

[9] Including nine (9) boreholes drilled during DSI in 2019. A review of DP (2019) is incorporated in DP (2021) report.

Potential Source	Description of Potential Contaminating Activity	Contaminants of Potential Concern
	Furthermore, the site history search identified that the former asylum and the Carriage Shed were demolished. The demolition / deterioration of the structures (likely to contain hazardous building materials) may over time have impacted the fill / soil.	
Hazardous building materials in existing structures (S2)	Considering the age of the existing structure, it is considered likely that hazardous building materials were used in the construction materials. More recent additions to the building constructed after 1990 are considered unlikely to contain some hazardous building materials such as asbestos.	Asbestos, lead and PCB, SMF[1].
Current Site Uses (S3)	The site is currently occupied by various retail stores and a hotel building. The basement of the hotel building was used for laundry services associated with the hotel operation. Various cleaning chemicals were stored in the basement and a grease trap was also observed.	Heavy metals, TPH, BTEX, PAH, VOC, VCH[2]
Previous and current offsite activities in the surrounding area (S4)	Central Station is located upgradient of the site, therefore, there is potential for contamination at the site from offsite sources.	Heavy metals, TPH, BTEX, PAH, VOC, per- and polyfluoroalkyl substances (PFAS) and cyanide
Containment Cell constructed in the late 1990s (S5)	Part of a historical containment cell, constructed in the late 1990s, appear to intersect the southern portion of the site, where the Henry Deane Plaza is located.	Lead, PAH and asbestos

Notes:

1. SMF will be assessed by visual inspection only.
2. VOC screening contaminant for VHC.

Potential Receptors

The following potential human receptors have been identified:

- R1: Future site users (site workers and visitors);
- R2: Construction and maintenance workers;
- R3: Adjacent site users (site workers and visitors);
- R4: Terrestrial ecology;
- R5: Surface water (Blackwattle Bay and Darling Harbour; brackish water);
- R6: Groundwater; and
- R7: In-ground structures.

Potential Pathways

The following potential pathways have been identified:

- P1: Direct contact.
- P2: Ingestion and dermal contact;
- P3: Inhalation of dust and / or vapours;
- P4: Surface water run-off;
- P5: Leaching of contaminants and vertical migration into groundwater; and
- P6: Lateral migration of groundwater providing base flow to water bodies.

A 'source - pathway - receptor' approach has been used to assess the potential risks of harm being caused to human or environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways (potential complete pathways). The potential source - pathway - receptor linkages considered to be applicable to the site, shown below in Table 5.

Table 5: Summary of Potentially Complete Exposure Pathways

Potential Source	Transport Pathway	Receptor
S1 to S5 COPC: Heavy metals, TPH, BTEX, PAH, PCB, OCP, OPP, phenols, VOC, PFAS, cyanide and asbestos.	(P1) Direct contact (P2) Ingestion and dermal contact	(R1) Future site users (R2) Construction and maintenance workers
	(P3) Inhalation of dust and/ or vapours	(R1) Future site users (R2) Construction and maintenance workers (R3) Adjacent site users
	(P4) Surface water run off (P6) Lateral migration of groundwater	(R5) Surface water
	(P5) Leaching and vertical migration into groundwater	(R6) Groundwater
	(P1) Direct contact	(R4) Terrestrial ecology
	(P1) Direct contact	(R7) In-ground structures

8. Data Gap Analysis

Several data gaps were identified by DP and the Site Auditor following a review of the previous investigation reports listed in Section 6, outlined in Table 6, below.

Table 6: Summary of Data Gaps

Data Gap Area	Potential Contamination Issue	Potential Area of Contamination Issue	Potential Contaminant of Concern
Data Gap Area 1 (DGA1)	Lead, PAH and potential asbestos contamination identified within the containment cell.	The footprint of the cell Refer to Drawing 2, in Appendix B.	Lead, PAH and potential Asbestos
Data Gap Area 2 (DGA 2)	Contaminants of potential concern outlined in Table 4 applied to the footprint of site buildings/structures and tenanted areas of the site.	Refer to Drawing 2, in Appendix B.	See Table 4 for contaminants of potential concern.

Given the presence of existing site buildings, structures and tenanted areas of the site, the above data gaps can be more appropriately addressed following vacancy of the tenanted areas and/or demolition.

The next sub-sections address the scope for data gap analysis.

8.1 DGA1

The key objective of the following scope is to assist with waste classification of the *in situ* fill material to be excavated from the containment cell and removed off site to an EPA approved waste facility during basement excavation:

- Drill seven (7) boreholes within the footprint of the cell to the clay base. It is understood from ERM (2001) report, the depth of the clay base ranges from 2.6 m and 4 m.
- Extend and/or convert two (2) of the boreholes into groundwater wells with one shallow well (screening/targeting the perched water table in the cell) and one deep well to be drilled outside of the cell (screening/targeting the water table in the bedrock).
- Sample the fill at every 0.5 m interval or where significant sign(s) of contamination (i.e. odour, staining and/or asbestos etc.) is observed;
- Development of two groundwater wells by removing a minimum of three bore volumes or until all standing water is removed from the well. The groundwater should be sampled at least 5-7 days later for it to recharge and restabilise to equilibrium;
- Sampling of two groundwater monitoring wells using low flow techniques;

- Laboratory analysis of soil and groundwater samples for contaminants of potential concern outlined in Table 4; distributing a higher percentage of soil samples for lead, PAH and asbestos (500 mL/1 kg) analysis.

- QA / QC Analysis:
  - Soil and groundwater samples including: 10% intra-laboratory replicate (metals and PAH); 5% inter-laboratory replicate (metals and PAH); a trip spike / a trip blank (per each round of field sampling) and a rinsate if decontamination is required in sampling equipment (metals and PAH).
- Prepare a formal report on the data gap assessment; and
- Prepare an addendum to this RAP, as required.

8.2 DGA2

The key objective of the following scope is to assist with waste classification of the *in situ* fill material to be excavated from existing building and tunnel footprints and removed off site to an EPA approved waste facility during basement excavation:

- Drill six (6) boreholes within the Adina Hotel area and Devonshire Street tunnel.
- Sample the fill at every 0.5 m interval or where significant sign(s) of contamination (i.e. odour, staining and/or asbestos etc.) is observed;
- Laboratory analysis of soil samples for contaminants of potential concern outlined in Table 4;
- QA / QC Analysis:
  - Soil samples including: 10% intra-laboratory replicate (metals and PAH); 5% inter-laboratory replicate (metals and PAH); a trip spike / a trip blank (per each round of field sampling) and a rinsate if decontamination is required in sampling equipment (metals and PAH).
- Prepare a formal report on the data gap assessment; and
- Prepare an addendum to this RAP, as required.

The location of the proposed boreholes is depicted on Drawing 2 in Appendix B.

9. Remediation Extent

The extent of remediation based on current data comprises:

- **Remediation Area:** Lead and PAH exceedances identified in the footprint of the containment cell as per ERM (2001) report; and lead and PAH waste class exceedances were detected in boreholes, BH1003 BH1004, BH1005 and BH1007 within or in proximity to the cell. In addition, friable asbestos was identified in borehole, BH1007 at depth of 2.0-2.1 in proximity to the cell.

The locations of BH1003, BH1004, BH1005 and BH1007 are depicted on Drawing 2 in Appendix B.

The actual extent (the final remediation extent) of the above areas will be established following the data gap investigation, demolition and during remediation.

The elevated levels of metals in groundwater are common in heavily urbanised areas and especially adjacent to Central Station. The levels are likely to represent regional background levels rather than site-specific levels subject to further confirmation from the data gap investigation.

Given dewatering is required at the Site, additional groundwater analytes are likely to be requested by the City of Sydney Council and/or authorities such as DPIE[10] and NRAR[11] to assess for the quality and suitability of groundwater prior to stormwater discharge. Alternatively, groundwater can be discharged into sewer subject to approval from Sydney Water or disposal of groundwater to a licensed liquid waste facility. Details of the dewatering plan should be incorporated in a dewatering management plan and will not be further expanded herein.

10. Remediation Options Assessment

The objective of the remediation options assessment and evaluation is to establish a preferred remediation strategy. The process involves canvassing various remedial options which may be viable and then ranking each option based on a number of evaluation criteria. The remediation options assessment was undertaken with reference to CRC CARE *Remediation Action Plan: Development - Guideline on Performing Remediation Options Assessment* (CRC CARE, 2019b).

The remediation options assessment is included in Appendix E.

11. Preferred Remediation Strategy

The rationale for the selection of the preferred remediation strategy is outlined in Appendix E. The preferred remediation strategy is for:

- **Remediation Area:** Removal and off-site disposal of lead, PAH and asbestos contaminated soils within or near the containment cell, and around the boreholes locations listed in Section 9..

11.1 Sequence of Remediation

The general sequence of remediation shall be determined by the Contractor and should consider the following recommended sequence.

A summary of the remediation procedures including an *in situ* and *ex situ* waste classification assessments is provided below.

[10] NSW Department of Planning and Environment
[11] NSW Department of Natural Resources Access Regulator

11.1.1 Asbestos Clearance and Validation following Demolition

The following asbestos clearance and validation work can be considered prior to and following demolition works:

- Undertake a hazardous building material (HBM) survey on site buildings to be demolished as part of the development;
- Removal of all hazardous building materials including asbestos-containing material identified during the hazardous building material (HBM) survey incorporating the pile of asbestos observed during DP (2021) investigation;
- Check PPE and WHS requirements;
- Provision of a clearance certificate to validate the removal of all HBM as part of the demolition programme. The pavement should be demolished following all demolition activity on site as the pavement can act as a buffer against potential cross-contamination of HBM with the underlain fill / natural soils;
- Removal of visible asbestos from the ground surface (if present) by the Asbestos Demolition Contractor following demolition of the buildings and removal of hardstand;
- Conduct an asbestos clearance inspection by the Occupation Hygienist of the surficial soil following removal of the hard stand for any signs of contamination, potential contamination sources, or local variations in soil conditions;
- Prepare an asbestos clearance for the removal of HBM.

11.1.2 Remediation of Contaminated Soil in/near the Cell

The specific remediation works for lead, PAH and asbestos contaminated soil to address RA1 in Table E1 in Appendix E are outlined below:

- Check PPE and WHS requirements prior to commencement of remediation;
- Prior to the commencement of excavation, the boundary of the containment cell should be clearly marked by a qualified surveyor;
- Clear underground services and other underground structures or obstructions in the area prior to excavation;
- Excavate fourteen (14) in situ test pits within the southern half of the site (including the cell = 2000 m^2) to assess for lead, PAH and asbestos in fill/soil;
- Sample soil samples recovered at 0.2 m then every 0.5 m interval for lead, PAH and asbestos (500 mL/1kg);
- Provision of an *in situ* waste classification assessment;
- Submit the final *in situ* waste classification letter report of the contaminated material to an NSW EPA licensed landfill to receive the waste;
- Load the contaminated material directly onto the trucks for transport to landfill. Disposal dockets should be incorporated in the final validation report;

- Obtain validation samples from the walls and base of the excavation as outlined in Section 13. The results of the validation testing should be assessed against the Remediation Acceptance Criteria (RAC) adopted for the remediation work. In the event of unsuccessful validation, further excavate the areas that failed and re-validate as outlined above; and
- Prepare a validation report documenting the above remediation work.

The proposed basement excavation will remove part of the containment cell wall and contents of the containment cell. It is understood that the proposed basement will be constructed with concrete walls initially installed prior to bulk excavation. As such, it is envisaged that the basement wall along the coincident boundary with the remainder of the containment cell (outside of the basement excavation) will form a new barrier wall to the containment cell. Should this not be the case, the Contractor is to propose an alternative method of reinstating the containment cell barrier wall at the boundary with the Site, to be approved by the Environmental Consultant and Site Auditor.

Confirmatory *in situ* waste classification of the remaining fill (outside of the cell footprint = 2,220 m^2) requiring off-site disposal following demolition and remediation works as per Section 11.1.2 at a lower sampling density of eight test pits.

12. Assessment Criteria

12.1 Remediation Acceptance Criteria

In the absence of derivation of Tier 2 site specific target levels (SSTL), the remediation acceptance criteria (RAC) for contaminants shall be the same as the Tier 1 site assessment criteria (SAC) adopted for DP (2022a), being protective of human health and ecology. The health and ecological related acceptance criteria are for a commercial development.

The following table provides a summary of the qualitative and concentration-based RAC.

Table 7: Remediation Acceptance Criteria

Item	Remediation Acceptance Criteria
Remediation Area (within/near the containment cell)	**Lead:** the RAC is for remaining soils within the site, following basement excavation, to have a concentration of lead of <1500 mg/kg; **B(a)P TEQ:** the RAC is for remaining soils within the site, following basement excavation to have a concentration of B(a)P TEQ of <40 mg/kg; **PAH:** the RAC is for remaining soils within the site, following basement excavation to have a concentration of B(a)P TEQ of <4000 mg/kg; and **Asbestos:** the RAC is for remaining soils within the site, following basement excavation to have absence of asbestos at a limit of reporting of 0.1 g/kg (AS:4964).

12.2 Site Assessment Criteria

Additional area(s) of contamination encountered beyond those outlined in Section 9 during the course of the remediation and site redevelopment will be subject to the contingency plan or unexpected find protocol (Appendix I) and be assessed using the SAC in Appendix H. This is on the provision that other considerations such as risks to groundwater are also taken into account.

The SAC in Appendix H will also be used to assess the analytical data obtained through the data gap investigation.

In the absence of RAC, the SAC (in Appendix H) should also be used as part of the assessment framework for imported soils (i.e. contaminant concentrations in imported soils must, as a minimum, comply with the SAC).

Any further assessment of groundwater that may be undertaken at the Site will utilise the SAC in Appendix H to assess the contamination status and risks. As noted previously, additional analytes are likely to be required for consideration when planning dewatering.

13. Validation Plan

13.1 Data Quality Objectives

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

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; and
  - Collecting validation / characterisation samples for materials to be re-used on site.
- Laboratory analysis of validation samples at a NATA accredited laboratory for:
  - The CoPC relevant to the remediation area; and
  - QA / QC samples in accordance with Section 15.
- Comparison by the Environmental Consultant of the laboratory results with the SAC and / or RAC as appropriate (refer to Section 1312); and
- Preparation by the Environmental Consultant of a validation report detailing the methods and results of the remediation works and validation assessment.

13.2.1 Visual Inspections

All areas to be assessed and validated will first be subject to a visual inspection by the Environmental Consultant. Contaminated fill within the footprint of the containment cellmust be removed prior to validation sampling.

13.2.2 Validation 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 take into account previous results, where applicable.

Small to medium excavations (base <500 m^2):

- Base of excavation: one sample per 25 m^2 to 50 m^2 or part thereof, with a minimum of three samples collected; and
- 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.

Large excavations (base ≥500 m^2):

- Base of excavation: sampling on a grid at a density in accordance with NSW EPA (1995) or a minimum of 10 samples. In sub-areas with any specific signs of concern, a higher sampling density may be required; and
- Sides of excavation: one sample per 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 filling.

Where contaminated soils are stored 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 RAC, as per the DQO (Appendix G). Where the RAC are considered to have not been met, the remediation excavation(s) will be expanded to ‘chase-out’ impacted material, as instructed by the Environmental Consultant, with the validation sampling then continuing into the extended excavation. This process will continue until the impacted material has been fully chased out.

14. Imported Material

Any soil, aggregate etc imported for the remediation works must have contaminant concentrations that meet the relevant criteria outlined in Section 12 and have no aesthetic issues of concern. Imported materials will only be accepted for use at the site if:

- It can legally be accepted onto the site (e.g., classified as virgin excavated natural material (VENM), accompanied by a report / certificate prepared by a qualified environmental consultant); and
- Visual inspection of the imported soil confirms that the soil has no signs of concern and is consistent with those described in the supporting classification documentation; and
- The materials are validated (by inspection / sampling) by the Environmental Consultant as being suitable for use at the site.

The classification report / certificate for all material proposed for import must be reviewed and approved in writing by the Environmental Consultant prior to import. Materials to be imported may need to meet geotechnical requirements which are to be assessed by others, as required.

If permitted by the development consent and approved by the site owner, Remediation Contractor and Environmental Consultant and Site Auditor, material classified under a NSW EPA RRO may also be accepted, provided the material can be used on site in accordance with the corresponding RRE. This could include excavated natural material (ENM), classified under NSW EPA *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 EPA, 2014d).

The need for check-sampling of RRO material is to be determined by the Environmental Consultant depending on the source of the material, adequacy of the supporting documentation provided and inspection(s) of material. Quarried material / VENM may need little or no check sampling.

Any imported recycled aggregates must be sampled at a frequency of sampling of one sample per 25 m^3, with a minimum of three samples per load. The recycled aggregate will not be permitted to be used on site until the results of the inspection and laboratory analysis have been approved in writing by the Environmental Consultant.

15. Quality Control and Quality Assurance

Field QA / QC testing will include the following:

- 5% sample inter-laboratory analysis, analysed for the same suite as primary sample;
- 5% 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;
- Trip spike samples (analysed for BTEX) (one per batch of samples tested for volatile contaminants are of concern); and
- Trip blank samples (analysed for BTEX) (one per batch of samples tested for volatile contaminants are of concern).

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

The quality control 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

17.1 Site Management Plan

A general site management plan for the operational phase of site remediation is included in Appendix F. 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 remedial works by incorporating the plan into their over-arching construction environmental management plan (CEMP).

17.2 Site Responsibilities

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

17.3 Contingency Plans and Unexpected Finds

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

17. Conclusions

It is considered that the site can be made suitable for the proposed residential development subject to implementation of the following:

- Completion of the data gap analysis and updating this RAP as required;
- Completion of remediation work as outlined in this RAP;
- Completion of site validation work as outlined in this RAP;
- Appropriate management of off-site disposal of contaminated soil in accordance with the RAP; and
- Proper implementation of unexpected finds protocols during remediation work.

Significant contamination identified during the data gap analysis and/or addressing unexpected finds may warrant further amendment or addendum to this RAP such that appropriate actions are managed and documented.

19. 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.

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

EPA Victoria. (2009). *Soil Sampling.* Publication IWRG702, June 2009: Environment Protection Authority Victoria, Melbourne, Australia.

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 DUAP/EPA. (1998). *Managing Land Contamination, Planning Guidelines, SEPP 55 – Remediation of Land .* NSW Department of Urban Affairs and Planning / Environment Protection Authority.

NSW EPA. (2014). *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. (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. (2020a). *Guidelines for Consultants Reporting on Contaminated Land.* Contaminated Land Guidelines: NSW Environment Protection Authority.

18. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project for proposed commercial development in 2-8a Lee Street, Haymarket under an amended Toga Major Consultancy Services agreement (contract number CSC-01, dated 10 March 2021) and undertaken in accordance with Douglas Partners Pty Ltd (DP) email proposal 86884.05.P.001.Rev0 dated 26 May 2022. This report is provided for the exclusive use of Toga Development and Construction Pty Ltd 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 DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and / or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific 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 DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling 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 (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. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

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

Douglas Partners Pty Ltd

Appendix A

About this Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

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

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

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

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

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

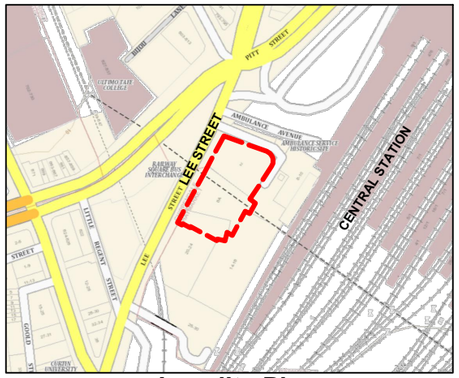
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate 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.

Appendix B

Drawings



Locality Plan

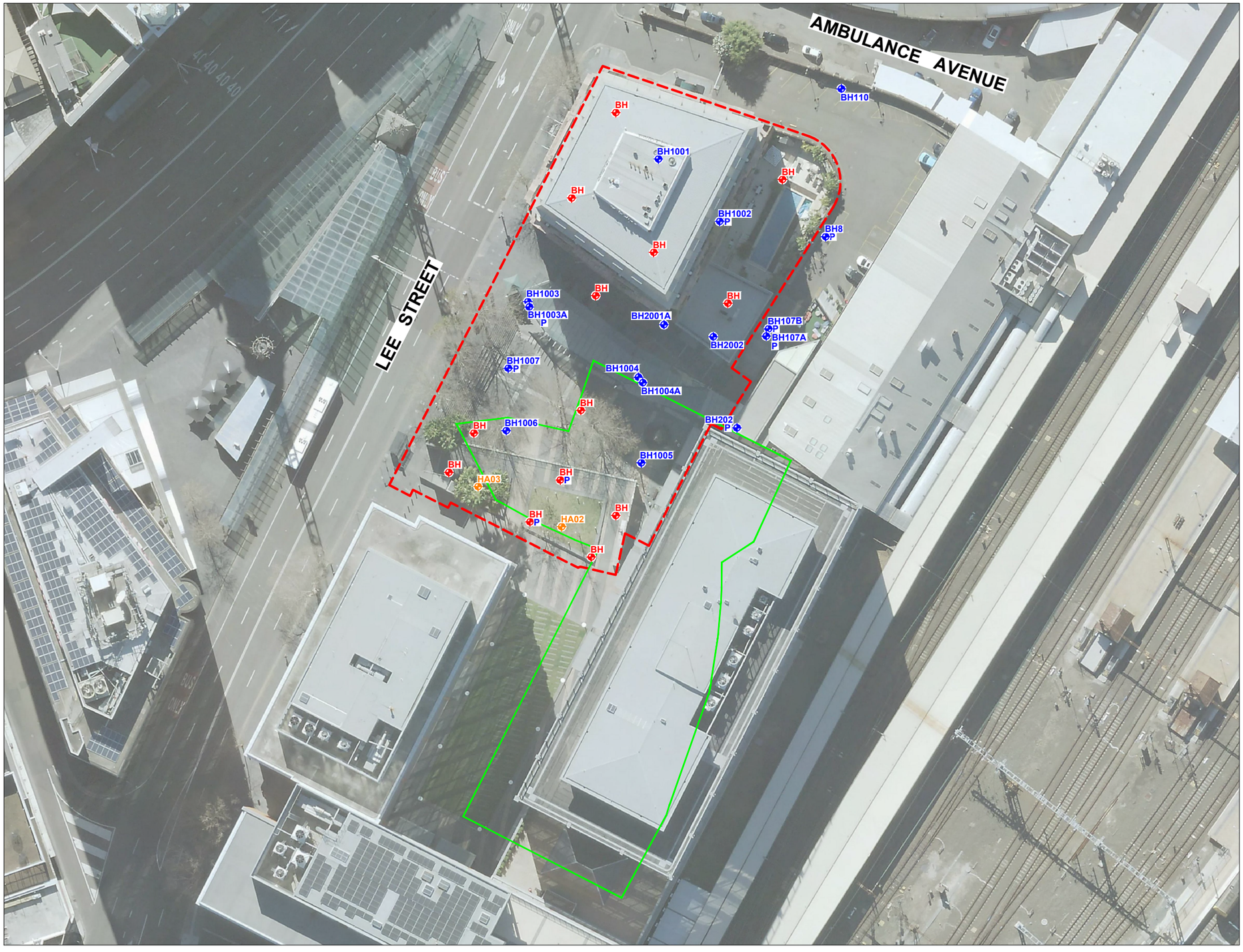
NOTE:
1: Base image from MetroMap, dated 30 July 2021
2: Co-ordinate system relative to Map Grid of Australia 1994 (MGA94).

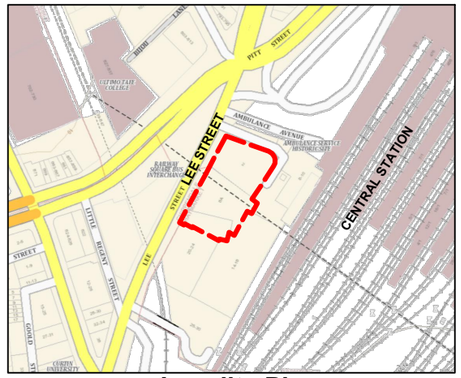
0 5 10 15 20 30 40 50m
1:500 @ A3

LEGEND
Site Boundary

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Toga Development and Construction Pty Ltd		TITLE: **Site Plan**	PROJECT No: 86884.05
OFFICE: Sydney	DRAWN BY: MG	**Proposed Commercial Development**	DRAWING No: 1
SCALE: 1:500 @ A3	DATE: 13.07.2022	**2-8A Lee Street, Haymarket**	REVISION: 0





Locality Plan

NOTE:
1: Base image from MetroMap, dated 30 July 2021
2: Co-ordinate system relative to Map Grid of Australia 1994 (MGA94).

0 5 10 15 20 30 40 50 75m
1:750 @ A3

LEGEND

- HA — Approximate Previous Borehole Locations (JBS&G 2019)
- BH — Previous DP Borehole Locations
- BH — Proposed Borehole Locations
- P — Standpipe Piezometer
- Approximate Outline of The Containment Cell
- Site Boundary

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Toga Development and Construction Pty Ltd		TITLE: **Previous and Proposed Boreholes and Existing Containment Cell**	PROJECT No: 86884.05
OFFICE: Sydney	DRAWN BY: MG	**Proposed Commercial Development**	DRAWING No: 2
SCALE: 1:750 @ A3	DATE: 13.07.2022	**2-8A Lee Street, Haymarket**	REVISION: 0

Appendix C

Tabulated Summary Results

Douglas Partners
Geotechnics | Environment | Groundwater

Table C1: Summary of Laboratory Results – Metals, TRH, BTEX, PAH, Phenol, OCP, OPP, PCB, Asbestos, Asbestos

			Metals								TRH						BTEX				PAH				Phenol	OCP										OPP	PCB	Asbestos						
			Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	TRH C6 - C10	TRH >C10-C16	TPH (C6-C10/BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene [b]	Benzo(a)pyrene (BaP)	Benzo(a)pyrene TEQ	Total PAHs	Phenol	DDD	DDT+ DDE+DDD [c]	DDE	DDT	Aldrin& Dieldrin	Total Chlordane	Endrin	Total Endosulfan	Heptachlor	Heptachlor Epoxide	Hexachlorobenzene	Methoxychlor	Chlorpyrifos	Total PCB	Asbestos ID in soil >0.1g/kg	Trace Analysis	Asbestos (S) g	Asbestos ID soil <0.1g/kg	ACM >7mm Estimation	FA and AF Estimation	FA and AF Estimation	Asbestos (FCB 04)
		PQL	4	0.4	1	1	1	0.1	1	1	25	50	25	50	100	100	0.2	0.5	1	1	1	0.05	0.5	0.05	5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1							<0.001	0.001
DP2021																																															
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	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	-	-	-	-	g	g	%(w/w)	-
BH1001	0.25-0.3 m	12/03/2021	<4	<0.4	**4**	**13**	**11**	<0.1	**4**	**16**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.1**	<0.5	**0.73**	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**NAD**	**NAD**	**NAD**	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1001	0.5-0.6 m	12/03/2021	**6**	<0.4	**7**	**4**	**7**	<0.1	<1	**5**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1002	0.25-0.35 m	11/03/2021	<4	<0.4	**6**	**20**	**13**	<0.1	**4**	**28**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.1**	<0.5	**0.65**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**NAD**	**NAD**	**NAD**	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1002	0.35-0.5 m	11/03/2021	<4	<0.4	**6**	**3**	**4**	<0.1	<1	**6**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**NAD**	**NAD**	**NAD**	**NAD**	-	**NAD**	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1003	0.25-0.3 m	10/03/2021	<4	<0.4	**6**	**17**	**40**	**0.2**	**4**	**37**	<25	<50	<25	<50	**170**	<100	<0.2	<0.5	<1	<1	**0.94**	**1.2**	**9.3**	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1003A	0.8-0.9 m	10/03/2021	<4	<0.4	**7**	**8**	**32**	**0.2**	**2**	**35**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.73**	**1**	**8.9**	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**NAD**	**NAD**	**NAD**	**NAD**	-	**NAD**	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1003A	1.9-2 m	10/03/2021	<4	<0.4	<1	**1**	<0.1	<1	**4**	<25	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**NAD**	**NAD**	**NAD**	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1004	0.3-0.4 m	11/03/2021	<4	<0.4	**8**	**37**	**72**	**0.5**	**6**	**82**	<25	<50	<25	<50	**170**	<100	<0.2	<0.5	<1	<1	**2.9**	**4.2**	**34**	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**NAD**	**NAD**	**NAD**	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1004	0.6-0.7 m	11/03/2021	<4	<0.4	**6**	**12**	**75**	**0.3**	**3**	**38**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**1.2**	**1.8**	**15**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**NAD**	**NAD**	**NAD**	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1004A	3.1 - 3.55 m	17/03/2021	<4	<0.4	**2**	**6**	**5**	<0.1	**2**	**48**	<25	**320**	<25	**320**	**250**	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000		630	NL	NL			3	NL	NL	NL	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1005	0.22-0.3 m	11/03/2021	<4	<0.4	**7**	**29**	**59**	**0.3**	**6**	**68**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**1.8**	**11**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**NAD**	**NAD**	**NAD**	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1005	0.5-0.6 m	11/03/2021	**5**	<0.4	**8**	**27**	**66**	**0.3**	**4**	**74**	<25	<50	<25	<50	**200**	<100	<0.2	<0.5	<1	<1	<1	**2.7**	**3.9**	**33**	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**NAD**	**NAD**	**NAD**	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1005	1.55-1.65 m	11/03/2021	<4	<0.4	**9**	**37**	**210**	**0.7**	**6**	**150**	<25	<50	<25	<50	**320**	<100	<0.2	<0.5	<1	<1	**9**	**8.4**	**12**	**160**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**NAD**	**NAD**	**NAD**	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1005	2.8 - 2.95 m	15/03/2021	<4	<0.4	**3**	**4**	**15**	<0.1	**1**	**14**	<25	<50	<25	<50	**110**	<100	<0.2	<0.5	<1	<1	<1	**0.54**	**0.7**	**7**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1007	0.2-0.3 m	11/03/2021	<4	<0.4	**9**	**24**	**53**	**0.3**	**7**	**50**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.3**	<0.5	**2.7**	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**NAD**	**NAD**	-	**NAD**	-	-	**NAD**	**NAD**
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1007	2 - 2.1 m	16/03/2021	<4	<0.4	**11**	**23**	**51**	**0.2**	**3**	**49**	<25	<50	<25	<50	**120**	<100	<0.2	<0.5	<1	<1	<1	**1.5**	**2.1**	**17**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**NAD**	**NAD**	-	**Chrysotile**	-	**0.0169**	**0.0016**	**NAD**
			3000	900	3600	240000	1500	730	6000	400000			630	NL			3	NL	NL	NL	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1007	2.5 - 2.95 m	16/03/2021	<4	<0.4	**4**	**2**	**8**	<0.1	**1**	**11**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	**3.5**	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**NAD**	**NAD**	**NAD**	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1007	4 - 4.45 m	16/03/2021	<4	<0.4	**1**	<1	<1	<0.1	<1	**4**	<25	**76**	<25	**76**	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			230	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1007 - [TRIPLICATE]	2.5 - 2.95 m	16/03/2021	<4	<0.4	**8**	**8**	**27**	<0.1	**2**	**13**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			630	NL			3	NL	NL	NL	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH1007	2 - 2.1 m	16/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			630	NL			3	NL	NL	NL	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH2001A	0.15-0.2 m	21/06/21	<4	<0.4	**22**	**32**	**11**	<0.1	**49**	**33**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**NAD**	-	-	**NAD**	**NAD**
			3000	900	3600	240000	1500	730	6000	400000			240	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH2001A	1.8-1.9 m	21/06/21	<4	<0.4	**4**	**4**	**12**	<0.1	**2**	**13**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.65**	**0.9**	**7.2**	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			240	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH2001A	1.0-1.1 m	21/06/21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**NAD**	-	-	**NAD**	**NAD**
			3000	900	3600	240000	1500	730	6000	400000			240	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH2001A/1.8-1.9 - [TRIPLICATE]	1.8-1.9 m	21/06/21	<4	<0.4	**4**	**4**	**10**	<0.1	**2**	**11**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			240	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH2002	0.1-0.2 m	21/06/21	<4	<0.4	**3**	**5**	**7**	<0.1	**4**	**7**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.06**	<0.5	**0.66**	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	**NAD**	-	-	**NAD**	**NAD**
			3000	900	3600	240000	1500	730	6000	400000			240	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BH2002	0.9-1 m	21/06/21	<4	<0.4	<1	<1	<1	<0.1	<1	<1	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			240	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BD1/110321	0.2-0.3 m	11/03/2021	<5	<1	**2**	<5	<5	<0.1	<2	**7**	<10	<50	<10	<50	<100	<100	<0.2	<0.5	<0.5	<0.5	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			240	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BD1/300321	1.9-2 m	10/03/2021	<4	<0.4	<1	**2**	**8**	<0.1	<1	**4**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			240	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
BD1/160321	4 - 4.45 m	16/03/2021	<4	<0.4	**1**	<1	<1	<0.1	<1	**6**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			240	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
JBSG2019																																														
HA02	0.0-1 m	30/09/2019	**2.4**	<0.4	**8.4**	**14**	**11**	<0.1	**5.4**	**42**	<20	<50	<20	<50	<100	<100	<0.1	<0.1	<0.1	<0.3	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**NAD**	**NAD**	**NAD**	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			240	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								
HA03	0.0-1 m	30/09/2019	**2.3**	<0.4	**14**	**41**	**18**	<0.1	**8**	**97**	<20	<50	<20	<50	**550**	**110**	<0.1	<0.1	<0.1	<0.3	<0.5	<0.5	<0.5	<0.5	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	**NAD**	**NAD**	**NAD**	-	-	-	-	-
			3000	900	3600	240000	1500	730	6000	400000			240	NL			3	NL	NL	230	NL	40	4000	660			3600		45	530	100	2000	50	80	2500	3000	2								

Lab result

HIL/HSL value

HIL/HSL 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 HSL 0-<1 Exceedance

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

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

Notes:

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

b Reported naphthalene laboratory result obtained from BTEXN suite

c Criteria applies to DDT only

Site Assessment Criteria (SAC):

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

SAC based on generic land use thresholds for Commercial/ industrial D

HIL D	Commercial / Industrial (NEPC, 2013)
HSL D	Commercial / Industrial (vapour intrusion) (NEPC, 2013)
DC HSL D	Direct contact HSL D Commercial/industrial (direct contact) (CRC CARE, 2011)
EIL/ESL C/Ind	Commercial and Industrial (NEPC, 2013)
ML C/Ind	Commercial and Industrial (NEPC, 2013)

Douglas Partners
Geotechnics / Environment / Groundwater

Table C2: Summary of Laboratory Results – VOC

			VOC														
			carbon tetrachloride	Monochlorobenzene	Chloroform	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	1,1,1-trichloroethane	1,1,2-trichloroethane	1,1,2-trichloroethylene	Vinyl Chloride
		PQL	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
BH1003/0.25-0.3	0 m	10/03/2021	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH1003A/0.8-0.9	0 m	10/03/2021	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH1004/0.6-0.7	0 m	11/03/2021	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH1007/0.2-0.3	0 m	11/03/2021	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	HIL/HSL		<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Lab result

HIL/HSL value

HIL/HSL 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 below the PQL, refer to the lab report **Blue** = DC exceedance

Bold = Lab detections NT = Not tested NL = Non limiting NC = No criteria NA = Not applicable NAD = No asbestos detected

Notes:

	Only samples analysed for VOC included in table
HIL/HSL/DC	NEPC, Schedule B1 - HIL D, HSL D, DC HSL D
ML	NEPC, Schedule B1 - ML C/Ind
a	QA/QC replicate of sample listed directly below the primary sample
b	reported naphthalene laboratory result obtained from BTEXN suite

Table C3: Summary of Results of Groundwater Analysis (All results in µg/L)

Sample ID	Sample Date	Metals (dissolved)									Metals (total)								PAH						TRH									BTEX				PCB			OCP																OPP																
		Arsenic	Cadmium	Chromium (III + VI)	Copper	Lead	Mercury	Nickel	Zinc	Iron	Arsenic	Cadmium	Chromium (III + VI)	Copper	Lead	Mercury	Nickel	Zinc	Iron	Naphthalene	Anthracene	Fluoranthene	Benzo(a)pyrene	Phenanthrene	Total Positive PAH	F 1 ((C6-C10)-BTEX)	TRH >C10-C16 less Naphthalene	TRH C6-C9	TRH C6-C10	C10-C14	TRH >C10-C16	C15-C28	C28-C36	TRH >C16-C34	TRH >C34-C40	Benzene	Toulene	Ethylbenzene	o-xylene	m+p-xylene	Aroclor 1242	Aroclor 1254	Other PCB	Aldrin	Dieldrin	gamma-Chlordane	alpha-Chlordane	pp-DDE	pp-DDT	Endosulfan I	Endosulfan II	Endrin	Heptachlor	Heptachlor Epoxide	Methoxychlor	Other OCP	Azinphos-methyl	Bromophos-ethyl	Chlorpyrifos	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Parathion	Methyl Parathion	Other OPP
Assessment Criteria																																																																													
Freshwater Default Guideline Values (DGV) - 95% level species protection [1]		24 as As (III); 13 as As(V)	0.2-0.6 [a]	3.9-9.6 as Cr (III) +, 1.0 as Cr(VI)	1.4	4.4-17.7 [a]	0.60	13.1-33.2 [a]	9.6-24.1 [a]	-	24 as As (III); 13 as As(V)	0.2-0.6 [a]	3.9-9.6 as Cr (III) +, 1.0 as Cr(VI)	1.4	4.4-17.7 [a]	0.60	13.1-33.2 [a]	9.6-24.1 [a]	-	16	0.4*	1.4*	0.2	2.0	-	-	-	-	-	-	-	-	-	-	-	950	180*	80*	350	75 as Xylene (m); 200 as Xylene (p)	0.6	0.03	-	0.001*	0.01*	0.08		-	0.01	0.2		0.02	0.09	-	0.005	-	0.02	-	0.01	0.01	-	0.15	-	0.2	0.05	0.004	-	-
Health Screening Level (HSL) - clay, groundwater 2 m-<4 m / 4 m-<8 m		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	NL	NL	-	-	-	-	-	-	-	30000	NL	NL	NL		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH107A	23/03/21	<1	<0.1	<1	<1	<1	<0.05	12	**25**	78	2	**0.8**	**13**	**13**	13	<0.05	18	**95**	2900	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<50	<10	<10	<50	<50	<100	<100	<100	<100	<1	<1	<1	<1	<2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH107B	23/03/21	<1	<0.1	<1	<1	<1	<0.05	26	7	<10	7	0.2	**41**	**38**	**38**	0.09	**100**	**190**	39000	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<50	<10	<10	<50	<50	120	<100	120	<100	<1	<1	<1	<1	<2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH202	23/03/21	<1	<0.1	<1	<1	<1	<0.05	22	18	3000	2	<0.1	4	5	5	<0.05	4	**42**	7500	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<50	<10	<10	<50	<50	<100	<100	<100	<100	<1	<1	<1	<1	<2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.02	<0.2	<0.009	<0.01	<0.2	<0.15	<0.2	<0.2	<0.05	<0.004	<0.2	<PQL
BH1002	23/03/21	<1	0.2	<1	**2**	<1	<0.05	4	**140**	<10	6	0.3	**20**	**37**	**45**	<0.05	17	**570**	18000	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<50	<10	<10	<50	<50	<100	<100	<100	<100	<1	<1	<1	<1	<2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.02	<0.2	<0.009	<0.01	<0.2	<0.15	<0.2	<0.2	<0.05	<0.004	<0.2	<PQL
BH1003A	23/03/21	<1	<0.1	<1	**18**	<1	<0.05	4	**86**	12	1	0.1	**21**	**31**	13	<0.05	8	**370**	8700	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<50	<10	<10	<50	<50	<100	<100	<100	<100	<1	2	<1	<1	<2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.02	<0.2	<0.009	<0.01	<0.2	<0.15	<0.2	<0.2	<0.05	<0.004	<0.2	<PQL
BH1007	23/03/21	<1	<0.1	<1	<1	<1	<0.05	3	**110**	850	7	**3.9**	**57**	**110**	**81**	0.11	**38**	**4300**	47000	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<50	<10	<10	<50	<50	<100	<100	<100	<100	<1	<1	<1	<1	<2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BD1/230321	23/03/21	<1	0.2	<1	**2**	<1	<0.05	4	**140**	-	-	-	-	-	-	-	-	-	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<50	<10	<10	<50	<50	<100	<100	<100	<100	<1	<1	<1	<1	<2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rinsate	23/02/21	<1	<0.1	<1	2	1	<0.05	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29	30	-	-	-	-	-	-	<1	<1	<1	<1	<2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

PQL Practical Quantitation Limit

NL Not Limiting

BOLD Exceeds DGV

Table C4: Summary of Results of Groundwater Analysis (All results in µg/L)

Sample ID	Sample Date	VOC																												Other
		Isopropylbenzene	1,1-Dichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	trans-1,3-Dichloropropene	cis-1,3-Dichloropropene	Vinyl chloride	Tetrachloroethene	Trichloroethene	1,2,3-Trichlorobenzene	1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Chlorobenzene	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,2-Dichloroethane	1,1,2,2-Tetrachloroethane	Carbon tetrachloride	Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	1,2-Dichloropropane	1,3-Dichloropropane	Other VOC	Cyanide
Assessment Criteria																														
Freshwater Default Guideline Values (DGV) - 95% level species protection [1]		30	-	-	-	-		-	-	-	10	170	160	260	60	-	270 *	6500	1900 *	400*	240*	770 *	-	-	-	900*	1100 *	-	7
Health Screening Level (HSL) - sand, groundwater 2 m-<4 m		-	-	-		-		-	-	-	-		-	-	-	-	-	-	-		-	-				-	-	-	-
Health Screening Level (HSL) - clay, groundwater 2 m-<4 m / 4 m-<8 m		-	-	-		-		-	-	-	-		-	-	-	-	-	-	-		-	-				-	-	-	-
BH107A	23/03/21	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<PQL	-
BH107B	23/03/21	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<PQL	-
BH202	23/03/21	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	11	<1	<1	<1	<1	<1	<PQL	<0.004
BH1002	23/03/21	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<PQL	<0.004
BH1003A	23/03/21	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	6	<1	<1	<1	<1	<1	<PQL	<0.004
BH1007	23/03/21	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	4	<1	<1	<1	<1	<1	<PQL	-
BD1/230321	23/03/21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

PQL	Practical Quantitation Limit
NL	Not Limiting
BOLD	Exceeds DGV
-	not defined/not analysed/not applicable

Douglas Partners
Geotechnics | Environment | Groundwater

Table C5: Summary of Laboratory Results – Metals, TRH, BTEX, PAH, Phenol, OCP, OPP, PCB, Asbestos, VOC

				Metals										TRH					BTEX					
				Arsenic	Cadmium	Total Chromium	Copper	Lead	Lead TCLP	Mercury (inorganic)	Nickel	Nickel TCLP	Zinc	TRH C6 - C9	TRH C10 - C14	TRH C15 - C28	TRH C29 - C36	C10-C36 recoverable hydrocarbons	Benzene	Toluene	Ethylbenzene	m+p-Xylene	o-Xylene	Xylenes (total)
		PQL		4	0.4	1	1	1	0.03	0.1	1	0.02	1	25	50	100	100	50	0.2	0.5	1	2	1	3
Sample ID	Depth (m)	Sample Date	Material Type	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/L	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
BH1001	0.25 - 0.3	12/03/2021	Fill	<4	<0.4	**4**	**13**	**11**	-	<0.1	**4**	-	**16**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH1001	0.5 - 0.6	12/03/2021	Natural	**6**	<0.4	**7**	**4**	**7**	-	<0.1	<1	-	**5**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH1002	0.25 - 0.35	11/03/2021	Fill	<4	<0.4	**6**	**20**	**13**	-	<0.1	**4**	-	**28**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH1002	0.35 - 0.5	11/03/2021	Natural	<4	<0.4	**6**	**3**	**4**	-	<0.1	<1	-	**6**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH1003	0.25 - 0.3	10/03/2021	Fill	<4	<0.4	**6**	**17**	**40**	-	**0.2**	**4**	-	**37**	<25	<50	**120**	<100	**170**	<0.2	<0.5	<1	<2	<1	<3
BH1003A	0.8 - 0.9	10/03/2021	Fill	<4	<0.4	**7**	**8**	**32**	-	**0.2**	**2**	-	**35**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH1003A	1.9 - 2.0	10/03/2021	Natural	<4	<0.4	<1	<1	**1**	-	<0.1	<1	-	**4**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH1004	0.3 - 0.4	11/03/2021	Fill	<4	<0.4	**8**	**37**	**72**	-	**0.5**	**6**	-	**82**	<25	<50	**110**	<100	**170**	<0.2	<0.5	<1	<2	<1	<3
BH1004	0.6 - 0.7	11/03/2021	Fill	<4	<0.4	**6**	**12**	**75**	-	**0.3**	**3**	-	**38**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH1004A	3.1 - 3.55	17/03/2021	Natural	<4	<0.4	**2**	**6**	**5**	-	<0.1	**2**	-	**48**	<25	**320**	**130**	**140**	**590**	<0.2	<0.5	<1	<2	<1	<3
BH1005	0.22 - 0.3	11/03/2021	Fill	<4	<0.4	**7**	**29**	**59**	-	**0.3**	**6**	-	**68**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH1005	0.5 - 0.6	11/03/2021	Fill	**5**	<0.4	**8**	**27**	**66**	-	**0.3**	**4**	-	**74**	<25	<50	**120**	**100**	**200**	<0.2	<0.5	<1	<2	<1	<3
BH1005	1.55 - 1.65	11/03/2021	Fill	<4	<0.4	**9**	**37**	**210**	**0.36**	**0.7**	**6**	-	**150**	<25	<50	**240**	**120**	**320**	<0.2	<0.5	<1	<2	<1	<3
BH1005	2.8 - 2.95	15/03/2021	Natural	<4	<0.4	**3**	**4**	**15**	-	<0.1	**1**	-	**14**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH1007	0.2 - 0.3	11/03/2021	Fill	<4	<0.4	**9**	**24**	**53**	-	**0.3**	**7**	-	**50**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH1007	2 - 2.1	16/03/2021	Fill	<4	<0.4	**11**	**23**	**51**	-	**0.2**	**3**	-	**49**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH1007	2.5 - 2.95	16/03/2021	Fill	<4	<0.4	**4**	**2**	**8**	-	<0.1	**1**	-	**11**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH1007	4..0- 4.45	16/03/2021	Natural	<4	<0.4	**1**	<1	<1	-	<0.1	<1	-	**4**	<25	**76**	<100	<100	**80**	<0.2	<0.5	<1	<2	<1	<3
BD3/100321	1.9 - 2.0	10/03/2021	Natural	<4	<0.4	<1	**2**	**8**	-	<0.1	<1	-	**4**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BD1/110321	0.2 - 0.3	11/03/2021	Fill	<5	<1	**2**	<5	<5	-	<0.1	<2	-	**7**	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
BD1/160321	4..0- 4.45	16/03/2021	Natural	<4	<0.4	**1**	<1	<1		<0.1	<1	-	**6**	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<2	<1	<3
BH2001A	0.15-0.2 m	21/06/21	Fill	<4	<0.4	**22**	**32**	**11**	-	<0.1	**49**	**0.06**	**33**	<25	<50	<100	<100	-	<0.2	<0.5	<1	<2	<1	<3
BH2001A	1.8-1.9 m	21/06/21	Fill	<4	<0.4	**4**	**4**	**12**	-	<0.1	**2**	-	**13**	<25	<50	<100	<100	-	<0.2	<0.5	<1	<2	<1	<3
BH2001A	1-1.1 m	21/06/21	Fill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH2002	0.1-0.2 m	21/06/21	Fill	<4	<0.4	**3**	**5**	**7**	-	<0.1	**4**	-	**7**	<25	<50	<100	<100	-	<0.2	<0.5	<1	<2	<1	<3
BH2002	0.9-0.1 m	21/06/21	Natural	<4	<0.4	<1	<1	<1	-	<0.1	<1	-	<1	<25	<50	<100	<100	-	<0.2	<0.5	<1	<2	<1	<3
BH2001A - [TRIPLICATE]	1.8-1.9 m	21/06/21	Fill	<4	<0.4	**4**	**4**	**10**	-	<0.1	**2**	-	**11**	-	-	-	-	-	-	-	-	-	-	-
HA02	0-0.1 m	30/09/2019	Fill	**2.4**	<0.4	**8.4**	**14**	**11**	-	<0.1	**5.4**	-	**42**	<20	<20	<50	<50	<50	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3
HA03	0-0.1 m	30/09/2019	Fill	**2.3**	<0.4	**14**	**41**	**18**	-	<0.1	**8**	-	**97**	<20	<20	**450**	**190**	**640**	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3
Waste Classification Criteria [f]																								
CT1				100	20	100	NC	100	N/A	4	40	NC	NC	650	NC	NC	NC	10000	10	288	600	NC	NC	1000
SCC1				500	100	1900	NC	1500	N/A	50	1050	1050	NC	650	NC	NC	NC	10000	18	518	1080	NC	NC	1800
TCLP1				N/A	1	N/A	NC	N/A	5	N/A	N/A	2	NC	N/A	NC	NC	NC	N/A	0.5	N/A	N/A	NC	NC	N/A
CT2				400	80	400	NC	400	N/A	16	160	NC	NC	2600	NC	NC	NC	40000	40	1152	2400	NC	NC	4000
SCC2				2000	400	7600	NC	6000	N/A	200	4200	4200	NC	2600	NC	NC	NC	40000	72	2073	4320	NC	NC	7200
TCLP2				N/A	4	N/A	NC	N/A	20	N/A	N/A	8	NC	N/A	NC	NC	NC	N/A	2	N/A	N/A	NC	NC	N/A
ENM Order (2014) Maximum Average Concentration				20	0.5	75	NC	100	NC	0.5	30	NC	NC	NC	NC	NC	NC	250	NC	NC	NC	NC	NC	NC
ENM Order (2014) Absolute Maximum Concentration				40	1	150	NC	200	NC	1	60	NC	NC	NC	NC	NC	NC	500	0.5	65	25	NC	NC	NC

CT1 exceedance | TCLP1 and/or SCC1 exceedance | CT2 exceedance | TCLP2 and/or SCC2 exceedance | Asbestos detection | ENMOrder 2014

NT = Not tested NL = Non limiting NC = No criteria NA = Not applicable

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	All criteria are in the same units as the reported results
PQL	Practical quantitation limit
CT1	NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values of specific contaminant concentration (SCC) for classification without TCLP: General solid waste
SCC1	NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: General solid waste
TCLP1	NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: General solid waste
CT2	NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values of specific contaminant concentration (SCC) for classification without TCLP: Restricted solid waste
SCC2	NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: Restricted solid waste
TCLP2	NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: Restricted solid waste

Douglas Partners
Geotechnics | Environment | Groundwater

Table C5: Summary of Laboratory Results – MTable A1: Summary of Laboratory Results – Metals, TRH, BTEX, PAH, Phenol, OCP, OPP, PCB, Asbestos, VOC

				PAH						Phenol	OCP		OPP	PCB	Asbestos				Total VOC
				Benzo(a)pyrene (BaP)	Benzo(a)pyrene (BaP) TCLP	Naphthalene	Naphthalene TCLP	Total PAHs	Total PAHs TCLP	Phenol	Total Endosulfan	Total Analysed OCP	Total Analysed OPP	Total Analysed PCB	Trace Analysis	Asbestos ID in soil <0.1g/kg	Asbestos (50 g)	FA and AF Estimation	
		PQL		0.05	0.001	1	0.001	0.05	-	5	0.1	0.1	0.1	0.1	-	<0.1	-	<0.001	1
Sample ID	Depth (m)	Sample Date	Material Type	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	-	g/kg	-	%(w/w)	mg/kg
BH1001	0.25 - 0.3	12/03/2021	Fill	**0.1**	-	<1	-	**0.73**	-	<5	<0.1	<0.1	<0.1	<0.1	NAD	-	NAD	-	-
BH1001	0.5 - 0.6	12/03/2021	Natural	<0.05	-	<1	-	<0.05	-	-	-	-	-	-	NAD	-	NAD	-	-
BH1002	0.25 - 0.35	11/03/2021	Fill	**0.1**	-	<1	-	**0.65**	-	-	-	-	-	-	NAD	-	NAD	-	-
BH1002	0.35 - 0.5	11/03/2021	Natural	<0.05	-	<1	-	<0.05	-	-	-	-	-	-	NAD	-	NAD	-	-
BH1003	0.25 - 0.3	10/03/2021	Fill	**0.94**	<0.001	<1	<0.001	**9.3**	**NIL(+)VE**	<5	<0.1	<0.1	<0.1	<0.1	NAD	<0.1	-	<0.001	<PQL
BH1003A	0.8 - 0.9	10/03/2021	Fill	**0.73**	-	<1	-	**8.9**	-	<5	<0.1	<0.1	<0.1	<0.1	NAD	<0.1	-	<0.001	<PQL
BH1003A	1.9 - 2.0	10/03/2021	Natural	<0.05	-	<1	-	<0.05	-	-	-	-	-	-	NAD	-	NAD	-	-
BH1004	0.3 - 0.4	11/03/2021	Fill	**2.9**	<0.001	<1	<0.001	**34**	**NIL(+)VE**	<5	<0.1	<0.1	<0.1	<0.1	NAD	-	NAD	-	-
BH1004	0.6 - 0.7	11/03/2021	Fill	**1.2**	-	<1	-	**15**	-	-	-	-	-	-	NAD	-	NAD	-	<PQL
BH1004A	3.1 - 3.55	17/03/2021	Natural	<0.05	-	<1	-	<0.05	-	-	-	-	-	-	-	-	-	-	-
BH1005	0.22 - 0.3	11/03/2021	Fill	**1.2**	-	<1	-	**11**	-	-	-	-	-	-	NAD	-	NAD	-	-
BH1005	0.5 - 0.6	11/03/2021	Fill	**2.7**	<0.001	<1	<0.001	**33**	**0.001**	<5	<0.1	<0.1	<0.1	<0.1	NAD	-	NAD	-	-
BH1005	1.55 - 1.65	11/03/2021	Fill	**8.4**	<0.001	**9**	**0.097**	**160**	**0.25**	-	-	-	-	-	NAD	-	NAD	-	-
BH1005	2.8 - 2.95	15/03/2021	Natural	**0.54**	-	<1	-	**7**	-	-	-	-	-	-	-	-	-	-	-
BH1007	0.2 - 0.3	11/03/2021	Fill	**0.3**	-	<1	-	**2.7**	-	<5	<0.1	<0.1	<0.1	<0.1	NAD	<0.1	-	<0.001	<PQL
BH1007	2 - 2.1	16/03/2021	Fill	**1.5**	<0.001	<1	**0.27**	**17**	**3.8**	-	-	-	-	-	NAD	AD	-	0.0016	-
BH1007	2.5 - 2.95	16/03/2021	Fill	**0.2**	-	<1	-	**3.5**	-	<5	<0.1	<0.1	<0.1	<0.1	NAD	-	NAD	-	-
BH1007	4..0- 4.45	16/03/2021	Natural	<0.05	-	<1	-	<0.05	-	-	-	-	-	-	-	-	-	-	-
BD3/100321	1.9 - 2.0	10/03/2021	Natural	<0.05	-	<1	-	<0.05	-	-	-	-	-	-	-	-	-	-	-
BD1/110321	0.2 - 0.3	11/03/2021	Fill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BD1/160321	4..0- 4.45	16/03/2021	Natural	<0.05	-	<1	-	<0.05	-	-	-	-	-	-	-	-	-	-	-
BH2001A	0.15-0.2 m	21/06/21	Fill	<0.05	-	<1	-	<0.05	-	-	-	-	-	-	NAD	<0.1	-	<0.001	-
BH2001A	1.8-1.9 m	21/06/21	Fill	**0.65**	<0.01	<1	-	**7.2**	**NIL(+)VE**	<5	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-
BH2001A	1-1.1 m	21/06/21	Fill	-	-	-	-	-	-	-	-	-	-	-	NAD	<0.1	-	<0.001	-
BH2002	0.1-0.2 m	21/06/21	Fill	**0.06**	-	<1	-	**0.66**	-	<5	<0.1	<0.1	<0.1	<0.1	NAD	<0.1	-	<0.001	-
BH2002	0.9-0.1 m	21/06/21	Natural	<0.05	-	<1	-	<0.05	-	-	-	-	-	-	-	-	-	-	-
BH2001A - [TRIPLICATE]	1.8-1.9 m	21/06/21	Fill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA02	0-0.1 m	30/09/2019	Fill	<0.5	-	<0.5	-	<0.5	-	-	-	-	-	-	NAD	-	NAD	-	-
HA03	0-0.1 m	30/09/2019	Fill	<0.5	-	<0.5	-	<0.5	-	-	<0.05	<0.1	-	<0.1	NAD	-	NAD	-	-
HA02	0-0.1 m	30/09/2019	Fill	<0.5	-	<0.5	-	<0.5	-	-	-	-	-	-	NAD	-	NAD	-	-
HA03	0-0.1 m	30/09/2019	Fill	<0.5	-	<0.5	-	<0.5	-	-	<0.05	<0.1	-	<0.1	NAD	-	NAD	-	-
CT1				0.8	N/A	NC	NC	200	N/A	288	60	<50	4	<50	NAD	NAD	NAD	NAD	N/A
SCC1				10	N/A	NC	NC	200	N/A	518	108	<50	7.5	<50	NAD	NAD	NAD	NAD	N/A
TCLP1				N/A	0.04	NC	NC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NAD	NAD	NAD	NAD	N/A
CT2				3.2	N/A	NC	NC	800	N/A	1152	240	<50	16	<50	NAD	NAD	NAD	NAD	N/A
SCC2				23	N/A	NC	NC	800	N/A	2073	432	<50	30	<50	NAD	NAD	NAD	NAD	N/A
TCLP2				N/A	0.16	NC	NC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NAD	NAD	NAD	NAD	N/A
ENM Order (2014) Maximum Average Concentration				N/A	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NAD	NAD	NAD	NAD	N/A
ENM Order (2014) Absolute Maximum Concentration				N/A	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NAD	NAD	NAD	NAD	N/A

CT1 exceedance | TCLP1 and/or SCC1 exceedance | CT2 exceedance | TCLP2 and/or SCC2 exceedance | Asbestos detection | ENMOrder 2014

NT = Not tested NL = Non limiting NC = No criteria NA = Not applicable

Notes:

a	QA/QC replicate of sample listed directly below the primar
b	Total chromium used as initial screen for chromium(VI).
c	Total recoverable hydrocarbons (TRH) used as an initial s
d	Criteria for scheduled chemicals used as an initial screen
e	Criteria for Chlorpyrifos used as initial screen
f	All criteria are in the same units as the reported results
PQL	Practical quantitation limit
CT1	NSW EPA, 2014, Waste Classification Guidelines Part 1;
SCC1	NSW EPA, 2014, Waste Classification Guidelines Part 1;
TCLP1	NSW EPA, 2014, Waste Classification Guidelines Part 1;
CT2	NSW EPA, 2014, Waste Classification Guidelines Part 1;
SCC2	NSW EPA, 2014, Waste Classification Guidelines Part 1;
TCLP2	NSW EPA, 2014, Waste Classification Guidelines Part 1;

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	All criteria are in the same units as the reported results
PQL	Practical quantitation limit
CT1	NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values of specific contaminant concentration (SCC) for classification without TCLP: General solid waste
SCC1	NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: General solid waste
TCLP1	NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: General solid waste
CT2	NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values of specific contaminant concentration (SCC) for classification without TCLP: Restricted solid waste
SCC2	NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: Restricted solid waste
TCLP2	NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: Restricted solid waste

Appendix D

Logs

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 13.4 m AHD
EASTING: 333923
NORTHING: 6249301
DIP/AZIMUTH: 90°/--

BORE No: BH1001
PROJECT No: 86884.02
DATE: 12/3/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
		CONCRETE SLAB										
	0.24	FILL/GRAVEL: coarse, brown, with fine to coarse sand, apparently in loose to medium dense condition							A/E*			PID<1ppm
13	0.35	Silty CLAY CI-CH: medium to high plasticity, orange-brown, trace fine to medium ironstone gravel and fine sand, w~PL (affected by diatube), apparently firm to stiff, residual soil							A/E			PID<1ppm
	1								A/E			PID<1ppm
12		Below 1.2m: relict rock texture, extremely weathered sandstone (Mittagong Formation)							C	100	20	
	1.54	SANDSTONE: medium grained, red-brown, orange-brown and pale grey, bedded at 0°-20°, with ironstone bands, very low strength to low to medium strength, highly weathered, fractured, Mittagong Formation						1.59m: B0°, pl, ro, cly vn 1.7m: CORE LOSS: 80mm				PL(A) = 0.3
	1.78 1.87							1.87m: B0°, pl, ro, cly co 2mm				PL(A) = 0.8
	2	SANDSTONE: medium to coarse grained, orange-brown and pale grey, bedded at 0°-20°, with ironstone bands, medium strength, highly weathered, fractured, Hawkesbury Sandstone						2.20-2.55m: J70°-80°, cu, ro, cbs	C	92	84	
11		Below 2.7m: moderately to slightly weathered						2.56m: Cs, 20mm 2.62m: B0°, pl, ro, cly co 15mm 2.68m: B0°, pl, ro, cly co 15mm 2.7m: B0°, pl, ro, cly co 5mm 2.93m: B0-5°, un, ro, fe stn 2.95 & 2.96m: B5-10° (x2), un, ro, fe stn				PL(A) = 0.7
	3 3.0	SANDSTONE: medium to coarse grained, pale grey, cross-bedded at 0°-20°, with 20% fine grained, grey to dark grey sandstone laminations and 5-10% carbonaceous laminations and flecks, medium to high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone							C	100	98	PL(A) = 0.8
10												PL(A) = 0.8
	4								C	100	100	
9												PL(A) = 1.3

RIG: XC Drill **DRILLER:** Terratest **LOGGED:** IT **CASING:** HWT to 1.2m

TYPE OF BORING: Diatube (200mm dia.) to 0.24m, Solid Flight Auger (TC-bit) 0.24-1.2m, NMLC Coring 1.2-14.22m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD2/120312 collected from 0.25-0.3m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 13.4 m AHD
EASTING: 333923
NORTHING: 6249301
DIP/AZIMUTH: 90°/--

BORE No: BH1001
PROJECT No: 86884.02
DATE: 12/3/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE: medium to coarse grained, pale grey, cross-bedded at 0°-20°, with 20% fine grained, grey to dark grey sandstone laminations and 5-10% carbonaceous laminations and flecks, medium to high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*							C	100	100	
								5.6m: B0°-5°, un, ro, cbs 5.75m: B0°-5°, un, ro, cbs 5.88m: B5°-10°, un, ro, cbs	C	100	100	PL(A) = 1.3
								6.72m: B0°, pl, un, cly vn				PL(A) = 1
									C	100	100	PL(A) = 1
								>>				
									C	100	100	PL(A) = 0.7
									C	100	100	PL(A) = 1.3

RIG: XC Drill **DRILLER:** Terratest **LOGGED:** IT **CASING:** HWT to 1.2m

TYPE OF BORING: Diatube (200mm dia.) to 0.24m, Solid Flight Auger (TC-bit) 0.24-1.2m, NMLC Coring 1.2-14.22m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD2/120312 collected from 0.25-0.3m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 13.4 m AHD
EASTING: 333923
NORTHING: 6249301
DIP/AZIMUTH: 90°/--

BORE No: BH1001
PROJECT No: 86884.02
DATE: 12/3/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
3		SANDSTONE: medium to coarse grained, pale grey, cross-bedded at 0°-20°, with 20% fine grained, grey to dark grey sandstone laminations and 5-10% carbonaceous laminations and flecks, medium to high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*						10.33m: B0°, pl, ro, cly co 5mm	C	100	100	
	11											PL(A) = 1
2								11.27m: B0°-5°, pl, ro, cly vn				
	12								C	100	100	PL(A) = 0.7
1								12.5m: B0°, pl, ro, cly co 2mm				
	13											PL(A) = 1.5
0									C	100	95	
								13.66m: B10°, pl, ro, cly vn				PL(A) = 1.2
	14											
	14.22	Bore discontinued at 14.22m - Target depth reached						14.15m: B0°-5°, pl, ro, cly vn				
-1												

RIG: XC Drill **DRILLER:** Terratest **LOGGED:** IT **CASING:** HWT to 1.2m

TYPE OF BORING: Diatube (200mm dia.) to 0.24m, Solid Flight Auger (TC-bit) 0.24-1.2m, NMLC Coring 1.2-14.22m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD2/120312 collected from 0.25-0.3m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 13.4 m AHD
EASTING: 333935
NORTHING: 6249290
DIP/AZIMUTH: 90°/--

BORE No: BH1002
PROJECT No: 86884.02
DATE: 11/3/2021
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
		CONCRETE SLAB										
	0.24	FILL/MIXTURE OF GRAVEL and BRICKS: coarse sandstone gravel and bricks, brown, apparently in loose to medium dense condition							A/E			PID<1ppm
	0.35								A/E			PID<1ppm
	0.53	Sandy CLAY CI: medium plasticity, pale grey with pale brown, with fine sandstone gravel and silt, w~PL (affected by diatube), apparently very stiff, extremely weathered sandstone (Mittagong Formation)						0.53m: Cs, 30mm (sandy clay) 0.63m: Cs, 40mm	C	100	60	PL(A) = 0.1
	0.67							0.82m: B0°, pl, ro, cly vn 0.87m: B0°, pl, ro, cly vn				PL(A) = 0.2
13	1	SANDSTONE: medium grained, orange-brown and pale grey, bedded at 0°-10°, highly weathered, very low to low strength, fractured, Mittagong Formation						1.17m: B0°, pl, ro, fe stn 1.19m: J10°-20°, un, ro, fe stn 1.21m: Cs, 40mm (with ironstone gravel)	C	100	95	PL(A) = 1.1
12		SANDSTONE: medium to coarse grained, red-brown and orange-brown with some pale grey, with ironstone bands, distinct and indistinct bedding at 0°-10°, highly weathered, high strength with very low strength bands, slightly fractured, Hawkesbury Sandstone										PL(A) = 0.4
	2	Below 1.67m: orange-brown and pale grey, moderately weathered to slightly weathered						1.88m: B10°, pl, ro, cly vn	C	100	100	PL(A) = 1.9
11								2.29m: B10°, pl, ro, cly vn				PL(A) = 0.6
	3							2.56 & 2.58m: B0-5° (x2), un, ro, cly co 2mm 2.62m: J20°, un, ti 2.67m: B5°-10°, pl, ti 2.77m: B5°, pl, ro, cly vn 2.8m: B5°-10°, pl, ro, cly vn 2.81m: B5°-10°, pl, ro, cly vn 2.82-3.00m: J80°, pl, ro, fe stn, partially ti	C	100	86	PL(A) = 0.5
10	3.0	SANDSTONE: medium to coarse grained, pale grey, cross-bedded at 10°-20°, with 20% fine grained, grey to dark grey sandstone laminations, medium or high strength, slightly weathered, slightly fractured to unbroken, Hawkesbury Sandstone										
	4											PL(A) = 1.1
9		Below 4.36m: grading to fresh						4.36m: B5°, pl, ro, fe stn 4.39m: B5°, pl, ro, cly vn	C	100	98	PL(A) = 0.6
												PL(A) = 1.2

RIG: XC Drill **DRILLER:** Terratest **LOGGED:** IT **CASING:** HWT to 0.5m

TYPE OF BORING: Diatube (200mm dia.) to 0.24m, Solid Flight Auger (TC-bit) 0.24-0.53m, NMLC Coring 0.53-18.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD1/110311 collected from 0.35-0.5m; Groundwater well installed: blank PVC 0.0-1.5m, screen PVC 1.5-18.0m, bentonite 0.0-1.3m, gravel 1.3-18.0m, backfill 18.0-18.1m, gatic cover at the surface; 100% water loss from 16.0-18.1m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 13.4 m AHD
EASTING: 333935
NORTHING: 6249290
DIP/AZIMUTH: 90°/--

BORE No: BH1002
PROJECT No: 86884.02
DATE: 11/3/2021
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
8		SANDSTONE: medium to coarse grained, pale grey, cross-bedded at 10°-20°, with 20% fine grained, grey to dark grey sandstone laminations, medium or high strength, slightly weathered, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*						5.2m: B5°, un, ro, cly vn	C	100	98	
		Below 5.2m: distinct and indistinct bedding at 0°-20°, with 5-10% carbonaceous laminations and flecks										
	6							5.91m: Cz, 50mm 5.96m: B10°, pl, un, cly vn				PL(A) = 0.7
7									C	100	97	
	7											PL(A) = 1.7
6												PL(A) = 1.3
								7.66m: B0°-5°, pl, ro, cbs	C	100	100	
	8											PL(A) = 1.2
5								8.29m: B5°, pl, ro, cbs				PL(A) = 1.1
	9											PL(A) = 1
4									C	100	100	
												PL(A) = 1.6

RIG: XC Drill **DRILLER:** Terratest **LOGGED:** IT **CASING:** HWT to 0.5m

TYPE OF BORING: Diatube (200mm dia.) to 0.24m, Solid Flight Auger (TC-bit) 0.24-0.53m, NMLC Coring 0.53-18.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD1/110311 collected from 0.35-0.5m; Groundwater well installed: blank PVC 0.0-1.5m, screen PVC 1.5-18.0m, bentonite 0.0-1.3m, gravel 1.3-18.0m, backfill 18.0-18.1m, gatic cover at the surface; 100% water loss from 16.0-18.1m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 13.4 m AHD
EASTING: 333935
NORTHING: 6249290
DIP/AZIMUTH: 90°/--

BORE No: BH1002
PROJECT No: 86884.02
DATE: 11/3/2021
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
3		SANDSTONE: medium to coarse grained, pale grey, cross-bedded at 10°-20°, with 20% fine grained, grey to dark grey sandstone laminations, medium or high strength, slightly weathered, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*						10.12m: B5°-10°, un, ro, cly vn				
2	11							10.82m: B0°, pl, ro, cly vn	C	100	100	PL(A) = 1.3
1	12							12.33m: B20°, pl, ro, cbs 12.48m: B5°, pl, ro, cly co 5mm	C	100	100	PL(A) = 0.8 PL(A) = 0.8
0	13								C	100	95	PL(A) = 1.4
-1	14							14.12m: B0°-5°, un, ro, cbs 14.19m: B5°, pl, ro, cly co 5mm	C	100	100	PL(A) = 2.6

RIG: XC Drill **DRILLER:** Terratest **LOGGED:** IT **CASING:** HWT to 0.5m

TYPE OF BORING: Diatube (200mm dia.) to 0.24m, Solid Flight Auger (TC-bit) 0.24-0.53m, NMLC Coring 0.53-18.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD1/110311 collected from 0.35-0.5m; Groundwater well installed: blank PVC 0.0-1.5m, screen PVC 1.5-18.0m, bentonite 0.0-1.3m, gravel 1.3-18.0m, backfill 18.0-18.1m, gatic cover at the surface; 100% water loss from 16.0-18.1m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 13.4 m AHD
EASTING: 333935
NORTHING: 6249290
DIP/AZIMUTH: 90°/--

BORE No: BH1002
PROJECT No: 86884.02
DATE: 11/3/2021
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-2		SANDSTONE: medium to coarse grained, pale grey, cross-bedded at 10°-20°, with 20% fine grained, grey to dark grey sandstone laminations, medium or high strength, slightly weathered, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*						15.16m: B0°-5°, un, ro, cly vn	C	100	100	
	16											PL(A) = 1.2
-3						19-03-21		16.19m: B20°, pl, ro, cly vn				PL(A) = 1.3
									C	100	100	
								16.86m: B10°, un, ti				
	17	Between 17.10-17.35m: siltstone clasts, up to 10mm						17.11m: B5°-10°, un, ro, cly vn 17.23m: fg/Cz, 70mm				PL(A) = 0.8
-4								17.43m: B0°, pl, ro, cly vn 17.55-17.80m: F80°, pl, ti, <5mm displacement	C	100	87	
	18							17.92-18.10m: J80°, pl, ro, cln				
	18.1	Bore discontinued at 18.1m - Target depth reached										
-5												
	19											
-6												

RIG: XC Drill **DRILLER:** Terratest **LOGGED:** IT **CASING:** HWT to 0.5m

TYPE OF BORING: Diatube (200mm dia.) to 0.24m, Solid Flight Auger (TC-bit) 0.24-0.53m, NMLC Coring 0.53-18.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD1/110311 collected from 0.35-0.5m; Groundwater well installed: blank PVC 0.0-1.5m, screen PVC 1.5-18.0m, bentonite 0.0-1.3m, gravel 1.3-18.0m, backfill 18.0-18.1m, gatic cover at the surface; 100% water loss from 16.0-18.1m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 13.4 m AHD
EASTING: 333935
NORTHING: 6249290
DIP/AZIMUTH: 90°/--

BORE No: BH1002
PROJECT No: 86884.02
DATE: 11/3/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
13.4	0.24	CONCRETE SLAB							
13.1	0.35	FILL/MIXTURE OF GRAVEL and BRICKS: coarse sandstone gravel and bricks, brown, apparently in loose to medium dense condition		A/E	0.25 0.35		PID<1ppm PID<1ppm		
12.9	0.53			A/E	0.5		PL(A) = 0.1		
12.8	0.67	Sandy CLAY CI: medium plasticity, pale grey with pale brown, with fine sandstone gravel and silt, w~PL (affected by diatube), apparently very stiff, extremely weathered sandstone (Mittagong Formation)			0.57				Bentonite 0.0-1.3m
12.4	1			A/E	0.9 0.91		PL(A) = 0.2		
				C	1.0 1.18		PL(A) = 1.1		
11.9		SANDSTONE: medium grained, orange-brown and pale grey, bedded at 0°-10°, highly weathered, very low to low strength, fractured, Mittagong Formation			1.46 1.5		PL(A) = 0.4		
11.4	2	SANDSTONE: medium to coarse grained, red-brown and orange-brown with some pale grey, with ironstone bands, distinct and indistinct bedding at 0°-10°, highly weathered, high strength with very low strength bands, slightly fractured, Hawkesbury Sandstone		C	1.96		PL(A) = 1.9		
					2.29		PL(A) = 0.6		
					2.5				
10.9		Below 1.67m: orange-brown and pale grey, moderately weathered to slightly weathered			2.67		PL(A) = 0.5		
10.4	3	SANDSTONE: medium to coarse grained, pale grey, cross-bedded at 10°-20°, with 20% fine grained, grey to dark grey sandstone laminations, medium or high strength, slightly weathered, slightly fractured to unbroken, Hawkesbury Sandstone		C					
10.4	3.0								
9.4	4				3.95 4.0		PL(A) = 1.1		
		Below 4.36m: grading to fresh			4.42		PL(A) = 0.6		
				C					
8.9	5				4.95		PL(A) = 1.2		
		Below 5.2m: distinct and indistinct bedding at 0°-20°, with 5-10% carbonaceous laminations and flecks							
					5.5				
7.9	6				5.96		PL(A) = 0.7		
				C					
7.4	7				6.95 7.0		PL(A) = 1.7		
					7.19		PL(A) = 1.3		
				C					
6.4	8				7.95		PL(A) = 1.2		
					8.3		PL(A) = 1.1		
					8.5				
5.4	9				8.96		PL(A) = 1		
				C					
4.4					9.95		PL(A) = 1.6		Sand filter 1.3-18.0m Slotted PVC pipe

RIG: XC Drill **DRILLER:** Terratest **LOGGED:** IT **CASING:** HWT to 0.5m

TYPE OF BORING: Diatube (200mm dia.) to 0.24m, Solid Flight Auger (TC-bit) 0.24-0.53m, NMLC Coring 0.53-18.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD1/110311 collected from 0.35-0.5m; Groundwater well installed: blank PVC 0.0-1.5m, screen PVC 1.5-18.0m, bentonite 0.0-1.3m, gravel 1.3-18.0m, backfill 18.0-18.1m, gatic cover at the surface; 100% water loss from 16.0-18.1m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 13.4 m AHD
EASTING: 333935
NORTHING: 6249290
DIP/AZIMUTH: 90°/--

BORE No: BH1002
PROJECT No: 86884.02
DATE: 11/3/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDSTONE: medium to coarse grained, pale grey, cross-bedded at 10°-20°, with 20% fine grained, grey to dark grey sandstone laminations, medium or high strength, slightly weathered, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*			10.03				1.5-18.0m
				C	10.92		PL(A) = 1.3		
					11.55				
				C	11.95		PL(A) = 0.8		
					12.95		PL(A) = 0.8		
				C	13.0				
					13.95		PL(A) = 1.4		
				C	14.5				
					14.95		PL(A) = 2.6		
				C	15.95		PL(A) = 1.2		
					16.0				
				C	16.38		PL(A) = 1.3	19-03-21	
		Between 17.10-17.35m: siltstone clasts, up to 10mm			17.38		PL(A) = 0.8		
				C	17.43				
	18.1	Bore discontinued at 18.1m - Target depth reached			18.1				Backfill 18-18.1m End Cap

RIG: XC Drill **DRILLER:** Terratest **LOGGED:** IT **CASING:** HWT to 0.5m

TYPE OF BORING: Diatube (200mm dia.) to 0.24m, Solid Flight Auger (TC-bit) 0.24-0.53m, NMLC Coring 0.53-18.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD1/110311 collected from 0.35-0.5m; Groundwater well installed: blank PVC 0.0-1.5m, screen PVC 1.5-18.0m, bentonite 0.0-1.3m, gravel 1.3-18.0m, backfill 18.0-18.1m, gatic cover at the surface; 100% water loss from 16.0-18.1m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 14.3 m AHD
EASTING: 333899
NORTHING: 6249275
DIP/AZIMUTH: 90°/--

BORE No: BH1003
PROJECT No: 86884.02
DATE: 10/3/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
14	0.04	STONE TILE							
	0.09	SAND and CEMENT							
	0.25	CONCRETE SLAB At 0.2m: 8mm steel reinforcement		A/E	0.25 0.3		PID<1ppm		
		FILL/Clayey SAND: fine to medium, brown, with medium to coarse sandstone gravel, boulders, concrete and brick rubble, trace ash and slag		A/E	0.7 0.8		PID<1ppm		
13	1.3	Bore discontinued at 1.3m - Refusal on bricks (3 courses deep, minimum 4 bricks long)							
12									
11									
10									

RIG: NDD and hand tools **DRILLER:** Excavac **LOGGED:** JS **CASING:** Uncased

TYPE OF BORING: Diatube (200mm dia.) to 0.25m, Non-Destructive Digging 0.25-1.3m

WATER OBSERVATIONS: No free ground water observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 14.3 m AHD
EASTING: 333900
NORTHING: 6249274
DIP/AZIMUTH: 90°/--

BORE No: BH1003A
PROJECT No: 86884.02
DATE: 10 - 19/3/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
14	0.04	STONE TILE										
	0.12	SAND and CEMENT										
	0.23	CONCRETE SLAB At 0.2m: 8mm steel reinforcement							A/E*			PID<1
		FILL/Clayey SAND: fine to medium, brown, with sandstone gravel and cobbles, concrete and brick rubble and bricks, trace ash and slag							A/E			PID<1
13	1.2	SAND SP: medium, pale brown and pale grey, moist, medium dense, alluvial							A/E			PID<1
12	2								A/E*			PID<1
		Below 2.8m: dense				19-03-21			S			8,15,22 N = 37
11	3											
	4	4.0 Silty CLAY CI-CH: medium to high plasticity, pale grey and brown, with ironstone gravel, w<PL, apparently stiff to very stiff, residual soil						Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-5°, with iron staining or clay coating				
10	4.3	Clayey SAND SC: medium, brown, moist, apparently medium dense to dense, extremely weathered sandstone							S			5/0 refusal
	4.58	SANDSTONE: medium grained, brown, pale grey and red-brown, bedded at 0-10°, very low to low strength, highly weathered, fractured, Mittagong Formation						4.83-4.87m: Ds 40mm	C	100	73	PL(A) = 0.05
	4.87											
	5.0											

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.0m, HQ to 5.0m

TYPE OF BORING: Diatube (200mm dia.) to 0.23m, Non-Destructive Digging 0.23-2.0m, Solid Flight Auger (TC-bit) 2.0-4.58m, NMLC Coring 4.58-14.41m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD2/100321 from 0.23-0.30m and field replicate BD3/100321 from 1.9-2.0m; Groundwater well installed: Blank PVC 0.0-1.7m, screen PVC 1.7-4.0m, bentonite 0.5-1.5m and 4.0-6.0m, sand 1.5-4m, backfill 0-0.5m and 6.0-14.41m, gatic cover

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 14.3 m AHD
EASTING: 333900
NORTHING: 6249274
DIP/AZIMUTH: 90°/--

BORE No: BH1003A
PROJECT No: 86884.02
DATE: 10 - 19/3/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
9		SANDSTONE: medium to coarse grained, brown, pale grey and red-brown, cross-bedded at 0-20°, medium strength with extremely low and very low strength bands, highly weathered, slightly fractured, Hawkesbury Sandstone						5.03m: B20°, pl, ro, fe co	C	100	73	PL(A) = 0.6
	6							5.60-5.64m: Ds 40mm				
8									C	100	80	PL(A) = 0.5
								6.61m: B10° (x2), pl, ro, fe co				
								6.70-6.82m: Ds 120mm				
	7	Below 6.85m: pale grey, distinct and indistinct bedding at 0-10° with some cross-bedding, medium and medium to high strength, slightly weathered then fresh										PL(A) = 1
7								7.62-7.67m: Ds 50mm				
								7.68m: J50°, pl, ro, cly co				
	8							7.9m: B5°, pl, ro, cly co 10mm	C	100	95	PL(A) = 1
6												
	9											
5		Between 9.23-9.35m: grey, fine to medium grained band						9.28-9.31m: B10° (x3), pl, ro, cly co	C	100	82	PL(A) = 0.9

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.0m, HQ to 5.0m

TYPE OF BORING: Diatube (200mm dia.) to 0.23m, Non-Destructive Digging 0.23-2.0m, Solid Flight Auger (TC-bit) 2.0-4.58m, NMLC Coring 4.58-14.41m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD2/100321 from 0.23-0.30m and field replicate BD3/100321 from 1.9-2.0m; Groundwater well installed: Blank PVC 0.0-1.7m, screen PVC 1.7-4.0m, bentonite 0.5-1.5m and 4.0-6.0m, sand 1.5-4m, backfill 0-0.5m and 6.0-14.41m, gatic cover

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 14.3 m AHD
EASTING: 333900
NORTHING: 6249274
DIP/AZIMUTH: 90°/--

BORE No: BH1003A
PROJECT No: 86884.02
DATE: 10 - 19/3/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE: medium to coarse grained, brown, pale grey and red-brown, cross-bedded at 0-20°, medium strength with extremely low and very low strength bands, highly weathered, slightly fractured, Hawkesbury Sandstone *(continued)*							C	100	82	PL(A) = 0.7
	11	Between 10.93-11.14m: extremely weathered seam						10.93-11.14m: Ds 210mm	C	100	86	PL(A) = 0.8
	12							12.35-12.40m: J50°, ir, ro, cln 12.46-12.53m: J60°, ir, ro, cln, healed	C	100	91	PL(A) = 1
	13	Between 13.58-13.84m: grey, fine to medium grained bed, with 10% dark grey siltstone laminations						13.81-13.83m: Ds 20mm	C	100	92	PL(A) = 0.9
	14											
	14.41	Bore discontinued at 14.41m - Target depth reached										

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.0m, HQ to 5.0m

TYPE OF BORING: Diatube (200mm dia.) to 0.23m, Non-Destructive Digging 0.23-2.0m, Solid Flight Auger (TC-bit) 2.0-4.58m, NMLC Coring 4.58-14.41m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD2/100321 from 0.23-0.30m and field replicate BD3/100321 from 1.9-2.0m; Groundwater well installed: Blank PVC 0.0-1.7m, screen PVC 1.7-4.0m, bentonite 0.5-1.5m and 4.0-6.0m, sand 1.5-4m, backfill 0-0.5m and 6.0-14.41m, gatic cover

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 14.3 m AHD
EASTING: 333900
NORTHING: 6249274
DIP/AZIMUTH: 90°/--

BORE No: BH1003A
PROJECT No: 86884.02
DATE: 10 - 19/3/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
14.3	0.04	STONE TILE							
	0.12	SAND and CEMENT		A/E*	0.23		PID<1		Backfill 0-0.5m
	0.23	CONCRETE SLAB At 0.2m: 8mm steel reinforcement			0.3				
		FILL/Clayey SAND: fine to medium, brown, with sandstone gravel and cobbles, concrete and brick rubble and bricks, trace ash and slag		A/E	0.8 0.9		PID<1		Bentonite 0.5-1.5m
13	1.2	SAND SP: medium, pale brown and pale grey, moist, medium dense, alluvial		A/E	1.4 1.5		PID<1		
12	2			A/E*	1.9 2.0		PID<1		
				S	2.5 2.95		8,15,22 N = 37	19-03-21	Sand filter 1.5-4.0m Slotted PVC pipe 1.7-4.0m
11	3	Below 2.8m: dense							
10	4.0	Silty CLAY CI-CH: medium to high plasticity, pale grey and brown, with ironstone gravel, w<PL, apparently stiff to very stiff, residual soil							End Cap
	4.3			S	4.5 4.58		5/0 refusal		
	4.58	Clayey SAND SC: medium, brown, moist, apparently medium dense to dense, extremely weathered sandstone			4.6		PL(A) = 0.05		
9	4.87 5.0	SANDSTONE: medium grained, brown, pale grey and red-brown, bedded at 0-10°, very low to low strength, highly weathered, fractured, Mittagong Formation		C	5.51		PL(A) = 0.6		Bentonite fill 4.0-6m
		SANDSTONE: medium to coarse grained, brown, pale grey and red-brown, cross-bedded at 0-20°, medium strength with extremely low and very low strength bands, highly weathered, slightly fractured, Hawkesbury Sandstone			6.0				
8	6				6.34		PL(A) = 0.5		
				C					
7	7	Below 6.85m: pale grey, distinct and indistinct bedding at 0-10° with some cross-bedding, medium and medium to high strength, slightly weathered then fresh			7.48 7.53		PL(A) = 1		
6	8			C	8.95		PL(A) = 1		
	9				9.13				
5		Between 9.23-9.35m: grey, fine to medium grained band		C	9.86		PL(A) = 0.9		

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.0m, HQ to 5.0m

TYPE OF BORING: Diatube (200mm dia.) to 0.23m, Non-Destructive Digging 0.23-2.0m, Solid Flight Auger (TC-bit) 2.0-4.58m, NMLC Coring 4.58-14.41m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD2/100321 from 0.23-0.30m and field replicate BD3/100321 from 1.9-2.0m; Groundwater well installed: Blank PVC 0.0-1.7m, screen PVC 1.7-4.0m, bentonite 0.5-1.5m and 4.0-6.0m, sand 1.5-4m, backfill 0-0.5m and 6.0-14.41m, gatic cover

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 14.3 m AHD
EASTING: 333900
NORTHING: 6249274
DIP/AZIMUTH: 90°/--

BORE No: BH1003A
PROJECT No: 86884.02
DATE: 10 - 19/3/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
4	11	SANDSTONE: medium to coarse grained, brown, pale grey and red-brown, cross-bedded at 0-20°, medium strength with extremely low and very low strength bands, highly weathered, slightly fractured, Hawkesbury Sandstone *(continued)*		C	10.56 10.66		PL(A) = 0.7		Backfill 6-14.41m
3		Between 10.93-11.14m: extremely weathered seam		C	11.63		PL(A) = 0.8		
2	12				12.19				
1	13			C	12.93		PL(A) = 1		
		Between 13.58-13.84m: grey, fine to medium grained bed, with 10% dark grey siltstone laminations			13.61 13.72		PL(A) = 0.9		
0	14			C					
	14.41	Bore discontinued at 14.41m - Target depth reached			14.41				
-1	15								
-2	16								
-3	17								
-4	18								
-5	19								

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.0m, HQ to 5.0m

TYPE OF BORING: Diatube (200mm dia.) to 0.23m, Non-Destructive Digging 0.23-2.0m, Solid Flight Auger (TC-bit) 2.0-4.58m, NMLC Coring 4.58- 14.41m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate BD2/100321 from 0.23-0.30m and field replicate BD3/100321 from 1.9-2.0m; Groundwater well installed: Blank PVC 0.0-1.7m, screen PVC 1.7-4.0m, bentonite 0.5-1.5m and 4.0-6.0m, sand 1.5-4m, backfill 0-0.5m and 6.0-14.41m, gatic cover

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.8 m AHD
EASTING: 333920
NORTHING: 6249261
DIP/AZIMUTH: 90°/--

BORE No: BH1004
PROJECT No: 86884.02
DATE: 10/3/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
15	0.04	STONE TILE							
	0.11	SAND and CEMENT							
	0.3	CONCRETE SLAB							
		FILL/Sandy CLAY: low to medium plasticity, brown and grey, with fine to medium sandstone and ironstone gravel, brick rubble, sandstone boulders, and igneous rock cobbles (railway ballast), trace ash and slag		A/E*	0.3 0.4		PID<1ppm		
				A/E	0.6 0.7		PID<1ppm		
	0.8	FILL: building rubble (concrete rubble, bricks, railway ballast and sandstone boulders in a clayey sand matrix)							
14	1.1	Bore discontinued at 1.1m - Refusal in fill							
13									
12									
11									

RIG: NDD and hand tools **DRILLER:** Excavac **LOGGED:** JS **CASING:** Uncased

TYPE OF BORING: Diatube (200mm dia.) to 0.30m, Non-Destructive Digging 0.30-1.1m

WATER OBSERVATIONS: No free ground water observed

REMARKS: *Field replicate BD2/10.03.21 collected from 0.3-0.4m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.8 m AHD
EASTING: 333921
NORTHING: 6249260
DIP/AZIMUTH: 90°/--

BORE No: BH1004A
PROJECT No: 86884.02
DATE: 11 - 18/3/2021
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.04	STONE TILE										
	0.1	SAND and CEMENT										
		CONCRETE SLAB										
	0.3	At 0.26m: 8mm reinforcement steel							A/E*			PID<1ppm
15		FILL/Clayey SAND: fine to medium, brown, with silty clay, sandstone gravel and cobbles, igneous rock cobbles (railway ballast), concrete and brick rubble, bricks and rubbish (plastic bottles), trace ash and slag										
	0.6											
	1	FILL: building rubble (concrete rubble, bricks, railway ballast, sandstone gravel, cobbles and boulders, in a clayey sand matrix)							A/E			PID<1ppm
14	2											
	2.1	FILL/SILT: low to non-plastic, grey, with sandstone gravel and bricks							A/E			PID<1ppm
	2.2	FILL: building rubble (concrete and bricks - possible footing)										
13	2.7	FILL/SAND: medium, brown, moist										
	3 3.0	SAND SP: medium, pale grey, wet, medium dense to dense, alluvial							S/E			7,12,18 N = 30 PID<1ppm REC = 0.3m
12	4 4.0	Silty CLAY CL-CI: low to medium plasticity, grey, trace charcoal, w>PL, very soft to soft, alluvial							S			pp = 50 2,0,0 N = 0 REC = 0.2m
11												

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.6m

TYPE OF BORING: Diatube (200mm dia.) and Non-Destructive Digging (NDD) to 2.1m, NDD 2.1-2.3m, NMLC coring 2.3-3.1m, washbore 3.1-6.0m, NMLC coring 6.0-18.22m

WATER OBSERVATIONS: No free ground water observed

REMARKS: *Field replicate BD4/110321 collected from 0.3-0.4m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.8 m AHD
EASTING: 333921
NORTHING: 6249260
DIP/AZIMUTH: 90°/--

BORE No: BH1004A
PROJECT No: 86884.02
DATE: 11 - 18/3/2021
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
10		Silty CLAY CL-CI: low to medium plasticity, grey, trace charcoal, w>PL, very soft to soft, alluvial *(continued)*						Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-5°, with ironstaining or clay coating				
	5.6	SANDSTONE: brown, low to medium strength, Mittagong Formation										
6	6.0	SANDSTONE: medium to coarse grained, brown, pale grey and red-brown, medium strength, highly weathered with 20-40% extremely weathered beds, slightly fractured, Mittagong Formation						6.33-6.83m: Ds 500mm	(S)			10/10 refusal PL(A) = 0.4
9	6.83	SANDSTONE: medium to coarse grained, red-brown, orange and pale grey, medium strength, highly then moderately weathered, slightly fractured, Hawkesbury Sandstone						7.41m: J30°, pl, ro, cly vn 7.50-7.54m: Ds 40mm 7.80-7.83m: Ds 30mm	C	100	60	PL(A) = 0.8
8		Below 7.86m: grading to pale grey, slightly weathered										PL(A) = 0.6
	8.36	SANDSTONE: fine to medium grained, pale grey, indistinct bedding at 0-10°, high strength, fresh, slightly fractured, Hawkesbury Sandstone						8.33-8.36m: Ds 30mm	C	100	93	PL(A) = 1.2
7	8.93	SANDSTONE: medium to coarse grained, pale grey, distinct and indistinct bedding at 0-10°, cross-bedded, medium strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone						8.93m: B10°, pl, ro, cly co 10mm	C	100	100	PL(A) = 0.8

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.6m

TYPE OF BORING: Diatube (200mm dia.) and Non-Destructive Digging (NDD) to 2.1m, NDD 2.1-2.3m, NMLC coring 2.3-3.1m, washbore 3.1-6.0m, NMLC coring 6.0-18.22m

WATER OBSERVATIONS: No free ground water observed

REMARKS: *Field replicate BD4/110321 collected from 0.3-0.4m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.8 m AHD
EASTING: 333921
NORTHING: 6249260
DIP/AZIMUTH: 90°/--

BORE No: BH1004A
PROJECT No: 86884.02
DATE: 11 - 18/3/2021
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE: medium to coarse grained, pale grey, distinct and indistinct bedding at 0-10°, cross-bedded, medium strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*							C	100	100	
	11								C	100	95	PL(A) = 0.7
	12								C	100	100	PL(A) = 0.9
	13											PL(A) = 0.9
	14							13.82m: B5°, pl, ro, cly co 5mm 14.31m: B10°, pl, ro, cly vn 14.91m: B10°, pl, ro, cly vn	C	100	99	PL(A) = 0.8 PL(A) = 0.8

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.6m

TYPE OF BORING: Diatube (200mm dia.) and Non-Destructive Digging (NDD) to 2.1m, NDD 2.1-2.3m, NMLC coring 2.3-3.1m, washbore 3.1-6.0m, NMLC coring 6.0-18.22m

WATER OBSERVATIONS: No free ground water observed

REMARKS: *Field replicate BD4/110321 collected from 0.3-0.4m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.8 m AHD
EASTING: 333921
NORTHING: 6249260
DIP/AZIMUTH: 90°/--

BORE No: BH1004A
PROJECT No: 86884.02
DATE: 11 - 18/3/2021
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
0	16	SANDSTONE: medium to coarse grained, pale grey, distinct and indistinct bedding at 0-10°, cross-bedded, medium strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)* Between 15.15-15.47m: extremely low strength, extremely weathered bed						15.15-15.47m: Ds 320mm 15.52-15.59m: J70°, pl, ro, cly vn, partially healed 15.83m: B10°, pl, ro, cly co 10mm 15.83-16.00m: J80°, ir, ro, cln, partially healed 15.96m: B10°, pl, ro, cly co 10mm	C	100	99	
									C	100	65	PL(A) = 0.9
-1	17	Between 16.72-17.42m: cross-bedded at 0-10°, low strength, with extremely weathered seams, fractured						16.6m: B10°, pl, ro, cly co 5mm 16.72m: B10°, pl, ro, cly co 5mm 16.85m: B10°, pl, ro, cly co 5mm 16.95m: B10°, pl, ro, cly co 10mm 17.18m: B10°, pl, ro, cly co 5mm 17.29-17.42m: Ds 130mm				PL(A) = 0.3
		Between 17.42-18.22m: cross-bedded at 0-10°, high strength, slightly fractured							C	100	86	
-2	18							17.7m: B10°, pl, ro, cly co 10mm 17.81m: B5°, ir, ro, cbs				PL(A) = 1.7
	18.22	Bore discontinued at 18.22m - Target depth reached										
-3	19											
-4												

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.6m

TYPE OF BORING: Diatube (200mm dia.) and Non-Destructive Digging (NDD) to 2.1m, NDD 2.1-2.3m, NMLC coring 2.3-3.1m, washbore 3.1-6.0m, NMLC coring 6.0-18.22m

WATER OBSERVATIONS: No free ground water observed

REMARKS: *Field replicate BD4/110321 collected from 0.3-0.4m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.9 m AHD
EASTING: 333920
NORTHING: 6249246
DIP/AZIMUTH: 90°/--

BORE No: BH1005
PROJECT No: 86884.02
DATE: 10 - 16/3/2021
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Type	Core Rec. %	RQD %	Test Results & Comments
15	0.02	STONE TILE				
	0.07	SAND and CEMENT				
	0.22	CONCRETE SLAB: 3x plastic conduit (empty)	A/E*			PID<1ppm
	0.3	Between 0.17-0.20m: 8mm steel reinforcement				
		FILL/Clayey SAND: fine to medium, brown, with fine to medium gravel and concrete rubble, dry	A/E			PID<1ppm
	1	FILL: building rubble (concrete rubble, bricks, sandstone gravel, cobbles and boulders, railway ballast, ash, slag, in sandy clay matrix)				
	1.3	FILL/Clayey SAND: fine to medium, brown and grey, with sandstone and igneous rock gravel and cobbles and brick rubble, trace ash and slag	A/E			PID<1ppm
14	2					
	2.8	SAND SP: medium, pale grey, wet, medium dense to dense, alluvial	S/E			8,15,15 N = 30 PID<1ppm
13	3		A/E			
12	4					
	4.2	SAND SP: medium, pale brown and red-brown, wet, dense to very dense, alluvial	S			10,25 refusal
11	5.0					

Degree of Weathering: EW, HW, MW, SW, FS, FR
Graphic Log
Rock Strength: Ex Low, Very Low, Low, Medium, High, Very High, Ex High
Water
Fracture Spacing (m): 0.01, 0.05, 0.10, 0.50, 1.00
Discontinuities: B - Bedding, J - Joint, S - Shear, F - Fault

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.3m

TYPE OF BORING: Diatube (200mm dia.) to 0.22m, Non-Destructive Digging 0.22-1.65m, Solid Flight Auger (TC-bit) 1.65-8.74m, NMLC coring 8.74-15.85m

WATER OBSERVATIONS: Groundwater not observed in open hole prior to auger drilling, due to surface water filling hole

REMARKS: *Field replicate BD1/100321 collected from 0.22-0.30m. Sand collapse at 2.5m, possible water table level

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.9 m AHD
EASTING: 333920
NORTHING: 6249246
DIP/AZIMUTH: 90°/--

BORE No: BH1005
PROJECT No: 86884.02
DATE: 10 - 16/3/2021
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SAND SP: refer previous page										
	5.2	Silty CLAY CI-CH: medium to high plasticity, grey, trace fine gravel and charcoal, w=PL, stiff to very stiff, alluvial							S			pp = 400 4,7,12 N = 19
	6.2	Silty CLAY CI-CH: medium to high plasticity, pale grey and pale brown, with fine to medium ironstone gravel, w>=PL, stiff with some soft to firm layers, residual soil							S			pp = 200 5,6,6 N = 12
	8.0	Clayey SAND SC: medium, brown, dry, very dense, extremely weathered sandstone						Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-5°, with ironstaining or clay infill	S			15/100 refusal
	8.74	SANDSTONE: medium grained, orange-brown, very low strength, highly weathered, fractured, Hawkesbury Sandstone										
	8.9	SANDSTONE: medium to coarse grained, pale grey, bedded at 0-10°, medium to high strength, slightly weathered, slightly fractured to unbroken, Hawkesbury Sandstone							C	100	87	PL(A) = 0.9
									C	100	92	PL(A) = 0.9

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.3m

TYPE OF BORING: Diatube (200mm dia.) to 0.22m, Non-Destructive Digging 0.22-1.65m, Solid Flight Auger (TC-bit) 1.65-8.74m, NMLC coring 8.74- 15.85m

WATER OBSERVATIONS: Groundwater not observed in open hole prior to auger drilling, due to surface water filling hole

REMARKS: *Field replicate BD1/100321 collected from 0.22-0.30m. Sand collapse at 2.5m, possible water table level

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.9 m AHD
EASTING: 333920
NORTHING: 6249246
DIP/AZIMUTH: 90°/--

BORE No: BH1005
PROJECT No: 86884.02
DATE: 10 - 16/3/2021
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
5	11	SANDSTONE: medium to coarse grained, pale grey, bedded at 0-10°, medium to high strength, slightly weathered, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)* Between 10.13-13.05m: fresh						10.11-10.13m: Ds 20mm	C	100	92	PL(A) = 0.9
4	12	Between 12.33-12.51m: fine to medium grained, grey							C	100	100	PL(A) = 0.9 PL(A) = 1.1
3	13 13.05	SANDSTONE: medium to coarse grained, pale grey, indistinct bedding at 0-10°, very low then low strength, highly weathered with extremely weathered seams, fractured, Hawkesbury Sandstone						13.05m: B 10°, pl, ro, cly co 13.31-13.33m: Ds 20mm 13.50-13.55m: Ds 50mm 13.60-13.6m: J40° (x2), pl, ro, cly co 10mm 13.84-13.86m: Ds 20mm	C	100	31	PL(A) = 0.1
2	14 14.21	SANDSTONE: medium to coarse grained, pale grey, bedded at 0-10°, low to medium strength, slightly weathered, slightly fractured, Hawkesbury Sandstone Below 14.75m: medium or medium to high strength, fresh						14.04m: B10°, pl, ro, cly co 10mm 14.1m: J60°, ir, ro, cly co 14.17m: J40°, ir, ro, cly co 14.21m: B10°, pl, ro, cly vn 14.62-14.66m: Ds 20mm 14.72-14.75m: Ds 30mm	C	100	84	PL(A) = 0.3 PL(A) = 0.8
1												

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.3m

TYPE OF BORING: Diatube (200mm dia.) to 0.22m, Non-Destructive Digging 0.22-1.65m, Solid Flight Auger (TC-bit) 1.65-8.74m, NMLC coring 8.74- 15.85m

WATER OBSERVATIONS: Groundwater not observed in open hole prior to auger drilling, due to surface water filling hole

REMARKS: *Field replicate BD1/100321 collected from 0.22-0.30m. Sand collapse at 2.5m, possible water table level

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.9 m AHD
EASTING: 333920
NORTHING: 6249246
DIP/AZIMUTH: 90°/--

BORE No: BH1005
PROJECT No: 86884.02
DATE: 10 - 16/3/2021
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE: medium to coarse grained, pale grey, bedded at 0-10°, low to medium strength, slightly weathered, slightly fractured, Hawkesbury Sandstone *(continued)*							C	100	84	PL(A) = 1
	15.85	Bore discontinued at 15.85m - Target depth reached										

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 2.3m

TYPE OF BORING: Diatube (200mm dia.) to 0.22m, Non-Destructive Digging 0.22-1.65m, Solid Flight Auger (TC-bit) 1.65-8.74m, NMLC coring 8.74-15.85m

WATER OBSERVATIONS: Groundwater not observed in open hole prior to auger drilling, due to surface water filling hole

REMARKS: *Field replicate BD1/100321 collected from 0.22-0.30m. Sand collapse at 2.5m, possible water table level

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.7 m AHD
EASTING: 333896
NORTHING: 6249252
DIP/AZIMUTH: 90°/--

BORE No: BH1006
PROJECT No: 86884.02
DATE: 10/3/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
15	0.02	STONE TILE							
	0.06	SAND and CEMENT							
	0.18	CONCRETE SLAB							
		At 0.18m: 20mm copper water pipe							
		FILL: igneous rock cobbles (railway ballast) with fine to medium grained sand and brick rubble							
		At 0.4m: 8mm steel reinforcement fragment							
	0.8	0.80-0.85m: 65mm and 100mm copper pipes (buried services)							
	1	Bore discontinued at 0.8m - Refusal on buried services							
14	2								
13	3								
12	4								
11									

RIG: NDD and hand tools **DRILLER:** Excavac **LOGGED:** JS **CASING:** Uncased

TYPE OF BORING: Diatube (200mm dia.) to 0.18m, Non-Destructive Digging 0.18-0.80m

WATER OBSERVATIONS: No free ground water observed

REMARKS: Terminated on copper pipes

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.8 m AHD
EASTING: 333896
NORTHING: 6249263
DIP/AZIMUTH: 90°/--

BORE No: BH1007
PROJECT No: 86884.02
DATE: 11 - 17/3/2021
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.02	STONE TILE										
	0.07	SAND and CEMENT										
	0.2	CONCRETE SLAB Between 0.14-0.15m: 8mm steel reinforcement							A/E*			PID<1ppm
15		FILL/Clayey SAND: fine to medium, brown and grey, with sandstone gravel and cobbles, igneous rock cobble (railway ballast), concrete rubble and bricks, trace ash and slag							A/E			PID<1ppm
	1											
									A/E			PID<1ppm
14												
	2								A/E			PID<1ppm
	2.3	FILL/SAND: medium to coarse, pale brown and grey, with pale grey and red-brown silty clay and fine to medium gravel, moist										
13									S/E			4,6,6 N = 12 PID60 ppm
	3											
	3.5	SAND SP: medium, pale grey, wet, dense, alluvial										
12						▼ 16-03-21			S/E*			8,16,25 N = 41 PID16 ppm
	4											
11												

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 1.7m, HQ to 9.2m

TYPE OF BORING: Diatube (200mm dia.) to 0.2m, Non-Destructive Digging 0.2-1.6m, Solid Flight Auger (TC-bit) 1.6-8.5m, washbore 8.5-9.5m, NMLC coring 9.5-16.2m

WATER OBSERVATIONS: Free groundwater observed at 4.2m depth whilst augering

REMARKS: *Field replicates BD1/110321 from 0.2-0.3m and BD1/160321 from 4.0-4.45m; 20% water loss below 12.8 and 80% loss below 14.64m; Standpipe installed:- Blank PVC 0.0-10.2m, screen PVC 10.2-16.2m, bentonite 8.5-9.5m, sand 9.5-16.2m, backfill 0-0.5m, gatic

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.8 m AHD
EASTING: 333896
NORTHING: 6249263
DIP/AZIMUTH: 90°/--

BORE No: BH1007
PROJECT No: 86884.02
DATE: 11 - 17/3/2021
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SAND SP: medium, pale grey, wet, dense, alluvial *(continued)* Below 5.0m: grading to loose										
	5.7	Silty CLAY CL-CI: low to medium plasticity, grey, trace fine gravel, w>PL, stiff to very stiff, alluvial							S			pp = 100 3,7,9 N = 16
	6.5	SAND SP: medium, brown, wet, medium dense, alluvial										
	7.2	Silty CLAY CI-CH: medium to high plasticity, pale grey and brown, with ironstone gravel, w>PL, very stiff, residual soil							S			pp = 500 8,15,15 N = 30
	8.0	Clayey SAND SC: medium to coarse, pale grey and brown, with silty clay layers, wet, medium dense, extremely weathered sandstone						Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-5°, with iron staining or clay coating	S			20,13,8 N = 21
	9.2	SANDSTONE: brown, very low strength, Hawkesbury Sandstone				19-03-21						
	9.5	SANDSTONE: medium to coarse grained, brown, indistinct bedding at 0-10°, very low strength, highly weathered, fractured, Hawkesbury Sandstone							C	100	97	PL(A) = 0.1
	9.83	SANDSTONE: refer following page										PL(A) = 1.2
	10.0											

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 1.7m, HQ to 9.2m

TYPE OF BORING: Diatube (200mm dia.) to 0.2m, Non-Destructive Digging 0.2-1.6m, Solid Flight Auger (TC-bit) 1.6-8.5m, washbore 8.5-9.5m, NMLC coring 9.5-16.2m

WATER OBSERVATIONS: Free groundwater observed at 4.2m depth whilst augering

REMARKS: *Field replicates BD1/110321 from 0.2-0.3m and BD1/160321 from 4.0-4.45m; 20% water loss below 12.8 and 80% loss below 14.64m; Standpipe installed:- Blank PVC 0.0-10.2m, screen PVC 10.2-16.2m, bentonite 8.5-9.5m, sand 9.5-16.2m, backfill 0-0.5m, gatic

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.8 m AHD
EASTING: 333896
NORTHING: 6249263
DIP/AZIMUTH: 90°/--

BORE No: BH1007
PROJECT No: 86884.02
DATE: 11 - 17/3/2021
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE: medium to coarse grained, pale grey, distinct bedding at 0-10°, high strength, fresh, slightly fractured, Hawkesbury Sandstone *(continued)*							C	100	97	
	11	Below 10.87m: with 5-10% fine to medium grained beds, and low to medium strength to 10.91m Below 10.98m: medium strength to high strength, unbroken						10.87-10.91m: Ds 40mm 10.98m: B10°, pl, ro, cly co 10mm				PL(A) = 0.3
									C	100	88	PL(A) = 0.4
	12											
	13								C	100	100	PL(A) = 1.1
	14								C	100	97	PL(A) = 0.9
								14.64-14.68m: B5° (x5), pl, ro, cly co				PL(A) = 1.5

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 1.7m, HQ to 9.2m

TYPE OF BORING: Diatube (200mm dia.) to 0.2m, Non-Destructive Digging 0.2-1.6m, Solid Flight Auger (TC-bit) 1.6-8.5m, washbore 8.5-9.5m, NMLC coring 9.5-16.2m

WATER OBSERVATIONS: Free groundwater observed at 4.2m depth whilst augering

REMARKS: *Field replicates BD1/110321 from 0.2-0.3m and BD1/160321 from 4.0-4.45m; 20% water loss below 12.8 and 80% loss below 14.64m; Standpipe installed:- Blank PVC 0.0-10.2m, screen PVC 10.2-16.2m, bentonite 8.5-9.5m, sand 9.5-16.2m, backfill 0-0.5m, gatic

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.8 m AHD
EASTING: 333896
NORTHING: 6249263
DIP/AZIMUTH: 90°/--

BORE No: BH1007
PROJECT No: 86884.02
DATE: 11 - 17/3/2021
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
0	16	SANDSTONE: medium to coarse grained, pale grey, distinct bedding at 0-10°, high strength, fresh, slightly fractured, Hawkesbury Sandstone *(continued)*							C	100	97	PL(A) = 0.8
									C	100	97	PL(A) = 1.3
	16.2	Bore discontinued at 16.2m - Target depth reached										
-1	17											
-2	18											
-3	19											
-4												

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 1.7m, HQ to 9.2m

TYPE OF BORING: Diatube (200mm dia.) to 0.2m, Non-Destructive Digging 0.2-1.6m, Solid Flight Auger (TC-bit) 1.6-8.5m, washbore 8.5-9.5m, NMLC coring 9.5-16.2m

WATER OBSERVATIONS: Free groundwater observed at 4.2m depth whilst augering

REMARKS: *Field replicates BD1/110321 from 0.2-0.3m and BD1/160321 from 4.0-4.45m; 20% water loss below 12.8 and 80% loss below 14.64m; Standpipe installed:- Blank PVC 0.0-10.2m, screen PVC 10.2-16.2m, bentonite 8.5-9.5m, sand 9.5-16.2m, backfill 0-0.5m, gatic

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.8 m AHD
EASTING: 333896
NORTHING: 6249263
DIP/AZIMUTH: 90°/--

BORE No: BH1007
PROJECT No: 86884.02
DATE: 11 - 17/3/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
15	0.02	STONE TILE							
	0.07	SAND and CEMENT		A/E*	0.2 0.3		PID<1ppm		
	0.2	CONCRETE SLAB Between 0.14-0.15m: 8mm steel reinforcement		A/E	0.6 0.7		PID<1ppm		
14	1	FILL/Clayey SAND: fine to medium, brown and grey, with sandstone gravel and cobbles, igneous rock cobble (railway ballast), concrete rubble and bricks, trace ash and slag		A/E	1.5 1.6		PID<1ppm		
	2			A/E	2.0 2.1		PID<1ppm		
13	2.3	FILL/SAND: medium to coarse, pale brown and grey, with pale grey and red-brown silty clay and fine to medium gravel, moist		S/E	2.5 2.95		4,6,6 N = 12 PID60 ppm		
	3								
12	3.5	SAND SP: medium, pale grey, wet, dense, alluvial		S/E*	4.0 4.45		8,16,25 N = 41 PID16 ppm	16-03-21	Backfill 0-0.5m
	4								
11	5	Below 5.0m: grading to loose							
	5.7	Silty CLAY CL-CI: low to medium plasticity, grey, trace fine gravel, w>PL, stiff to very stiff, alluvial		S	5.5 5.95		pp = 100 3,7,9 N = 16		
10	6								
	6.5	SAND SP: medium, brown, wet, medium dense, alluvial							
9	7			S	7.0 7.45		pp = 500 8,15,15 N = 30		
	7.2	Silty CLAY CI-CH: medium to high plasticity, pale grey and brown, with ironstone gravel, w>PL, very stiff, residual soil							
8	8								
	8.0	Clayey SAND SC: medium to coarse, pale grey and brown, with silty clay layers, wet, medium dense, extremely weathered sandstone		S	8.5 8.95		20,13,8 N = 21		
7	9								Bentonite 8.5-9.5m
	9.2	SANDSTONE: brown, very low strength, Hawkesbury Sandstone						19-03-21	
	9.5	SANDSTONE: medium to coarse grained, brown, indistinct bedding at 0-10°, very low strength, highly weathered, fractured, Hawkesbury Sandstone		C	9.5 9.52		PL(A) = 0.1		
6	9.83 10.0								

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 1.7m, HQ to 9.2m

TYPE OF BORING: Diatube (200mm dia.) to 0.2m, Non-Destructive Digging 0.2-1.6m, Solid Flight Auger (TC-bit) 1.6-8.5m, washbore 8.5-9.5m, NMLC coring 9.5-16.2m

WATER OBSERVATIONS: Free groundwater observed at 4.2m depth whilst augering

REMARKS: *Field replicates BD1/110321 from 0.2-0.3m and BD1/160321 from 4.0-4.45m; 20% water loss below 12.8 and 80% loss below 14.64m; Standpipe installed:- Blank PVC 0.0-10.2m, screen PVC 10.2-16.2m, bentonite 8.5-9.5m, sand 9.5-16.2m, backfill 0-0.5m, gatic

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 15.8 m AHD
EASTING: 333896
NORTHING: 6249263
DIP/AZIMUTH: 90°/--

BORE No: BH1007
PROJECT No: 86884.02
DATE: 11 - 17/3/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDSTONE: refer following page			9.96		PL(A) = 1.2		
		SANDSTONE: medium to coarse grained, pale grey, distinct bedding at 0-10°, high strength, fresh, slightly fractured, Hawkesbury Sandstone *(continued)*		C	10.7				
	11	Below 10.87m: with 5-10% fine to medium grained beds, and low to medium strength to 10.91m			10.94		PL(A) = 0.3		11
		Below 10.98m: medium strength to high strength, unbroken		C	11.44		PL(A) = 0.4		
	12				12.28				12
	13			C	12.96		PL(A) = 1.1		13 Sand filter 9.5-16.2m; Slotted PVC pipe 10.2-16.2m
					13.71				
	14				13.94		PL(A) = 0.9		14
				C					
	15				14.95		PL(A) = 1.5		15
					15.27		PL(A) = 0.8		
					15.3				
				C					
	16				15.96		PL(A) = 1.3		16
	16.2	Bore discontinued at 16.2m - Target depth reached			16.2				End Cap
	17								17
	18								18
	19								19

RIG: NDD, hand tools, XC Drill **DRILLER:** Excavac, Terratest **LOGGED:** JS **CASING:** HW to 1.7m, HQ to 9.2m

TYPE OF BORING: Diatube (200mm dia.) to 0.2m, Non-Destructive Digging 0.2-1.6m, Solid Flight Auger (TC-bit) 1.6-8.5m, washbore 8.5-9.5m, NMLC coring 9.5-16.2m

WATER OBSERVATIONS: Free groundwater observed at 4.2m depth whilst augering

REMARKS: *Field replicates BD1/110321 from 0.2-0.3m and BD1/160321 from 4.0-4.45m; 20% water loss below 12.8 and 80% loss below 14.64m; Standpipe installed:- Blank PVC 0.0-10.2m, screen PVC 10.2-16.2m, bentonite 8.5-9.5m, sand 9.5-16.2m, backfill 0-0.5m, gatic

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 14.0 AHD
EASTING: 333924.5
NORTHING: 6249271
DIP/AZIMUTH: 90°/--

BORE No: BH2001A
PROJECT No: 86884.02
DATE: 21 - 22/6/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (XW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
14	0.15	CONCRETE SLAB: no steel reinforcement observed										
		FILL/SAND: medium, brown, with sandstone gravel, cobbles and boulders, trace concrete rubble, moist, generally in a very dense condition							A/E			PID<1
13	1.0	FILL/SAND: medium, brown and grey, with silty clay and sandstone, siltstone and igneous gravel, wet, generally in a medium dense condition				21-06-21		Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-10°, with ironstaining or clay coating	A/E			PID<1
12	2.0	Sandy CLAY CL-CI: low to medium plasticity, pale grey and brown, fine sand, w>PL, inferred very stiff to hard, residual soil							A/E			PID<1
	2.5	SANDSTONE: medium grained, brown and red-brown with pale grey bands, medium strength, highly weathered, slightly fractured, Mittagong Formation							C	100	0	PL(A) = 0.6
11	3							3.40m: Ds, 90mm	C	100	79	
	3.78	SANDSTONE: medium to coarse grained, red-brown and grey, cross-bedded and medium bedded, medium strength, moderately weathered, fractured, Hawkesbury Sandstone						3.60-3.70m: J80-90°, ir, ro, cly vn, he 3.75m: Ds, 30mm				PL(A) = 0.6
10	4											
	4.68							4.58-4.60m: B0-5°(x3), pl, ro, fe co	C	100	97	PL(A) = 0.7

RIG: Proline **DRILLER:** Tightsite **LOGGED:** JS **CASING:** HQ to 2.5 m
TYPE OF BORING: Diatube (150mm dia) to 0.15m, hand auger to 1.8m, rotary washbore to 2.5m, NMLC coring to 12m

WATER OBSERVATIONS: Free groundwater observed at 1.2m

REMARKS: Co-ordinates interpolated relative to site features. Surface level taken from Synman Justin Blalek Architects Pty Ltd, Job 4000, Drawing No. WD05, Rev D, dated 29 July 1989. Borehole re-instated using cement grout.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 14.0 AHD
EASTING: 333924.5
NORTHING: 6249271
DIP/AZIMUTH: 90°/--

BORE No: BH2001A
PROJECT No: 86884.02
DATE: 21 - 22/6/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (XW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
9		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, with fine to medium grained bands, medium strength, fresh, slightly fractured, Hawkesbury Sandstone *(continued)*							C	100	97	
								5.67m: Ds, 20mm				
8	6											PL(A) = 0.7
		Below 6.4m: high strength, unbroken							C	100	100	
7	7											PL(A) = 1.4
		Below 7.33m: 1-5% carbonaceous laminations Below 7.6m: thinly to thickly bedded, medium to high strength										
6	8								C	100	100	PL(A) = 1.1
5	9											PL(A) = 0.8
									C	100	100	
												PL(A) = 1.2

RIG: Proline **DRILLER:** Tightsite **LOGGED:** JS **CASING:** HQ to 2.5 m
TYPE OF BORING: Diatube (150mm dia) to 0.15m, hand auger to 1.8m, rotary washbore to 2.5m, NMLC coring to 12m

WATER OBSERVATIONS: Free groundwater observed at 1.2m

REMARKS: Co-ordinates interpolated relative to site features. Surface level taken from Synman Justin Blalek Architects Pty Ltd, Job 4000, Drawing No. WD05, Rev D, dated 29 July 1989. Borehole re-instated using cement grout.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 14.0 AHD
EASTING: 333924.5
NORTHING: 6249271
DIP/AZIMUTH: 90°/--

BORE No: BH2001A
PROJECT No: 86884.02
DATE: 21 - 22/6/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (XW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
4		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, with fine to medium grained bands, medium strength, fresh, slightly fractured, Hawkesbury Sandstone *(continued)*										
3	11								C	100	100	PL(A) = 1
												PL(A) = 0.9
2	12 12.0	Bore discontinued at 12.0m - Target depth										
1	13											
0	14											

RIG: Proline **DRILLER:** Tightsite **LOGGED:** JS **CASING:** HQ to 2.5 m
TYPE OF BORING: Diatube (150mm dia) to 0.15m, hand auger to 1.8m, rotary washbore to 2.5m, NMLC coring to 12m
WATER OBSERVATIONS: Free groundwater observed at 1.2m
REMARKS: Co-ordinates interpolated relative to site features. Surface level taken from Synman Justin Blalek Architects Pty Ltd, Job 4000, Drawing No. WD05, Rev D, dated 29 July 1989. Borehole re-instated using cement grout.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 14.0 AHD
EASTING: 333933.5
NORTHING: 6249269
DIP/AZIMUTH: 90°/--

BORE No: BH2002
PROJECT No: 86884.02
DATE: 21 - 23/6/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (XW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
14	0.08	CONCRETE SLAB: no steel reinforcement observed							A/E			PID<1
		FILL/SAND: medium, brown, with concrete, brick and ceramic tile rubble, sandstone and igneous gravel and cobbles (up to 130mm), moist, generally in a medium dense condition							A/E			PID<1
	0.6	SAND SW: medium, pale grey and brown, moist, dense to very dense, alluvial soil										
13	1	Below 0.95m: wet				21-06-21			A/E			PID<1
		Below 1.2m: medium dense to very dense						Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-10°, with ironstaining or clay coating				
	1.65	Sandy CLAY CL-CI: low to medium plasticity, pale grey and brown, fine sand, w<=PL, very stiff, residual soil										
12	1.95	Sandy CLAY CL-CI: low to medium plasticity, brown and red-brown, fine sand, w<=PL, very stiff to hard, relict rock texture, extremely weathered sandstone										
	2.47	SANDSTONE: medium grained, brown, red-brown and pale grey, very low strength with medium to high strength bands, highly weathered with extremely weathered bands, fractured, Mittagong Formation						2.51m: Ds, 50mm 2.58m: B20°, pl, ro, cly vn 2.61m: B20°, pl, ro, cly co 2.63m: Ds, 40mm 2.71m: Ds, 70mm 3.00m: Ds, 240mm	C	100	0	PL(A) = 0.9
11	3											
	3.24	SANDSTONE: medium to coarse grained, pale grey and brown, low then medium to high strength, highly weathered to slightly weathered, slightly fractured, Hawkesbury Sandstone						3.24m: J70°, pl, ro, cly co 3.30-3.42m: J70°, pl, ro, cly co 3.41m: Ds, 10mm				PL(A) = 0.2
								3.90m: Ds, 2mm	C	100	48	PL(A) = 1.1
10	4											
	4.28	SANDSTONE: medium to coarse grained, with fine to medium grained bands, pale grey, distinctly and indistinctly cross-bedded at 0-10°, thinly to medium bedded, medium to high strength with bands of medium or high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone							C	100	100	PL(A) = 1

RIG: Proline **DRILLER:** Tightsite **LOGGED:** JS **CASING:** HQ to 2.1m
TYPE OF BORING: Diatube (150mm dia) to 0.08m, hand auger to 1.0m, rotary washbore to 2.12m, NMLC coring to 12m

WATER OBSERVATIONS: Free groundwater observed at 0.95m

REMARKS: Co-ordinates interpolated relative to site features. Surface level taken from Synman Justin Blalek Architects Pty Ltd, Job 4000, Drawing No. WD05, Rev D, dated 29 July 1989. Borehole re-instated using cement grout.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 14.0 AHD
EASTING: 333933.5
NORTHING: 6249269
DIP/AZIMUTH: 90°/--

BORE No: BH2002
PROJECT No: 86884.02
DATE: 21 - 23/6/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (XW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
9		SANDSTONE: medium to coarse grained, with fine to medium grained bands, pale grey, distinctly and indistinctly cross-bedded at 0-10°, thinly to medium bedded, medium to high strength with bands of medium or high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*							C	100	100	
8	6											PL(A) = 0.8
												PL(A) = 1.5
7	7								C	100	100	
												PL(A) = 0.9
		Below 7.6m: medium to high strength, thinly to thickly bedded						7.61-8.11m: J80°, pl, ro, cly vn (partially healed)				
6	8								C	100	100	
5	9											PL(A) = 1.1
		Below 9.3m: high strength										PL(A) = 1.5
									C	100	100	

RIG: Proline **DRILLER:** Tightsite **LOGGED:** JS **CASING:** HQ to 2.1m
TYPE OF BORING: Diatube (150mm dia) to 0.08m, hand auger to 1.0m, rotary washbore to 2.12m, NMLC coring to 12m

WATER OBSERVATIONS: Free groundwater observed at 0.95m

REMARKS: Co-ordinates interpolated relative to site features. Surface level taken from Synman Justin Blalek Architects Pty Ltd, Job 4000, Drawing No. WD05, Rev D, dated 29 July 1989. Borehole re-instated using cement grout.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 2-8a Lee Street, Haymarket

SURFACE LEVEL: 14.0 AHD
EASTING: 333933.5
NORTHING: 6249269
DIP/AZIMUTH: 90°/--

BORE No: BH2002
PROJECT No: 86884.02
DATE: 21 - 23/6/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (XW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
4		SANDSTONE: medium to coarse grained, with fine to medium grained bands, pale grey, distinctly and indistinctly cross-bedded at 0-10°, thinly to medium bedded, medium to high strength with bands of medium or high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*										PL(A) = 1.3
3	11								C	100	100	
												PL(A) = 1.5
2	12 12.0	Bore discontinued at 12.0m - Target depth										
1	13											
0	14											

RIG: Proline **DRILLER:** Tightsite **LOGGED:** JS **CASING:** HQ to 2.1m

TYPE OF BORING: Diatube (150mm dia) to 0.08m, hand auger to 1.0m, rotary washbore to 2.12m, NMLC coring to 12m

WATER OBSERVATIONS: Free groundwater observed at 0.95m

REMARKS: Co-ordinates interpolated relative to site features. Surface level taken from Synman Justin Blalek Architects Pty Ltd, Job 4000, Drawing No. WD05, Rev D, dated 29 July 1989. Borehole re-instated using cement grout.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

Sampling Methods

Douglas Partners

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

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

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 – 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)
- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)
- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with ‘Mix of Soil and Cobbles/Boulders’ with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;
- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.
  Soil tends to stick together.
  Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.
  Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- ‘Moist, dry of plastic limit’ or ‘w <PL’ (i.e. hard and friable or powdery).
- ‘Moist, near plastic limit’ or ‘w ≈ PL (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- ‘Moist, wet of plastic limit’ or ‘w >PL’ (i.e. soils usually weakened and free water forms on the hands when handling).
- ‘Wet’ or ‘w ≈LL’ (i.e. near the liquid limit).
- ‘Wet’ or ‘w >LL’ (i.e. wet of the liquid limit).

Rock Strength

Rock strength is defined by the Unconfined Compressive Strength and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $Is_{(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

Strength Term	Abbreviation	Unconfined Compressive Strength MPa	Point Load Index * $Is_{(50)}$ MPa
Very low	VL	0.6 - 2	0.03 - 0.1
Low	L	2 - 6	0.1 - 0.3
Medium	M	6 - 20	0.3 - 1.0
High	H	20 - 60	1 - 3
Very high	VH	60 - 200	3 - 10
Extremely high	EH	>200	>10

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Rock Descriptions

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq \text{100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or stronger. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Symbols & Abbreviations

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

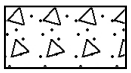
Symbols & Abbreviations

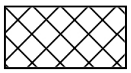
Graphic Symbols for Soil and Rock

General

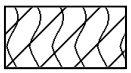

Asphalt

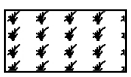

Road base

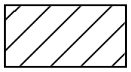

Concrete

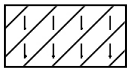

Filling

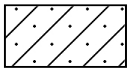
Soils


Topsoil

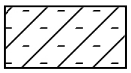

Peat

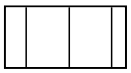

Clay

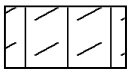

Silty clay

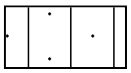

Sandy clay

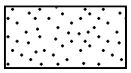

Gravelly clay

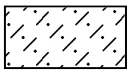

Shaly clay

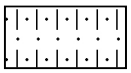

Silt


Clayey silt


Sandy silt

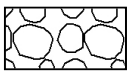

Sand

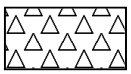

Clayey sand


Silty sand


Gravel

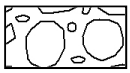

Sandy gravel


Cobbles, boulders

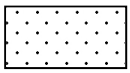

Talus

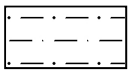
Sedimentary Rocks

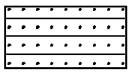

Boulder conglomerate

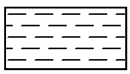

Conglomerate


Conglomeratic sandstone

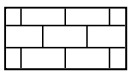

Sandstone


Siltstone

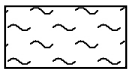

Laminite

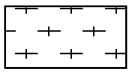

Mudstone, claystone, shale

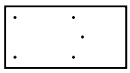

Coal


Limestone

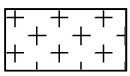
Metamorphic Rocks

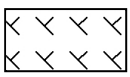

Slate, phyllite, schist

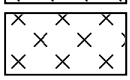

Gneiss

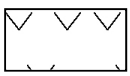

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Appendix E

Remediation Options Assessment and Evaluation

Appendix E
Remediation Options Assessment and Evaluation
2-8a Lee Street, Haymarket

E1.0 Introduction

The following key guidelines and technical reports were consulted in the preparation of this remediation options assessment:

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)* [NEPM]) (NEPC, 2013); and
- CRC CARE *Remediation Action Plan: Development - Guideline on Performing Remediation Options Assessment* (CRC CARE, 2019b).

The first stage of developing a remediation strategy is to establish clear and measurable remediation objectives and remediation criteria (clean-up levels). These will form the requirements against which remediation options are assessed.

The next stage of the remediation options assessment is to select technology and management options, or combinations of options, that have the potential to reduce contaminant concentrations and / or apply management controls as necessary so that the remediation objectives are achieved, and no unacceptable risk is posed by the contamination in the context of the current and proposed site use. Where several viable options have been identified, an assessment of each of the options will be required to determine which option will most adequately and sustainably meet the remediation objectives (CRC CARE, 2019b).

The remediation objectives are to:

- Address potentially unacceptable risks to relevant environmental values from contamination (refer to the CSM in Section 7); and
- Render the site suitable, from a contamination perspective, for the proposed development (refer to Section 1).

E1.1 Hierarchy of Remediation Options

NEPC (2013) stipulates the preferred hierarchy of options for site clean-up (remediation) and / or management which is outlined as follows:

- On-site treatment of the contamination so that it is destroyed, or the associated risk is reduced to an acceptable level; and
- Off-site treatment of excavated soil, so that the contamination is destroyed, or the associated risk is reduced to an acceptable level, after which soil is returned to the site.

If the above two options are not practicable;

- Consolidation and isolation of the soil on site by containment with a properly designed barrier; and
- Removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material.

Where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

When deciding which option to choose, the sustainability (environmental, economic and social) of each option should be considered, in terms of achieving an appropriate balance between the benefits and effects of undertaking the option. In cases where no readily available or economically feasible method is available for remediation, it may be possible to adopt appropriate regulatory controls or develop other forms of remediation (NEPC, 2013).

E2.0 Remediation Options Assessment

E2.1 Introduction

The following issues have been identified at the site which require remediation. Please refer to Section 11 for a summary of the remediation procedures including data gap assessment(s).

Table E1: Summary of Area of Known Extent of Remediation

Remediation Area	Contamination Issue	Area of Contamination Issue	Contaminant of Concern
Remediation Area (RA1)	Lead and PAH exceedances identified in the footprint of the cell as per ERM (2001) report; and lead and PAH waste class exceedances were detected in boreholes, BH1003 BH1004, BH1005 and BH1007 within or in proximity of the cell. In addition, friable asbestos was identified in borehole, BH1007 at depth of 2.0-2.1.	Please refer to Drawing 2 in Appendix B.	Lead, PAH and asbestos

The following table presents a review of remediation options.

Table E2: Evaluation of Remedial Options

Remedial Option	Assessment of Option	Comment
On-Site or Off-Site Treatment of Contaminated Soil	Some of the on-site soil treatment options include: **Bio-remediation:** Addition of oxygen and nutrient compounds to accelerate the natural process of organic compound decay within the environment. Not suitable for all contaminants. **Soil Washing:** Soil is stripped of contaminants via a leaching process and the concentrated contaminated liquid product retained for disposal or treatment. **Air Sparging and Extraction:** Air is forced through the contaminated soil to volatilise organic contaminants. The air is then extracted and captured for treatment leaving reduced contaminant concentrations; and **Thermal Desorption:** Contaminated soil are heated within an incinerator to volatilise or combust the contaminants. Contaminants are trapped within an air filtration system.	On-site treatment is likely to delay the civil and construction programme and is not considered feasible in the CBD area. The proposed development includes a basement across virtually the whole site and therefore on-site treatment for potential re-use is not practical. Off-site treatment is a possibility if lead and PAH levels exceed restricted solid waste category during the data gap investigation or remediation/validation programme.
Containment of Contaminated Soil	This would include the placement of an impermeable barrier such as concrete, warning barrier, non-contaminated soil material over existing ground surface to isolate contaminated material. The advantage of this option includes the reduction of transport contaminants via wind and water mechanisms. The disadvantage of this option includes the implementation of an environmental management plan which is required to be documented in the council planning certificate and / or title deeds which would in turn impact future land development and value.	Given the footprint of the basement levels would cover the entire site, there would no capacity to cap and contain the contaminated soils.

Remedial Option	Assessment of Option	Comment
Off-Site Disposal of Contaminated Soil	Off-site disposal of contaminated material is considered a suitable option for managing human health and environmental impacts from the contaminated materials. Off-site disposal comprises the excavation of soil, classification of spoil, and disposal to a facility which can legally receive it.	Given that basement excavation is required as part of the proposed development, off-site disposal of contaminated soil is considered to be the most viable option.

References

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.

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

NSW EPA. (2014). *Investigation of Service Station Sites.* NSW Environment Protection Authority.

NSW EPA. (2020). *Underground Petroleum Storage Systems - Guidelines for implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019.* Doc Ref: EPA 2020P2700: NSW Environment Protection Authority.

Douglas Partners Pty Ltd

Appendix F

Site Management Plan

Appendix F
Site Management Plan
2-8a Lee Street, Haymarket

F1.0 Introduction

This 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 2011* Cth (WHS Act) and Work *Health and Safety Regulations 2011* Cth.

F2.0 Roles and Responsibilities

F2.1 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 Principal Contractor on behalf of the Principal.

The Principal is responsible for providing appropriate information to the 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.

F2.2 Principal Contractor

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

In addition to the implementation of the RAP it will be the 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;
- 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;
- 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 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.

F2.3 Asbestos Contractor

The Asbestos Contractor will be responsible for undertaking all asbestos work involving any asbestos impacted filling and will hold a Class A licence for the removal of asbestos (issued by SafeWork NSW), on the basis that the asbestos identified at the site to date has included both friable and bonded asbestos.

The Asbestos Contractor can be the same entity as the Principal Contractor.

F2.4 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.

F2.5 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 Principal with any results of assessments, and any observed non-conformances.

F2.6 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).

F3.0 Stormwater Management

F3.1 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.

F4.0 Soil Management Plan

F4.1 Excavation and 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:

- 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;
- Any stockpile to remain on-site overnight should be adequately secured in order to reduce the risk of sediment runoff; and
- Should the stockpile remain on-site for over 24 hours, geotextile silt fences must be erected to prevent losses by surface erosion.

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

F4.2 Loading and Transport of Contaminated Material

Transport of contaminated material from the site shall be via a clearly delineated haul route and this route shall be used exclusively for entry and egress of vehicles used to transport contaminated materials within and away from the site. The proposed waste transport route (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 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
- Utilise 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.

F5.0 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.

F6.0 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;
- Covering of all stockpiles of contaminated soil remaining on site more than 24 hours;
- 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.

F7.0 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 required:

- 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 the impacted areas / materials;
- The use of water spray, as and when appropriate;
- Use of sprays or sprinklers on stockpiles or loads to lightly condition the material;
- Restriction of stockpile heights to ~4 m above surrounding site level. 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.

F8.0 Work Health and Safety Plan

F8.1 General

It is the Remediation Contractor's responsibility to devise a safe work method statement (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.

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

F8.2 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).

F8.3 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.

F8.4 Chemical Contamination Hazards

Chemical compounds or substances that may be present in the soils at the site include the key CoPC lead, PAH and asbestos. 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.

F8.5 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.

F8.6 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 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, 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).

F9.0 Remediation Schedule and Hours of Operation

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

F10.0 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. Table F1 contains 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.

Table F1: Summary of Roles and Contact Details

Role	Personnel / Contact	Phone Contact Details
Principal	TBC	TBC
Principal's Representative	TBC	TBC
Site Manager	TBC	TBC
Remediation Contractor and Builder	TBC	TBC
Site Office	TBC	TBC
Environmental Consultant	TBC	TBC
Consent Authority	TBC	TBC
Regulator	NSW EPA (pollution line and general enquiries)	131 555
Utility Provider	Water (Sydney Water Corporation)	13 20 92

Role	Personnel / Contact	Phone Contact Details
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

F11.0 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.

Douglas Partners Pty Ltd

Appendix G

Data Quality Objectives

Appendix G
Data Quality Objectives – Validation of Remediation
2-8a Lee Street, Haymarket

G1.0 Introduction

The objective of the validation plan is to assess the results of post remediation 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 (DQOs) as outlined in NEPC (2013), described below. The DQO in NEPC (2013) is in turn, based on the DQO process outlined in USEPA (2006), and associated guidelines.

G2.0 Data Quality Objectives

Step	Summary
1: State the problem	The site requires remediation and validation of remediation in order to render it suitable for commercial use. 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: • Lead; • PAH; and • Asbestos. The validation sampling results will be compared against the RAC. The preferred remediation strategy as outlined in the RAP is the excavation and disposal of contaminated soils under a formal waste classification. 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 and, if necessary, compared to the 95% UCL of the mean concentrations.

3: Identify the information inputs	Relevant inputs to the decision include: • The CSM, identifying the 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 and Drawing 2 in Appendix A. The vertical boundaries are to the extent of contamination impact as determined from the site history assessment, site observations and results of 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. Initial comparisons will be with individual results then, where required, summary statistics (including mean, standard deviation and 95% upper confidence limit (UCL) of the arithmetic mean (95% UCL) to assess potential risks posed by the site contamination. Quality control results are to be assessed according to their relative percent difference (RPD) values. For field and laboratory duplicate results, RPDs should generally be below 30%; for field blanks, results should be at or less than the limits of reporting (NEPC, 2013). The field and laboratory quality assurance assessment is included in Section 15.
6: Specify the performance or acceptance criteria	**Baseline condition:** Contaminants at the site and/or statistical analysis of data exceed the RAC and pose a potentially unacceptable risk to receptors (null hypothesis). **Alternative condition:** Contaminants at the site and statistical analysis of data complies with the RAC and as such, do not pose a potentially unacceptable risk to receptors (alternative hypothesis). Unless conclusive information from the collected data is sufficient to reject the null hypothesis, it is assumed that the baseline condition is true.
7: Optimise the design for obtaining data	Sampling design and procedures to be implemented to optimise data collection for achieving the DQOs include the following: • Sampling frequencies in accordance with Sections 8, 11, 13, 14 and15; • Analysis for the CoPC at NATA accredited laboratories using NATA endorsed methods will be used to perform laboratory analysis whenever possible; and • Adequately experienced environmental scientists/engineers will conduct field work and sample analysis interpretation.

G3.0 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.

USEPA. (2006). *Guidance on systematic planning using the data quality objectives process, EPA QA/G-4.* Washington DC.: United States Environmental Protection Agency, Office of Environmental Information.

Douglas Partners Pty Ltd

Appendix H

Site Assessment Criteria

Appendix H
Site Assessment Criteria
2-8a Lee Street, Haymarket

H 1.0 Introduction

H 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).
- HEPA *PFAS National Environmental Management Plan* (NEMP) (HEPA, 2020).
- 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).

H 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: commercial / industrial: corresponding to land use category 'D', commercial such as shops and offices.
- Soil type: sand and clay (dominant soil types)

H 2.0 Soils

H 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 H1 and Table H2.

Table H1: Health Investigation Levels (mg/kg)

Contaminant	HIL-D
Metals	
Arsenic	3000
Cadmium	900
Chromium (VI)	3600
Copper	240 000
Lead	1500
Mercury (inorganic)	730
Nickel	6000
Zinc	400 000
Cyanide	
Cyanide (free)	1 500
PAH	
B(a)P TEQ	40
Total PAH	4000
Phenols	
Phenol	240 000
Pentachlorophenol	660
OCP	
DDT+DDE+DDD	3600
Aldrin and dieldrin	45
Chlordane	530
Endosulfan	2000
Endrin	100
Heptachlor	50
HCB	80
Methoxychlor	2500
OPP	
Chlorpyrifos	2000
PCB	
PCB	7
VOC (various analytes)	-

Table H2: Health Screening Levels (mg/kg)

Contaminant	HSL-D	HSL-D	HSL-D	HSL-D
SAND	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4 m**	**4 m+**
Benzene	3	3	3	3
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	230	NL	NL	NL
Naphthalene	NL	NL	NL	NL
TRH F1	260	370	630	NL
TRH F2	NL	NL	NL	NL
SILT	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4 m**	**4 m+**
Benzene	4	4	6	10
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	NL	NL	NL	NL
Naphthalene	NL	NL	NL	NL
TRH F1	250	360	590	NL
TRH F2	NL	NL	NL	NL
CLAY	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4 m**	**4 m+**
Benzene	4	6	9	20
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	NL	NL	NL	NL
Naphthalene	NL	NL	NL	NL
TRH F1	310	480	NL	NL
TRH F2	NL	NL	NL	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'

The HSL for direct contact derived from CRC CARE (2011) are in H3.

Table H3: Health Screening Levels for Direct Contact (mg/kg)

Contaminant	DC HSL-D	DC HSL-IMW
Benzene	430	1100
Toluene	99 000	120 000
Ethylbenzene	27 000	85 000
Xylenes	81 000	130 000
Naphthalene	11 000	29 000
TRH F1	26 000	82 000
TRH F2	20 000	62 000
TRH F3	27 000	85 000
TRH F4	38 000	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

H 2.2 Health Investigation Levels for Per- and Poly-Fluoroalkyl Substances in Soil

The laboratory analytical results for per- and poly-fluoroalkyl substances (PFAS) in soil have been assessed against HIL published in HEPA (2020). The HIL represent a nationally-agreed suite that should be used to inform site investigations. The HIL are intentionally conservative, and an exceedance of these criteria may not constitute a risk if other exposure pathways are controlled. An exceedance of the HIL should trigger further investigations, such as a site-specific risk assessment. At the time of this investigation, screening values were available only for perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and perfluorohexane sulfonate (PFHxS).

The HIL derived from Table 2 of HEPA (2020) are in Table .

Table H4: Health Investigation Levels (mg/kg)

Contaminant	HIL-D
PFOS and PFHxS *	20
PFOA	50

Notes: * Includes PFOS only, PFHxS only and the sum of the two.

H 2.3 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.

H 2.4 Ecological Investigation/Screening Levels

Schedule B5A of NEPC (2013) states that the aim *of the EILs is that varying levels of protection will be provided to the following ecological receptors at all sites:*

- Biota supporting ecological processes, including microorganisms and soil invertebrates;
- Native flora and fauna;
- Introduced flora and fauna; and
- Transitory or permanent wildlife.

Furthermore, Schedule B5A of NEPC (2013) states that *Commercial and industrial land, particularly in long-established industrial areas, is often heavily contaminated by past activities or fill materials used to level the area. In these cases, jurisdictions may determine that HILs are the most appropriate soil quality criteria and that EILs are not applicable.*

In determining the relevance of EILs and ESLs the presence or absence of sensitive ecological receptors must be considered. In this regard both the potential ecological receptors on and off-site must be considered and the current / proposed development.

H 2.5 Management Limits

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

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

The adopted management limits are in Table .

Table H5: Management Limits (mg/kg)

Contaminant	Soil Type	ML-D
TRH F1	Coarse	700
TRH F2	Coarse	1000
TRH F3	Coarse	3500
TRH F4	Coarse	10 000
TRH F1	Fine	800
TRH F2	Fine	1000
TRH F3	Fine	5000
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-D commercial/industrial

H 3.0 Groundwater

H 3.1 Introduction

The groundwater investigation levels (GIL) used for interpretation of the groundwater data (as a Tier 1 assessment) have been selected based on the potential risks posed from contamination sourced from the site to receptors at or down-gradient of the site, as identified by the conceptual site model (CSM). The receptors, exposure points and pathways are summarised in Table .

Table H6: Summary of Potential Receptors and Potential Risks

Receptor	Location	Exposure Point	Exposure Pathway
Surface water aquatic ecosystem	Down-gradient from site.	Receiving surface water body at the groundwater discharge point.	Exposure to contaminants.

The rationale for the selection of GIL is in Table 3.

Table 3: Groundwater Investigation Level Rationale

Receptor / Beneficial Use	GIL	Source	Comments / Rationale
Aquatic ecosystem	DGV	ANZG (2018)	Freshwater 99% LOP for bioaccumulative contaminants 95% LOP for non-bioaccumulative contaminants Marine water 99% LOP for bioaccumulative contaminants 95% LOP for non-bioaccumulative contaminants
Aquatic ecosystem	DGV	HEPA (2020)	Freshwater 99% LOP Marine water 99% LOP Screening values were only available for PFOS and PFOA at the time of this investigation.

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)

H 3.2 Groundwater Investigation Levels for Aquatic Ecosystems

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

Table H8: Groundwater Investigation Levels for Protection of Aquatic Ecosystems (µg/L)

Contaminant	Fresh Water	Marine
Metals		
Arsenic	24 as As(III) 13 as As(V)	24 as As(III)
Cadmium	0.2-0.6	24[a]
Chromium (VI)	1	4.4
Copper	1.4	1.3
Lead	4.4-17.7	4.4
Mercury (inorganic)	0.6	0.4
Nickel	13.1-33.2	7[a]
Zinc	9.6-24.1	15
PAH		
B(a)P TEQ	0.2	0.1[a]
Total PAH	-	-
Naphthalene	16	50[a]
Anthracene	0.4	-
Fluoranthene	1.4	-
Phenanthrene	2.0	-
BTEX		
Benzene	950	500[a]
Toluene	180	180
Ethylbenzene	80	80
Xylene (o)	350	-
Xylene (p)	200	-
Xylene (m)	75	75
Phenols		
Phenol	320	400
Pentachlorophenol	3.6	11[a]
OCP		
DDT+DDE+DDD	0.06	-
Aldrin and dieldrin	-	-
Chlordane	0.08	-

Contaminant	Fresh Water	Marine
Endosulfan	0.2	0.005[a]
Endrin	0.02	0.004[a]
Heptachlor	0.09	-
VOC		
Chloroform	770	770
1,2-dichloroethane	1900	1900
Carbon tetrachloride	240	240
Benzene	950	700
1,2-dichloropropane	900	-
Toluene	180	180
1,3-dichloropropane	1100	1100
Ethylbenzene	80	80
Cyanide		
Cyanide	7	4

Notes:

Where the contaminant does not have a % LOP, the 'unknown' LOP has been adopted
a - 99% LOP adopted due to potential to bioaccumulate or to protect from chronic toxicity as recommended per ANZG (2018)

The DGV for the protection of aquatic ecosystems derived from HEPA (2020) are in Table H9.

Table H9: Groundwater Investigation Levels for Protection of Aquatic Ecosystems (µg/L)

Contaminant / LOP	Fresh Water DGV	Interim Marine Water DGV
PFOS 99% LOP	0.00023	0.00023
PFOA 99% LOP	19	19

H 4.0 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.

HEPA. (2020). *PFAS National Environmental Management Plan (NEMP).* Version 2.0: Heads of EPAs Australia and New Zealand and Australian Government Department 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.

Douglas Partners Pty Ltd

Appendix I

Contingency Plan and Unexpected Finds Protocol

Appendix I
Contingency Plans and Unexpected Finds Protocol
2-8a Lee Street, Haymarket

I1.0 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 and inform the Site Auditor. Where necessary the Environmental Consultant will prepare an addendum to, or revision of, this RAP. Any addendum or revision is to be reviewed and agreed by the Site Auditor before its implementation.

I2.0 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 detailed investigation, 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., evidence of asbestos containing material (ACM), petroleum, or other chemical odours which were not 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) and Site Auditor;
- The agreed management / remedial strategy, based on the RAP, shall be implemented;
- The impacted soil will be stockpiled for:
    - Remediation (if evaluated to be feasible by the Environmental Consultant); or
    - Waste classification (the Environmental Consultant is to sample the stockpile(s) in accordance with Section 14 in the RAP) prior to off-site disposal.

- In dry and windy conditions, the stockpile will be lightly wetted and covered with plastic sheet whilst awaiting remediation / disposal;
- If disposed off-site, documentary evidence (weighbridge dockets) of correct disposal is to be provided to the Environmental Consultant;
- At the completion of the excavation, the Environmental Consultant is to complete validation sampling of the resultant excavation in accordance with Section 13 in the RAP; and
- All details of the assessment and remedial works are to be included in the site validation report.

I3.0 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 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 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 NEPC (2013) guidelines.

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.

I4.0 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.

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. (2014). *Investigation of Service Station Sites.* NSW Environment Protection Authority.

NSW EPA. (2020). *Underground Petroleum Storage Systems - Guidelines for implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019.* Doc Ref: EPA 2020P2700: NSW Environment Protection Authority.

WA DoH. (2009). *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.* WA Department of Health.

Douglas Partners Pty Ltd