Remediation Action Plan

Royal Prince Alfred Hospital

304100230

Prepared for
TSA Management

10 November 2022

Cardno

now

Stantec

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Executive Summary

Cardno (NSW/ACT) Pty Ltd, now Stantec was engaged by TSA Management (TSA) ("the Client"), on behalf of NSW Health Infrastructure, to prepare a Remediation Action Plan (RAP) for the Eastern area and Emergency Bay Area (EBA) of the East Campus of the Royal Prince Alfred Hospital (RPA), Camperdown, NSW (the site), as shown in **Figure 1** and **2**, **Appendix A**. For ease of reference throughout the report, the subject area has been designated as Eastern Development and EBA.

This RAP has been prepared to detail methodologies required to remediate asbestos, B(α)P TEQ, B(α)P and metals (copper and zinc) contaminated soils identified during investigations completed by Cardno in 2022 within Eastern Development.

Based on previous investigations undertaken at the site, the contamination present and requiring remediation consists of asbestos and B(α)P TEQ found to exceed human health criteria, and copper, zinc and B(α)P found to exceed ecological criteria. Other CoPCs (i.e. OCPs) were detected below adopted human health and ecological criteria, and given the presence of site infrastructure, access to soils for investigation purposes was inhibited in many areas. As such, other contaminants may be discovered during site constructions works and should continue to be considered during construction.

This assessment follows on from a previous investigation completed by Cardno August 2022:

> Cardno (2022a). Detailed Site Investigation Report – Royal Prince Alfred Hospital, East Campus, Job Reference 80022023_R001, Revision 0, dated 10 November 2022.

The current land use for the Eastern Development comprises of landscaping, access roadways, pathology services and as loading bay. A parcel of land within University of Sydney, currently vacant, is also to form part of the development for landscaping. The EBA current land use comprises of a roadway, ambulance parking area, Covid testing hub, and hospital patient drop off point.

The purpose of the RAP is to outline the procedures required to remediate the site for the proposed development. As outlined in **Section 7.3**, the preferred remedial strategy for this site is offsite disposal of contaminated soils (Option 7) for the human health exceedances and in-situ encapsulation for fill material exceeding the ecological criteria (Option 9).

The following brief remediation strategy is recommended for implementation:

1. Preliminaries and site establishment;
2. Visual Inspection and asbestos clearance inspection of soil surface soils across all areas of Eastern Development area post hardstand removal;
3. Investigation of Lambie Dew Drive (north and south extensions); Whale Garden extension; EBA area; and University of Sydney land;
4. Eastern Area post-demolition investigation of building(s) footprint soil assessment;
5. Remedial excavation of contaminated soils and waste classifications;
6. Preparation of encapsulation cells, where required and onsite encapsulation works;
7. Validation of remedial excavations following the removal of contaminated materials; and
8. Reporting.

Once all remediation works have been undertaken and the validation works have been completed successfully in accordance with this RAP, then the site would be considered suitable for the land use.

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Abbreviations

ACM	Asbestos containing material
AEC	Areas of Environmental Concern
AF	Asbestos fines
ARCP	Asbestos Removal Control Plan
AS	Australian Standard
ASS	Acid Sulfate Soil
B(α)P	Benzo(α)pyrene
BTEX	Benzene, toluene, ethylbenzene and xylene
CAR	Contamination Assessment Report
CBD	Central business district
CEWMP	Construction Environmental and Waste Management Plan
COC	Chain of Custody
COPC	Chemicals of Potential Concern
CSM	Conceptual Site Model
DP	Deposited plan
DPIE	Department of Planning Industry and Environments (now Department of Planning and Environment
DQI	Data Quality Indicators
DQO	Data Quality Objectives
EIL	Ecological Investigation Level
EMP	Environmental Management Plan
EPA	Environment Protection Authority
FA	Friable asbestos
HIL	Health Investigation Level
LAA	Licenced Asbestos Assessor
LOR	Limit of Reporting
m	metres
mBGL	metres Below Ground Level
NATA	National Association of Testing Authorities
NEPC	National Environmental Protection Council
NEPM	National Environmental Protection Measures
NSW	New South Wales
OCP	Organochlorine Pesticides
OPP	Organophosphorus Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulfate Soils
PCB	Polychlorinated Biphenyls
PID	Photoionization Detector
PoEO	Protection of Environment Operations

PPE	Personal protective equipment
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance / Quality Control
RAP	Remediation Action Plan
REF	Review Environmental Factors
RG	Remediation Goals
RPA	Royal Prince Alfred Hospital
RPD	Relative Percentage Difference
SEPP	State Environmental Planning Policy
SOP	Standard Operating procedures
SPR	Source-pathway-receptor
SSDA	State Significant Development
SWMS	Safework Method Statement
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxicity Equivalent Quotient
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
UFP	Unexpected finds protocol
UST	Underground storage tanks
WADoH	Western Australia Department of Health
WHESP	Work Health, Environment and Safety Plan
WHS	Work Health and Safety
WHSP	Work Health and Safety Plan

1 Introduction

1.1 Background

Cardno (NSW/ACT) Pty Ltd, now Stantec was engaged by TSA Management (TSA) ("the Client"), on behalf of NSW Health Infrastructure, to prepare a Remediation Action Plan (RAP) for the Eastern area and Emergency Bay Area (EBA) of the East Campus of the Royal Prince Alfred Hospital (RPA), Camperdown, NSW (the site), as shown in **Figure 1** and **2**, **Appendix A**. For ease of reference throughout the report, the subject area has been designated as Eastern Development and EBA.

This RAP has been prepared to detail methodologies required to remediate asbestos, B(α)P TEQ, B(α)P and metals (copper and zinc) contaminated soils identified during investigations completed by Cardno in 2022 within the Eastern Development; and to outline the data gaps required for further soil and groundwater characterisation. Based on previous investigations undertaken at the site, the contamination present and requiring remediation consists of asbestos and B(α)P TEQ found to exceed human health criteria, and copper, zinc and B(α)P found to exceed ecological criteria.

This assessment follows on from a previous investigation completed by Cardno August 2022:

> Cardno (2022a). Detailed Site Investigation Report – Royal Prince Alfred Hospital, East Campus, Job Reference 80022023_R001, Revision 0, dated 10 November 2022.

The current land use for the Eastern Development comprises of landscaping, access roadways, pathology services and as loading bay. A parcel of land within University of Sydney, currently vacant, is also to form part of the development for landscaping. The EBA current land use comprises of a roadway, ambulance parking area, Covid testing hub, and hospital patient drop off point.

1.2 Proposed Development

The proposed development zone is situated within the east campus as shown in the proposed development plans prepared by Jacobs (Ref: Project No. SE1250, drawing no. RPA-ARX-BAS-DRG-MW-DA0001(D), DA0102(C), DA0103(C), DA104(D) and DA0901(D), DA0902(D)) and attached under **Appendix A**. Based on the development plans, the alterations and additions to the RPA Hospital East Campus will comprise of the following:

> **Eastern wing:** A new fifteen (15) storey building with clinical space for Inpatient Units (IPU's), Medical Imaging, Delivery, Neonatal and Women's Health Services, connecting to the existing hospital building and a rooftop helicopter landing site (HLS);

> **Eastern extension:** A three (3) storey extension to the east of the existing clinical services building to accommodate new operating theatres and associated plant areas;

> **Northern expansion:** A two (2) storey vertical expansion over RPA Building 89 accommodating a new Intensive Care Unit and connected with the Eastern Wing;

> **Internal refurbishment:** Major internal refurbishment to existing services including Emergency Department and Imaging, circulation and support spaces;

> Enhanced Northern Entry/ Arrival including improved pedestrian access and public amenity;

> Demolition of affected buildings, structures and trees;

> Changes to internal road alignments and paving treatments; and

> Landscaping works and compensatory tree planting including off-site within University of Sydney land.

Offsite works within University of Sydney land as outlined in **Section 2.1,** and ancillary works to the RPA Hospital West Campus, comprising:

> Temporary helicopter landing site above existing multi storey carpark;

> Re-routing of existing services; and

> Associated tree removal along Grose Street.

This RAP is related to the area considered to require remediation, namely, the designated Eastern Area of Eastern Campus (approximate area 6,758 m^2), and Emergency Bay Area (EBA), as shown in **Figure 2**, **Appendix A**.

1.3 Purpose and Objectives

The purpose of the RAP is to set remediation objectives and document the process to remediate the contaminated site for the proposed development.

The objectives of this RAP are:

- Define remediation and validation requirements;
- Evaluate the relative feasibility and effectiveness of potentially applicable remedial options;
- Recommend appropriate remedial strategy;
- Establish the site validation criteria;
- Outline the remedial process to be undertaken to achieve the selected remediation strategy for the site;
- Outline a Construction Environmental and Waste Management Plan (CEWMP), Workplace Health and Safety (WHS) requirements, and an unexpected finds protocol and contingency plan;
- Identify work health and safety measures to minimise the potential risks to human health and the environment during the remedial works;
- Address SEARs condition 17 – Contamination and Remediation; and
- Address DPE SEARs cover letter dated 8 August 2022, whereby it requires a Remediation Action Plan to be completed if contamination is identified. The condition also states that the RAP is to be reviewed and approved by a NSW EPA Accredited Site Auditor

1.4 Scope of Work

In order to meet the objectives outlined in **Section 1.3**, the following scope of works were implemented:

- Summarise the site features and history, areas of environmental concern and develop a Conceptual Site Model (CSM);
- Identify remediation options suitable for identified contaminants of potential concern (CoPC);
- Evaluate the various remedial options and identify the preferred remediation strategy;
- Document the process for implementing the preferred remediation strategy;
- Develop a Construction Environmental and Waste Management Plan (CEWMP), which outlines environmental controls required for the duration of the works including an Unexpected Finds Protocol and contingency plan;
- Detail environmental and Work Health and Safety (WHS) control measures and community consultation requirements associated with implementation of the preferred remedial strategy; and
- Preparation of the Remediation Action Plan (RAP).

1.5 Guidelines and Legislation

The scope of the assessment has been developed in accordance with the following guidelines and legislation:

- NEPC National Environment protection (Assessment of Site Contamination) Measure 1999. National Environmental Protection Council (NEPC 2013).
- NSW Department of Urban Affairs and Planning Managing Land Contamination: Planning Guidelines: State Environmental Planning Policy (Resilience and Hazards), 2021 (Resilience and Hazards SEPP).
- NSW EPA Consultants Reporting on Contaminated Land: Contaminated Land Guidelines. New South Wales Environment Protection Authority, April 2020, Updated May 2020 (EPA 2020).
- NSW EPA Waste Classification Guidelines, Part 1: Classifying Waste (EPA 2014).
- NSW EPA Contaminated Sites Sampling Design Guidelines. New South Wales Environment Protection Authority (EPA), August 2022 (NSW EPA 2022).

Other key documents provided by TSA include:

- NSW Health Infrastructure, Contaminated Land Management Framework, Version No. V0.4, dated 3 May 2022, prepared by external consultant (NSW HI CLM Framework). The NSW HI CLM Framework document essentially points to and is consistent with the NSW EPA framework.
- Health Infrastructure, Design Guidance Note No. 060, Contaminated Land Management Framework, 31 August 2021, Revision A, prepared by Health Infrastructure (DGN 060).

Cardno completed this RAP report in accordance with the NSW EPA framework.

1.6 Deviation from this RAP

To ensure that the correct measures are implemented during the remediation works, a qualified Environmental Engineer / Scientist should be involved with the project to ensure that critical stages of the site remediation/validation process are appropriately supervised and documented.

If required due to site constraints, any deviations from the works specified in this RAP as detailed in **Section 8.1** are to be justified and properly documented and approved. Amendments to and deviations from the RAP must be discussed with and agreed to by the appointed Environmental Consultant prior to implementation.

2 East Campus Identification

2.1 East Campus Details

Details related to the areas of investigation are included in **Table 2-1** below. An aerial photograph of the site is presented in **Figure 2**, **Appendix A**.

Table 2-1 Emergency Bay and Eastern Development Details

Details	Comments
Address	RPA Hospital – John Hopkins Drive and Lambie Dew Drive, Camperdown NSW, and part of Sydney University grounds
Applicable Lot and Deposited Plan	Part of Lot 1000 DP 1159799 (lands within RPA Hospital); and Part of Lot 1 DP1171804 and part of Lot 1001 DP1159799 (University of Sydney grounds that are to be used for landscaping purposes by RPA. It is unknown if lands are to be acquired of leased).
Eastern Development : East area of Eastern Campus and Maternity Ward Parking Area current land use and total area, including University of Sydney landscaping lands.	Landscaping, access roadways, pathology services and loading bay. Area is predominantly paved with landscaping areas mainly located in the south east. Total area: 8,803m^2. Area was based on *Extent of Works Diagram* Royal Prince Alfred Hospital Redevelopment Stage 1, dwg no. IA021300-SK-2001, dated 11 February 2022; provided by the Client.
Emergency Bay Area	Access roadway, ambulance parking area, covid testing hub. Area is predominantly paved with localised landscaping areas located along the west boundary. Total area: 1212m^2. Area was based on *Extent of Works Diagram* Royal Prince Alfred Hospital Redevelopment Stage 1, dwg no. IA021300-SK-2001, dated 11 February 2022; provided by the Client.
Proposed land use	The land will continue to serve hospital land uses. The development details are summarised in **Section 1.2**.
Local Government Authority (LGA)	City of Sydney Local Government Area
Current zoning (Sydney Local Environmental Plan 2012)	SP2: Infrastructure and Educational Establishment
Site coordinates	- 33.889162, 151.183961

2.2 Surrounding Land Use

The land uses immediately surrounding each of the areas are summarised below in **Table 2-2**. The areas of investigation and surrounding land uses are shown in **Figure 2** in **Appendix A**.

Table 2-2 Surrounding Land Use

Direction	Eastern Development : East area of Eastern Campus Surrounding Land Use or Activity	Emergency Bay Area Surrounding Land Use or Activity
North	Centenary Institute, followed by Grose Farm Lane and University of Sydney infrastructure further north	John Hopkins Drive with St John's College further north
East	University of Sydney Campus	RPA Main Hospital Building 63
South	RPA hospital building with the grounds of St Andrews College further south	RPA Main Hospital Building 64 and 65, followed by Gloucester Drive further south
West	RPA hospital building with Missenden Road further west	Missenden Road followed by RPA West Campus Building 13

2.3 Regional and Overall Site Settings

Site setting information, as listed within publicly available data sets, is summarised in **Table 2-3**. Given that the areas of investigation form part of the overall RPA Hospital site, the information below is representative of Areas A and B.

Table 2-3 Site Setting Information

Item	Details
Regional Soil Landscape	The NSW DPIE *eSPADE* v2.1 website indicated that the site overlies Blacktown (bt) residual soil landscape. Soils within the Blacktown landscape consisted of shallow to moderately deep (<100 cm) red and brown podzolic soils on crests, upper slopes and well drained areas, whilst deep yellow podzolic soils and soloths are evident on lower slopes and in poor drainage areas.
Regional Geology	The Sydney 1:100 000 Geological Map, Herbert C, 1983, illustrates that the subject site ins underlain by Ashfield Shale (Rwa) of Wianamatta Group from Middle Triassic period of Mesozoic era. The map shows the site is underlain by Ashfield Shale (Rwa) which is charactered as Black to dark-grey shale and laminite.
Regional Groundwater	The WaterNSW Real Time Water Data Portal was accessed on 16 February 2022 and registered groundwater bores within a 500 m radius of the site. The five nearest bores included: ▪ GW116424 – no further information available; ▪ GW116421 – no further information available; ▪ GW116422 – no further information available; ▪ GW109230 – installed as a private bore in 2008 with a final depth of 1.80m BGL. The listed intended purpose is as a monitoring bore; and ▪ GW109231 – installed as a private bore in 2008 with a final depth of 3.2m BGL. The listed intended purpose is as a monitoring bore. ▪ As part of Preliminary Site Investigation (Refer to **Section 3**), groundwater levels within the East Campus were measured at depths of 1.68 – 7.81 mBGL.
Surface Water Bodies	The nearest surface water body is Johnstons Creek, which is located approximately 1 km north east of the site and discharges to Rozelle Bay. The site and surrounds are mostly paved and surface water flows, and potentially groundwater migration, are inferred to flow north toward Johnstons Creek.
Acid Sulfate Soils	The NSW Government Planning Industry and Environment online mapping tool, eSPADE Version 2.1, indicates that the site is not mapped as being situated within or near an ASS risk area. The nearest mapped ASS risk area is approximately 600m north west in the vicinity of Johnstons Creek.
Salinity	The Soil Landscape Map accessed from the NSW Government Planning Industry and Environment online mapping tool, eSPADE Version 2.1, indicates that the site lies within the Blacktown Soil Landscape, which typically comprises of four dominant soil materials that overlie Wianamatta geology. 'Localised sodicity' and 'localised salinity' are listed as potential soil limitations of the Blacktown Soil Landscape within the four dominant soils comprising of clays and loams. In the absence of surface salting and obvious corrosion on nearby structures, the likelihood of saline soil existing to a level that could constrain future development is considered low.

3 Site Characterisation

3.1 Previous Report Review

In the DSI completed for the Eastern Campus, (Cardno, 2022a) a detailed summary of previous reports (Cardno, 2021 and 2022b to 2022e) was provided. As such the below review provides a detailed summary of the DSI report (Cardno, 2022a) and a brief summary of all other previous investigations.

3.1.1 Detailed Site Investigation, East Campus, Camperdown

Reference: Detailed Site Investigation Report, Royal Prince Alfred Hospital, East Campus, Camperdown, 80022026_R001_Rev0, dated 10 November 2022 (Cardno 2022a).

Cardno was engaged by TSA Management to complete a DSI Report for the maternity ward parking bay area north of Royal Prince Alfred Hospital (RPA) and the area to the east of RPA; both of which are located within the East Campus of the RPA building, Camperdown, NSW (the site).

The areas of investigation form a small part of the site and as such are referred herein as Eastern Development which comprises of the Maternity Ward Parking Area and East Area of RPA East Campus; and the Emergency Bay Area (EBA). The investigation was considered limited to the areas investigated (Eastern Development and EBA).

Upon completion of the agreed scope of works the following was concluded:

- Receipt and review of a Dangerous Goods Search through SafeWork NSW for the entire RPA site (As part of the original PSI request) identified a diesel UST to the west and of the Eastern Development and EBA accordingly; flammable liquids cabinets were also identified within the buildings and surrounding building of Eastern Development and EBA; and potentially decommissioned underground fuel storage tank areas were identified at distances ranging from 170m south west of Maternity Ward Parking Area, 160m west of East area of Eastern Campus and 100m south of EBA. It is inferred that these tanks could have been historically decommissioned during past new building construction, however, this is not confirmed.

Key Findings:

Eastern Development – Maternity Ward Parking Area

- The soil profile encountered across the area of investigation comprised of concrete paver and roadbase gravel, overlying FILL consisting of Silty Sand, Sandy Gravel, Sandy Clay, Gravelly Sand, Clayey Gravel; overlying residual soil. The maximum depth of the fill was equal to the maximum depth of test pit advancement at TP403 (i.e. 3.0m BGL) located within the whale garden. It is noted that the fill thickness was not fully penetrated across all borehole locations due to buried slabs, sampling method (hand auger) and safety issues (test pit depth >3mBGL).
- All contaminants of concern analysed were found to be below the human health and ecological criteria in Maternity Ward Parking Area. It is considered that the soils within the depth of investigation in this area pose low risk to the hospital land use.
- Asbestos was not observed in any of the tested samples for the Maternity Ward Parking Area, however, due to the nature of fill Cardno conclude that it should be assumed asbestos may be present in the fill in other areas. Cardno note that asbestos was found within the undercroft area located to the south of the Maternity Ward Parking Area (Cardno, 2022a).
- Due to the extension of this development into the Whale Garden following completion of intrusive investigations, it was recommended that one additional investigation location is carried out in the Whale Garden. This is further described in **Section 8** of this RAP.
- The data collected to date for the Maternity Ward Parking Area indicates that no remediation is required, and the site is considered to be suitable for the proposed development, pending additional investigation as noted at one location covering a small area.

Eastern Development – East Area of Eastern Campus

- The soil profile encountered across East Area of Eastern Campus comprised of asphaltic concrete / concrete paver and roadbase gravel; overlying FILL consisting of Sand, Silty Sand, Clayey Sand, Gravelly Sand, Sandy Clay, Gravelly Clay, Sandy Silt; overlying possible residual soil, comprising of CLAY, Sandy CLAY; overlying siltstone bedrock. The maximum depth of the fill was equal to 2.0m BGL at BH408 located

next to the diesel generator. It is noted that the fill thickness was not fully penetrated across all borehole locations due to buried concrete slabs, and sampling method (hand auger).

- Bonded ACM was detected in sample HA415_0.1-0.2 above the high density residential and public open space human health criteria. Extensive evidence of asbestos was not observed or detected at the other sample locations within the full depth of fill soils, however, it should be assumed that it may be present given the nature of fill and historical demolitions that have occurred at this part of the site. Cardno note that asbestos was also found within the undercroft area located to the west of the East Area of Eastern Campus (Cardno, 2022a).
- The concentration of B(α)P-TEQ in fill material at sampling locations BH408, HA413, and HA416 to various depths exceeded the high density residential and public open space human health criteria. As such, within East Area of Eastern Campus , human health contamination is considered to be localised rather than wide-spread. The locations of this contamination are shown on **Figure 4, 5**.
- The concentration of benzo(α)pyrene across the surficial fill layer was found to be contaminated above urban residential, open space, and industrial/commercial ecological criteria, with the exception of the fill material located along the ramp area covered by boreholes (BH419 to BH422).
- The concentration of copper within fill material at locations BH320, BH412 and HA414 was found to be contaminated above urban residential, open space, and industrial/commercial ecological criteria.
- The concentration of zinc within fill at location HA414 was found to be contaminated above urban residential, open space, and industrial/commercial ecological criteria.
- The ecological and human health contaminants of concern were found to have low leaching potential. However, leachable concentrations of benzo(α)pyrene, copper, mercury, lead were found to exceed groundwater fresh aquatic ecosystem criteria. However, given that the natural soil underlying the fill is of low permeability the probability of these contaminants migrating is considered low. In addition the groundwater results did not indicate contamination by benzo(α)pyrene, mercury, and lead.
- Traces of OCPs (DDE and DDT) were detected in fill sample BH320_0.0-0.2 (0.08 mg/kg and 0.06 mg/kg, respectively) and traces of OCPs (aldrin and dieldrin) were detected in fill sample HA415 (0.4 mg/kg and 4.8mg/kg, respectively). Concentrations of the detected OCPs were below the adopted NEPC 2013 Tier 1 human health screening criteria. These detections indicate historic use of pesticides at the site.
- Due to the extension of the development into Lambie Dew Drive, at both the north and southern ends of this road, following completion of intrusive investigations, it was recommended that one additional investigation location is carried out in the north extension and south extension of Lambie Dew Drive. This is further described in **Section 8** of this RAP.
- The data collected to date for the East Area of the Eastern Campus indicates that remediation is required to make the site suitable for the proposed development; and as such a Remediation Action Plan is to be developed.

Emergency Bay Area

- Based on the historical imagery review, the site target location of the EBA is has not varied significantly, however, the historical activities have been limited to use as access way to the main hospital entrance located on Missenden Road.
- Soils encountered at the borehole BH1 (TP301) competed 2m east of the EBA roadway retaining wall, consisted of asphalt overlying fill which was underlain by extremely weathered siltstone bedrock encountered at a depth of approximately 0.75mBGL.
- Generally, TRH, BTEX, OCP/OPP, PCB, Phenol and PFAS compounds were reported below the laboratory LOR and/or the applicable guideline at BH1 (TP301). Asbestos was not detected in any sample nor observed during fieldwork.
- The samples collected south of the EBA indicated that the soil is contaminated by PAHs and petroleum hydrocarbons (F2, F3). However, given the locality of the sample, it is not considered to be representative of the soil material underlaying EBA development footprint. The information obtained within the vicinity of the EBA provides background information on the soil quality across different areas of the RPA site. Given the limitations of the investigation completed within close proximity of the EBA, it is considered that a detailed site assessment is warranted for the EBA and is to be carried out once an alternative location for the ambulance drop off area is assigned, and the area becomes accessible to any form of safe or physical foot traffic or mechanical equipment.

- The preliminary waste classification for the fill material at BH1(TP301) from a depth of 0.2mBGL to a depth of 1.3mBGL, is Restricted Solid Waste, however, this is subject to further leachability testing and appropriate sampling at the time of works. It is also noted that the investigation location is approx. 4 m lower than the roadway surface at the EBA and so may not be representative of soils to be excavated at the EBA.
- Given that the current uses of the Emergency Bay Area, which is for covid testing hub, patient drop off and the high foot and vehicle traffic that is seen on a day to day basis, in particular during the pandemic; the area was inaccessible to any form of safe mechanical drilling. As such, a soil sampling and groundwater sampling program required to further assess the potential for contamination to be present within the EBA.

Groundwater

- During the GME on 16 and 20 September, groundwater was encountered at depths ranging from 1.79 mBGL (BH201), 5.27 mBGL (BH202) to 7.14 mBGL (BH303). Based on estimates of ground surface topography and groundwater standing water levels, groundwater is estimated to flow in a north-easterly direction, however, this would require confirmation via survey.
- Based on the baseline ground water field parameters, the groundwater was indicated to be oxidising, fresh (BH202 and BH202) to brackish (BH303), acidic (all), and low (BH303) to medium (BH201 and BH202) dissolved oxygen.
- The groundwater concentrations for all analytes with the exception of PFAS, cadmium, copper, nickel, mercury and zinc were all below the applicable laboratory LOR, the adopted NEPC 2013 Tier 1 groundwater Human Health and Ecological Criteria, and/or bioaccumulative aquatic ecosystem criteria.
- The noted exceedances for metals (copper, nickel and zinc) are generally consistent with previous sampling events, and it is considered that the results are representative of background groundwater concentration and likely attributable to the local geological profile.
- Comparison of the PFAS, cadmium, nickel and mercury results to the 99% level of protection, is required as these are bioaccumulative contaminants in an aquatic ecosystem. As the receiving water body (Orphan School Creek and Johnstons Creek) for groundwater underlying the site is 650m to >1km to the north to north west, it is considered that comparison with the 95% level criteria is appropriate at the site and that these contaminant concentrations would not pose a risk to the aquatic ecosystem. With regards to the PFOS the detected concentration is less than drinking water (0.07µg/L) and recreational water (2µg/L), and as such this is not considered to pose a risk to construction workers.

Based on the findings of this assessment and with reference to the purpose and objectives of this investigation, the following recommendations are made:

Eastern Development – Maternity Ward Parking Area

- Whilst the laboratory data and observations gathered during the investigation generally indicated the absence of asbestos in soil, an extensive fill profile was encountered across Maternity Ward Parking Area and presence of asbestos cannot be ruled out completely. As such, it is recommended that excavation works are conducted in accordance with a Construction Environmental Management Plan including Asbestos Awareness and an Unexpected Finds Protocol.
- Any material being removed from site (including virgin excavated natural materials or VENM) must be classified for off-site disposal in accordance the EPA (2014) Waste Classification Guidelines and/or a NSW EPA Resource Recovery Order.
- If required, any groundwater management should be conducted in accordance with the local water authority.
- Due to the extension of this development into the Whale Garden following completion of intrusive investigations, it was recommended that one additional investigation location is carried out in the Whale Garden. This is further described in **Section 8** of this RAP.

Eastern Development – East Area of Eastern Campus

- Develop a Remediation Action Plan (RAP) to evaluate the potential management, remediation and / or risk assessment options, detail additional works for data gap investigation relating to B(α)P-TEQ, asbestos, ecological exceedances and building footprints; including waste classification / re-use requirements and validation criteria to guide and inform the development works. As part of the RAP it will be recommended that the delineation of identified contamination is conducted following removal of infrastructure and buildings to allow better access and also to be completed once the final plans are reviewed. The RAP should also include:

- A site history desktop review and site visit of the University of Sydney land (155m^2), interviews with University of Sydney staff and review of proposed development landscape plans; to inform a sampling and analysis plan.
- Further soil sampling within the new added areas (part of Lambie Drew Drive – one investigation at the north end and one at the southern end, and Whale Garden – one investigation location).
- An Unexpected Finds Protocol to manage any risks of unidentified impacts such as hazardous materials or waste in fill material;
- A Construction and Environmental Management Plan (CEMP) to minimise potential risks to human health and the environment during implementation of the RAP;

> For the waste classification component, it is recommended that stockpiling and assessment of each area or spoil type to confirm the final classification due to the heterogeneity in the fill.

> Any material being removed from site (including virgin excavated natural materials or VENM) must be classified for off-site disposal in accordance the EPA (2014) Waste Classification Guidelines and/or a NSW EPA Resource Recovery Order.

> If required, any groundwater management should be conducted in accordance with the local water authority.

Emergency Bay Area

> A detailed site visit of the EBA and review of proposed development civil plans; to inform a sampling and analysis plan.

> Develop a soil and groundwater sampling program that is to be carried out within the Emergency Bay Area extent of works. It is recommended for this program to be outlined in the Remediation Action Plan (RAP) that is required to be completed for the Eastern Development as outlined above.

> Any material being removed from site (including virgin excavated natural materials or VENM) must be classified for off-site disposal in accordance the EPA (2014) Waste Classification Guidelines and/or a NSW EPA Resource Recovery Order.

> If required, any groundwater management should be conducted in accordance with the local water authority.

3.1.2 Detailed Site Investigation, East Campus, Loading Dock and Gloucester House Plaza

Reference: Draft Detailed Site Investigation Report, Royal Prince Alfred Hospital East Campus, 80022026_R001_Detailed Site Investigation RevB_DRAFT, dated 8 August 2022 (Cardno 2022b)

Cardno was engaged to complete a Detailed Site Investigation Report for the for the landscaped area east of Royal Prince Alfred Hospital (RPA) loading dock and Gloucester House Plaza (GHP); both of which are located within the East Campus of the RPA building, Camperdown, NSW ("the site").

Upon completion of the agreed scope of works the following was concluded:

> Receipt and review of a Dangerous Goods Search through SafeWork NSW for the entire RPA site (As part of the original PSI request) indicated no specific dangerous goods storage associated within the boundaries of the areas of investigation. Flammable liquids cabinets and above ground-storage tanks of medical gases were identified within many buildings on the RPAH Campus and underground storage tanks were identified at distances ranging from 160m - 300m west of loading dock and 160m – 260m west of GHP. It is inferred that these tanks could have been historically decommissioned during past new building construction, however, this is not confirmed.

The soils encountered and sampled during the investigation in loading dock and GHP are preliminarily classified as General Solid Waste (non-putrescible), however, it was noted that that the level of investigation completed does not enable off-site disposal of materials.

Key Findings:

Landscape and Loading Dock Area (LLD Area)

> Soils encountered across the LLD Area generally consisted of:
  - Fill consisting of Silty Clay, and Clay between 0.0 m and 1.0 m (maximum depth of borehole), overlying;
  - Possible residual soil, comprising of silty CLAY, between 0.8 m to 1.1 m (maximum depth of borehole).

- The exceedance of lead for human health open space recreational settings (HIL-C) was observed in one shallow fill sample (BH320_0.0-0.2) but did not extend beyond a depth of 1.0mBGL at this location. Statistical analysis of the fill materials of the LLD Area confirmed that the soils are not contaminated by lead.
- The exceedance of copper against ecological criteria was observed in one shallow fill sample (BH320_0.0-0.2) but did not extend beyond a depth of 1.0mBGL at this location. Statistical analysis of the fill materials of the LLD Area confirmed that the soils are ecologically contaminated by copper.
- The exceedance of benzo(α)pyrene against ecological criteria was observed in two fill soil samples (BH318_0.5-0.7) but did extend beyond a depth of 1.0mBGL at this location. Statistical analysis of the fill materials of the LLD Area confirmed that the soils are ecologically contaminated by benzo(α)pyrene.
- The ecological exceedances (copper and benzo(α)pyrene) were considered localised. Reuse of these soils in landscaped areas should be minimised where possible to avoid potential impact to sensitive terrestrial flora and fauna.
- Asbestos was not detected in any soil samples submitted for laboratory testing. Soil analytical results were representative of conditions at the specific locations where samples were collected.
- Traces of OCPs (DDE and DDT) were detected in fill sample BH320_0.0-0.2 (0.08 mg/kg and 0.06 mg/kg, respectively), but concentrations were below the adopted NEPC 2013 Tier 1 human health screening criteria. These detections indicate historic use of pesticides at the site.

Gloucester House Plaza Area (GHP Area)

- Soils encountered across the GHP Area generally consisted of:
  - Asphaltic concrete / concrete paver and roadbase gravel, between 0.00 m and 0.45 m;
  - Fill consisting of Silty Sand, between 0.0 m and 0.7 m, overlying;
  - Stabilised sand and gravel between 0.5m to 1.0m (maximum depth of borehole), overlying;
  - Concrete slab. The concrete slab was cored to a maximum thickness of 1.0m but the total thickness and its variability across Gloucester House Plaza is unclear.
- Exceedance of the adopted human health criteria was limited to one fill sample collected from borehole BH325, which contained a benzo(α)pyrene-TEQ concentration marginally above the HIL-B and HIL-C criteria. Subsequent delineation sampling and statistical analyses of all applicable soil results indicated that the benzo(α)pyrene-TEQ does not meet the definition of contamination and therefore is not considered to exceed the human health criteria.
- No other exceedances of the adopted NEPC 2013 Tier 1 human health screening criteria were detected and asbestos was not detected in any soil samples submitted for laboratory testing. However, Cardno note that asbestos has been previously found within the undercroft area located to the west of the GHP Area (Cardno, 2022a).
- Two soil samples contained contaminant concentrations above the applicable ecological Tier 1 guideline value for benzo(α)pyrene. Statistical analysis of the fill materials of the garden bed (BH323, BH325 to BH325-3) within the GHP Area confirmed that the soils are ecologically contaminated by benzo(α)pyrene. The exceedance of the ecological criteria was found to be localised within an area of 1.5m^2 surrounding borehole BH325 and with a high level estimated volume of 1.5m^3. Reuse of these soils in landscaped areas should be minimised where possible to avoid potential impact to sensitive terrestrial flora and fauna.

Key Recommendations:

Landscape and Loading Dock Area (LLD Area)

- Localised soils within LLD Area due to the copper and benzo(α)pyrene ecologically contaminated soils identified at boreholes BH318 and BH320, should not be re-used in landscaped areas but may be re-used under roadway hardstands or beneath building footprints. To minimise the volume of soils that require further management it is recommended that some additional soil sampling close to borehole BH318 and BH320 are completed to complete statistical analyses so as to reduce overall soil volumes requiring management costs.
- Whilst the laboratory data and observations gathered during the investigation generally indicated the absence of asbestos in soil, an extensive fill profile was encountered across LLD Area and presence of asbestos cannot be ruled out completely. As such, it is recommended that excavation works are conducted

in accordance with a Construction Environmental Management Plan including Asbestos Awareness and an Unexpected Finds Protocol.

- Any material being removed from site (including virgin excavated natural materials or VENM) must be classified for off-site disposal in accordance the EPA (2014) Waste Classification Guidelines and/or a NSW EPA Resource Recovery Order.

Gloucester House Plaza Area (GHP Area)

- The soils located within the vicinity of boreholes BH325, which exceeded the ecological criteria could be re-used beneath hardstand areas and reuse of these soils in landscaped areas is not recommended to avoid potential impact to sensitive terrestrial flora and fauna. The removal and validation of the area should form part of the construction activity.
- It is recommended that excavation works are conducted in accordance with a Construction Environmental Management Plan and an Unexpected Finds Protocol.
- Any material being removed from site (including virgin excavated natural materials or VENM) must be classified for off-site disposal in accordance the EPA (2014) Waste Classification Guidelines and/or a NSW EPA Resource Recovery Order.

3.1.3 Remediation Action Plan - Undercroft

Reference: Remediation Action Plan, Royal Prince Alfred Hospital, 80022026_R004_RPA Undercroft_RAP_Rev0, dated 14 April 2022 (Cardno 2022c).

Cardno was engaged by TSA Management, on behalf of NSW Health Infrastructure, to prepare a Remediation Action Plan (RAP) for the 'undercroft area' of the Mortuary Access within Building 89 at the East Campus of RPA. The RAP was prepared following the asbestos (friable) removal and validations works completed at the site within the vicinity of HA16, by sub-consultants. As such, the report outlined the required remedial works to remove the localised B(α)P TEQ contaminated soils exceeded human health soil criteria and that posed a potential risk to human health, ensuring the suitability of the site for the continued undercroft and hospital use.

3.1.4 Preliminary Site Investigation, East Campus

Reference: Draft Preliminary Site Investigation Report, Royal Prince Alfred Hospital, East Campus, Job Reference 80022026, Revision A, dated 3 March 2022 (Cardno 2022d).

Cardno was engaged by TSA Management to undertake a Preliminary Site Investigation (PSI) for the northern and eastern periphery of the Royal Prince Alfred Hospital (RPA) building, bound by John Hopkins Drive and Lambie Dew Drive, Camperdown, NSW (the site), which is situated within the East Campus. The investigation included a review of historical documentation and drilling of eight (8) boreholes using a track and ute mounted drill rig to depths of up to 15.21 m, installation of one groundwater monitoring well, well development of newly installed well and two existing monitoring bores; measurement of the groundwater levels within tall three wells and laboratory testing of selected soil and groundwater samples.

Key Findings

- The Conceptual Site Model (CSM) developed for the site identified the potential for contamination resulting from site filling, commercial operations such as incinerations / burial of medical waste, weathering of exposed building materials, and leakage from parked motor vehicles and / or petroleum stored in the RPA building for backup power generation.
- Soils encountered across the site generally consisted of:
  - Asphaltic concrete / concrete paver, between 0.00 m and 0.40 m, overlying;
  - Fill consisting of Gravelly Sand, Silty/Sandy Clay, between 0.10 m and 3.30 m, overlying;
  - Possible residual soil, comprising of silty CLAY, between 0.15 m to 3.30 m, overlying;
  - Residual Silty CLAY, between 1.45 m to 7.00 m, overlying;
  - Bedrock, comprising of Siltstone / Laminite, between 4.10 m to 15.21 m.
- Two boreholes (BH305A and BH305B) were completed within Eastern Development (Refer to **Figure 2.1**). Shallow fill soil samples (0.1m) and deeper soil samples (2.0m) were collected at BH305A, and were tested for heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), TRH, phenols, BTEX, OCP, OPP, PCB, sVOCs. The concentrations were within the applicable human health and ecological Tier 1 screening criteria.

- Overall, a limited number of soil samples contained contaminant concentrations above the applicable human health and ecological Tier 1 screening criteria. Consistent with the Douglas Partners (2020) investigation, preliminarily it is inferred that elevated concentrations of PAH may be attributable to interference from asphaltic pavement materials rather than contamination in soil. Soil analytical results were representative of conditions at the specific locations from where samples were collected. Due to the preliminary nature of this investigation the number of samples was not sufficient to identify if the identification is statistically valid.
- Soils encountered and sampled during the investigation are not considered to be acid sulfate soils based on the preliminary observations and data gathered during the investigation.
- The soils encountered and sampled during the investigation are preliminarily classified as General Solid Waste (non-putrescible), however, we note that the level of investigation completed does not enable off-site disposal of materials.
- All groundwater concentrations of TRH, PAHs, BTEX, VOCs, and pesticides were below the adopted criteria, with exceedances limited to heavy metals. In the absence of elevated concentrations of metals in soil and the absence of an obvious source, it is considered that the metals may be attributable to naturally occurring concentrations in the local geological profile.

Key Recommendation

- The laboratory data and observations gathered during the preliminary investigation generally indicated the absence of contaminants in soil and groundwater that would constrain the future development. An extensive fill profile was encountered across the site. As the investigation of contamination was considered opportunistic and not statistically sufficient, further investigation of the fill profile should be undertaken in areas where earthworks are proposed and also to assess the potential contamination at each of the identified Areas of Environmental Concern.

3.1.5 Undercroft Contamination Assessment Report – Delineation Sampling

Reference: Contamination Assessment Report, Royal Prince Alfred Hospital, 80022026_R002_Undercroft Delineation_Rev0, 23 February 2022 (Cardno 2022e).

Cardno was engaged by TSA Management to undertake a Contamination Assessment Report for the undercroft area of the Royal Prince Alfred Hospital (RPA) building, bound by John Hopkins Drive and Lambie Dew Drive, Camperdown, NSW (the site), which is situated within the East Campus. The investigation included drilling of nineteen (19) boreholes using a hand auger and crow bar to depths of up to 0.55 m; soil sampling and laboratory testing of selected soil samples.

Key Findings

Upon completion of the intrusive delineation assessment the following was concluded:

- Elevated concentrations of benzo(a)pyrene TEQ appear to be limited predominantly to the northern portion of the undercroft and correlate to elevated concentrations of heavy end fraction petroleum hydrocarbons, indicating that the likely source of contamination within shallow soil is spillages and/or uncontrolled releases of diesel fuel.
- Statistical analysis of the data gathered during the initial and supplementary soil assessments indicated that potential risk to human health from benzo(a)pyrene TEQ is limited to the location of HA01 and HA03 and the soils surrounding these point locations up to areas where the benzo(a)pyrene TEQ was found to be below the adopted SAC. At HA01 and HA03, the benzo(a)pyrene TEQ concentrations were greater than 250% of the applicable criteria for the current and proposed land use which is considered to be contamination in accordance with NEPC 2013.
- Friable asbestos in the form of asbestos loose fibre bundles (asbestos fines) was laboratory detected in a surface soil sample collected from soil bore HA16. A source of asbestos was not observed during the soil sampling or identified during the HAZMAT (2021) completed in the undercroft, however, several samples were described as containing plaster by Eurofins, which may be indicative of potential poor historical demolition within the undercroft. Asbestos was not detected or observed on any other soils inspected or sampled during the 2021 and 2022 assessments.
- A crystalline formation on the ground surface within the undercroft appeared to have formed from dripping of an overhead pipe. A preliminary assessment of the material indicates that the substance is a residue from high salt content, however, the origin of the liquid is currently unknown. The substance was tested for a broad suite of heavy metals which were not detected at concentrations above the applicable human health

screening criteria, however, the source material is not understood and therefore all potential contaminants associated with the crystalline material are not known.

Recommendations

- Consistent with Clause 7 of the State Environmental Planning Policy No 55—Remediation of Land, Cardno recommends that a Remediation Action Plan (RAP) be prepared, and the land be remediated prior to the land being redeveloped and used for the intended purpose. The RAP should specify an appropriate remedial approach to address the elevated benzo(a)pyrene TEQ concentrations in shallow soil / rock at HA01 and HA03.
- Petroleum infrastructure associated with the RPA building, for example fuel lines and storage tanks associated with backup power generation, should be subjected to inspection and integrity testing (where systems are found to be inadequate) to ensure no uncontrolled releases of petroleum hydrocarbons are occurring.
- Due to the presence of friable asbestos, the location of soil bore HA16 and the surrounding area should be:
  - Isolated using fencing and signage to prevent interaction with potentially asbestos containing material. Individuals who work within or access the undercroft should also be advised of the exclusion zone;
  - Subjected to further investigation to delineate impact and inform the requirement for remediation;
  - Subjected to removal of impacted materials following further investigation and delineation, at the earliest point in time, by a suitably SafeWork NSW licensed Class A asbestos removal contractor, followed by an Asbestos Clearance inspection by an independent Licensed Asbestos Assessor, and validation sampling by an environmental consultant. Works in and around the asbestos impacted area should conform to the Work Health and Safety Regulation 2017.

3.1.6 Undercroft Targeted Soil Contamination Assessment

Reference: Royal Prince Alfred Hospital Stage 1 Redevelopment – Enabling / Early Works – Ref Package 1 – Targeted Soil Contamination Assessment, 80022026-R00180022026-R001:MB_RevB, dated 10 December 2021 (Cardno 2021).

Cardno was engaged by TSA Management, on behalf of NSW Health Infrastructure, to undertake a targeted soil contamination assessment within the 'undercroft area' of the Mortuary Access within the East Campus of the RPA. The purpose of the assessment was to assess the soils remaining within the 'undercroft area' of the Mortuary Access within Building 89 of the eastern campus of RPA to identify potential areas of environmental concern (AEC) and to provide a preliminary assessment of in-situ waste classification of soils.

The scope of work included shallow soil sampling at five locations in the undercroft area followed by laboratory analyses of soil samples for a broad range of contaminants and preparation of a letter report.

Key Findings

The soil investigation indicated that polycyclic aromatic hydrocarbon, particularly benzo(a)pyrene TEQ, is present is shallow soils at concentrations that exceed the conservative soil assessment criteria derived from the ASC NEPM (2013). Further assessment of soils is necessary to delineate contaminant impact and assess the risk to human and ecological receptors.

A preliminary waste classification undertaken for the soils within the undercroft area indicates that majority of soils are preliminarily classified as General Solid Waste (non-putrescible), with the exception of soils at borehole HA03 which are preliminarily classified as Restricted Solid Waste (non-putrescible). The classifications provided in this document do not enable offsite disposal of material and must be confirmed through further sampling and analysis that satisfies the requirements of the Waste Classification Guidelines (EPA 2014).

Recommendations

Additional characterisation of soil within the undercroft is necessary to laterally and vertically delineate B(a)P TEQ contamination. On the basis of the investigation findings, the site conceptual site model must be updated and the potential risk to human and ecological receptors reassessed. The findings of the additional investigation will inform the requirement for further investigation, management and/or preparation of a Remediation Action Plan (RAP) and subsequent site remediation.

Any soils proposed for removal from site will require further assessment and classification in accordance with the NSW EPA (2014) Waste Classification Guidelines. Any material removed from site must also be disposed of off-site at a NSW EPA licensed waste disposal facility permitted to legally accept the waste.

3.2 Eastern Development Area History Summary

Based on the previous report reviews, the land use of the Eastern Campus appears to be limited to hospital services / medical health buildings and infrastructure. The grounds of the eastern precinct of the RPA hospital grounds have undergone significant alteration and refurbishment since operations commenced in 1873. Specific activities of relevance to potential contamination that appear to have occurred on site include demolition, filling, storage and handling of dangerous goods, construction electrical substation infrastructure (substation), and the presence of a NSW EPA licence to produce, store and handle hazardous waste.

With respect to storage of dangerous goods as indicated in Cardno (2022a):

- No dangerous goods appear to have been stored within the EBA, but flammable liquids cabinets were identified within the building 63, which is the building located to the east of the area of investigation.
- No dangerous goods are currently located within the boundaries of the Maternity Ward Parking Area. Historically, within the footprint of this area, storage of medical gas and unspecified liquids in a previously standing gardeners shed were identified.
- Dangerous goods were identified within the boundary of the Eastern Development – East area of Eastern Campus, which includes an underground storage tank containing diesel fuel located within the loading bay area; flammable liquid cabinets containing kerosene, adhesives, acetone, ethanol, methanol, toluene, located to the east of the Pathology building, flammable liquids cabinet containing xylene located within the footprint of the Pathology building.
- Furthermore, a potentially decommissioned underground fuel storage tank(s) (i.e. listed as containing white and methylated spirits) area was identified at distances ranging from 170m south west of the Maternity Ward Parking Area, 160m west of the East area of the Eastern Campus and 100m south of the EBA, as shown in Appendix G. It is inferred that these tanks could have been historically decommissioned during past new building construction, however, this is not confirmed.

The surrounding land uses to the north, east and south appear to have generally been occupied by buildings, structures and grounds associated with the Sydney University. West of the eastern precinct is Missenden Road and additional buildings and infrastructure associated with the RPA hospital. A sports oval to the east of the East Campus, situated within the grounds of Sydney University, appears to have existed on this land prior to the earliest available aerial photograph of 1930.

Previous site investigation (Cardno 2022a) indicated that the site target location of the EBA has not varied significantly, however, the historical activities have been limited to use as access way to the main hospital entrance located on Missenden Road.

Based on the information presented across all reports outlined in **Section 3.1**, the specific activities of relevance to potential contamination for areas of investigation include demolition, weathering of hazardous building materials onto soils or ground surfaces, filling likely imported from coal fired power ash plant as was used across the inner Sydney Area, possible pesticide spraying, leakage from parked motor vehicles and/or UST, and use of chemicals for the operational use of the buildings (Pathology Building and surrounding sheds, chapel) that will be demolished as part of the redevelopment.

3.3 Existing Contamination

Based on review of the previous investigations summarised above in **Section 3.1**, a summary of the laboratory analytical results exceeding adopted assessment criteria identified at the site has been provided below in **Table 3-1**, **Table 3-2** and **Table 3-3**. A copy of the tabulated data is provided under **Appendix B**. Refer to **Figures 3, 4** and **5** for exceedance plans.

Table 3-1 Summary of Identified Soil Exceedances

Analyte	Human Health Criteria (mg/kg)	Human Health Exceedance Sample ID (concentration)	Ecological Criteria (mg/kg)	Ecological Exceedance Sample ID (concentration)	Comments
Eastern Development: East Area of Eastern Campus					

Analyte	Human Health Criteria (mg/kg)	Human Health Exceedance Sample ID (concentration)	Ecological Criteria (mg/kg)	Ecological Exceedance Sample ID (concentration)	Comments
Copper	Not applicable	Not applicable	UR: 120 Ind: 160	▪ HA02_0.3 (360 mg/kg); ▪ BH320_0.0-0.2 (460 mg/kg); ▪ HA410_0.1-0.2 (370 mg/kg); ▪ BH412_0.1-0.2 (3,400 mg/kg); and ▪ HA414_0.1-0.2 (970 mg/kg).	**Ecological:** Based on statistical analysis completed during the Cardno (2022a) investigation, the ecological contamination is considered to be localised to undefined areas represented by BH320_0-0.2 (460 mg/kg, [Cardno, 2022e]) and samples BH412_0.1-0.2 (3,400 mg/kg) and HA414_0.1-0.2 (970 mg/kg). As such, there are ecological limitations on the use of this soil refer to **Section 3.3**.
Lead	HIL C: 600mg/kg	BH320_0.0-0.2 (730 mg/kg)	Not applicable	Not applicable	**Human Health:** Based on statistical analysis completed during the Cardno (2022a) investigation, human health lead contamination is not considered to be of concern for the site. As such remediation is not required.
Zinc	Not applicable	Not applicable	UR: 520 Ind: 750	▪ HA414_0.1-0.2 (2,400 mg/kg)	**Ecological:** Based on statistical analysis completed during the Cardno (2022a) investigation, the ecological contamination is considered to be localised to undefined areas represented by sample at HA414_0.1-0.2. As such, there are ecological limitations on the use of this soil refer to **Section 3.3**.
Benzo(α)pyrene	Not Applicable	Not applicable	UR: 0.7 Ind: 1.4	The following samples exceeded ESL-URPOS (0.7 mg/kg) criteria: ▪ HA02_0.3 (1.2 mg/kg); ▪ BH320_0.0-0.2 (1.0 mg/kg); ▪ BH409_0.1-0.2 (0.8 mg/kg); ▪ HA412_0.1-0.2 (1.2 mg/kg);	**Ecological:** Based on statistical analysis completed during the Cardno (2022a) investigation, the ecological contamination was confirmed. As such, there are ecological limitations on the use of this soil refer to **Section 3.3**.

Analyte	Human Health Criteria (mg/kg)	Human Health Exceedance Sample ID (concentration)	Ecological Criteria (mg/kg)	Ecological Exceedance Sample ID (concentration)	Comments
				▪ HA414_0.1-0.2 (0.8 mg/kg); and ▪ BH415_0.1-0.2 (0.9 mg/kg). The following samples exceeded ESL-URPOS (0.7 mg/kg) and ESL- I/C (1.4 mg/kg) criteria: ▪ BH318_0.5-0.7 (1.5 mg/kg); ▪ BH408_0.1-0.2 (19 mg/kg); ▪ BH408_1.0-1.5 (12 mg/kg); ▪ HA410_0.1-0.2 (1.6 mg/kg); ▪ HA413_0.2-0.3 (8.8 mg/kg); ▪ HA416_0.1-0.2 (1.7 mg/kg); ▪ Intra lab sample 400QD2 of primary sample HA416_0.1-0.2 (9.4 mg/kg); ▪ Inter lab sample 400QT2 of primary sample HA416_0.1-0.2 (1.9 mg/kg); ▪ HA417_0.4-0.5 (1.8 mg/kg); ▪ TP423_0.1(3.2 mg/kg); and ▪ TP427_0.5 (2.2 mg/kg).	
B(α)P TEQ	HIL B: 4 HIL C: 3	▪ BH408_0.1-0.2 (27 mg/kg); ▪ BH408_1.0-1.5 (18 mg/kg); ▪ HA413_0.2-0.3 (13 mg/kg); ▪ Intra lab sample 400QD2 of primary sample HA416_0.1-0.2 (14 mg/kg); and ▪ TP423_0.1(4.2 mg/kg).	Not Applicable	Not applicable	**Human Health:** Based on statistical analysis completed during the Cardno (2022a) investigation, human health contamination is considered to be localised to undefined areas represented by samples at BH408, HA413, and HA416. As such **remediation is required**.
Asbestos	HIL B: 0.04% w/w HIL C: 0.02% w/w	HA415_0.1-0.2 0.22% w/w).	Not Applicable	Not Applicable	**Human Health:** Asbestos was identified at concentrations exceeding human health criteria and as such **remediation is required.**
Emergency Bay Area					

Analyte	Human Health Criteria (mg/kg)	Human Health Exceedance Sample ID (concentration)	Ecological Criteria (mg/kg)	Ecological Exceedance Sample ID (concentration)	Comments
Naphthalene	HSL A&B: 3mg/kg	BH1(TP301)_0.5-0.6 (6.9 mg/kg)	Not Applicable	Not Applicable	The samples collected south of the EBA indicated that the soil is contaminated by PAHs and petroleum hydrocarbons (F2, F3). However, given the locality and depth (ground surface elevation difference of about 4m) of the sample, it is not considered to be representative of the soil material underlaying EBA development footprint. The information obtained within the vicinity of the EBA provides background information on the soil quality across different areas of the RPA site. Given the limitations of the investigation completed within close proximity of the EBA, it is considered that a detailed site investigation is warranted for the EBA and is to be carried out once an alternative location for the ambulance drop off area is assigned.
Benzo(α)pyrene	Not Applicable	Not applicable	UR: 0.7 Ind: 1.4	▪ BH1(TP301)_0.5-0.6 (100 mg/kg); and ▪ BH1(TP301)_1.3-1.4 (1.9 mg/kg).	
B(α)P TEQ	HIL B: 4 HIL C: 3	BH1(TP301)_0.5-0.6 (150 mg/kg)	Not Applicable	Not applicable	
Total PAH	HIL B: 400 HIL C: 300	BH1(TP301)_0.5-0.6 (1,300 mg/kg)	Not Applicable	Not applicable	
TRH F2	HSL A&B: 110 mg/kg	BH1(TP301)_0.5-0.6 (230 mg/kg)	Ind: 170	BH1(TP301)_0.5-0.6 (230 mg/kg)	
TRH F3	Not Applicable	Not applicable	UR: 1,300 Ind: 2,500	BH1(TP301)_0.5-0.6 (5,600mg/kg)	

Note:

UR: Ecological Urban/Residential and Public Open Space Criteria.

Ind: Ecological Commercial/Industrial Criteria.

Table 3-2 Summary of Identified Groundwater Exceedances

Analyte	Criteria (µg/L)	Exceedance Sample ID (concentration)	Comment
Copper	AE-Fresh = 1.4[1]	▪ GWBH202-2 (2 µg/L)	The results of laboratory metals (copper, nickel and zinc) analyses were considered to be attributable to naturally occurring concentrations in the local geological profile. As such, remediation is not required.
Nickel	AE-Fresh= 8[1]	▪ GWBH303-2 (15 µg/L); ▪ GWBH201-2 (24 µg/L); ▪ GWBH202-2 (50 µg/L); ▪ Intra and inter laboratory samples GWQD2-2 (21	

Analyte	Criteria (µg/L)	Exceedance Sample ID (concentration)	Comment
		µg/L) and GWQT2-2 (23 µg/L) of primary sample GWBH201-2.	
Zinc	AE-Fresh = 8[1]	▪ GWBH201-2 (17 µg/L); ▪ GWBH202-2 (36 µg/L); ▪ GWBH303-2 (24 µg/L); and ▪ Intra and inter laboratory samples GWQD2-2 (17 µg/L) and GWQT2-2 (15 µg/L) of primary sample GWBH201-2.	

Note:

1 – Protection of Aquatic Ecosystems, Marine, 95% Level of Protection

2 – Recreational Water Criteria

Based on the findings of the site investigation phase, it is considered that contaminants relevant to the RAP are as follows:

> Eastern Development:
  - Human Health
    - Soil: Asbestos (Bonded) and B(α)P-TEQ.
  - Ecological
    - Soil: Copper, zinc, and B(α)P.

  It is also noted that remediation and construction works must also be considerate of other contaminants detected and/or that may exist given the nature of the site, and unexpected finds that may be discovered during construction. Other contaminants of concern include:

  - OCP – Traces of OCPs (aldrin and dieldrin) were detected in fill sample HA415 (0.4 mg/kg and 4.8mg/kg, respectively), but concentrations were below the adopted NEPC 2013 Tier 1 human health screening criteria. These detections indicate historic use of pesticides at the site.
  - PCB – Substations exist within the area of demolition. Sub soils are to be investigated once demolition works occur.
  - Biological waste – Given the nature of the setting (pathology building), the potential for biological waste should be considered.

> Eastern Development: With regards to the investigation completed within close proximity of the Emergency Bay Area, due to access restrictions (i.e. emergency bay area) the collected samples (BH1(TP301)) were not considered representative of the site target (EBA), and the results are considered to provide background information of the soil quality within close proximity of the EBA. As such, the contaminants relevant to the data gap investigation for this area are as per the CSM presented in **Section 4** below.

4 Conceptual Site Model

Outlined within NEPM (2013) *Schedule B2 – Guideline on Site Characterisation,* a Conceptual Site Model (CSM) is required to aid the assessment of data collected for the site.

A CSM provides an assessment of the fate and transport of contaminants of potential concern within the context of site-specific subsurface conditions with regard to their potential risk to human health and the environment. Risk to human health and the environment is identified through complete Source – Pathway – Receptor (SPR) linkages. In order to identify SPR linkages the CSM considers site specific factors including:

- Source(s) of contamination;
- Identification of contaminants of concern associated with past (and present) source(s);
- Site specific information including soil type(s), depth to groundwater, effective porosity, groundwater flow velocity and surface water bodies and interactions;
- Locations of any identified sources relative to the proposed site development; and
- Actual or potential receptors considering both current and future land use both for the site, adjacent properties and any sensitive ecological receptors.

4.1 Identified Contamination Sources

Based on review of the historical site, surrounding land uses (**Section 2.2**), and previous environmental reports (**Section 3**), the following contamination sources have been identified to remain onsite:

- Imported fill material potentially used for filling and levelling the or beneath former building slabs.
- Potential contamination from current and historical land uses – potential boiler ash, poor demolition, use of pesticides, leakage from fuel storage, leakage of fuel, coolants and lubricants used in electrical substations;
- Low-level fuel leakage from parked vehicles (cars and trucks) both historically and currently on site;
- Use of corrosive and flammable chemicals such as toluene, kerosene, ethanol, methanol which are chemicals that are associated with the current land use;
- Hazardous building materials contained in former (demolition rubble) and existing site structures; and
- Weathering of exposed building structures including painted surfaces, metallic objects and cement fibre sheeting (containing lead-based paint and/or asbestos etc.).

4.1.1 Identified Receptors

A high-level summary of potential receptors considered to be susceptible to site contamination include:

- Current and future site workers and hospital patients and visitors;
- Current and future site workers and hospital patients and visitors; and
- Neighbouring site users.

A refined CSM for the human health and ecological contamination identified in the DSI (Cardno 2022a) within the Eastern Development site footprint, is summarised in **Table 4-1** and applies to the current and proposed future land use settings.

Table 4-1 Conceptual Site Model – Eastern Development (Eastern Area of Eastern Campus)

Contaminant Source	Impacted Media	Contaminants of Potential Concern	Potential Exposure Pathways	Receptors	Likelihood of Complete Exposure Pathway
▪ Imported fill material ▪ Fuel storage for backup generator ▪ Low-level leakage from parked vehicles ▪ Historical Site Use: potential for boiler ash, poor demolition ▪ Weathering of exposed building structures containing Hazardous Building Materials	Fill soils within upper 0.5-1.5 mBGL	**Human Health** Actual CoPC detected: ▪ Asbestos (Bonded) ▪ B(α)P-TEQ	▪ Direct Contact ▪ Incidental Inhalation (where respirable asbestos fibres become released) ▪ Incidental Ingestion	**Human Health:** ▪ Site users ▪ Site workers (including maintenance workers) ▪ Neighbouring site users	**Low to medium:** Asbestos was found on ground surfaces and within soil and can be susceptible to degradation causing release of fibres thereby increasing exposure risks to site users and workers. B(α)P-TEQ was found in shallow soils and may be related to the degraded asphalt and /or the contaminant sources noted. Exposure may be increased to site users during dust generation and worker access to soils.
		Ecological Actual CoPC detected: ▪ Copper ▪ Zinc ▪ B(α)P	▪ Terrestrial flora and fauna uptake ▪ Leaching to groundwater	**Ecological:** ▪ Terrestrial based flora and fauna ▪ Aquatic ecosystems	**Medium to high:** Actual CoPCs were detected in soil including exposed soil surfaces, where terrestrial flora and fauna are exposed. Actual consequence to flora and fauna has not been investigated. Complete exposure pathway to aquatic ecosystems is considered to be low given the >1km distance to the inferred groundwater discharge receiving water body.
Hazardous building materials contained within former and existing site structures	▪ Air ▪ Surficial Soils	Potential CoPC: ▪ Asbestos ▪ Lead ▪ PCB ▪ Synthetic mineral fibres	▪ Direct Contact ▪ Incidental Inhalation ▪ Incidental Ingestion	**Human Health:** ▪ Site users ▪ Site workers (including maintenance workers) ▪ Neighbouring site users **Ecological:** ▪ Terrestrial based flora and fauna ▪ Aquatic environmental organisms	**Low to medium:** The building infrastructure is aged and containing hazardous materials in all buildings (Refer to Hazardous Building Material surveys completed by SEG). Post demolition, soils surfaces in surrounding areas may become impacted and should be subject to both clearance inspections and validation sampling and analysis events.
▪ Leakage of coolants and lubricants used in electrical substations ▪ Imported fill material	Soils	Potential CoPC: ▪ Metals ▪ PAH ▪ OCP ▪ PCB	▪ Direct Contact ▪ Incidental Inhalation (where respirable asbestos fibres become released)	**Human Health:** ▪ Site users ▪ Site workers (including maintenance workers) ▪ Neighbouring site users	**Low:** Other CoPCs (i.e. OCPs) were detected below adopted human health and ecological criteria, and given the presence of site infrastructure, access to soils for investigation purposes was inhibited in many areas. As such, other contaminants

Contaminant Source	Impacted Media	Contaminants of Potential Concern	Potential Exposure Pathways	Receptors	Likelihood of Complete Exposure Pathway
▪ Leakage of fuel storage for backup generator ▪ Use of pesticides ▪ Low-level leakage from parked vehicles ▪ Historical Site Use: potential for boiler ash, poor demolition ▪ Use of corrosive and flammable chemicals such as toluene, kerosene, ethanol, methanol ▪ Weathering of exposed building structures containing Hazardous Building Materials		▪ Asbestos ▪ Biological ▪ TRH ▪ BTEX Volatile halogenated compounds (VHC)	▪ Incidental Ingestion	**Ecological:** ▪ Terrestrial based flora and fauna ▪ Aquatic environmental organisms	may be discovered during site constructions works and should continue to be considered during construction.

Table 4-2 Conceptual Site Model – Emergency Bay Area

Contaminant Source	Impacted Media	Contaminants of Potential Concern	Potential Exposure Pathways	Receptors	Likelihood of Complete Exposure Pathway
Imported fill material Fuel storage for backup generator Use of pesticides Low-level leakage from parked vehicles Historical Site Use: potential for boiler ash, poor demolition	Surficial soils	▪ Metals ▪ TRH ▪ PAH ▪ BTEX ▪ OCP ▪ OPP ▪ PCB ▪ Asbestos	▪ Direct Contact ▪ Incidental Inhalation ▪ Incidental Ingestion	**Human:** ▪ Current site users ▪ Future Site workers (including maintenance workers ▪ Neighbouring site users (including neighbouring basement users) **Ecological:** ▪ Existing and future plant-based biota within the site	**Medium to high:** The soil within the EBA has not been characterised and as such the soil quality is unknown.
Historical Site Use Potential for medical waste, boiler ash, poor demolition, and underground storage tank containing methylated and white spirits located 100m south of EBA Use of corrosive and flammable chemicals such as toluene, kerosene, ethanol, methanol	▪ Soils at depth ▪ Groundwater	▪ TRH ▪ BTEX ▪ PAH ▪ Metals ▪ Phenols ▪ Volatile Organic Compounds	▪ Incidental Inhalation ▪ Incidental Ingestion		**Medium to high:** The soil and groundwater within the EBA has not been characterised and as such the soil and groundwater quality is unknown.
Weathering of exposed building structures Hazardous building materials contained within former and existing site structures	▪ Air ▪ Surficial Soils	▪ Asbestos ▪ Lead ▪ PCB ▪ Synthetic mineral fibres	▪ Direct Contact ▪ Incidental Inhalation ▪ Incidental Ingestion		**Low to medium:** There are limited amount of structures (emergency bay canopy and guard shed) within the Emergency Bay Area. Given the age of the guard shed which based on the DSI (Cardno, 2022a) it was erected circa 1982, there is a medium to high probability of the existing shed containing hazardous material within the building fabrics.

4.2 Data Gaps

Based on Cardno's assessment of the site historical information, which included a review of the existing environmental reports (Ref. **Section 3**), the following data gaps were identified:

Eastern Development (Maternity Ward Parking Area and East Area of Eastern Campus):

- The proposed sampling location grid could not be achieved predominantly in the eastern parts of East Area of Eastern Campus due to site access restrictions, multiple buried utilities. As such, characterisation of soil in this part of the site might be incomplete.
- Majority of the site surfaces were sealed with either concrete or asphalt pavement, inhibiting the use of test pits thereby limiting observations subsurface soil quality.
- Sampling within footprint of Pathology Building (Building 94) and associated sheds, electrical substation, and chapel could not be completed due to access restrictions, height clearance, operational use, thick concrete slabs, and underground services.
- Waste classification of soils for offsite disposal is not complete.
- The onsite reuse of material remains unknown as volumes of material to be excavated and location of re-use have not been confirmed.
- Groundwater flow direction is to be confirmed. Survey data, specifically the surface elevation, for borehole BH201, BH202 and BH303 is to be provided.
- Sections of Lambie Dew Drive (to the north and south), part of the existing Whale Garden, and lands within University of Sydney were added to the proposed works area in November 2022 following completion of field investigations documented in this report.

East Area of Eastern Campus:

- Soil quality beneath the building footprints are unknown and within the north east corner of the site which is the University of Sydney Land.
- Lateral and vertical extent of B(α)P-TEQ human health contamination at borehole location HA413 and HA416 is not fully defined.
- Lateral extent of B(α)P-TEQ human health contamination at borehole location HA408 and TP423 is not fully defined.
- Lateral and vertical extent of asbestos impact at borehole location HA415 is not fully defined.
- Lateral extent of copper ecological contamination at locations BH320 (Cardno, 2022c), BH412 and HA414 is not fully defined.
- The lateral extent of zinc ecological contamination at location HA414 is not known.
- Desktop, site inspection, and/or intrusive investigation on within University of Sydney lands were not conducted. It is understood that tree removal and new plantings are to form part of construction works within these lands.

Emergency Bay Area:

- The environmental quality of soil underlying the EBA is unknown as drilling within the development footprint was not possible due to the current uses of the area which is for hospital patient drop off and covid testing hub. A detailed site walkover is also to be completed once the drop off zone is relocated and the emergency bay can be accessed in a safely manner.
- Due to the use of hand auger equipment, soil samples may not be representative of discrete intervals and potential cross contamination of materials such as cave in of asphalt pavement fragments into underlying soils may have occurred.
- The sampling method did not enable sufficient sampling volume or observations of fill to assess for the presence of asbestos. This was due to the constrained area, presence of surface pavement, and the relatively small volume of material excavated.
- Confirmation of the existence and/or status of reported methylated and white spirit tank(s) identified approximately 100 m south of the site target could not be confirmed.
- Groundwater quality and level within the Emergency Bay Area is unknown.

4.3 Extent of Remediation Required

Based on the summary provided above (in **Section 3.1** and **3.2**), of the previous investigations undertaken at the site, the areas of the site requiring remediation are outlined in **Figure 3** and **4 Appendix A** and outlined in the following sub-sections. It is noted that as part of the RAP, further soil and groundwater testing is required and as such the extent of remediation as outlined in **Section 4.3.1** below may vary.

4.3.1 Soil

Human health contamination remains within fill soils of the Eastern Area development across sampling locations BH408, HA413, HA415, HA416 and TP423. The final lateral and vertical extent is to be determined during remediation.

The contamination present and requiring remediation consists of B(α)P TEQ and bonded asbestos found to exceed human health criteria; and metals (copper, zinc) and B(α)P found to exceed ecological criteria.

Based on the findings of the recent investigation (Cardno, 2022a) as outlined in **Section 3.1.1**, Cardno have made a preliminary volume estimate of contaminated fill soils to be remediated on the basis of the existing soil sampling analytical results and experience with similar sites. This estimate should not be considered as a guarantee of volume. It is noted that delineation sampling to determine the exact volume of contaminated soils has not been undertaken and as such these estimates are uncertain.

Table 4-1 Estimated Known Soil Contamination Onsite

Remediation Area	Contaminant	Estimated Depth of Contaminated Material	Preliminary Dimensions of Contaminated Area	Estimated Volume of known contamination	Validation Requirements
Human Health (Area also includes ecological contamination).					
Located within Eastern Area at locations BH408, HA416, (Refer to **Figure 3**)	B(α)P-TEQ	1.5m Fill; Silty Sand, Clayey Sand, Sandy Clay	9 x 6 m = 54 m^2	81m^3	Sample wall and base to confirm removal. Final lateral extent of contamination is not known and validation samples may dictate further excavation requirements.
Located within Eastern Area at locations HA413, TP423 (Refer to **Figure 3**)	B(α)P-TEQ	1.0m Fill; Silty Sand, Clayey Sand, Sandy Clay	Irregular shape 77 m^2	77m^3	Sample wall and base to confirm removal. Final lateral extent of contamination is not known and validation samples may dictate further excavation requirements.
Located within Eastern Area at sample locations HA415 (Refer to **Figure 3**)	Asbestos	0.7m Fill; Silty Sand	2x 2m = 4 m^2	17.5 m^3	Sample wall and base to confirm removal. Final lateral extent of contamination is not known and validation samples may dictate further excavation requirements.
Ecological (Not including soils within the extent of Human Health contaminated soils above).					
Located within Eastern Area at sample location BH320, [Cardno,	Copper	Average: 0.5m Fill; Silty Sand, Silty Clay	2 x 2 = 4m^2	2 m^3	Sample wall and base to confirm removal.

Remediation Area	Contaminant	Estimated Depth of Contaminated Material	Preliminary Dimensions of Contaminated Area	Estimated Volume of known contamination	Validation Requirements
2022e]), BH412 and HA414 (Refer to **Figure 4**).					Final lateral extent of contamination is not known and validation samples may dictate further excavation requirements.
Located within Eastern Area at sample location HA414 (Refer to **Figure 4**).	Zinc	0.3m Fill; Silty Sand	2 x 2 = 4 m^2	1.2 m^3	Sample wall and base to confirm removal. Final lateral extent of contamination is not known and validation samples may dictate further excavation requirements.
Located across Eastern Area with the exception of the fill material under the ramp connecting Lambie Drew Drive to the undercroft area of the main RPA building (Refer to **Figure 4**).	B(α)P	1.0m Fill; Silty Sand, Clayey Sand, Sandy Clay, Sandy Silt.	5,255 m^2	5,076 m^3 – *Note: value takes into account the removal of localised contamination noted above*	Sample wall and base to confirm removal.

Waste classifications are to be integrated into the remedial excavations and disposal phase of the development, to ensure proper management of waste materials, in accordance with EPA (2014) *Waste Classification Guidelines*.

5 Remediation Objectives and Criteria

5.1 Remediation Objectives

The purpose of the proposed remedial works is to remove the bonded asbestos and B(α)P TEQ contaminated soils that currently exceed human health soil criteria and that pose a potential risk to human health; and to remove the copper, zinc and B(α)P contaminated soils that exceed the ecological criteria, thus ensuring the suitability of the site for the continued hospital use.

The remediation objectives are:

- To ensure that soil and groundwater characterisation are completed across the areas where the quality of the soil and groundwater are unknow.
- To ensure the identified asbestos and B(α)P-TEQ contaminated soils are appropriately managed so that they do not pose risk to human health and the environment at the site for the future land use;
- To ensure the identified copper, zinc and B(α)P contaminated soils are appropriately managed so that they do not pose ecological risk for the future land use; and
- To validate that the requirements of this RAP have been successfully completed such that the site is suitable for the proposed concept development as high-density residential land use.

The approximate areas that are required to be remediated and/or further investigated in the implementation of this plan are shown on **Figure 3, 4** and **5** presented in **Appendix A**.

5.2 Soil Validation Criteria

Where offsite removal of contaminated material is selected, then the underlying soils and/or bedrock must be validated ensuring that contamination no longer remains following removal of the contaminated soil from the area. Validation must also include documentation that the contaminated soils were placed in the appropriate location as approved in this RAP, either on-site or off-site.

Specific adopted soil validation criteria for the site have been obtained from the NEPC 2013 and are further presented in **Table 5-1** to **Table 5-2** below. All retained soils and/or bedrock must be below the adopted criteria, ensuring the contaminated soils have been adequately removed such that there are no complete exposure pathways.

Soils remaining onsite must also comply with the aesthetic requirements provided in Section 3.6 of Schedule B1 of the NEPM (NEPC, 1999). The general assessment considerations include:

- The risk for a person to be injured by metal, glass or other sharp objects;
- That chemically discoloured soils or large quantities of various types of insert refuse, particularly if unsightly, may cause ongoing concerns to site users;
- The depth of any residue in relation to the final surface of the site; and
- The need for and practicality of any long-term management of foreign material.

Soils remaining within the site should be such that at surface there is no detectable odour, identifiable staining or large quantities of inert waste.

Table 5-1 Soil Validation Criteria

Value	Guideline	Criteria
Human Health	NEPC, 2013, Schedule B1, Section 6, Tables 1A(1) and 1A(3); For asbestos: Section 4, Table 7.	The criteria have been derived in consideration of the proposed end land use and associated development activities, which are hospital infrastructure upgrades. NEPC 2013, Schedule B7, Appendix C, Section 3.2.5.3 notes that *The HILs developed for the commercial/industrial land use scenario are not applicable to a site used frequently by more sensitive groups such as children (within childcare centres, hospitals and hotels) and the elderly (within hospitals, aged care facilities and hospices).* As the development areas consist of new building or building alterations within a hospital setting, the HIL-B exposure scenario, residential with minimal opportunities for soil access is considered appropriate given the potential for migration of soil, dust, vapours. For external landscaped areas, the HIL-C open space criteria (more sensitive than HIL-B) should be used. Where specific external areas are to be used for child-care or immuno-suppressed or immuno-compromised persons, more conservative criteria such as HIL-A or less should be considered on the basis of a further review of the construction design and purpose, however, based on the information and preliminary architectural plans provided to date, it does not appear that there will be courtyards where potential soil exposure or gardening (i.e. planting of seeds for food) is proposed. On this basis thespecific criteria to be used for building footprint areas are summarised below: ▪ Health Investigation Level (HIL-B) for '*Residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments*' ▪ Health Screening Level (HSL A&B) for '*Low – high density residential*' For external landscaped, public open space, or recreational areas: ▪ HIL for *Public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths (HIL-C).* ▪ HSL for *Public open space (HSL-C).* **For asbestos**: ▪ No visible asbestos for surface soils. ▪ HSL-B: for bonded ACM 0.04% w/w

Value	Guideline	Criteria
		▪ HSL-C: for bonded ACM 0.02% w/w ▪ 0.001% w/w for friable asbestos in soil Note: Criteria may need to be reviewed once final detailed design is completed and provided.
Ecological	NEPC 2013, Schedule B1	Within the footprint of proposed buildings, buildings, and roadways, the ecological criteria for an industrial/commercial setting is considered appropriate. Outside of existing and proposed building footprint and roadways, the ecological criteria for urban residential and public open space is considered to be appropriate. **Within building footprint and roadways**: ▪ Ecological Screening Levels (ESL) for commercial / industrial, coarse soil, 0-2m. ▪ Ecological Investigation Levels (EIL) for commercial / industrial, aged, NSW setting, high traffic **Within landscaped areas**: ▪ Ecological Screening Levels (ESL) for urban residential and public open space, coarse soil, 0-2m. ▪ Ecological Investigation Levels (EIL) for urban residential and public open space, aged, NSW setting, high traffic.

In accordance with NEPC 2013, the EIL is calculated as the sum of the Added Contaminant Limit (ACL) and the Ambient Background Concentration (ABC) (i.e. EIL = ACL + ABC). ABCs have been based on the 25th percentile values for aged, urban settings, high traffic, NSW by Olszowy et al.

The derived EIL criteria for copper, nickel, chromium III, and zinc are based on high traffic volume and aged contamination (>2 years) and the inputs shown in **Table 5-2**:

Table 5-2 Soil Ecological Investigation Criteria

Analytes		EIL or ESL, Urban residential and public open space (mg/kg)	Inputs
Metals	Arsenic	100	▪ pH – 6 (estimated) ▪ Cation Exchange Capacity (CEC) – 10 cmolc/kg (estimated) ▪ Total Organic Carbon (toc) – 0.5% (estimated) ▪ % Clay – 10%
	Copper	160	
	Chromium III	680	
	Lead	1,100	
	Nickel	290	
	Zinc	750	
PAHs	Naphthalene	170	
	Benzo(α)pyrene	ESL = 0.7	
OCPs	DDT	180	

5.3 Waste Classification

Prior to being removed from the site, excavated soils must be classified in accordance with the EPA *Waste Classification Guidelines* (EPA 2014). Under these guidelines, fill or natural soils may be classified into the following groups: *General Solid Waste*, *Restricted Solid Waste* or *Hazardous Waste*, subject to chemical assessment using NATA-registered laboratory methods for total and leachable contaminant levels. Any soils containing asbestos would also be classified as *Special Waste (Asbestos)*. The soil analytical results collected during the DSI (Cardno, 2022a), remedial and validation works could be utilised to assist the waste classification of spoil so it can be appropriately managed if transported off-site. Additional samples and analysis would be required in order to meet the requirements and sampling density as per NSW EPA (2014).

In accordance with the *NSW Waste Regulation 2014*, waste soils must only be disposed to a waste facility that is appropriately licenced to receive the incoming waste.

Unexpected material may need to be segregated depending on the source of the waste, prior to conducting waste classification assessment. This approach is discussed in more detail under *Contingency Plan* in **Section 12**.

Due to the highly variable fill material and contaminant concentrations encountered, Cardno recommends excavation and stockpiling of each waste stream, soil type, fill type, and/or area followed by check sampling to confirm the final classification of material for off-site disposal. Where different soil types are mixed together, this can inadvertently lead to increased soil management and disposal costs.

5.3.1 Exported Materials

Waste classification assessment will be required for any soil materials that need to be exported or disposed off-site during the development in accordance with the NSW EPA Waste Classification Guidelines (EPA 2014) and current Resource Recovery Exemptions / Orders. This assessment will be required in addition to the preliminary waste assessment undertaken during the previous contamination assessments (Cardno, 2022a and 2022b).

5.3.2 Imported Materials

Waste classification assessment will be required for any soil materials that need to be imported to the site during the development in accordance with the NSW EPA (2014) Waste Classification Guidelines and current Resource Recovery Exemptions / Orders. As such, to deem soils suitable for reuse on the subject site, all imported soils are to meet the following criteria:

- Be certified as VENM by the supplier in accordance with the informational requirements of NSW EPA; and
- Supporting documentation demonstrates that the material satisfies an EPA Resource Recovery Order, or a NSW EPA Special Exemption by application where a current NSW EPA Resource Recovery Order does not exist. The documentation required will include a specification sheet from the supplier showing the type of material imported is approved, and the materials are inspected by the appointed Environmental Consultant.
- The site land owner must declare acceptance of the imported material on the basis that the material satisfies all importation and receival requirements. In this regard, it is recommended that:
  - The documentation is reviewed by a qualified environmental consultant prior to it being accepted; and,
  - All importation sites should be assessed by the environmental consultant via site visit, sampling and analyses of representative samples from the importation site.

5.4 Groundwater Assessment Criteria

The groundwater assessment criteria (GAC) adopted during the investigation are outlined in **Table 5-3**.

Table 5-3 Groundwater Assessment Criteria

Assessed Value	Guideline or Standard	Criteria
Aquatic Ecosystems	ANZG 2018	Fresh 95% ecosystem level of protection default guideline values (DGVs). For bioaccumulative contaminants, the 99% level of protection is adopted.
Primary and Secondary Contact Recreation	ANZG 2018	ANZG 2018 refers NHMRC 2008, Chapter 9, Table 9.3 Criteria is to be taken as the lowest value of the (Health criteria x 10) or the Aesthetic criteria.
Non-use scenarios (Vapour Intrusion)	NEPC 2013, Schedule B1, Table 1A(4)	HSL-A&B for low to high density residential land use, Sand. As with the SAC, due to the sensitive land use the residential criteria are most appropriate
Buildings and structures	Australian Standard 2159-2009 Piling-Design and Installation (AS2159)	Section 6 – Durability Design
Visual amenity	ANZG 2018	ANZG 2018 refers to NHMRC 2008, Chapter 10.

5.5 Triggers for Further Management

Further investigation or remediation may be required during the construction phase of the proposed works. Triggers for further management include:

- Change of the development plan which may involve shallower excavation works, retention of fill soils;
- Unexpected finds of contaminated material which are incompatible with the remedial approach;
- Finalisation of development plans;
- Gross contamination in groundwater at EBA; and
- Any modification to NSW environmental or planning legislation affecting the RAP.

Where the triggers for further management are identified, refer to **Section 9.6** for the measures to be implemented.

6 Data Quality Objectives

6.1 Data Quality Objective

The NEPC (2013) which is endorsed by the NSW EPA under s105 of the *Contaminated Land Management Act 1997*, requires that Data Quality Objectives (DQOs) are adopted for all assessment and remediation programs. The DQO process as adopted by the NSW EPA is described within the US EPA (2000) *Guidance for the Data Quality Objectives Process and Data Quality Objectives Process for Hazardous Waste Site Investigations.*

The DQOs for the remediation of the site are summarised below in **Table 6-1**.

Table 6-1 Data Quality Objectives

DQO Step	Discussion
Step 1: State the Problem (Summarise the contamination problem that will require new environmental data, and identify the resources available to resolve the problem; develop a conceptual site model).	Soil materials at the site have been contaminated by CoPCs at concentrations above the Tier 1 screening guidelines. There is a potential complete source to receptor pathway, indicating a potential risk to human health and the environment. Therefore, remediation or management of soils is necessary to render the site suitable for the intended hospital land use.
Step 2: Identify the decision / goal of the study (Identify the decisions that need to be made on the contamination problem and the new environmental data required to make them).	Based on the objectives outlined in **Section 1.3**, the following decision / goals of the study are: 1. Have the site contamination issues been resolved so as to remove potential human health and ecological exposure risk to a suitable level for the proposed land use and any off-site risks? 2. Has the site been suitably validated to confirm conformance to the RAP? 3. Is an Environmental Management Plan required for long-term management of contamination at the site following its remediation? 4. Is on-going monitoring at the site required post-remediation?
Step 3: Identify the information inputs (Identify the information needed to support any decision and specify which inputs require new environmental measurements).	Inputs to the decision making process include: ▪ The proposed end land use outlined in **Section 1.2**; ▪ Guidelines made or approved by the NSW EPA under the Contaminated Land Management Act 1997; ▪ Client information provided; ▪ Previous investigations performed at the site, summarised in **Section 3**; ▪ Soil validation sampling of remedial excavation surfaces including the identified contamination points; ▪ Sampling and laboratory analysis from stockpiled soil material for waste classification assessment; ▪ Laboratory analytical results of soil validation samples; and ▪ Assessment of analytical results in relation to the remediation criteria. At the end of the validation, a decision must be made regarding whether the environmental conditions are suitable for the proposed development, or if additional investigation or remedial works are required to make the site suitable.
Step 4: Define the boundaries of the study (Specify the spatial and temporal aspects of the environmental media that the data must represent to support decision)	The boundaries of the study are: ▪ Lateral – the intrusive investigation is limited to the lateral extent of the site (i.e. Eastern Development within the east area of the Eastern Campus, RPAH), as shown in **Figure 1, 2, 3, 4** and **5** in **Appendix A**; ▪ Vertical – from existing ground surface, underlying fill and natural soil horizons to the base of contaminated soil; and ▪ Temporal – Results are valid on the day of data / sample collection and remain valid as long as no changes occur on site or contamination (if present) does not migrate on site or on to the site from offsite sources.

DQO Step	Discussion
Step 5: Develop the analytical approach (To define the parameter of interest, specify the action level, and integrate previous DQO outputs into a single statement that describes a logical basis for choosing from alternative actions).	Parameters of interest include the laboratory results of primary and quality control soil analytical testing. Decision rules for soil and criteria exceedance are outlined as follows: ▪ If the laboratory quality assurance/ quality control data are within the acceptable ranges, the data will be considered suitable for use. ▪ The Practical Quantitation Limit (PQL) for all analyses is at or below the adopted criteria level; ▪ Soil: The laboratory soil test results will be considered to have met the adopted soil criteria when the following occur: – The laboratory reported result is below the investigation human health and ecological criteria for the site; or, – The calculated 95% Upper Confidence Level of the arithmetic mean (95%UCL) contaminant concentration does not exist in soil samples at concentrations in excess of Tier 1 Assessment Criteria; and – The standard deviation of the results is less than 50% of the relevant adopted criteria; and, – No single analytical result for a COPC should exceed 250% of the relevant investigation level or screening level. ▪ RPDs for duplicate samples are within accepted limits. ▪ Further decisions are also required following any additional assessment. This may require updating of the RAP to include groundwater remediation or management. ▪ Soil concentrations of chemicals of concern that are below investigation/validation criteria made or approved by the NSW EPA will be treated as acceptable and indicative of suitability for the proposed land use(s). ▪ Groundwater concentrations of chemicals of concern that are reported to be below or equal to the adopted remediation criteria made or approved by the NSW EPA, will be considered as acceptable and indicative of site suitability for the proposed land use. Where low reliability criteria are considered for the groundwater, Stantec may also adopt risk-based criteria should these provide a more practical verification outcome and amend acceptance criteria provided at Step 6 of remediation goals.
Step 6: Specify performance or acceptance criteria (Specify the decision-maker's acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainties in the data).	Decision errors are incorrect decisions caused by using data that is not representative of site conditions due to sampling or analytical error. The two types of decision errors are: the sampling program does not detect the variability of a contaminant from point to point across the site; and errors made during sample collection, handling, preparation, analysis and data reduction. Decision errors will be minimised by the following: ▪ The field sampling design, frequency, and methodology, sample preservation techniques and laboratory analytical procedures will be conducted in accordance with accepted NSW EPA, NEPM (2013) and NATA accredited methodologies; ▪ A check of the field and laboratory works is to be made against the Data Quality Indicators for precision, accuracy, representativeness, completeness and comparability as outlined in NEPM (2013) Schedule B2, Site Characterisation and included in **Section 6**; ▪ A decision that soil is acceptable for the site land use is based on calculation of the 95% Upper Confidence Level of the arithmetic mean (95%UCL) and standard deviation for contaminant concentration and comparison with the adopted soil criteria. Therefore, the acceptable limit of a decision error is 5% that a conclusive statement may be a false positive or false negative. ▪ Sampling errors may occur when the sampling program does not adequately detect the variability of a contaminant from point to point across the site or is not representative. Some examples of this scenario include but are not limited to: – Restrictions in borehole and test pit depth due to drilling refusal.

DQO Step	Discussion
	– Proposed samples are not collected due to access being restricted to a given location. Measurement errors can occur during sample collection, handling, preparation, analysis and data reduction. To address this the following measures are proposed: – Field staff to follow a standard procedure when undertaking samples, including decontamination of tools, removal of adhered soil to avoid false positives in results, collection of representative samples and use of appropriate sample containers and preservation methods. – Laboratories to follow a standard procedure when preparing samples for analysis and undertaking analysis. – Laboratories to report quality assurance/ quality control data for comparison with the DQIs established for the project.
Step 7: Develop the plan for obtaining data (Identify the most resource-effective sampling and analysis design for general data that are expected to satisfy the DQOs).	The work plan is designed to meet the project objectives in **Section 1.3** and the DQOs outlined above. To ensure resource-effective sampling, analysis and data collection that satisfied the DQOs, the following actions are to be taken: ▪ Written instructions will be used to guide field personnel in the required fieldwork activities; ▪ Representative soil samples will be collected from the site and analysed for validation and characterisation purposes; and ▪ Validation field works and analyses will be undertaken in accordance with Cardno Standard Operating Procedures. ▪ Soil remedial excavation is to be performed as per **Section 8**. Soil validation sampling is to be completed as per the methodology prescribed in **Section 11**. ▪ Groundwater investigations will adopt the methodology outlined in this RAP. ▪ Review of the soil results will be undertaken to determine if further excavation and additional sampling are warranted.

6.2 Data Quality Indicators

To ensure that the investigation results were of an acceptable quality, the data set was assessed against the data quality indicators (DQIs) outlined in **Table 6-2**.

Table 6-2 Data Quality Indicators

QAQC Measure	Field Quality Indicator	Laboratory Quality Indicator
Precision: A quantitative measure of the variability (or reproducibility) of data.	SOPs are appropriate and complied with. Field duplicates and Blind field duplicates are collected and analysed at a rate of 5% (1 per 20 samples). Use of calibrated equipment.	Laboratory analyses of laboratory and inter-laboratory duplicates, field duplicates, laboratory prepared volatile trip spiles. Relative Percent Difference (RPD) calculation results: <30% Relative Percentage Difference (RPD). The RPD values are calculated using the following equation: $RPD = \frac{I C_O - C_R I}{[(C_O + C_R) / 2]} \times 100$ Where, C_O = Analyte concentration of the original sample C_R = Analyte concertation of the duplicate sample
Accuracy: A quantitative measure of the closeness of reported data to the "true" value.	SOPs are appropriate and complied with. Use of calibrated equipment. Field interlaboratory duplicates sampled and analysed at a rate of 1 per 20 samples.	Laboratory holds NATA-accreditation for the analyses. Laboratory limit of reporting is below the adopted investigation level. Laboratory analysis of: field blanks, rinsate blank, reagent blank, method blank, matrix spike, matrix spike duplicate, surrogate spike, reference

QAQC Measure	Field Quality Indicator	Laboratory Quality Indicator
	<30% Relative Percentage Difference (RPD) Analysis of rinsate sample collected at rate of 1 per day. Trip spike and trip blanks were used.	material, laboratory control sample, laboratory-prepared spikes. The nominal acceptance limits on laboratory control samples are: Laboratory spikes: 70-130% recovery for metals 60-140% for organics Laboratory duplicates. If contaminant concentration is: < 10 x PQL, no RPD limit 10-20 x PQL, RPD is 0% to 50% >20 x PQL, RPD is 0% to 20% Laboratory surrogates: 60-140% recovery. Laboratory blanks: <PQL Laboratory control samples, 70-130% recovery
Representativeness: The confidence (expressed qualitatively) that data are representative of each media present on site and the conditions encountered in the field	Appropriate media sampled. Preservation and storage of samples upon collection and during transport to the laboratory occurs. Sampling is undertaken by an experienced sampler.	Blank samples run in parallel with field samples to confirm there are no unacceptable instances of laboratory artefacts. Review of RPD values for field and laboratory duplicates to provide an indication that the samples are generally homogeneous, with no unacceptable instances of significant sample matrix heterogeneities The appropriateness of collection methodologies, handling, storage and preservation techniques will be assessed to ensure/confirm there was minimal opportunity for sample interference or degradation (i.e. volatile loss during transport due to incorrect preservation / transport methods). Rinsate samples used when sampling equipment is reused have analytical results <LOR.
Completeness: A measure of the amount of useable data from the data collected during the fieldwork program	All critical locations sampled. All samples collected (from grid and at depth). Standard operating practices (SOPs) appropriate and complied with. Sampling is undertaken by an experienced sampler. Suitable records of field work are documented. Completed laboratory sample chain-of-custody and documentation.	All critical samples are analysed according to the SAQP. All COPC are analysed. Appropriate methods and PQLs are implemented. Sample documentation is complete. Samples are analysed within holding times.
Comparability: The confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event	Same SOP is used on each field occasion. Climatic conditions are documented. Experienced sampler Sample type, preservation and handling are consistent at sampling events. Use of calibrated equipment.	Sample analytical methods used (including clean-up) Sample PQLs (justify/quantify if different) Same laboratories are used and justification is given where differences occur. Same analytical methods, Practical Quantification Limits (PQLs), and units of measurement are used.

7 Remediation Options

7.1 Remediation Options Hierarchy

Contaminated site management strategies should reflect the need to protect all segments of the environment, both biological and physical (air, land and water, including groundwater). In accordance with the ASC NEPM, the preferred hierarchy of options for site clean-up and management of soil contamination is:

1. On-site treatment of soil contamination, so that the risk associated with the contaminant is reduced to an acceptable level.
2. Off-site treatment of excavated soil, so that the risk associated with the contaminant is reduced to an acceptable level, after which it is returned to the site.

If it is not possible for either of the above options to be implemented, then other options for consideration can include, for example:

1. Removal of contaminated soil to an approved site or facility, and replacement with clean fill where necessary.
2. Containment of the contamination on-site either in-situ with appropriate controls that reduce the risk to an acceptable level, or in an appropriately designed and managed containment facility.
3. Adoption of a less sensitive land use or controls on site activities that will reduce the need for remedial worksites, there should be appropriate controls in place to control emissions to air, land and water.

Potential remediation options include:

1. “Do Nothing” The ‘do nothing’ option involves not removing or addressing any of the identified impacts
2. On-site treatment of soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable limit
3. Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable limit, after which the soil is returned to the site
4. Removal of contaminated soil to an approved site or facility, and if necessary replacement with imported fill, and
5. Isolation and management of the soil on-site by capping/containment within an appropriate barrier.

7.2 Remediation Options Evaluation

Cardno has identified and evaluated the potential remedial options listed in the hierarchy above to provide a recommended remedial strategy to address the impacted soils at the Site. General description of the options are described in **Table 7-1** below and the evaluation process of each option is summarised in **Table 7-2**.

Table 7-1 Remedial Option Identification

Remedial Option	Description
Option 1: Do Nothing	This alternative involves not removing or addressing the identified impacted media.
Option 2: Monitored Natural Attenuation	This alternative involves not removing or addressing the identified impacted media but includes periodic monitoring to track CoPCs concentrations with time. Some COPCs are amenable to concentration, toxicity and/or mass reductions through natural processes such as volatilisation, dispersion, and biodegradation among others.
Option 3: On-site treatment of soil – Immobilisation Fixation/Stabilisation	This option involves mixing a reagent to the impacted media to solidify or fix the contaminants to make them chemically unavailable or immobile. This technology can be applied to contaminated material either in-situ or ex-situ.
Option 4: On-site treatment of soil – Soil Washing	This is an ex-situ treatment alternative which includes removing contaminants from soils and sediments by dissolving or suspending them in a water-based solution. The process utilises the difference in grain size and density of the sediment particles to separate the contaminants from the impacted media. The water-based solution used for the washing is then collected, treated and discharged or collected and disposed off-site.
Option 5: Off-site treatment of	This option is the same as described in Option 3 but the impacted soil/sediment would be transported off-site prior to the stabilisation.

Remedial Option	Description
excavated soil – Immobilisation Fixation/Stabilisation	
Option 6: Off-site treatment of excavated soil – Soil Washing	This option is the same as described in Option 4 but the impacted soil would be transported off-site prior to soil washing/treatment.
Option 7: Off-site disposal – Excavation and Disposal at Landfill	This alternative includes excavating the impacted soil and sediment from the site and transporting it to an appropriately licensed landfill.
Option 8: Isolation and management of the soil on-site by Above-ground Consolidation Encapsulation	This alternative includes consolidation of the impacted material above ground in engineered mounds, stockpiles or embankments which are isolated via barrier layers and clean material capping. This option would be undertaken in conjunction with encapsulation of in-situ material beneath a capping layer, where excess material is required to be managed to achieve design levels.
Option 9: isolation and management of the soil on-site by In-situ Encapsulation	This option includes installation of a capping layer over the impacted soils to isolate the material from potential receptors. This option can be undertaken in conjunction with other consolidation measures or off-site disposal if raising the level of the area is not appropriate. This alternative could be a standalone option or implemented in conjunction with another remedial alternative.

Table 7-2 Remediation Options Evaluation

Option	Description	Advantages	Disadvantages	Outcome
1	Do Nothing	▪ Elimination of remedial costs.	▪ Contaminated media has been identified at the site that must be addressed to minimize potential risks to human health and/or the environment; and ▪ Does not address the RGs listed in **Section 5**, and as such the land would remain unsuitable for the proposed use.	Considered unsuitable.
2	Monitored Natural Attenuation	▪ Elimination of remedial costs.	▪ The identified COPCs are not amenable to concentration reduction through natural processes in a timely manner; and ▪ Does not address the remediation goals listed in **Section 5**, and as such the land would remain unsuitable for the proposed use.	Considered unsuitable.
3	On-site Immobilisation Fixation/Stabilisation and re-use on-site	▪ Technology has shown to be reliable at immobilising the identified COPCs; ▪ The COPCs are amenable to stabilisation; ▪ Moderate cost; ▪ The operation and management costs are low, with minimal long-term monitoring once CoPCs are stabilised; and ▪ No significant WHS requirements.	▪ Some limitations with fully mixing the stabilisation reagent in media with a range of grain sizes; ▪ Requires excavation of the material with potential vegetation clearance; ▪ Would require segregation from growing mediums; ▪ Would require an Environmental Management Plan (EMP) for long-term monitoring and protection of the remediated soil. ▪ Would require bench-scale study requiring long time period to determine if methods employed are validated.	Considered unsuitable.
4	On-site Soil Washing and re-use on-site	▪ The material requiring remediation has varying grain sizes.	▪ Soil washing will not remove asbestos or waste materials (boiler ash); ▪ Would require bench-scale study. ▪ May require multi-stage process. ▪ Would require construction of a secure soil wash containment area. ▪ Would require liquid waste disposal and soil validation process.	Considered unsuitable.
5	Off-site Immobilisation Fixation/Stabilisation and re-use either on-site or off-site	▪ Technology has shown to be reliable at immobilising the identified CoPCs; ▪ The CoPCs are amenable to stabilisation; ▪ Would be completed at an appropriate facility. ▪ The operation and management costs are low, with minimal long-term	▪ May require bench-scale study. ▪ Requires certainty from an EPA licenced treatment facility; ▪ Greater cost than Option 3 due to transportation and facility treatment costs. ▪ Requires substantial more testing to validate soils for re-use once treated. ▪ Requires waste treatment documentation to be complete.	Considered unsuitable.

Option	Description	Advantages	Disadvantages	Outcome
		maintenance once CoPCs are stabilised; and ▪ No significant WHS requirements.		
6	Off-site Soil Washing and re-use on-site or off-site	▪ The material requiring remediation has varying grain sizes. ▪ Would be completed at an appropriate facility.	▪ Soil washing will not remove asbestos or waste materials (boiler ash); and ▪ Requires certainty from an EPA licenced treatment facility; ▪ Would require bench-scale study. ▪ May require multi-stage process. ▪ Requires substantial more testing to validate soils for re-use once treated. ▪ Would require liquid waste disposal. ▪ Requires waste treatment documentation to be complete.	Considered unsuitable.
7	Excavation and Offsite Disposal at Landfill	▪ Relatively easy to implement and proven solution; ▪ Minimises potential risks to human health and environment; ▪ Sustainable long-term remediation option; ▪ Low ongoing operation and maintenance; ▪ Economically viable for smaller, localised areas of contamination with soils classified as general solid waste; and ▪ Removes liability for ongoing management.	▪ Costs of offsite disposal at a licenced facility; ▪ Costs to import soil for construction purposes (if required); ▪ Uses up landfill space; ▪ Higher energy expenditure and costs to transport off-site ▪ Requires waste documentation to be complete.	**Considered suitable**.
8	Above-ground consolidation and encapsulation	▪ Ease of implementation at the site; ▪ Reliable option at removing human health and ecological receptor pathways; ▪ The open space at the site could accommodate landscaped mounds or embankments; ▪ Moderate costs; ▪ The ongoing operation and maintenance have low costs as it requires minimal long-term monitoring; and ▪ Relatively sustainable.	▪ Contamination is not reduced, only isolated; ▪ Ongoing management required via legally enforceable Environmental Management Plan (EMP); ▪ Additional engineering of containment within final design and construction; ▪ Requires separate civil/landscaping/engineering design to locate and accommodate the volume of soil to be encapsulated; ▪ Not well understood at private individual scale and may hinder buyers.	Considered unsuitable.

Option	Description	Advantages	Disadvantages	Outcome
9	In-situ Encapsulation	▪ Easy implementation at site; ▪ Amenable to both asbestos and B(α)P-TEQ. ▪ Reliable option at removing human health and ecological receptor pathways; ▪ Moderate costs if used in conjunction with above-ground consolidation; ▪ The ongoing operation and maintenance have low costs as it requires minimal long-term monitoring; and ▪ Sustainable option.	▪ Contamination is not reduced, only isolated; ▪ Where applicable ongoing management required via legally enforceable Environmental Management Plan (EMP); ▪ Requires separate civil/landscaping/engineering design to locate and accommodate the volume of soil to be encapsulated; ▪ Although excavation may not be required for soils in some areas, ground treatments will be required (i.e. lateral confinement, marker layers); ▪ Not well understood at private individual scale and may hinder buyers.	**Considered suitable**.

7.3 Preferred Remediation Option

Based on the localised contamination previously identified onsite (**Section 4.3**), the continued land use as a hospital, and discussion with the Client and Sydney Local Health District, a combination of **Option 7** (excavation and offsite disposal) and **Option 9** (In-situ encapsulation) are agreed as the preferred options for the human health and ecological contamination to render the site suitable. Where sufficient space is not available to encapsulate excess contaminated soils, these soils will be removed from site as per **Option 7**.

On-site encapsulation for the contaminants of concern will require a legally enforceable environmental management plan (EMP), however, the level of management is considered to be passive while the encapsulated areas are not disturbed. Routine inspections of the encapsulated areas, and an approval process for any planned disturbances will be required, as will be outlined in the EMP.

8 Remediation Methodology

8.1 Remediation Outline

As outlined above in **Section 7.3,** the preferred remedial strategy for this site is a combination of offsite disposal (Option 7) and in-situ encapsulation (Option 9) of human health and ecological contaminated soils.

Details of the remedial strategy are outlined in the sections below and Construction Environmental and Waste Management Plan (CEWMP) is included in **Section 9**. Potential risks to future site workers can be managed through standard WHS practices which are detailed in **Section 10**. The validation plan including inspection regime is detailed in **Section 11**.

Should areas of previously unidentified contamination be encountered during the remediation and validation works, the requirement for additional investigation and remedial measures shall be assessed. If encountered during construction, the Unexpected Finds Protocol detailed in **Section 9.6** should be implemented. Details on the requirements during asbestos removal, including WHS measures, are included in **Section 9.4.**

Following hazardous building materials abatement and demolition/removal of building structures as required, a data gap investigation will be required within the building footprint and demolition work zone as the demolition practice may result in dispersal of hazardous building materials, and the building footprints have generally been inaccessible.

The remedial strategy is to ensure that any complete source – pathway - receptor linkages to contaminated soil are mitigated to the extent practicable and/or eliminated. The remedial approach will take advantage of the proposed development for the site as outlined in **Section 1.2**.

The remedial approach would be performed jointly by a suitably qualified environmental consultant, occupational hygienist and licensed contractor and would be conducted in the following general sequence:

1. Preliminaries and site establishment;
2. Visual Inspection and asbestos clearance inspection of soil surface soils across all areas of Eastern Development area post hardstand removal;
3. Investigation of Lambie Dew Drive (north and south extensions); Whale Garden extension; EBA area; and University of Sydney land;
4. Eastern Area post-demolition investigation of building(s) footprint soil assessment;
5. Remedial excavation of contaminated soils and waste classifications;
6. Preparation of encapsulation cells, where required and onsite encapsulation works;
7. Validation of remedial excavations following the removal of contaminated materials; and
8. Reporting.

Details regarding each remediation stage, have been outlined below.

8.1.1 Preliminaries and Site Establishment

Prior to remediation works commencing, the following documentation must be prepared by the licenced contractor to ensure the specifics of excavation, on-site encapsulation, and human health and environmental protection during all remediation works at the site:

- A Health and Safety Management Plan / Asbestos Removal Control Plan / Hazardous Materials Removal Control Plan and Safe Work Method Statement detailing the proposed works and site-specific control measures including decontamination requirements. All works involving asbestos or hazardous materials must be undertaken in accordance with approved plans, and the recommendations in **Section 9**.
- A Soil Excavation, Encapsulation, and Disposal Management Plan (or similar) must be prepared to coordinate the works required to meet the remediation and validation requirements set out in this RAP. It is recommended that this plan is reviewed by the environmental consultant to flag any unresolved issues.
- A Construction Environmental Management Plan detailing the environmental controls required, including the temporary relocation of the Emergency Bay Area so that the field works can be completed. Further details are provided in **Section 9**.
- A notification to SafeWork NSW of the Intention to Remove Friable and Non-Friable Asbestos must be lodged with sufficient notice time.

> Notification to stakeholders in accordance with DPIE protocols.

Site establishment including setup of amenities, decontamination areas, staging and stockpile areas is to be undertaken as per a works plan agreed with relevant stakeholders.

8.1.2 Visual and Asbestos Clearance Inspection at Eastern Campus

Following the removal of hardstands and infrastructure, a visual inspection by an environmental consultant should be conducted to identify visual evidence of potential contamination and to inform any areas of necessary investigation not previously identified due to inaccessibility and investigation methods.

Following the demolition and removal of existing buildings in the Eastern Area, a visual asbestos clearance inspection across applicable soil surfaces within and adjacent to work zones, and /or as stipulated by the inspector, is to be conducted. The works should be conducted by a competent person knowledgeable in conducting asbestos clearance inspections, and where and if friable asbestos is involved, the inspector should be a Licensed Asbestos Assessor (LAA). Permission to access the space for construction works is to be recommended by the inspector.

A detailed site inspection should also be completed across the EBA and the proposed landscaping area located to the north east of the Eastern Development footprint. During this inspection discussions regarding further investigation as outlined in **Sections 8.1.3** and **8.1.4** below should be decided.

8.1.3 Data Gap Investigations - Building Footprints, EBA, Whale Garden, Lambie Dew Drive, University of Sydney lands

8.1.3.1 Desktop Assessment – University of Sydney Lands

A desktop assessment of the extension into University of Sydney lands (155 m^2) will be required. This will require a review of aerial photographs, a site walk-over, review of development plans, review of utility plans and interviews with University of Sydney staff that are knowledgeable on the area of interest. Further historical review may be required on the basis of findings of the above. The information above will be used to inform a sampling and analysis plan for the area which would be conducted to determine if remediation is required for the proposed landscaping land use.

8.1.3.2 Sampling Density

Soil samples are required to characterise the soil quality in the areas identified in the DSI (Cardno 2022a) as data gaps including the footprint of all buildings to be demolished in the Eastern Area, the EBA (soil and groundwater), the northern and southern extensions of Lambie Dew Drive, extension into the Whale Garden, and extension into University of Sydney lands to confirm their suitability for the proposed land uses.

The proposed characterisation sampling approach for each footprint has been selected in consideration of Section 4 ‘Sampling Plan for Site Validation’ of the *Sampling Design Guidelines* (NSW EPA, 2022). A systematic sampling pattern is proposed. **Table 8-1** specifies the number of samples required for each area. Refer to **Figure 3** and **5**, **Appendix A** for location of proposed sample locations for the Emergency Bay Area, Lambie Dew Drive, Whale Garden and University of Sydney Land.

Table 8-1 Building Footprint Sampling

Area ID	Approximate Area (m^2)	Indicative Number of Investigation Locations
Building 94, Building 1 (located to the north of Eastern Area Development), Building 2 (located to the south west of Building 94), and Building 3 (located to the north west of Building 94).	838	8
Chapel	229	4
Emergency Bay Area, as shown in **Figure 5**, **Appendix A**	1,212	8, including two wells
Whale Garden and Lambie Drew Drive Areas as shown in **Figure 3**, **Appendix A**	908	3

Area ID	Approximate Area (m^2)	Indicative Number of Investigation Locations
Landscaping area within University of Sydney Land	155	3

The proposed sampling densities allow the noted areas to be assessed. These findings would be reported and incorporated within the RAP as an Addendum, and are also to be included in the site validation report as requested by the Site Auditor in Site Audit Memo No. BE167_SAM02, dated 7 November 2022.

Any further changes to the site development plans and future site configuration may require the sampling plan to be amended.

8.1.3.3 Soil Sampling Scope

The environmental consultant is to conduct the following works:

1. Preparation of a Sampling and Analysis Quality Plan (SAQP).
2. Preparation of Health, Safety and Environment (HSE) documentation.
3. Complete a dial before you dig (DBYD) search and engage an underground service locator to locate utilities prior to the intrusive investigation.
4. Advancement of soil sampling at the frequency described above in **Table 8-1**. Based on the current design plans, excavation work within the building footprints during the site redevelopment are anticipated to be <1.5 mbgl. The investigation should seek to characterise the fill profile and extend into the underlying natural soil, and provide any limitations in the report where natural soils could not be reached. Where possible, soil sampling locations should be advanced as test pits using an excavator / backhoe, with the exception of two (2) locations within the EBA development footprint. These two locations should be completed using an auger drill as two of them will be converted to groundwater monitoring bores – Refer to **Section 8.1.3.3** for groundwater investigation within the EBA.
5. Logging of the soil profile at each sampling location including screening of material for visual and olfactory indications of contamination. Additionally, soil samples are to be field screened for volatile organic vapour content with a photo-ionisation detector (PID).
6. Collection of at least two (2) soil samples per sampling location based on the results of the field screening and observations.
7. Submission of at least fifty two (52) primary soil samples to a National Association of Testing Authorities, Australia (NATA) accredited laboratory for analysis of contaminants of concern including PCB, TRH C_6 to C_{40}, BTEXN, VHC, PAHs, PFAS (selected samples only), eight metals including As, Cd, Cr, Cu, Hg, Ni, Pb and Zn, OCP and asbestos (per the NEPM 2013 method).
8. Additionally, one (1) inter-laboratory soil sample duplicate, and one (1) intra-laboratory soil sample duplicate, must be collected per 20 samples analysed for Quality Assurance/Quality Control (QA/QC) purposes. A trip spike and trip blank will also be analysed during each field mobilisation with a rinsate sample collected from any hand tools/reusable per day after the sampling is complete to verify that cross contamination between sampling locations has not occurred

Should areas of previously unidentified contamination be encountered during the data gap investigation, the requirement for additional remedial measures shall be assessed. Additionally, this RAP should be revisited following consideration of data and information gathered during the DGI with respect to delineation sampling and further site characterisation in unassessed areas.

8.1.3.4 Groundwater Sampling Scope

The environmental consultant is to conduct the following works:

1. Preparation of a Sampling and Analysis Quality Plan (SAQP).
2. Preparation of Health, Safety and Environment (HSE) documentation.
3. Complete a dial before you dig (DBYD) search and engage an underground service locator to locate utilities prior to the intrusive investigation.
4. Installation of two groundwater monitoring bores within the EBA development footprint or based on soil results and site observations. Groundwater bore is to be installed to a maximum depth of 8mBGL.

5. Well gauging and development of newly installed groundwater bore. Bore is to be developed until dry or until 2xwater volumes are removed.
6. Completing one groundwater monitoring event across the newly installed groundwater bores. The groundwater sampling is to be completed using a low-flow/minimal draw-down sampling method with a MicroPurge kit (MP15) and a portable MicroPurge pump following well gauging. The MicroPurge system incorporates a low density poly-ethylene (LDPE) pump bladder, and a Teflon-lined LDPE sample delivery tube. Wells are to be purged using the peristaltic pump until water quality parameters, assessed using a calibrated water quality meter with flow cell, stabilised over three (3) continuous readings, or as the amount of water present allowed. Once water quality parameters stabilised in accordance with the NEPC (2013) guidelines (i.e. within ±10% for DO, ± 3% for EC, ± 0.2 for pH, ± 0.2° for temperature and ± 20 mV for redox) the flow cell was is to be removed from the pump and samples are to be then collected directly into laboratory supplied sampling containers containing appropriate preservative.

   For PFAS sampling disposable High-Density Polyethylene (HDPE) bailers are to be used for collection of groundwater samples. Samples are to be collected following measurement of SWL and **prior** to using the low flow pump.

   All equipment in direct contact with samples (i.e. tubing) must be disposable. All metal samples are to be filtered and preserved onsite.
7. Submission of primary groundwater sample to a National Association of Testing Authorities, Australia (NATA) accredited laboratory for analysis of contaminants of concern including TRH C_6 to C_{40}, BTEXN, PAHs, eight metals including As, Cd, Cr, Cu, Hg, Ni, Pb and Zn, and total phenols, and VOCs.
8. Additionally, one (1) inter-laboratory groundwater sample duplicate, and one (1) intra-laboratory groundwater sample duplicate, must be collected per 20 samples analysed for Quality Assurance/Quality Control (QA/QC) purposes. A trip spike and trip blank will also be analysed during each field mobilisation with a rinsate sample collected from any hand tools/reusable per day after the sampling is complete to verify that cross contamination between sampling locations has not occurred.
9. Review and assessment of data against the guidelines. A technical memo is to be produced outlining the results and any recommendations. Should gross groundwater contamination be encountered during the data gap investigation, the requirement for additional remedial measures shall be assessed. Additionally, this RAP should be revisited following consideration of data and information gathered during the data gap investigation.

8.1.4 Remedial Excavation and Waste Classification

Where construction requires bulk excavation through areas of human health or recological exceedance as shown on **Figure 3,** and **Figure 4, Appendix A**, should be excavated and validated. If excavations are not required in these areas, onsite encapsulation is an alternative remediation method as outlined in **Section 8.1.5**. If required, the dimensions of proposed excavations are outlined in **Table 4-2** and as observed during excavations. The lateral extent of the remedial mechanical excavations will be until no visual or olfactory evidence of residual contamination is observed and the laboratory results of validation samples confirm that contaminated soils do not remain.

The excavated soils should be stockpiled adjacent to the excavation on either hardstand or lined surfaces (i.e. with builders' plastic), prior to sampling the stockpile for waste classification purposes. Stockpiles should be placed in a safe area that will not pose risk to human health, environment, potential off-site migrations, the localised terrain (i.e. slopes that may fail due to overburden pressures), and climatic conditions that could cause severe collapse, erosion, or run-off. Should the soils be placed on bare soil or un-lined surfaces then validation sampling and an inspection of the underlying soils will need to be undertaken following the removal of the stockpiled soil.

The stockpiled materials must be classified in accordance with the NSW EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste*, prior to disposal offsite. The waste classification process in summary will include the following:

- Collection of one sample per 25 m^3 of stockpiled material, as per NEPM (2013) guidelines. A minimum of three samples is required for waste classification purposes for stockpiles <25 m^3;
- Laboratory Analysis of all collected soil samples for metals, TRHs, PAHs, BTEX, OC/OP pesticides, PCBs and asbestos (quantification). Leachability analysis for select analytes may be required should impacts exceed CT criteria; and

> Preparation of a waste classification certificate report per stockpile detailing the material sampled, analytical results and overall classification for offsite disposal purposes.

As noted in **Section 3.1.2**, at sampling location HA415, contaminated soil/gravels have a preliminary waste classification of Special Waste (Asbestos). Careful segregation and further sampling and analyses of this material should be undertaken to avoid cross contamination. Failure to do this additional investigation could result in a larger volume being classified needlessly as Special Waste (Asbestos) resulting in exorbitant excavation, transport and disposal costs. Asbestos waste must be reported and tracked via the NSW EPA's WasteLocate tracking program, in accordance with Clause 79 of the POEO (Waste) Regulation 2014.

General waste handling (including transport and loading) and management procedures are outlined in **Section 9.1.1**. Waste must be tracked and disposed offsite at appropriately licenced facilities in accordance with the NSW EPA requirements. As such, in accordance with the *Protection of the Environment Operations (POEO)* Waste Regulation 2014, a tracking register will need to be maintained along with the collation of waste weighbridge disposal dockets from the receiving facilities for site validation purposes. An example of a suitable waste tracking template has been provided in **Appendix C**.

8.1.5 Onsite Encapsulation

The soil contaminated by the contaminants of concern (PAH, metals, asbestos),may be managed by onsite in-situ encapsulation at selected site locations such that they are located beneath an appropriate cover that should include as a minimum, a marker layer, a separation layer, and a hardstand layer. The contaminated soils are not suitable for exposure within garden beds and encapsulation areas should not be situated against site boundaries.

The encapsulation would consist of:

> Locating appropriate location(s) within the civil design and landscaping plans for the volume of material to be encapsulated;

> Capping thickness design subject to infrastructure design i.e. depth of services;

> Levelling and preparation of the area to be filled with contaminated soils, where soils have to be moved;

> Excavation of soils to allow for capping layers, and/or to move contaminated soils to encapsulation cell locations;

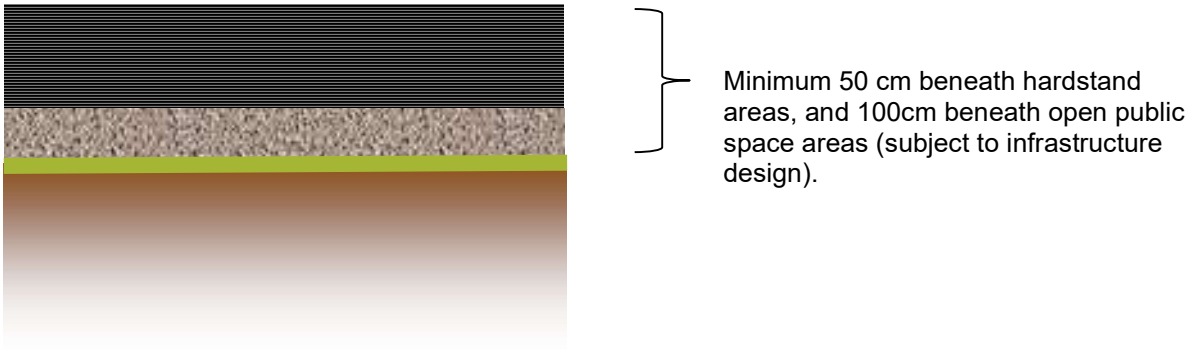
> Witnessing and validating the excavation (removal of soil) and placement of soil within the encapsulation areas;

> Validation of capping thicknesses and lateral extents of construction;

> Tracking of material and survey of final encapsulation construction including elevations and lateral extents.

A schematic of the proposed capping is shown below as **Figure 8-1**.

Figure 8-1 Schematic of Capping



It is recommended that prior to construction, a design specification is prepared consistent with the clients civil and structural requirements for the proposed encapsulation area. Each element of the design must be validated at construction prior to continuing with construction. These Hold Point validations must include:

- Design approval;
- Set-out and survey of contamination area;
- Site levelling and preparation;
- Placement of cushioning layer;
- Placement of concrete layer including any concrete testing required by the Design Specification;
- Survey of completed construction.

8.1.6 Site Validation

Upon removal of contaminated soil, validation of remining soil along the base and walls of excavations is to be completed, prior to the commencement of further excavation works. The remaining soils may be subject to further excavation if contaminated; however, surface inspection and validation of any fill materials underlying excavated areas down to and including the natural soil surface by sampling and analysis is required. A validation plan is outlined in **Section 11**.

Where impact is identified in the remaining soils, it will be remediated and validated in accordance with the remedial excavation procedure described in **Section 8.1.4**. The resulting spoil would be assessed and classified in accordance with the NSW EPA *Waste Classification Guidelines* (EPA 2014).

8.1.6.1 Validation of Imported Backfill Soils

Should reinstatement of remedial excavations require importation of backfill soils from off-site source(s), the imported materials must be deemed suitable prior to importation to the site and is to meet the criteria outlined in **Section 5.2**. Any validation sampling as part of this process is to be completed in accordance with the procedure outlined in **Section 11.2**.

8.1.6.2 Validation Reporting

Following the completion of all remedial works onsite, a Remediation and Site Validation Report must be prepared in accordance with the NSW EPA (2020) guidelines, detailing the following:

- A clear description of the remedial works undertaken, the validation carried out and the final condition of the site;
- Assess the results of the post-remediation testing against the remediation criteria stated in the remedial action plan (RAP). Where these criteria have not been achieved, reasons must be stated and additional site work proposed to achieve the original objectives, or a management plan put in place. Should any unexpected finds be encountered during the works, then the unexpected finds protocol will need to be implemented, along with an addendum to this RAP; and
- The report will provide a conclusive statement regarding site suitability for the proposed high-density residential land use as outlined in **Section 1.2**.

9 Construction Environmental and Waste Management Plan

The following sections provide frameworks for a Construction Environmental and Waste Management Plan which identifies measures required to minimise the potential impact of works on the local environment, site workers and third parties. In all cases, environmental issues must be managed by the Principal Contractor in accordance with good environmental management practices and as requested, periodic supervision and documentation by the appointed environmental consultant. The purpose of these measures is to prevent site workers, the public and environmental exposure to potential health risks associated with these works.

9.1 Stockpile Management

Soil placed in stockpiles are to be tracked according to the location of removal and location of stockpile. Stockpiles in place longer than 24 hours are to be placed on an impervious base away from steep slopes and in a location that will not be subject to run-off, compacted and covered with geofabric or similar.

Stockpiles are to be contoured to minimise the loss of material during rainfall, with upstream drainage and levee banks installed to divert water flows around the stockpile. Silt fencing is to be appropriately placed and installed to avoid sediment loading of stormwater drains and pipes. The installation of these controls is to be undertaken in accordance with the Landcom (2004) “Blue Book”.

The stockpile(s) should be clearly labelled, with stockpiles containing asbestos materials appropriately identified with warning signage. In the event that larger stockpiles of asbestos, an area can be lined with plastic and used as a stockpiling area. Any stockpiled asbestos impacted material should be dampened and covered with either geofabric layer or black plastic, which is to be disposed of as asbestos waste after completion of asbestos works.

The location, positioning, sizes, and management of stockpiles is to be made by the Site Manager in consideration of potential risks to humans, the local environment, to prevent potential off-site migration via run-off and air dispersion, and health, safety, environment, and security considerations.

9.1.1 Waste Management and Tracking

Any wastes generated as part of remediation and construction works will have to be classified in accordance with NSW EPA (2014) Waste Classification Guidelines and this report prior to disposal off-site.

Tracking of waste movements around the site and material transported off-site for disposal is a critical component to demonstrate the remedial strategy is being implemented appropriately. Waste tracking will be achieved through copies of weighbridge slips, tip dockets and consignment disposal confirmation (where appropriate, including NSW EPA WasteLocate), survey of stockpiled materials or excavations and photographic documentation of movements of soil around and off-site. A site log or a waste tracking software application shall be implemented and maintained by waste generator (or on their behalf). All waste stockpiles must be marked to enable the tracking of disposed loads against on-site origin and location of the waste. Such information should be provided to the site owner for reporting purposes. A suitably qualified environmental professional should be present on-site to oversee the remedial works to ensure that appropriate waste tracking procedures are employed.

Particular recommendations for potential Hazardous Waste are to be sought after from the environmental consultant.

All the tracking records should be maintained in a template similar to that provided in **Appendix C** and be reviewed by a competent person.

9.2 Excavation Water Management

It is not anticipated that the water table or dewatering will be required as part of the remediation works. Should any excavations or works accumulate water, or if dewatering is required, water contained or that collects in the soil excavations are to managed in accordance with the Local Water Authority and EPA disposal requirements. The details of the discharge/disposal requirements of any water that collects in the excavation will require further consideration during the remedial and validation works. Any water intended for disposal (either off-site or to stormwater/sanitary sewer) will require sampling to ensure it meets discharge water quality requirements.

9.3 Air and Dust

9.3.1 Odours

Due to the nature of impact on-site, it is not anticipated that excessive odours will result from remediation works. However, qualified and experienced technical staff will be on site during all excavation works and should excessive odour be generated as a result of the process, then on-site spraying of the excavated material with a suitable odour suppressant (i.e. Anotec) must be undertaken to minimise any odour. Other treatment options include:

- A reduction in the size of the excavation face that is open at any one time to reduce the surface area generating the odour;
- Location of any temporary stockpiles of impacted soil as far as possible (and in the predominant down wind direction) from sensitive receptors;
- Smothering of the odours by covering the portion of the site that is generating the odour; and
- Minimal spraying of the stockpiles and excavations to minimise volatile emissions.

9.3.2 Dust Control

The Principal Contractor will be responsible for ensuring that dust is managed during excavation, loading, carting, and stockpiling operations. Dust mitigation measures include; but are not limited to:

- Stockpile protection;
- Water application on stockpiles and access roads;
- Limiting the area of exposed excavations and surfaces;
- Wind fences around earthworks areas; and
- Air monitoring.

In the event that excessive dust is generated during any operations on-site, the works will cease and modifications to the process will be made before the operation is resumed. There must be no observable dust transported off-site.

9.4 Removal of Asbestos Waste

Based on results of previous investigations, fill materials and soils onsite have been remediated of asbestos.

Should asbestos be discovered during remediation works, any asbestos removal activities are to be conducted in accordance with the SafeWork NSW (2019) Code of Practice: *How to Safely Remove Asbestos* and SafeWork NSW (2014) *Managing Asbestos in or on Soil*. This includes:

- Preparation of an Asbestos Removal Control Plan (ARCP) by an appropriately licenced asbestos removal contractor;
- Notification and seeking of approvals from SafeWork NSW at least five business days prior to removal works commencing;
- Establishment of appropriate controls required for asbestos removal works for either friable or bonded asbestos. Asbestos controls for friable asbestos include:
  - Establish an exclusion zone, appropriately signed;
  - The exclusion zone will have one entry and exit point with a decontamination unit set-up;
  - The exclusion zone will have appropriate dust suppression (water misting) controls in place during the removal works;
  - Prior to entering the exclusion zone, appropriate PPE will need to be worn, including Tyvek coveralls (appropriate category and class), tyvek boot covers (or gumboots), half face or full-face respirator (recently fit tested), safety glasses and disposable nitrile gloves. All PPE will need to be wetted down and or discarded prior to leaving the exclusion zone;
- Removal conducted by an appropriately licenced asbestos removalist, Class A for friable, or Class B for bonded;

- Asbestos air monitoring is to be undertaken for the duration of the removal of friable asbestos, which will be set-up by a Licenced Asbestos Assessor (LAA) and fibres will be counted by a NATA accredited laboratory; and
- Independent competent person (bonded) or LAA (friable) providing clearance and validation sampling at the end of the removal works.

Should additional asbestos be identified outside of the prescribed areas subject to remediation, then all works in the area must cease, with the Unexpected Finds Protocol (UFP) must be implemented with an additional Asbestos Removal Control Plan (ARCP) being prepared to guide future works in the area, including remediation of the identified asbestos contamination.

9.5 Acid Sulfate Soils Management (if required)

Acid Sulfate Soils (ASS) or Potential Acid Sulfate Soils (PASS) have not been identified at the site, therefore an Acid Sulfate Soils Management Plan is not required. During the remedial process if soils exposed display signs of ASS/PASS, sampling and laboratory analysis should be undertaken to ensure that soils are not ASS or PASS. Investigation and assessment for ASS/PASS should only be undertaken by a competent environmental professional as both field and laboratory procedures are required.

The following observations can be used for preliminary indications of ASS:

- Rust-coloured iron stains on drain surfaces;
- Butter-coloured jarosite present in surface spoil;
- Red, iron oxide mottling or corrosion of concrete and/or steel structures.

The following observations can be used for preliminary indications of PASS:

- Any soils that are naturally waterlogged;
- Mid to dark grey to dark greenish grey in colour; and
- Soft, buttery consistency of a clay.

ASS/PASS are not to be imported to the site.

9.6 Unexpected Finds

In the case that an environmental consultant is not available for oversight, workers are to be vigilant for observations of hazardous or biological materials that may be uncovered during excavations. Unexpected finds may include, but are not limited to, odour, visual contamination, ASS or PASS, deleterious material inclusions (i.e. biological matter), asbestos containing material, Underground Storage Tanks (USTs) or any other suspect materials. Any unexpected finds will be reported to the Contractor's on-site manager immediately. Additionally, the site owner/occupier should be informed as soon as practical following an unexpected find.

If hazardous or biological materials are uncovered / discovered during excavations the Contractor shall:

- Cease all work in that vicinity (and fence the area if safe to do so and appropriate);
- Remove workers from the vicinity;
- An experienced environmental consultant should be contacted to assess the potential risks associated with the Unexpected Finds and provide appropriate management options;
- Investigate the nature of the risk of the materials, determine the appropriate response and document the actions in accordance with contractual obligations.

In the event of a serious unexpected find, which could cause immediate harm to human health and/or the environment, the City of Sydney Council and the NSW EPA may need to be informed.

The risks posed by the removal works to Aboriginal or European heritage are expected to be minimal. However, in the event potential heritage items are encountered during excavations, works will cease and the Site Supervisor notified.

In the case of observations of biological, clinical and/or related waste (clinical waste, cytotoxic waste, pharmaceutical drug or medicine waste, and/or sharps waste) as defined in the NSW EPA Waste Classification Guidelines (2014) and/or defined by NSW Health (https://www.health.nsw.gov.au/environment/clinicalwaste/Pages/default.aspx) all works should stop. Clinical and related wastes discovered within soil (as buried) may be deemed an incident and may be subject to other

legislative requirements regarding who must be informed if there is an incident. Cardno considers that the highest risk area for potentially encountering this sort of contaminant are buildings currently and historically associated with pathology and clinical waste management. Mainly due to the type of activities that have been completed there.

9.7 Stormwater

9.7.1 Erosion and Sediment Control

Cleared areas and exposed excavations may promote erosion. The following erosion and sediment controls are to be implemented:

- Limiting the extent of cleared areas and exposed excavations;
- Backfilling of excavated areas as soon as practicable;
- Diversion of stormwater from active areas using hay bales or sediment fences;
- Covering of temporary stockpiles with plastic (HDPE) or geofabric and placement of silt socks around excavations when necessary;
- Covering open stormwater grates in the vicinity of stormwater pits and excavations with silt fences or other appropriate materials;
- Placement of stockpiles away from footpaths, roadways, kerbs, access ways, drainage lines, natural or man-made slopes, and property boundaries;
- Minimising translocation of contaminated soils throughout the site by ensuring excavator operators do not track over contaminated areas;
- If possible, a single vehicle entry and exit to minimise translocating soil; and
- Depending on the volume of soil to be excavated, rumble strips may be required at the site access in order to prevent contaminated soil being transported off-site.
- Additional preventative measures should be undertaken on the basis of severe climatic conditions.

9.7.2 Water Management

Stormwater runoff quality may be adversely affected in the event of rainfall. Hay bales or similar mitigation measures are to be placed near down-gradient stormwater entry points to prevent entry of contaminated sediment to stormwater, which may result from the project works.

Additional preventative measures should be undertaken on the basis of severe climatic conditions.

9.8 Noise

Hours of operation, noise control and noise generating activities are to comply with the DA, Client, and local requirements for the project.

9.9 Land Disturbance

Works include excavation, loading, carting and stockpiling operations of associated soils. These works shall be carried out in an orderly manner to minimise impact to the surrounding residential properties.

- Excavation – the removal of soil shall be performed by the appointed excavation contractor using appropriate methodology given the tight access requirements. If a transport truck is not on-site during excavation and soil will need to be temporarily stockpiled, no contaminated soils should be placed on areas validated as suitable for the proposed land use. In these locations, soil shall be excavated and placed on black plastic liners or on concrete surfaces in discrete stockpiles prior to off-site disposal. Stockpiles should be segregated for each potential contamination source.
- Loading and Carting – the loading of the stockpile material shall occur with an appropriately sized machinery to minimise and control potential transmission of dust. The trucks and trailers shall be covered for transport as deemed necessary, and shall meet any other statutory requirements.

9.10 General

The appointed Principal Contractor shall ensure compliance with relevant SafeWork NSW guidelines and Work Health and Safety Acts and Regulations. The Principal Contractor shall also ensure compliance with any amendments to the Act or Regulations during the project duration.

The Principal Contractor shall monitor and control the access of all persons to the site and ensure that no unauthorised persons enter the site during remedial works (wherever practicable). All site personnel and visitors will be inducted and shall wear appropriate personal protective equipment (PPE).

The appointed Principal Contractor shall undertake additional underground and overhead service location specifically in areas surrounding the remediation location.

Any open excavation(s) are to be barricaded in accordance with the NSW Work Health and Safety Act; Clause 16 (1) and the Construction Safety Regulation Section 73, as administered by SafeWork NSW.

The appointed Principal Contractor shall install warning signs on the barricades surrounding the excavations, including but not limited to: DANGER: OPEN EXCAVATIONS; DANGER: NO SMOKING.

9.10.1 Vehicles

The appointed Principal Contractor shall ensure all vehicles are suitably contained and covered in the transport of all debris, spoil, rubbish and materials to or from the site, such that spillage or contamination of adjoining and other areas or property shall be prevented.

Vehicles shall also be maintained to prevent the transfer of mud or wastes onto adjacent streets or other areas. If wheel treads contain significant quantities of site soils the contractor is to manually remove and dispose in stockpiles.

Measures shall be implemented to ensure no contaminated material is spilled onto public roadways or tracked off-site on vehicle wheels. Such measures could include the deployment of a vehicle washing/cleaning facility, which should be placed at a location before the site egress. The facility shall be capable of handling all vehicles and plant operating on site. Residue from the cleaning facility is to be deemed contaminated unless show by validation to be below Reportable Acceptance Criteria

9.10.2 Traffic Control

The Principal Contractor shall supply signs and safety cones; erect at the appropriate entry and exit points; and maintain these devices in good condition. Excavation works, stockpiles and other hazards, shall be individually barricaded at all times. The site is to be fully fenced to exclude the public.

On-site pedestrian traffic will be averted from the work areas and excavation by means of signage, fencing and safety barricading.

9.10.3 Refuse Disposal

All site refuse, including food, equipment wrappings, unused materials, etc. shall be handled and disposed of appropriately into a skip.

9.10.4 Site Security

The site shall be secured by a lockable fence around the perimeter of the site and access to the site is to be restricted. All excavations and above-ground remediation equipment will be barricaded with reflective barricades, with pertinent reflective signage. Keys to the gate will be restricted to approved personnel.

9.10.5 Roles and Responsibilities

9.10.5.1 Client

A summary of the client's role and responsibilities includes:

- Overall responsibility for the project development and outcomes of the RAP;
- Liaison with neighbours and other stakeholders;
- Engagement of environmental management consultant to oversee implementation of the RAP;
- Engagement of contractors to perform further investigation works, and any subsequent contaminated soil disposal and site rehabilitation works as required;
- Provision of health and safety measures for site personnel and the works area; and

> Maintain relevant records associated with the RAP.

9.10.5.1.1 Distribution of RAP

The RAP and any subsequent amendments must be distributed by the client to the following parties:

> Current Site Owner;
> City of Sydney Council and any other authority such a EPA Accredited Site Auditor (if applicable); and
> Remediation Contractor responsible for remedial works, construction, demolition, management and maintenance of the site.

9.10.5.2 Principal Contractor

The principal contractor engaged for the management of impacted soils must:

> Undertake all works in compliance with the provisions of the RAP;
> Coordinate works with the Client and Environmental Consultant;
> Liaison with site supervisor regarding progress of works;
> Report any environmental incidents and unexpected finds to the site supervisor;
> Collate all project documentation including landfill disposal dockets (where relevant); and
> Conduct works in accordance with the Site WH&S plan.

9.10.5.3 Environmental Consultant

A suitably qualified environmental consultant familiar with the implementation of environmental controls, NEPC 2013, NSW EPA contaminated guidelines made or approved under the CLM Act 1997 should be appointed to monitor implementation of this RAP at the Site during excavation of impacted soils. The Environmental Consultant's duties should include:

> Regular inspection of the site and site activities at critical moments. Inspection times should be coordinated by the Principal Contractor;
> Completion of daily monitoring notes;
> Provision of on-site advice and direction with regard to implementation and compliance with the RAP;
> Liaison with site personnel/contractors and the client regarding progress of works;
> Provide and maintain a photographic record of works and results in addition to those made by the Principal Contractor and Site Manager;
> Identification, reporting and management of the rectification of any non-conformances with the RAP;
> Validation sampling;
> Preparation of the Remediation and Site Validation report.

10 Work Health and Safety

10.1 WHS Planning and Preparation

Prior to mobilising to complete the remedial works, the Principal Contractor and appointed remedial contractor will develop site and project specific Work Health and Safety Plans (WHSPs), Safe Work Method Statements (SWMS) and Job Safety Analyses for the scope of works to be undertaken. The WHS documentation will detail measures to mitigate potential risks to site workers, third parties and the local environment during the remedial works. General, minimal WHS procedures to be implemented during the remedial works are outlined as follows:

- The contaminants identified B(α)P-TEQ, asbestos, metals (copper, zinc) and B(α)P, excavation works to be undertaken pose potential for exposure via inhalation of dusts. Respirators, dust masks and disposable coveralls should be available and used on site for all works. The additional management practices detailed in **Section 9** should also be followed and included in the WHSPs.
- Given the nature of the proposed works which have not identified asbestos in soils, air monitoring may be implemented under guidance of an occupational hygienist until deemed sufficient to cease in accordance with WHS Regulation 2017. This may involve the measurement of particulate matter, air fibres, and hazardous atmospheres.
- Potential exposure pathways for contaminants include dermal absorption (skin contact, ingestion) of dust. All workers should wear long sleeve trousers/shirts on-site. Gloves and safety glasses shall be worn by all workers involved in handling of potentially contaminated soils.
- Protective footwear (steel capped boots) to be worn on site at all times.
- Hearing protection should be worn during soil removal activities (or when working in the vicinity of heavy plant/machinery).
- Unauthorised access should be limited by ensuring that security gates are locked at the completion of each day's work.
- Excavations greater than 0.3m depth need to be "stepped" by the appointed civil contractor or otherwise made safe.
- Personnel are not to enter excavations (>1m depth) at any time.
- PPE shall be provided in sufficient quantities to provide for the duties of each on-site individual.

For bonded asbestos works, the minimum WHS and PPE requirements will be as follows:

- Respirator
- Boot covers or gumboots
- Nitrile gloves
- Dust suppression (water misting)
- Exclusion zone
- Signage
- Asbestos Air Monitoring (optional for bonded asbestos works; however it is recommended given the land occupants which include immunosuppressed individuals)

10.2 Incident Management Plan

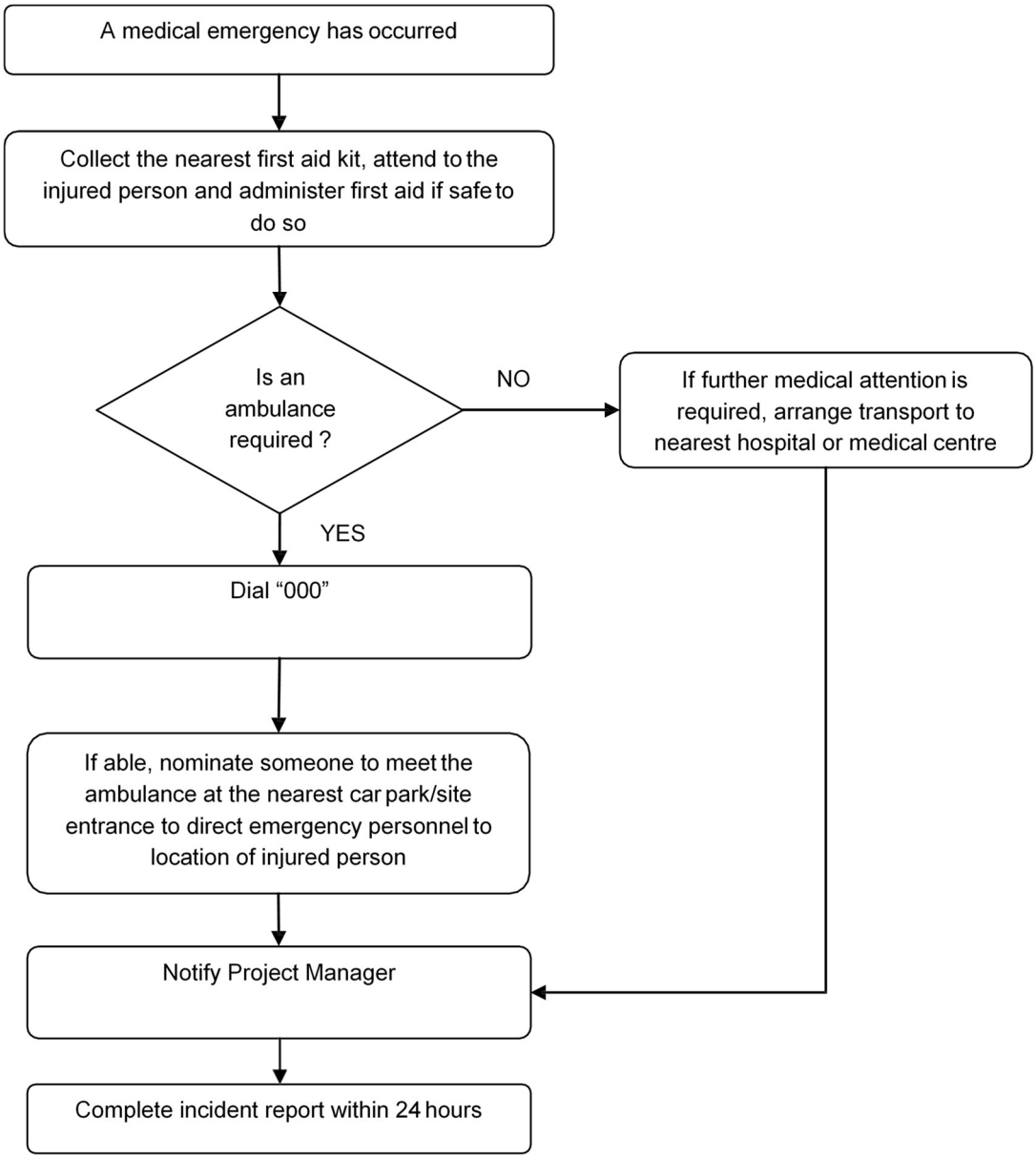
Emergency response includes pre-emergency planning, lines of authority and communication, emergency recognition and prevention, site control, evacuation routes, decontamination and first aid.

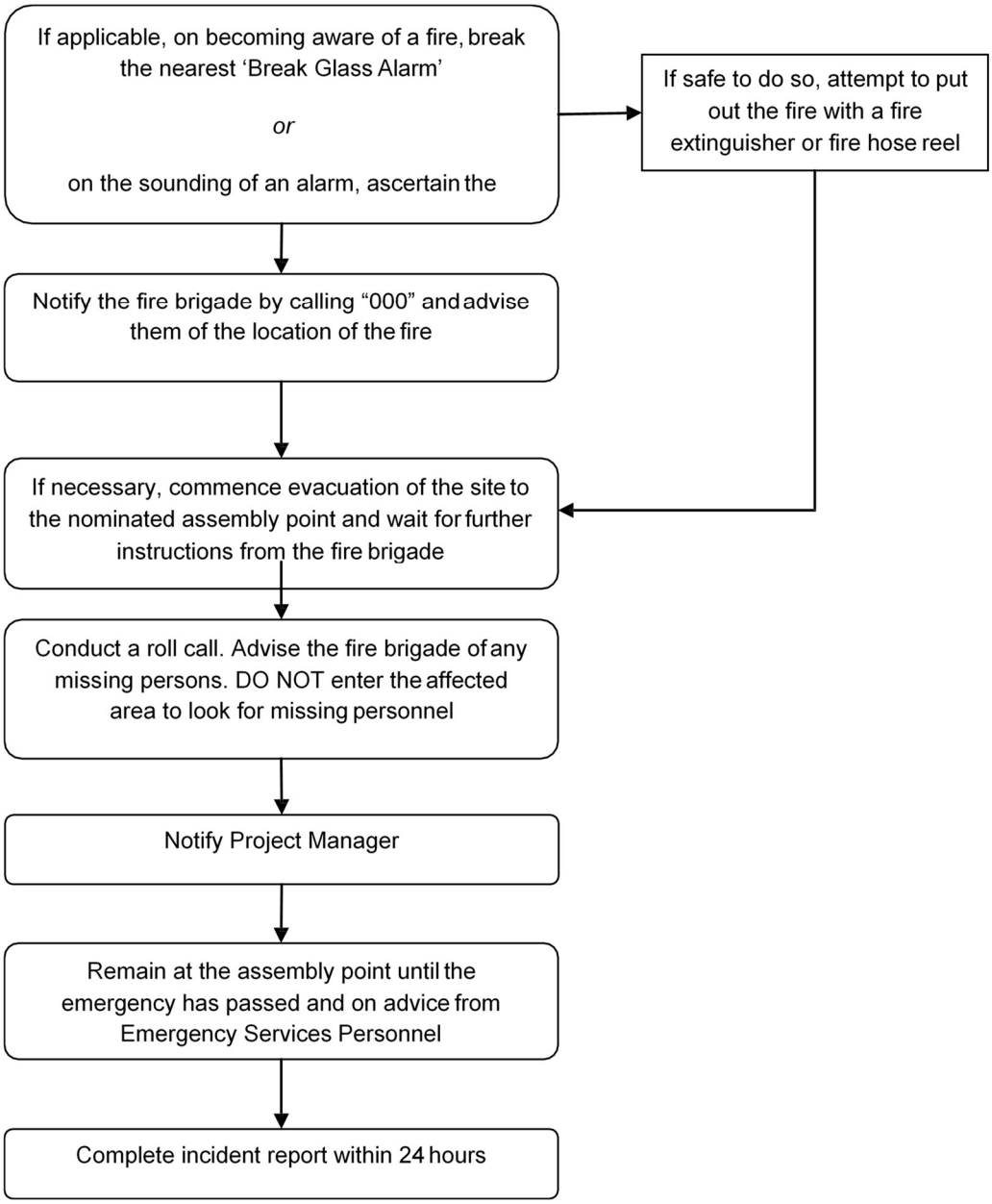
10.2.1 Medical Emergency/Serious Injury

In the event of an accident or an emergency situation involving a serious injury or medical emergency, immediate action must be taken by the first person to recognise the event (refer to flowchart below).

A portable and fully-stocked first aid kit shall be retained on site at all times.

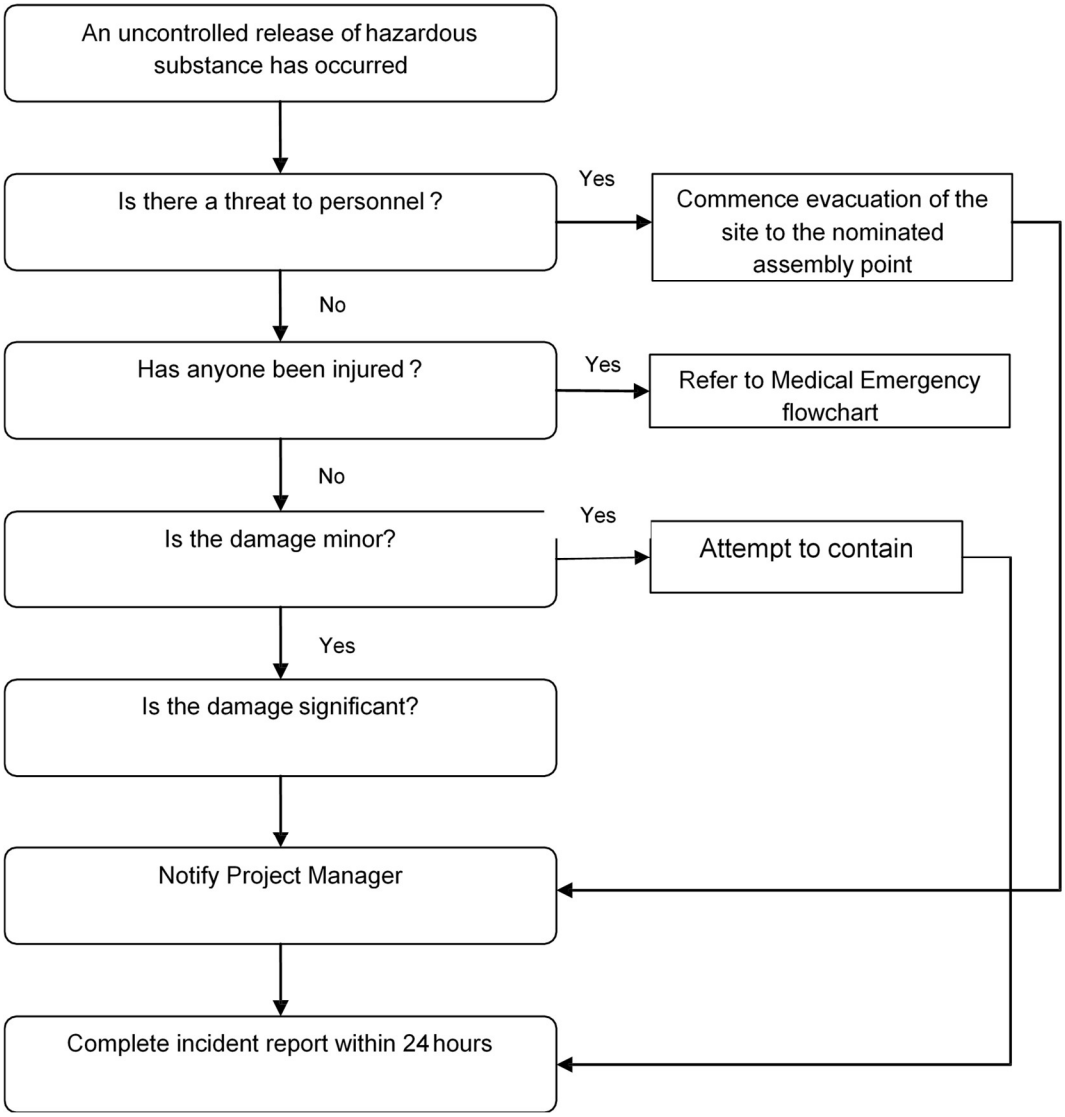
In the event of a fatality, the Police, Site Manager, and Project Manager shall be notified immediately.


A medical emergency has occurred
Collect the nearest first aid kit, attend to the injured person and administer first aid if safe to do so
Is an ambulance required ?
NO
If further medical attention is required, arrange transport to nearest hospital or medical centre
YES
Dial “000”
If able, nominate someone to meet the ambulance at the nearest car park/site entrance to direct emergency personnel to location of injured person
Notify Project Manager
Complete incident report within 24 hours


If applicable, on becoming aware of a fire, break the nearest 'Break Glass Alarm'
or
on the sounding of an alarm, ascertain the
If safe to do so, attempt to put out the fire with a fire extinguisher or fire hose reel
Notify the fire brigade by calling "000" and advise them of the location of the fire
If necessary, commence evacuation of the site to the nominated assembly point and wait for further instructions from the fire brigade
Conduct a roll call. Advise the fire brigade of any missing persons. DO NOT enter the affected area to look for missing personnel
Notify Project Manager
Remain at the assembly point until the emergency has passed and on advice from Emergency Services Personnel
Complete incident report within 24 hours

10.2.2 Environment Incident

In the event of an environmental incident, the actions outlined below shall be taken:



10.3 Incident Reporting

Cardno employees and sub-contractors are required to verbally report incidents, accidents and near-misses to the Project Manager immediately after an event has occurred. It is the responsibility of the Project Manger to notify the Client Representative immediately after the occurrence of an environmental incident and to forward the completed a written incident report within 24 hours. Additional investigations may be necessary should a serious incident occur.

10.4 Community Consultation

Cardno anticipates that community consultation will be required during the course of the remedial and validation works. Unless incorporated into other management documents, a detailed Community Consultation Plan may be developed to manage communications with third parties.

11 Site Validation Requirements

During and after the remedial works are complete, additional soil samples will be required to:

- Validate the excavated soil surface where removal of impacted materials is employed as the remediation strategy.
- Validate that on-site containment measures have been implemented appropriately (as required).
- Validate any imported soil is suitable for the proposed public open space land use and is not a potential source of contamination.

11.1 Validation Sampling

Validation sampling will be undertaken following the supplementary data gap investigation and the removal of identified contaminated material to ensure that the vertical and lateral extent of the contamination has been defined, as outlined in **Table 11-1**. Should residual contamination be identified, it would be "chased out" where appropriate until material exceeding the validation criteria has been removed. Soil sampling and handling of the collected samples will be as described in **Table 11-2.**

The collection of validation samples will be based on:

- Visual and olfactory observations; and
- Screening of material using a photo-ionisation detector (PID) for the presence of elevated levels of volatile organic compounds (VOCs) in headspace samples.

The samples will be submitted under appropriate 'chain of custody' (COCs) procedure to NATA accredited laboratories.

If the levels of contaminants are found to exceed the criteria for solid waste, soil treatment by stabilisation and/or micro-encapsulation could be required before disposal.

Table 11-1 Soil Validation Sampling Summary

Remediation Area	Sampling Density	Chemical of concern
Area of human health and ecological contaminated soils shown in **Figure 3**, and any other areas identified during future sampling data gap investigations or construction works.	Linear – 1 sampling location per 5m length (asbestos), and 1 sampling location per 10m (chemical) of excavation wall. Vertical –1 sampling location per 0.5m depth of excavation or change in soil horizon. Base – 1 sample location per 25m^2 (chemical: grid size 5m x 5m, to allow detection of a circular hotspot with a nominal diameter of 6m with 95% certainty). For asbestos validation completed double density (1 sample/12.5m^2).	Metals (copper, zinc), PAH, asbestos (quantification)
Existing building footprint	Linear (Building 94, Building 1, Building 2, Building 3): 1 sampling location per 125m^2, 8 sample locations in total. Linear (Chapel): 1 sampling location per 62.5 m^2, 4 sample locations in total. Vertical (all buildings) –1 sampling location per 0.5m depth of excavation or change in soil horizon. For asbestos validation completed double density (1 sample/12.5m^2).	Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), TRH, BTEX, PCB, OCP, PAH, VHC, PFAS (selected samples only) and asbestos (quantification), with TCLP testing (as required)
EBA, Lambie Drew Drive, Whale Garden, University of Sydney lands (if validation is required)	Linear – 1 sampling location per 5m length of excavation wall. Vertical –1 sampling location per 0.5m depth of excavation or change in soil horizon.	Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), TRH, OCP, BTEX, PCB, PAH, VHC, PFAS (selected samples only) and

Remediation Area	Sampling Density	Chemical of concern
	Base – 1 sample location per 25m^2 (grid size 5m x 5m, to allow detection of a circular hotspot with a nominal diameter of 6m with 95% certainty). For asbestos validation completed double density (1 sample/12.5m^2).	asbestos (quantification), with TCLP testing (as required)
Stockpile Material	One sample per 25m^3 of stockpiled material, up to 250m^3. A minimum of three samples is required for any stockpile. For stockpiles >250m^3 but <2500 m^3 in size, a statistical analysis approach may be used for classification, with the collection of at least 10 samples.	Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), TRH, BTEX, PAH, OCP, OPP, PCB and asbestos, with TCLP testing (as required) and any additional chemicals that may be identified by the supplementary investigation
Capping soils and imported material	If material is required to be sourced from off-site to reinstate the site, it should be certified suitable for the intended use and should be VENM or a NSW EPA Resource Recovery Order as per NSW EPA Waste Classification Guidelines. If the material does not have suitable certification, then the material should be rejected. Inspection of source sites and sampling at a minimum rate of one per 75 m^3 and minimum 3 primary samples to be analysed. The imported material is to be inspected at the site in small batches to confirm that the material conforms to the assessed material at the source site.	

Excavation of contaminated material shall continue until the analytical results indicate compliance with the soil validation criteria (i.e. either the concentrations of all contaminants are within the criteria, or the 95% UCL average contaminant concentration for each detected parameter is within the criteria). If results indicate that additional excavation is necessary, the excavation shall be extended until the excavation surface samples indicate that the location is validated as meeting the criteria for each respective contaminant. Near site boundaries, excavations should extend to a safe distance so as to not undermine off-site lands. Where contamination extends to the site boundary and cannot be further excavated, an assessment of Duty to Report should be undertaken and suitable measures to stop contamination from re-entering the site should be designed, implemented, and validated.

The validation sampling collection and handling should be completed as outlined in **Table 11-2** and **Table 11-3** below. Modifications to the below should be made based on the works that are to be completed.

Table 11-2 Validation Sample Collection

Activity	Details
Soil Sampling	> Soil samples to be collected directly from exposed surface or the excavator bucket using disposable nitrile gloves, and transferred to laboratory provided glass jars and sampling bags. The soil samples are to be collected on the same day as excavation to ensure that contaminants prone to degradation / weathering (such as pathogens, TRH and BTEX) are representative. > Analytical testing of soil samples are to generally target fill materials, however, at least one soil sample is to be collected from the underlying natural soil and may be tested if physical evidence of contamination is noted or if overlying fill is found to be significantly contaminated. > Primary and duplicate soil samples to be submitted to National Association of Testing Authorities, Australia (NATA) accredited laboratory. > Field procedure for asbestos identification in soils to include: Visual assessment at each sample location; if asbestos is identified WA DoH field assessment methodology of soils including collection of 10L soil samples and visual assessment against a coloured tarp for asbestos fragments. This process will be conducted at locations

Activity	Details
	observed to contain adversely impacted fill, and at locations previously identified as being impacted with asbestos.
Sampling Frequency and Laboratory Analysis	As outlined in **Table 11-1**.
Soil Logging	Soils encountered during the investigation to be described and logged in accordance with Australian Standard AS 1726:2017 – Geotechnical site investigations.
Soil sample containers and holding times	> Metals - 250g glass jar / refrigeration 4oC / 6 months (maximum holding period). > TRH/VOCs - 250g glass jar / refrigeration 4oC / 14 days (maximum holding period). > PAH/OCP/OPP/PCB - 250g glass jar / refrigeration 4oC / 14 days (maximum holding period). > Asbestos – up to a 1kg resealable bag and/or 10 litre resealable plastic (polyethylene) container/no refrigeration/indefinite holding time.
Groundwater sample Containers and holding time	> Metals – HDPE preserved with hydrochloric acid (1 mL)/ refrigeration 4oC / 6 months (maximum holding period). > TRH/VOCs – amber vials preserved with hydrochloric acid (1 mL) / refrigeration 4oC / 14 days (maximum holding period). > PAH - Amber glass, acid-washed and solvent rinsed bottles / refrigeration 4oC / 14 days (maximum holding period). > Unpreserved HDPE bottles.
Decontamination Procedure	Reusable sampling equipment such as hand tools (shovel, trowel, mattock), water level metre and micropurge groundwater pump to be decontaminated by washing with phosphate free detergent (Decon 90) followed by a rinse with potable water
Sample Preservation and Transport	Samples will be placed in laboratory supplied containers and stored on ice in an ice box while on Site and in transit to the laboratory under Chain of Custody documentation.
Quality Control, Laboratory Analysis and transport	All soil samples are to be submitted for analysis of previously-identified chemicals of concern by a NATA Certified laboratory as outlined in **Section 6**. Field duplicate samples to be collected for QA/QC purposes, by carefully mixing the material and distributing evenly between sampling containers. Quality assurance (QA) and quality control (QC) procedures as outlined in **Section 6** will be adopted throughout the field sampling program to ensure sampling precision and accuracy. QA/QC testing is to also comprise of rinsate blank and trip blank samples. All samples are to be transported under strict Chain-of-Custody (COC) conditions.

11.2 Imported Fill Sampling

Material imported to the site for the intention of engineering or landscaping purposes must meet the definition of virgin excavated natural material (VENM) and be accompanied by a VENM classification certificate. Classification documentation must include material source, volume and descriptions, sampling methodology and laboratory analysis results and certificates as per the NSW EPA VENM form.

Each load of imported VENM must be inspected by an appropriately experienced and suitably qualified individual to confirm the material is consistent with the description of the accompanying Certificate and meet the definition of VENM. Imported materials must also be sampled and analysed at a minimum rate of one sample per 100 m^3 (as outlined in **Section 11.1**) with at least three (3) samples per source. Material must also be considered geotechnically and aesthetically suitable by the validation consultant. A register of imported material will be maintained by the validation consultant which will include the origin of the material, classification type, volumes, date of importation, photographs and a description of imported material.

Analysis should include the following common contaminant analytes as a minimum: total recoverable hydrocarbons, polycyclic aromatic hydrocarbons, metals and asbestos. For imported VENM, all metals results should be compared to the NSW EPA Resource Recovery Order for Excavated Natural Material (ENM RRO) and have non-detection of for organic compounds.

A register of imported material is to be maintained which is to include the origin of the material, classification type, volumes, date of importation, haulage contractor name, photographs and a description of imported material.

12 Contingency Plan

As with any remedial scope of work, unanticipated events or outcomes may be encountered during the remedial program. Cardno has developed contingencies throughout the RAP to mitigate risks associated with potential issues that may arise during the remedial works. Contingency items considered for the current remediation are summarised in **Table 12-1** noting that there may be other unforeseen circumstances that may arise during the course of the works.

Table 12-1 Remedial Works Contingency Plan

Potential Issue	Contingency Measure
Evidence of additional contamination not previously identified	Further assessment involving intrusive investigations or remediation may be required to quantify and delineate potential contamination. The COPC analytical suite may be adjusted based on the nature of the potential source. The Unexpected Finds Protocol (UFP, **Section 9.6**) will be communicated, implemented and followed during the construction phase of the project.
Greater than anticipated volumes of soil require management	The proposed remedial strategy is scalable in that additional soil can be excavated and retained on-site. Off-site soil disposal is scalable for if large, unexpected volumes of soil are produced. In the case of additional contaminated soil being identified and on-site containment is feasible, this may be undertaken subject to approval by the relevant authority.
Unintentional release of stockpiled soil or water drained from stockpile	Construction of appropriate erosion and sedimentation controls around stockpiles Spill equipment will be staged on-site during the remedial works. Weather forecasts will be monitored throughout the course of the remedial works to anticipate any significant storm events. Works may be suspended if large volumes of rain are anticipated. Soil stockpiles would be sufficiently covered prior to any storm event. Assess if off-site migrations cause Duty to Report.
Water ingress to excavation is unmanageable	Consider aggressive means to remove the water (multiple vacuum trucks) or below ground dewatering equipment. Consider installation of a physical barrier to block the water ingress.
Elevated COPC concentrations are encountered within remaining soils following remedial excavations	Following the validation sampling of the initial remedial excavations (walls and base), should contamination be identified to remain then additional excavation will be required to chase out the extent of contamination. Further validation sampling will be undertaken. This process will be repeated until soils are suitable to remain onsite.
Imported material is determined unsuitable	If identified prior to entry onto site, material is to be stopped at the site gate and returned to point of origin. If emplaced prior to unsuitability is identified, material is to be isolated and demarcated. If stockpiled prior to removal offsite the stockpile should be lined to avoid contact with unimpacted ground surfaces. Any material leaving the site must undergo waste classification to allow for appropriate disposal offsite.

13 Regulatory Approvals / Licences

13.1 Regulatory Compliance Requirements

Regulations and sources of regulatory guidance relevant to this remediation programme relate to waste management, environment protection and occupational health and safety.

13.1.1 Waste Management

The remediation program must comply with the following legislation and policies:

- *Waste Avoidance and Resource Recovery Act 2001*;
- *Protection of the Environment Operations (Waste) Regulation 2014*; and
- NSW EPA (2014) *Waste Classification Guidelines.*

13.1.2 Environmental Protection

The remediation of asbestos impacted soils and environmental media with elevated contamination concentrations, must be carried out in a manner compliant with national, state and local environmental regulations, including the:

- NSW Work Health and Safety Act 2011;
- NSW Work Health and Safety Regulation 2017;
- Protection of the Environment Operations Act 1997;
- SafeWork NSW Code of Practice – How to Safely Remove Asbestos 2019;
- State Environmental Planning Policy (SEPP) – Resilience and Hazard, 2021;
- Contaminated Land Management Act 1997
- National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013).

13.1.3 Planning Controls

Planning controls applicable to the proposed remediation are provided in the following:

- State Environmental Planning Policy (SEPP) (Transport and Infrastructure) 2021;
- Sydney Development Control Plan (DCP) 2012; and
- Sydney Local Environmental Plan (LEP) 2012.

The proposed remedial works are to be managed as Category 2 remediation as per the Resilience and Hazards SEPP definition subject to Client requirements or requirements set out in any Development or Ministerial Consent, if applicable, which requires the site to be treated as a Category 1 site.

14 Conclusions

Cardno (NSW/ACT) Pty Ltd, now Stantec was engaged by TSA Management (TSA) ("the Client"), on behalf of NSW Health Infrastructure, to prepare a Remediation Action Plan (RAP) for the Eastern area and Emergency Bay Area (EBA) of the East Campus of the Royal Prince Alfred Hospital (RPA), Camperdown, NSW (the site), as shown in **Figure 1** and **2**, **Appendix A**. For ease of reference throughout the report, the subject area has been designated as Eastern Development and EBA.

This RAP has been prepared to detail methodologies required to remediate asbestos, B(α)P TEQ, B(α)P and metals (copper and zinc) contaminated soils identified during investigations completed by Cardno in 2022 within Eastern Development.

Based on previous investigations undertaken at the site, the contamination present and requiring remediation consists of asbestos and B(α)P TEQ found to exceed human health criteria, and copper, zinc and B(α)P found to exceed ecological criteria. Other CoPCs (i.e. OCPs) were detected below adopted human health and ecological criteria, and given the presence of site infrastructure, access to soils for investigation purposes was inhibited in many areas. As such, other contaminants may be discovered during site constructions works and should continue to be considered during construction.

This assessment follows on from a previous investigation completed by Cardno August 2022:

> Cardno (2022a). Detailed Site Investigation Report – Royal Prince Alfred Hospital, East Campus, Job Reference 80022023_R001, Revision 0, dated 4 November 2022.

The current land use for the Eastern Development comprises of landscaping, access roadways, pathology services and as loading bay. A parcel of land within University of Sydney, currently vacant of buildings, is also to form part of the development for landscaping. The EBA current land use comprises of a roadway, ambulance parking area, Covid testing hub, and hospital patient drop off point.

The purpose of the RAP is to outline the procedures required to remediate the site for the proposed development. As outlined in **Section 7.3**, the preferred remedial strategy for this site is offsite disposal of contaminated soils (Option 7) for the human health exceedances and in-situ encapsulation for fill material exceeding the ecological criteria (Option 9).

The following brief remediation strategy is recommended for implementation:

1. Preliminaries and site establishment;
2. Visual Inspection and asbestos clearance inspection of soil surface soils across all areas of Eastern Development area post hardstand removal;
3. Investigation of Lambie Dew Drive (north and south extensions); Whale Garden extension; EBA area; and University of Sydney land;
4. Eastern Area post-demolition investigation of building(s) footprint soil assessment;
5. Remedial excavation of contaminated soils and waste classifications;
6. Preparation of encapsulation cells, where required and onsite encapsulation works;
7. Validation of remedial excavations following the removal of contaminated materials; and
8. Reporting.

Once all remediation works have been undertaken and the validation works have been completed successfully in accordance with this RAP, then the site would be considered suitable for the land use.

15 References

Cardno (2022a). *Detailed Site Investigation, Royal Prince Alfred Hospital, East Campus*, Job Reference 80022026 R001, Revision 0, dated 10 November 2022.

Cardno (2022b). *Draft Detailed Site Investigation Report, Royal Prince Alfred Hospital East Campus*, 80022026_R001_Detailed Site Investigation RevB_DRAFT, dated 8 August 2022 .

Cardno (2022c). Remediation Action Plan, Royal Prince Alfred Hospital, East Campus, Job Reference 80022026 R004 Undercroft, Revision 0, dated 14 April 2022.

Cardno (2022d). *Preliminary Site Investigation Report, Royal Prince Alfred Hospital, East Campus*, Job Reference 80022026, Revision A, dated 3 March 2022.

Cardno (2022e). *Contamination Assessment Report – Delineation Sampling, Royal Prince Alfred Hospital*, Job Reference 80022026_R002_Undercroft Delineation, Revision 0, dated 23 February 2022;

Cardno (2022f). *Targeted Soil Contamination Assessment Report – Delineation Sampling, Royal Prince Alfred Hospital*, Job Reference *80022026-R00180022026-R001:MB_RevB*, dated 10 December 2021;

Guideline on the Investigation Levels for Soil and Groundwater' of the *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM) *1999* (NEPC, 1999) as varied May 2013 (the 'NEPM 2013').

NSW Department of Urban Affairs and Planning (2021) *Managing Land Contamination: Planning Guidelines: Resilience and Hazards SEPP,* 2021.

NSW EPA (1995) *Contaminated Site Sampling Design Guidelines*. New South Wales Environment Protection Authority (EPA), September 2017.

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

NSW EPA (2015) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*. NSW Environment Protection Authority, Sydney. September 2015.

NSW EPA (2020) *Consultants reporting on contaminated land, Contaminated Land Guidelines*, NSW Environment Protection Authority, Sydney, April 2020.

Limitations

This assessment has been undertaken in general accordance with the current "industry standards" for a Remediation Action Plan and contamination assessment for the purpose, objectives and scope identified in this report. These standards are set out in:

- National Environment Protection Measure (NEPM) - *Assessment of Site Contamination 1999* (NEPC, 1999) as varied May 2013 (the 'NEPM 2013').
- AS4482.1- 2005: Guide to the sampling and investigation of potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds. Standards Australia (2005).

The scope of this assessment is limited to the scope identified in **Section 1.4**. The assessment may not identify contamination occurring in all areas of the Site, or occurring after sampling was conducted. Subsurface conditions may vary considerably away from the sample locations where information has been obtained.

This Document has been provided by Cardno subject to the following limitations:

- This Document has been prepared for the particular purpose outlined in Cardno's proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.
- The scope and the period of Cardno's services are as described in Cardno's proposal, and are subject to restrictions and limitations. Cardno did not perform a complete assessment of all possible conditions or circumstances that may exist at the Site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Cardno in regards to it.
- Conditions may exist which were undetectable given the limited nature of the enquiry Cardno was retained to undertake with respect to the Site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the Site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.
- In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Cardno's opinions are based upon information that existed at the time of the production of the Document. It is understood that the services provided allowed Cardno to form no more than an opinion of the actual conditions of the Site at the time this Document was prepared and cannot be used to assess the effect of any subsequent changes in the quality of the Site, or its surroundings, or any laws or regulations.
- Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.
- Where data supplied by the client or other external sources, including previous Site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Cardno for incomplete or inaccurate data supplied by others.
- Cardno may have retained sub consultants affiliated with Cardno to provide services for the benefit of Cardno. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any direct legal recourse to, and waives any claim, demand, or cause of action against, Cardno's affiliated companies, and their employees, officers and directors.

This assessment report is not any of the following:

- An assessment of hazardous building materials.
- An assessment of Acid Sulfate Soils (ASS) within the Site or nearby.
- A Site Audit Report or Site Audit Statement as defined under the *Contaminated Land Management Act, 1997*.
- A detailed hydrogeological assessment in conformance with NSW DEC (2007) Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination.
- A Site Validation Report or Environmental Management Plan.
- An assessment of groundwater contaminants potentially arising from other Sites or sources nearby.

APPENDIX

A

FIGURES

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NSW GOVERNMENT Health Infrastructure

Site Location Plan

ROYAL PRINCE ALFRED HOSPITAL

Legend

- East Campus Boundary
- Eastern Development - East Area of Eastern Campus
- Eastern Development - Maternity Ward Parking Area
- Emergency Bay Area
- Suburb Boundary (LPI, 2011)
- Cadastre (NSW SS, 2022)

Camperdown Location

FIGURE 1

1:8,500 Scale at A3

m

0 100 200 300 400

N

Cardno now Stantec

Map Produced by Stantec Australia Pty Ltd (3048)
Date: 2022-11-03 | Project: 80022026
Coordinate System: GDA2020 MGA Zone 56
Map: 80022026-GS-001-SiteLocationPlan.mxd 03
Aerial imagery supplied by MetroMap (June, 202)

Eastern Campus Sampling Location Plan

ROYAL PRINCE ALFRED HOSPITAL, CAMPERDOWN

NSW GOVERNMENT Health Infrastructure

Legend

- Test Pit (Cardno, 2022)
- Test Pit (Cardno, 2021)
- Test Pit (Sydney Environmental Group, 2022)
- Groundwater Well (Cardno, 2021)
- Groundwater Well (Douglas Partners, 2020)
- Eastern Development - East Area of Eastern Campus
- Eastern Development - Maternity Ward Parking Area
- Emergency Bay Area
- Site Boundary
- USTs
- Cadastre (NSW SS, 2022)
- Borehole (Cardno, 2022)
- Hand Auger (Cardno, 2022)
- Borehole (Cardno, 2021-2022)
- Hand Auger (Cardno, 2021)
- Borehole (Douglas Partners, 1989 / 1998)
- Hand Auger (Douglas Partners, 1989 / 1998)

FIGURE 2

1:1,500 Scale at A3

m
0 20 40 60 80

N

Cardno now Stantec

Map Produced by Stantec Australia Pty Ltd (3048)
Date: 2022-11-10 | Project: 80022026
Coordinate System: GDA2020 MGA Zone 56
Map: 80022026-GS-029-EastCampus_SamplingPlan.mxd 01
Aerial imagery supplied by Metromap (July, 2021)

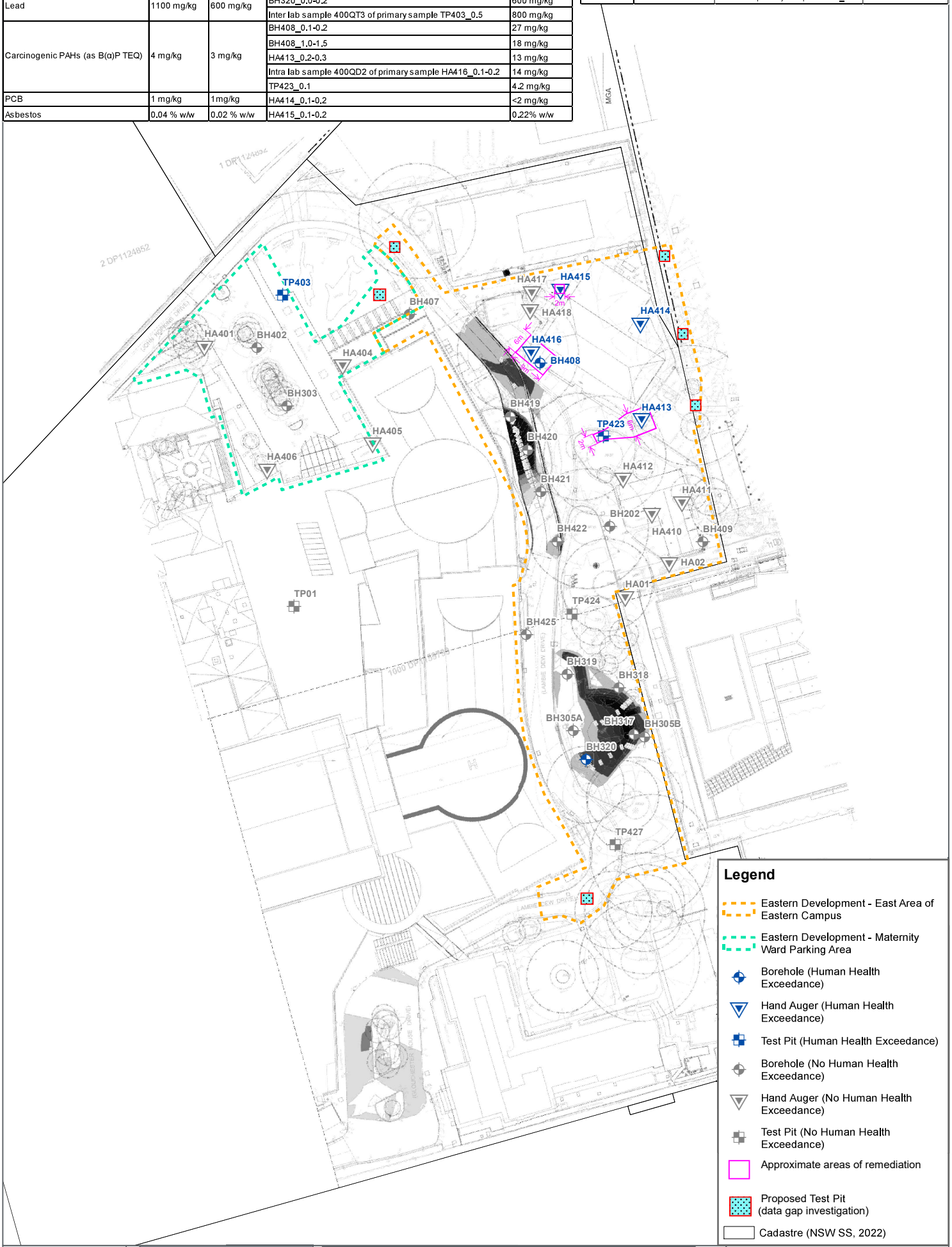
Approximate area of Diesel UST located within loading dock building footprint

Approximate location of USTs as indicated in SafeWork searches

JOHN HOPKINS DRIVE
LAMBIE DEW DRIVE
MISSENDEN ROAD
GLOUCESTER HOUSE DRIVE
BLACKBURN CIRCUIT
CADIGAL LANE

East Area of Eastern Campus Human Health Exceedances				
Contaminant	**HIL B Criteria**	**HIL C Criteria**	**Sample ID**	**Concentration**
Lead	1100 mg/kg	600 mg/kg	BH320_0.0-0.2	600 mg/kg
			Inter lab sample 400QT3 of primary sample TP403_0.5	800 mg/kg
Carcinogenic PAHs (as B(α)P TEQ)	4 mg/kg	3 mg/kg	BH408_0.1-0.2	27 mg/kg
			BH408_1.0-1.5	18 mg/kg
			HA413_0.2-0.3	13 mg/kg
			Intra lab sample 400QD2 of primary sample HA416_0.1-0.2	14 mg/kg
			TP423_0.1	4.2 mg/kg
PCB	1 mg/kg	1mg/kg	HA414_0.1-0.2	<2 mg/kg
Asbestos	0.04 % w/w	0.02 % w/w	HA415_0.1-0.2	0.22% w/w

Maternity Ward Parking Area Human Health Exceedances			
Contaminant	**HIL C Criteria mg/kg**	**Sample ID**	**Concentration mg/kg**
Lead	600	400QT3 of primary sample TP403_0.5	800



NSW GOVERNMENT Health Infrastructure

FIGURE 3

1:850 Scale at A3

m 0 10 20 30

Human Health Exceedance Plan

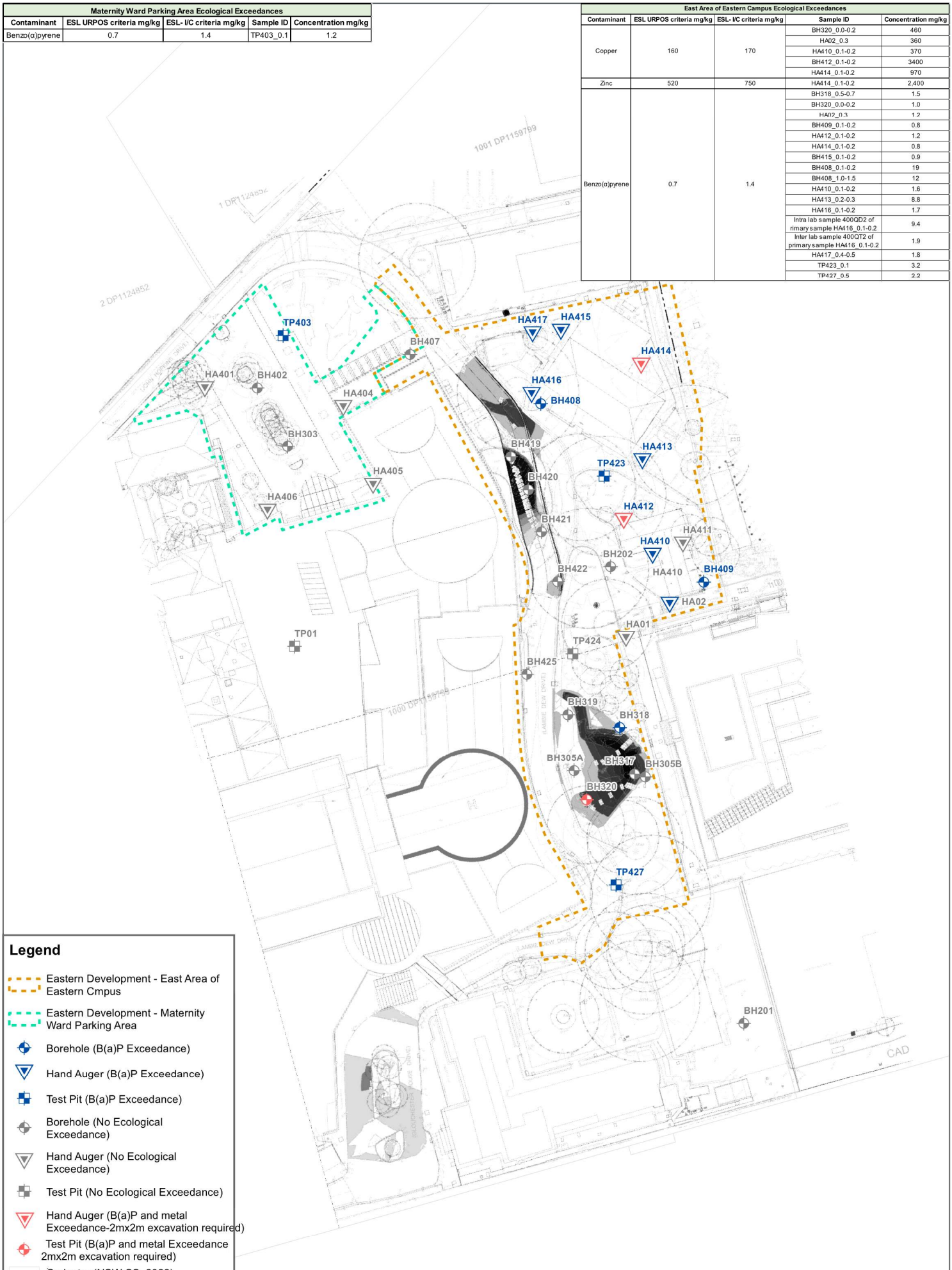
ROYAL PRINCE ALFRED HOSPITAL, CAMPERDOWN

Cardno now Stantec

Map Produced by Stantec Australia Pty Ltd (3048)
Date: 2022-11-03 | Project: 80022026
Coordinate System: GDA2020 MGA Zone 56
Map: 80022026-GS-026-HumanHealth.mxd 01

Maternity Ward Parking Area Ecological Exceedances				
Contaminant	ESL URPOS criteria mg/kg	ESL- I/C criteria mg/kg	Sample ID	Concentration mg/kg
Benzo(α)pyrene	0.7	1.4	TP403_0.1	1.2

East Area of Eastern Campus Ecological Exceedances				
Contaminant	ESL URPOS criteria mg/kg	ESL- I/C criteria mg/kg	Sample ID	Concentration mg/kg
Copper	160	170	BH320_0.0-0.2	460
			HA02_0.3	360
			HA410_0.1-0.2	370
			BH412_0.1-0.2	3400
			HA414_0.1-0.2	970
Zinc	520	750	HA414_0.1-0.2	2,400
Benzo(α)pyrene	0.7	1.4	BH318_0.5-0.7	1.5
			BH320_0.0-0.2	1.0
			HA02_0.3	1.2
			BH409_0.1-0.2	0.8
			HA412_0.1-0.2	1.2
			HA414_0.1-0.2	0.8
			BH415_0.1-0.2	0.9
			BH408_0.1-0.2	19
			BH408_1.0-1.5	12
			HA410_0.1-0.2	1.6
			HA413_0.2-0.3	8.8
			HA416_0.1-0.2	1.7
			Intra lab sample 400QD2 of rimary sample HA416_0.1-0.2	9.4
			Inter lab sample 400QT2 of primary sample HA416_0.1-0.2	1.9
			HA417_0.4-0.5	1.8
			TP423_0.1	3.2
			TP427_0.5	2.2



Legend

- Eastern Development - East Area of Eastern Cmpus
- Eastern Development - Maternity Ward Parking Area
- Borehole (B(a)P Exceedance)
- Hand Auger (B(a)P Exceedance)
- Test Pit (B(a)P Exceedance)
- Borehole (No Ecological Exceedance)
- Hand Auger (No Ecological Exceedance)
- Test Pit (No Ecological Exceedance)
- Hand Auger (B(a)P and metal Exceedance-2mx2m excavation required)
- Test Pit (B(a)P and metal Exceedance 2mx2m excavation required)
- Cadastre (NSW SS, 2022)

NSW GOVERNMENT Health Infrastructure

FIGURE 4

1:850 Scale at A3

m

0 10 20 30

Ecological Exceedance Plan

ROYAL PRINCE ALFRED HOSPITAL, CAMPERDOWN

Cardno now Stantec

Map Produced by Stantec Australia Pty Ltd (3048)
Date: 2022-11-03 | Project: 80022026
Coordinate System: GDA2020 MGA Zone 56
Map: 80022026-GS-027-EcologicalExceedance.mxd 01

Emergency Bay Area Human Health Exceedances				
Contaminant	**HIL B Criteria**	**HIL C Cirteria**	**Sample ID**	**Concentration**
Carcinogenic PAHs (as B(α)P TEQ)	4 mg/kg	3 mg/kg	BH1(TP301)_0.5-0.6	150 mg/kg
Total PAH	400 mg/kg	300 mg/kg	BH1(TP301)_0.5-0.6	1,300 mg/kg
Contaminant	**HSL A & B Criteria**		**Sample ID**	**Concentration**
Naphthalene	3 mgkg		BH1(TP301)_0.5-0.6	6.9 mg/kg
TRH F2	110 mgkg		BH1(TP301)_0.5-0.6	230 mg/kg

Emergency Bay Area Ecological Exceedances				
Contaminant	**ESL URPOS criteria mg/kg**	**ESL- I/C criteria mg/kg**	**Sample ID**	**Concentration mg/kg**
Benzo(α)pyrene	0.7	1.4	TP403_0.1	1.2
TRH F2	-	170	BH1(TP301)_0.5-0.6	230
TRH F3	1,300	2,500	BH1(TP301)_0.5-0.6	5,600

Legend

- Emergency Bay
- Test Pit (Cardno, 2021)
- Proposed borehole
- Proposed Test Pit
- Cadastre (NSW SS, 2022)

NSW GOVERNMENT Health Infrastructure

FIGURE 5

1:500 Scale at A3

m 0 5 10 15

Emergency Bay Area Exceedances

ROYAL PRINCE ALFRED HOSPITAL, CAMPERDOWN

Cardno now Stantec

Map Produced by Stantec Australia Pty Ltd (3048)
Date: 2022-11-03 | Project: 80022026
Coordinate System: GDA2020 MGA Zone 56
Map: 80022026-GS-028-EmergencyExceedances.mxd 01

TOTAL AREA: 9995m²

PROFESSOR
MARIE BASHIR CENTRE

BRODIE STREET

ANATOMICAL PATHOLOGY

ANSTO RESEARCH CYCLOTRON FACILITY

PBU

KING GEORGE V PARKING

KING GEORGE V BUILDING

SUSAN STREET

RPA SURGICAL & ROBOTIC TRAINING INSTITUTE

SALISBURY ROAD

RADIATION ONCOLOGY DEPARTMENT

CHRIS O'BRIEN LIFEHOUSE

ST JOHNS COLLEGE

MISSENDEN ROAD

JOHNS HOPKINS DRIVE

KERRY PACKER
EDUCATION
CENTRE

NORTHEN ENTRY

LAMBIE DERRYBRY

CENTENARY INSTITUTE

NEW EAST

VERTICAL EXTENSION ABOUT CSB

EAST EXTENSION

SUSAN WAKIL CENTRE SYDNEY UNI

ALBERT PAVILION

ADMINISTRATION BUILDING / ADMISSION BLOCK

EDINBURGH
BUILDING

CLINICAL SERVICES BUILDING

VICTORIA PAVILION

PATHOLOGY / LABORATORY SERVICES

GLOUCESTER HOUSE

GLOUCESTER HOUSE DRIVE

SBA
(RPAH)

SBA
(USYD)

CADIGAL LANE

N 6248765.190
E 332015.762

N 6248763.112
E 332015.172

N 6248743.543
E 332006.952

N 6248760.743
E 332012.462

N 6248739.713
E 332000.619

N 6248757.711
E 332015.511

N 6248755.152
E 332015.970

N 6248768.866
E 332019.967

N 6248751.896
E 332032.604

N 6248763.972
E 332088.834

N 6248732.810
E 331968.452

N 6248730.606
E 331955.556

N 6248729.192
E 331955.966

N 6248730.881
E 331971.956

N 6248720.988
E 331974.823

N 6248721.545
E 331976.745

N 6248742.792
E 332027.886

N 6248730.646
E 332006.088

N 6248724.348
E 332037.917

N 6248701.374
E 331982.589

N 6248706.083
E 331991.411

N 6248702.986
E 331992.309

N 6248710.273
E 332017.455

N 6248703.737
E 332048.792

N 6248730.023
E 332096.512

N 6248718.820
E 332096.122

N 6248718.355
E 332094.515

N 6248679.136
E 332049.764

N 6248685.178
E 332101.662

N 6248677.420
E 332074.405

N 6248674.645
E 331904.086

N 6248654.339
E 331888.998

N 6248651.317
E 331893.832

N 6248648.475
E 331894.896

N 6248628.729
E 331900.473

N 6248624.702
E 331897.228

N 6248616.868
E 331899.455

N 6248615.770
E 331904.134

N 6248598.923
E 331908.954

N 6248603.487
E 331924.706

N 6248604.303
E 332055.770

N 6248610.478
E 332093.346

N 6248596.171
E 332056.997

N 6248606.209
E 332075.457

N 6248597.223
E 332061.944

N 6248599.753
E 332072.343

N 6248595.389
E 332066.520

1 : 500 at A1

EXTENT OF WORKS DIAGRAM

ROYAL PRINCE ALFRED HOSPITAL REDEVELOPMENT STAGE 1

DATE	REVISION DESCRIPTION

11/02/22_ IA0251300- SK-SK-2001

Jacobs
BATESSMART
NEESON MURCUTT + NEILLE
Level 7, 177 Pacific Highway, North Sydney, NSW, 2060 T: +61 2 9928 2100 F: +61 2 9928 2510 W: jacobs.com

NSW GOVERNMENT Health Infrastructure

APPENDIX

B

SUMMARY ANALYTICAL TABLES

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			BTEX							TPH					CRC Care TPH Fractions							
			Naphthalene (VOC)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	C6-C10	C10-C16	C16-C34 (F3)	C34-C40 (F4)	TRH C37-C40	C10 - C40 (Sum of total)	F1: C6-C10 less BTEX	F2: >C10-C16 less Naphthalene
			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
LOR			0.1	0.1	0.1	0.1	0.2	0.1	0.3	0.6	20	20	45	45	50	20	25	90	100	100	100	20	25
NEPM 2013 EIL Comm./Ind., low pH, CEC, clay content - fresh																							
0-2m																							
NEPM 2013 EIL UR/POS, low pH, CEC, clay content - fresh																							
0-2m																							
NSW 2014 General Solid Waste CT1 (No Leaching)				10	288	600			1000		650				10000								
NSW 2014 General Solid Waste SCC1 (with leached)				18	518	1080			1800		650|6500				10000								
NSW 2014 Restricted Solid Waste CT2 (No Leaching)				40	1152	2400			4000		2600				40000								
NSW 2014 Restricted Solid Waste SCC2 (with leached)				72	2073	4320			7200		2600				40000								
PFAS NEMP 2.0 Table 2 Health Industrial/Commercial (HIL C)																							
PFAS NEMP 2.0 Table 2 Health Residential min soil access (HIL B)																							
PFAS NEMP 2.0 Table 3 Ecological Direct Exposure - All Land Uses																							
PFAS NEMP 2.0 Table 3 Ecological Indirect Exposure - All Land Uses																							
NEPM 2013 ESL Comm./Ind., Fine Soil																							
0-2m				95	135	185			95			170[#4]						2500	6600			215	170
NEPM 2013 ESL UR/POS, Fine Soil																							
0-2m				65	105	125			45			120[#4]					120	1300	5600			180	
NEPM 2013 HIL, Commercial/Industrial D																							
NEPM 2013 HIL, Recreational C																							
NEPM 2013 HIL, Residential B																							
NEPM 2013 Soil HSL Residential A&B, for Vapour Intrusion, Sand																							
0-1m				0.5	160	55			40													45	110
1-2m				0.5	220	NL[#14]			60													70	240
2-4m				0.5	310	NL[#14]			95													110	440
>4m				0.5	540	NL[#14]			170													200	NL[#14]
NEPM 2013 Management Limits, C/I, Fine Soil											800[#4]	1000[#4]				800	1000	5000	10000				
NEPM 2013 Management Limits, R/P&POS, Fine Soil											800[#4]	1000[#4]				800	1000	3500	10000				
Field_ID	**Sample_Depth_Range**	**Sampled_Date_Time**																					
BH302_0.1	0.1	29/11/2021	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<500	<500	<500	<500	<20	<500	<1000	<1000	-	<1000	<20	<500
BH302_1	1	29/11/2021	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	-	<100	<20	<50
BH302_3.5	3.5	29/11/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH303_0.5	0.5	3/12/2021	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	54	65	119	<20	<50	<100	<100	-	<100	<20	<50
BH303_3.5	3.5	3/12/2021	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	-	<100	<20	<50
BH303_5.0	5	3/12/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH304_0.5	0.5	29/11/2021	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	170	180	350	<20	<50	290	130	-	420	<20	<50
BH304_3	3	29/11/2021	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	-	<100	<20	<50
BH305A_0.1	0.1	30/11/2021	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	23	170	200	393	<20	<50	290	170	-	460	<20	<50
BH305A_2.0	2	30/11/2021	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	-	<100	<20	<50
BH306_0.1	0.1	2/12/2021	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	120	110	230	<20	<50	190	<100	-	190	<20	<50
BH306_1.5	1.5	2/12/2021	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	61	57	118	<20	<50	<100	<100	-	<100	<20	<50
BH306_5.0	5	2/12/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA01_0.5	0.5	27/04/2022		< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.3	-	< 20	< 20	< 50	< 50	< 50	< 20	< 50	< 100	< 100	-	< 100	< 20	< 50
HA01_1	1	27/04/2022		< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.3	-	< 20	< 20	< 50	< 50	< 50	< 20	< 50	< 100	< 100	-	< 100	< 20	< 50
HA02_0.3	0.3	27/04/2022		< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.3	-	< 20	< 20	92	65	157	< 20	< 50	130	< 100	-	130	< 20	< 50
HA02_0.8	0.8	27/04/2022		< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.3	-	< 20	< 20	< 50	< 50	< 50	< 20	< 50	< 100	< 100	-	< 100	< 20	< 50
HA02_1.6	1.6	27/04/2022		< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.3	-	< 20	< 20	< 50	< 50	< 50	< 20	< 50	< 100	< 100	-	< 100	< 20	< 50
BH317_0.0-0.2	0-0.2	10/06/2022	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	31	58	57	146	<20	<50	120	130	-	250	<20	<50
BH317_1.0-1.1	1-1.1	10/06/2022	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	-	<100	<20	<50
BH318_0.0-0.2	0-0.2	10/06/2022	<0.5	<0.1	<0.1	<0.1	0.4	0.2	0.6	-	<20	<20	100	<50	100	<20	<50	170	<100	-	170	<20	<50
BH318_0.5-0.7	0.5-0.7	10/06/2022	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	93	<50	93	<20	<50	150	<100	-	150	<20	<50
BH319_0.0-0.2	0-0.2	10/06/2022	<0.5	<0.1	<0.1	<0.1	0.2	0.2	0.4	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	-	<100	<20	<50
BH319_1.0-1.1	1-1.1	10/06/2022	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	-	<100	<20	<50
BH320_0-0.2	0-0.2	10/06/2022	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	-	<100	<20	<50
BH320_1.0-1.1	1-1.1	10/06/2022	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	-	<100	<20	<50
HA401_0.1-0.2	0.1-0.2	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
HA401_0.4-0.45	0.4-0.45	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
HA402_0.3-0.5	0.3-0.5	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	94	61	160	<25	<25	140	<120	<100	<210	<25	<25
BH402_2.1-2.5	2.1-2.5	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
HA404_0.1-0.2	0.1-0.2	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
HA405_0.1-0.2	0.1-0.2	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
400QD1	BH405_0.1-0.2	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
400QT1	BH405_0.1-0.2	31/08/2022	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<101	<100	<20	<50
HA406_0.1-0.2	0.1-0.2	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
HA406_0.75-0.9	0.75-0.9	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
BH408_0.1-0.2	0.1-0.2	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	39	720	500	1300	<25	55	1100	180	<100	1300	<25	55
BH408_1.0-1.5	1-1.5	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	540	290	840	<25	28	750	<120	<100	780	<25	28
BH408_2.1-2.4	2.1-2.4	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
BH409_0.1-0.2	0.1-0.2	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	46	57	<110	<25	<25	<90	<120	<100	<210	<25	<25
BH409_0.4-0.6	0.4-0.6	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
HA410_0.1-0.2	0.1-0.2	31/08/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	83	63	150	<25	<25	130	<120	<100	<210	<25	<25
BH412_0.1-0.2	0.1-0.2	1/09/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	62	120	99	290	<25	76	170	<120	<100	250	<25	76
HA413_0.2-0.3	0.2-0.3	1/09/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	180	110	290	<25	<25	250	<120	<100	250	<25	<25
HA414_0.1-0.2	0.1-0.2	1/09/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
BH414_1.0-1.1	1-1.1	1/09/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
BH415_0.1-0.2	0.1-0.2	1/09/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	48	110	160	<25	<25	110	<120	<100	<210	<25	<25
HA416_0.1-0.2	0.1-0.2	1/09/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	48	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
400QD2	HA416_0.1-0.2	1/09/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	290	140	420	<25	<25	370	<120	<100	370	<25	<25
400QT2	HA416_0.1-0.2	31/08/2022	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<101	<100	<20	<50
HA417_0.1-0.2	0.1-0.2	1/09/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
HA417_0.4-0.5	0.4-0.5	1/09/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
HA418_0.15-0.25	0.15-0.25	1/09/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
HA418_0.7-0.8	0.7-0.8	1/09/2022	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
BH419_0.5-0.6	0.5-0.6	5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	64	54	120	<25	<25	110	<120	<100	<210	<25	<25
BH420_0.5-0.5	0.5-0.6	5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	87	140	220	<25	<25	180	<120	<100	<210	<25	<25
BH421_0.5-0.6	0.5-0.6	5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
BH421_0.9-1.0	0.9-1.0	5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
BH422_0.4-0.5	0.4-0.5	5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
BH422_0.8-1.0	0.8-1.0	5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
BH425M_0.5-0.7	0.5-0.7	5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	48	62	110	<25	<25	96	<120	<100	<210	<25	<25
BH425M_1.5-1.6	1.5-1.6	5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
BH425M_1.8-2.0	1.8-2.0	5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
BH425M_4.0-4.2	4.0-4.2	5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
400TB3		5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	-	-	-	-	-	-	-	-	-	-	-	-	-
400TS4		5/09/2022	-	[72%]	[80%]	[83%]	[84%]	[84%]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP403_0.1	0.1	7/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	46	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
TP403_0.5	0.5	7/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
TP403_2.0	2	5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	68	110	180	<25	<25	140	<120	<100	<210	<25	<25
TP423_0.1	0.1	7/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	130	120	250	<25	<25	220	<120	<100	220	<25	<25
TP423_1.0	1	7/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP424_0.1-0.2	0.1-0.2	7/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	58	<45	<45	<110	<25	60	<90	<120	<100	<210	<25	60
TP424_0.5	0.5	7/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
TP424_1.5	1.5	7/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
TP424_2.5	2.5	7/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
TP427_0.1	0.1	7/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
TP427_0.5	0.5	7/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	72	56	130	<25	<25	120	<120	<100	<210	<25	<25
400QD3(QA101)	TP403_0.5	5/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	<20	<20	<45	<45	<110	<25	<25	<90	<120	<100	<210	<25	<25
400QT3(QA101)	TP403_0.5	5/09/2022	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	280	460	<50	<20	<50	<100	<100	<101	1000	<20	<50
400TB5		7/09/2022	<0.6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<0.6	-	-	-	-	-	-	-	-	-	-	-	-	-
400TS6		7/09/2022	-	[93%]	[96%]	[96%]	[97%]	[97%]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

			PAH																							
			BaP TEQ (zero)	Benzo(a)pyrene TEQ (half LOR)_	Benzo(a)pyrene TEQ (upper bound) *	1-Methylnaphthalene	2-methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b+j)fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Total PAH (NEPM/WHO 16)	Phenanthrene	Pyrene
			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
LOR			0.5	0.5	0.5	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	0.1	0.1	0.5	0.8	0.1	0.1
NEPM 2013 EIL Comm./Ind., low pH, CEC, clay content - fresh																										
0-2m																					370[#1]					
NEPM 2013 EIL UR/POS, low pH, CEC, clay content - fresh																										
0-2m																					170[#1]					
NSW 2014 General Solid Waste CT1 (No Leaching)												0.8										200				
NSW 2014 General Solid Waste SCC1 (with leached)												10														
NSW 2014 Restricted Solid Waste CT2 (No Leaching)												3.2														
NSW 2014 Restricted Solid Waste SCC2 (with leached)												23														
PFAS NEMP 2.0 Table 2 Health Industrial/Commercial (HIL C)																										
PFAS NEMP 2.0 Table 2 Health Residential min soil access (HIL B)																										
PFAS NEMP 2.0 Table 3 Ecological Direct Exposure - All Land Uses																										
PFAS NEMP 2.0 Table 3 Ecological Indirect Exposure - All Land Uses																										
NEPM 2013 ESL Comm./Ind., Fine Soil																										
0-2m												1.4[#5]														
NEPM 2013 ESL UR/POS, Fine Soil																										
0-2m												0.7[#6]														
NEPM 2013 HIL, Commercial/Industrial D				40[#7]																		4000[#8]				
NEPM 2013 HIL, Recreational C				3[#7]																		300[#8]				
NEPM 2013 HIL, Residential B				4[#7]																		400[#8]				
NEPM 2013 Soil HSL Residential A&B, for Vapour Intrusion, Sand																										
0-1m																					3					
1-2m																					NL[#14]					
2-4m																					NL[#14]					
>4m																					NL[#14]					
NEPM 2013 Management Limits, C/I, Fine Soil																										
NEPM 2013 Management Limits, R/P&POS, Fine Soil																										
Field_ID	**Sample_Depth_Range**	**Sampled_Date_Time**																								
BH302_0.1	0.1	29/11/2021	4.7	4.7	4.7	-	-	<0.5	0.7	0.6	2.4	3.1	2.2	2.7	3.5	2.7	0.6	5.1	<0.5	2.3	<0.5	35.7	-	3.9	5.9
BH302_1	1	29/11/2021	<0.5	0.6	1.2	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
BH302_3.5	3.5	29/11/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH303_0.5	0.5	3/12/2021	0.7	1	1.3	-	-	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	2.7	-	<0.5	0.8
BH303_3.5	3.5	3/12/2021	<0.5	0.6	1.2	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
BH303_5.0	5	3/12/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH304_0.5	0.5	29/11/2021	2	2.3	2.5	-	-	<0.5	<0.5	<0.5	0.9	1.6	1	1.3	0.9	1.4	<0.5	1.8	<0.5	0.8	<0.5	12.6	-	0.6	2.3
BH304_3	3	29/11/2021	<0.5	0.6	1.2	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
BH305A_0.1	0.1	30/11/2021	<0.5	0.6	1.2	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
BH305A_2.0	2	30/11/2021	<0.5	0.6	1.2	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
BH306_0.1	0.1	2/12/2021	1.6	1.8	2.1	-	-	<0.5	<0.5	<0.5	0.9	1.2	0.9	1.1	0.9	1.1	<0.5	1.6	<0.5	0.8	<0.5	10.8	-	0.7	1.6
BH306_1.5	1.5	2/12/2021	<0.5	0.6	1.2	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
BH306_5.0	5	2/12/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA01_0.5	0.5	27/04/2022	< 0.5	0.6	1.2	-	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	-	< 0.5	< 0.5
HA01_1	1	27/04/2022	< 0.5	0.6	1.2	-	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.5	< 0.5	1	-	< 0.5	0.5
HA02_0.3	0.3	27/04/2022	1.6	1.9	2.1	-	-	< 0.5	< 0.5	< 0.5	1.3	1.2	0.8	1.4	0.7	1.2	< 0.5	2.7	< 0.5	0.7	< 0.5	15	-	2.2	2.6
HA02_0.8	0.8	27/04/2022	< 0.5	0.6	1.2	-	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	-	< 0.5	< 0.5
HA02_1.6	1.6	27/04/2022	< 0.5	0.6	1.2	-	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	1	< 0.5	< 0.5	< 0.5	2.7	-	0.8	0.9
BH317_0.0-0.2	0-0.2	10/06/2022	<0.5	0.6	1.2	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	0.6	-	<0.5	<0.5
BH317_1.0-1.1	1-1.1	10/06/2022	<0.5	0.6	1.2	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
BH318_0.0-0.2	0-0.2	10/06/2022	1	1.3	1.6	-	-	<0.5	<0.5	<1	0.6	0.8	<0.5	0.8	<0.5	1.1	<0.5	1.8	<0.5	<0.5	<0.5	6.9	-	<1	1.8
BH318_0.5-0.7	0.5-0.7	10/06/2022	2	2.2	2.5	-	-	<0.5	<0.5	<0.5	1	1.5	0.9	1.9	1	1.7	<0.5	2	<0.5	0.7	<0.5	13	-	<1	2.1
BH319_0.0-0.2	0-0.2	10/06/2022	<0.5	0.6	1.2	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
BH319_1.0-1.1	1-1.1	10/06/2022	<0.5	0.6	1.2	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
BH320_0-0.2	0-0.2	10/06/2022	1.3	1.5	1.8	-	-	<0.5	<0.5	<0.5	0.7	1	0.5	0.7	0.6	0.8	<0.5	0.6	<0.5	0.5	<0.5	7.3	-	0.5	1.4
BH320_1.0-1.1	1-1.1	10/06/2022	<0.5	0.6	1.2	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
HA401_0.1-0.2	0.1-0.2	31/08/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
HA401_0.4-0.45	0.4-0.45	31/08/2022	0.7	0.8	0.8	<0.1	<0.1	<0.1	<0.1	0.2	0.5	0.5	0.6	0.2	0.3	0.4	<0.1	1	<0.1	0.3	<0.1	5.8	5.8	0.6	1
HA402_0.3-0.5	0.3-0.5	31/08/2022	0.3	0.4	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.3	0.1	0.2	0.2	<0.1	0.4	<0.1	0.2	<0.1	2.5	2.5	0.2	0.4
BH402_2.1-2.5	2.1-2.5	31/08/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
HA404_0.1-0.2	0.1-0.2	31/08/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
HA405_0.1-0.2	0.1-0.2	31/08/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
400QD1	BH405_0.1-0.2	31/08/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
400QT1	BH405_0.1-0.2	31/08/2022	<0.5	0.6	1.2	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
HA406_0.1-0.2	0.1-0.2	31/08/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
HA406_0.75-0.9	0.75-0.9	31/08/2022	0.3	0.3	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.2	0.2	<0.1	0.1	0.1	<0.1	0.2	<0.1	0.1	<0.1	1.5	1.5	<0.1	0.3
BH408_0.1-0.2	0.1-0.2	31/08/2022	27	27	27	0.4	0.5	0.3	4.5	5.6	20	19	23	9.4	7.6	18	2.2	33	1.4	8.6	0.7	210	210	21	35
BH408_1.0-1.5	1-1.5	31/08/2022	18	18	18	0.3	0.3	0.3	4.1	5.8	15	12	15	5.9	4.1	13	1.3	28	1.4	4.9	0.3	160	160	21	29
BH408_2.1-2.4	2.1-2.4	31/08/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
BH409_0.1-0.2	0.1-0.2	31/08/2022	1	1.1	1.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	0.8	0.9	0.3	0.3	0.3	<0.1	0.4	<0.1	0.3	<0.1	4.4	4.4	<0.1	0.6
BH409_0.4-0.6	0.4-0.6	31/08/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	0.1
HA410_0.1-0.2	0.1-0.2	31/08/2022	2.3	2.3	2.3	0.1	<0.1	<0.1	0.5	0.6	1.5	1.6	1.9	0.8	0.6	1.3	0.2	3.1	<0.1	0.7	0.1	18	18	1.9	2.9
BH412_0.1-0.2	0.1-0.2	1/09/2022	1.7	1.7	1.7	<0.1	<0.1	<0.1	0.3	0.3	0.9	1.2	1.5	0.6	0.5	0.9	0.2	1.8	<0.1	0.6	<0.1	11	11	0.8	1.8
HA413_0.2-0.3	0.2-0.3	1/09/2022	13	13	13	0.1	<0.1	<0.1	1.6	1.7	8.4	8.8	11	4.4	3.9	8.2	1.1	16	0.4	4.5	0.3	95	95	7.3	17
HA414_0.1-0.2	0.1-0.2	1/09/2022	1.1	1.1	1.1	<0.2	<0.2	<0.2	<0.2	<0.2	0.6	0.8	0.9	0.4	0.4	0.6	<0.2	1	<0.2	0.4	<0.2	7.1	7.1	0.4	1.1
BH414_1.0-1.1	1-1.1	1/09/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
BH415_0.1-0.2	0.1-0.2	1/09/2022	1.2	1.2	1.2	<0.1	<0.1	<0.1	0.1	0.1	0.3	0.9	0.9	0.3	0.6	0.3	0.1	0.3	<0.1	0.5	<0.1	5.1	5.1	0.1	0.4
HA416_0.1-0.2	0.1-0.2	1/09/2022	2.5	2.5	2.5	<0.1	<0.1	<0.1	0.5	0.6	1.6	1.7	2	0.9	0.7	1.4	0.2	3.3	0.2	0.8	<0.1	19	19	1.8	3.2
400QD2	HA416_0.1-0.2	1/09/2022	14	14	14	0.3	0.3	0.5	3.1	6.3	13	9.4	11	5	3.3	9.8	1.1	24	1.9	4.1	0.4	130	130	15	23
400QT2	HA416_0.1-0.2	31/08/2022	2.6	2.9	3.1	-	-	<0.5	<0.5	0.8	1.9	1.9	1.3	2.3	1.7	2	<0.5	4.8	<0.5	1.2	<0.5	26	-	3.3	4.6
HA417_0.1-0.2	0.1-0.2	1/09/2022	0.4	0.5	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.3	0.4	0.1	0.1	0.2	<0.1	0.3	<0.1	0.2	<0.1	2.3	2.3	0.1	0.4
HA417_0.4-0.5	0.4-0.5	1/09/2022	2.7	2.7	2.7	<0.1	<0.1	<0.1	0.3	0.4	1.6	1.8	2.1	0.9	0.9	1.4	0.2	2.8	<0.1	1	<0.1	18	18	1.2	2.8
HA418_0.15-0.25	0.15-0.25	1/09/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
HA418_0.7-0.8	0.7-0.8	1/09/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
BH419_0.5-0.6	0.5-0.6	5/09/2022	1.4	1.4	1.4	<0.1	<0.1	0.1	<0.1	0.2	1.0	1.0	1.1	0.5	0.7	0.9	0.2	1.8	<0.1	0.7	<0.1	9.3	9.3	0.8	1.8
BH420_0.5-0.5	0.5-0.6	5/09/2022	0.4	0.4	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.3	0.3	0.2	0.2	0.3	<0.1	0.6	<0.1	0.2	<0.1	2.8	2.8	0.3	0.6
BH421_0.5-0.6	0.5-0.6	5/09/2022	0.2	0.3	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.2	<0.1	0.1	0.2	<0.1	0.4	<0.1	0.1	<0.1	1.7	1.7	0.2	0.4
BH421_0.9-1.0	0.9-1.0	5/09/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
BH422_0.4-0.5	0.4-0.5	5/09/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
BH422_0.8-1.0	0.8-1.0	5/09/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
BH425M_0.5-0.7	0.5-0.7	5/09/2022	<0.2	0.3	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.2	<0.1	0.1	0.2	<0.1	0.4	<0.1	<0.1	<0.1	1.8	1.8	0.2	0.5
BH425M_1.5-1.6	1.5-1.6	5/09/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
BH425M_1.8-2.0	1.8-2.0	5/09/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
BH425M_4.0-4.2	4.0-4.2	5/09/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
400TB3		5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400TS4		5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP403_0.1	0.1	7/09/2022	1.6	1.6	1.7	<0.1	<0.1	0.3	<0.1	0.4	1.0	1.2	1.3	0.5	1.1	1.0	0.2	1.8	<0.1	0.9	<0.1	11	11	0.7	1.9
TP403_0.5	0.5	7/09/2022	0.3	0.4	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.3	0.3	0.1	0.2	0.2	<0.1	0.5	<0.1	0.2	<0.1	2.3	2.3	0.2	0.5
TP403_2.0	2	5/09/2022	0.5	0.6	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.4	0.4	0.2	0.2	0.3	<0.1	0.6	<0.1	0.3	<0.1	3.8	3.8	0.3	0.7
TP423_0.1	0.1	7/09/2022	4.2	4.2	4.2	<0.1	<0.1	0.6	<0.1	0.6	2.9	3.2	3.6	1.4	2.2	2.8	0.5	5.0	0.1	2.2	<0.1	27	27	2.1	5.2
TP423_1.0	1	7/09/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	-	-
TP424_0.1-0.2	0.1-0.2	7/09/2022	0.5	0.6	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	0.4	0.5	0.2	0.3	0.4	<0.1	0.8	<0.1	0.3	<0.1	3.7	3.7	0.3	0.7
TP424_0.5	0.5	7/09/2022	0.7	0.8	0.9	<0.1	<0.1	0.1	<0.1	0.1	0.6	0.6	0.7	0.3	0.5	0.5	<0.1	1.1	<0.1	0.4	<0.1	5.5	5.5	0.4	1.1
TP424_1.5	1.5	7/09/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
TP424_2.5	2.5	7/09/2022	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.8	<0.1	<0.1
TP427_0.1	0.1	7/09/2022	0.4	0.5	0.5	<0.1	<0.1	<0.1	<0.1	0.1	0.3	0.3	0.4	0.2	0.3	0.3	<0.1	0.7	<0.1	0.2	<0.1	3.4	3.4	0.4	0.7
TP427_0.5	0.5	7/09/2022	3	3	3	<0.1	<0.1	0.3	<0.1	0.4	2.0	2.2	2.6	1.1	1.6	2.1	0.4	3.6	<0.1	1.6	<0.1	19	19	1.5	3.8
400QD3(QA101)	TP403_0.5	5/09/2022	0.4	0.4	0.5	<0.1	<0.1	<0.1	<0.1	0.1	0.3	0.3	0.3	0.1	0.3	0.3	<0.1	0.6	<0.1	0.2	<0.1	2.9	2.9	0.4	0.6
400QT3(QA101)	TP403_0.5	5/09/2022	0.7	1	1.3	-	-	<0.5	<0.5	<0.5	0.6	0.6	<0.5	0.6	<0.5	0.6	<0.5	0.8	<0.5	<0.5	<0.5	5	-	0.6	1.2
400TB5		7/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400TS6		7/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

			Metals								Phenols	OCP																	
			Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc	Phenol (total)	Vic EPA IWRG 621 Other OCP (Total)*	Vic EPA IWRG 621 OCP (Total)*	4,4-DDE	Aldrin	Aldrin + Dieldrin	Chlordane	gamma-Chlordane	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Heptachlor	Hexachlorobenzene	Methoxychlor	Toxaphene
			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
LOR			1	0.3	0.5	0.5	1	0.05	0.5	2	0.5	0.1	0.1	0.05	0.05	0.05	0.1	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.5
NEPM 2013 EIL Comm./Ind., low pH, CEC, clay content - fresh																													
0-2m			160		680	170	1800		290	750									640[#1]										
NEPM 2013 EIL UR/POS, low pH, CEC, clay content - fresh																													
0-2m			100		410	160	1100		170	520									180[#1]										
NSW 2014 General Solid Waste CT1 (No Leaching)			100	20	100		100	4	40													60[#3]	60[#3]	60[#3]					
NSW 2014 General Solid Waste SCC1 (with leached)			500	100	1900		1500	50	1050		518											108	108	108					
NSW 2014 Restricted Solid Waste CT2 (No Leaching)			400	80	400		400	16	160													240[#3]	240[#3]	240[#3]					
NSW 2014 Restricted Solid Waste SCC2 (with leached)			2000	400	7600		6000	200	4200		2073											432	432	432					
PFAS NEMP 2.0 Table 2 Health Industrial/Commercial (HIL C)																													
PFAS NEMP 2.0 Table 2 Health Residential min soil access (HIL B)																													
PFAS NEMP 2.0 Table 3 Ecological Direct Exposure - All Land Uses																													
PFAS NEMP 2.0 Table 3 Ecological Indirect Exposure - All Land Uses																													
NEPM 2013 ESL Comm./Ind., Fine Soil																													
0-2m																													
NEPM 2013 ESL UR/POS, Fine Soil																													
0-2m																													
NEPM 2013 HIL, Commercial/Industrial D			3000[#9]	900		240000	1500[#10]	730[#11]	6000	400000	240000					45	530			3600					100	50	80	2500	160
NEPM 2013 HIL, Recreational C			300[#9]	90		17000	600[#10]	80[#11]	1200	30000	40000					10	70			400					20	10	10	400	30
NEPM 2013 HIL, Residential B			500[#9]	150		30000	1200[#10]	120[#11]	1200	60000	45000					10	90			600					20	10	15	500	30
NEPM 2013 Soil HSL Residential A&B, for Vapour Intrusion, Sand																													
0-1m																													
1-2m																													
2-4m																													
>4m																													
NEPM 2013 Management Limits, C/I, Fine Soil																													
NEPM 2013 Management Limits, R/P&POS, Fine Soil																													
Field_ID	**Sample_Depth_Range**	**Sampled_Date_Time**																											
BH302_0.1	0.1	29/11/2021	3	<0.4	15	52	34	0.2	31	65	<0.5	<1	<1	<0.5	<0.5	<0.5	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
BH302_1	1	29/11/2021	9.1	<0.4	31	19	25	<0.1	5.7	17	<0.5	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH302_3.5	3.5	29/11/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH303_0.5	0.5	3/12/2021	3.6	<0.4	24	27	38	<0.1	20	66	<0.5	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH303_3.5	3.5	3/12/2021	41	<0.4	28	34	37	<0.1	5.1	43	<0.5	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH303_5.0	5	3/12/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH304_0.5	0.5	29/11/2021	8.3	<0.4	15	9.8	130	0.2	<5	57	<0.5	<1	<1	<0.5	<0.5	<0.5	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
BH304_3	3	29/11/2021	6.1	<0.4	18	6	20	<0.1	6.1	20	<0.5	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH305A_0.1	0.1	30/11/2021	4.1	<0.4	14	71	39	0.2	9.7	110	<0.5	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH305A_2.0	2	30/11/2021	8.1	<0.4	36	7.2	36	<0.1	10	17	<0.5	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH306_0.1	0.1	2/12/2021	5.2	<0.4	14	20	77	0.2	6.5	71	<0.5	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH306_1.5	1.5	2/12/2021	6.7	<0.4	24	<5	27	<0.1	7.7	9.7	<0.5	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH306_5.0	5	2/12/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA01_0.5	0.5	27/04/2022	2.2	< 0.4	9.9	6.6	10	< 0.1	< 5	19	-	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.1		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5
HA01_1	1	27/04/2022	6.8	< 0.4	21	9.4	44	0.2	5.3	18	-	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.1		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5
HA02_0.3	0.3	27/04/2022	11	< 0.4	28	360	87	0.2	12	270	-	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.1		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5
HA02_0.8	0.8	27/04/2022	< 2	< 0.4	< 5	22	35	0.2	11	180	-	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.1		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5
HA02_1.6	1.6	27/04/2022	9.2	< 0.4	10	17	45	< 0.1	< 5	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH317_0.0-0.2	0-0.2	10/06/2022	6.5	<0.4	13	53	110	0.2	9.4	130	<0.5	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH317_1.0-1.1	1-1.1	10/06/2022	7.6	<0.4	23	13	60	0.1	5.5	32	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH318_0.0-0.2	0-0.2	10/06/2022	11	<0.4	16	75	140	0.4	11	190	<0.5	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH318_0.5-0.7	0.5-0.7	10/06/2022	9.6	<0.4	23	15	97	0.4	5.2	61	<0.5	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH319_0.0-0.2	0-0.2	10/06/2022	<2	<0.4	21	50	6.5	<0.1	94	59	<0.5	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH319_1.0-1.1	1-1.1	10/06/2022	8.1	<0.4	19	6.3	39	<0.1	<5	8.4	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH320_0-0.2	0-0.2	10/06/2022	42	0.5	17	460	730	1	10	290	<0.5	<0.1	0.14	0.08	<0.05	<0.05	<0.1	-	0.06	0.14	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
BH320_1.0-1.1	1-1.1	10/06/2022	7.7	<0.4	25	<5	35	<0.1	<5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA401_0.1-0.2	0.1-0.2	31/08/2022	2	<0.3	7.5	9.9	13	<0.05	4.8	35	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
HA401_0.4-0.45	0.4-0.45	31/08/2022	4	<0.3	7.2	16	28	0.08	5.1	34	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
HA402_0.3-0.5	0.3-0.5	31/08/2022	3	<0.3	9.6	18	30	<0.05	6.9	39	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
BH402_2.1-2.5	2.1-2.5	31/08/2022	<1	<0.3	2	13	8	<0.05	<0.5	3.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA404_0.1-0.2	0.1-0.2	31/08/2022	1	<0.3	4.5	7.6	7	<0.05	2.2	17	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
HA405_0.1-0.2	0.1-0.2	31/08/2022	2	<0.3	5.5	4.3	6	<0.05	2.8	11	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
400QD1	BH405_0.1-0.2	31/08/2022	2	<0.3	6.2	5.8	7	<0.05	3.4	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400QT1	BH405_0.1-0.2	31/08/2022	<2	<0.4	8.3	7.1	9.1	<0.1	<5	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA406_0.1-0.2	0.1-0.2	31/08/2022	2	<0.3	6.5	13	10	<0.05	3.8	42	0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
HA406_0.75-0.9	0.75-0.9	31/08/2022	4	<0.3	7.1	20	45	0.05	4.8	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH408_0.1-0.2	0.1-0.2	31/08/2022	7	0.4	9.9	48	260	0.96	5.5	210	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
BH408_1.0-1.5	1-1.5	31/08/2022	5	<0.3	13	21	180	1.1	3.4	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH408_2.1-2.4	2.1-2.4	31/08/2022	5	<0.3	7.5	24	14	<0.05	<0.5	6.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH409_0.1-0.2	0.1-0.2	31/08/2022	2	<0.3	6.2	4.8	4	<0.05	<0.5	7.8	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
BH409_0.4-0.6	0.4-0.6	31/08/2022	5	<0.3	9.8	5.2	21	<0.05	0.7	8.1	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
HA410_0.1-0.2	0.1-0.2	31/08/2022	6	0.4	14	370	290	0.82	5.4	160	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
BH412_0.1-0.2	0.1-0.2	1/09/2022	5	1.5	13	3400	470	9.6	11	400	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
HA413_0.2-0.3	0.2-0.3	1/09/2022	6	<0.3	17	16	76	0.25	2.6	34	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
HA414_0.1-0.2	0.1-0.2	1/09/2022	15	0.9	73	970	350	0.42	16	2400	2	-	<2	<0.2	<0.2	-	-	<0.2	<0.2	-	<0.4	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH414_1.0-1.1	1-1.1	1/09/2022	3	<0.3	4.2	3	11	<0.05	<0.5	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH415_0.1-0.2	0.1-0.2	1/09/2022	5	<0.3	9.4	72	110	0.88	8.1	160	<0.5	-	**5**	<0.1	**0.4**	-	-	<0.1	<0.1	-	**4.8**	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
HA416_0.1-0.2	0.1-0.2	1/09/2022	7	0.5	15	46	300	2.2	5.6	170	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
400QD2	HA416_0.1-0.2	1/09/2022	8	0.9	15	67	340	3.8	7	330	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400QT2	HA416_0.1-0.2	31/08/2022	10	0.8	19	72	460	5.7	8.3	320	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA417_0.1-0.2	0.1-0.2	1/09/2022	3	0.3	15	65	44	0.42	7.8	150	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
HA417_0.4-0.5	0.4-0.5	1/09/2022	7	<0.3	14	30	110	0.39	4.3	89	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
HA418_0.15-0.25	0.15-0.25	1/09/2022	5	<0.3	14	14	23	<0.05	3.6	32	<0.5	-	<1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
HA418_0.7-0.8	0.7-0.8	1/09/2022	6	<0.3	14	27	12	<0.05	<0.5	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH419_0.5-0.6	0.5-0.6	5/09/2022	14	<0.3	16	63	79	0.3	12	89	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
BH420_0.5-0.5	0.5-0.6	5/09/2022	8	<0.3	13	45	64	0.25	15	75	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
BH421_0.5-0.6	0.5-0.6	5/09/2022	5	<0.3	7.4	19	19	<0.05	23	35	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
BH421_0.9-1.0	0.9-1.0	5/09/2022	4	<0.3	14	6.4	37	<0.05	1.5	7.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH422_0.4-0.5	0.4-0.5	5/09/2022	5	<0.3	17	2	16	<0.05	1.1	5.7	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
BH422_0.8-1.0	0.8-1.0	5/09/2022	2	<0.3	9.9	2.7	16	<0.05	2.5	11	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
BH425M_0.5-0.7	0.5-0.7	5/09/2022	4	<0.3	11	16	22	0.08	6.9	58	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
BH425M_1.5-1.6	1.5-1.6	5/09/2022	4	<0.3	15	10	15	<0.05	1.6	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH425M_1.8-2.0	1.8-2.0	5/09/2022	18	<0.3	11	17	15	<0.05	<0.5	5.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH425M_4.0-4.2	4.0-4.2	5/09/2022	-	-	-	-	15	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400TB3		5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400TS4		5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP403_0.1	0.1	7/09/2022	3	0.7	7.8	30	85	0.18	6.2	89	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
TP403_0.5	0.5	7/09/2022	3	<0.3	16	21	61	0.23	13	46	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
TP403_2.0	2	5/09/2022	6	<0.3	9.2	25	170	0.27	4.9	160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP423_0.1	0.1	7/09/2022	11	0.7	19	74	300	2.4	9	290	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
TP423_1.0	1	7/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP424_0.1-0.2	0.1-0.2	7/09/2022	7	<0.3	19	64	71	0.27	16	130	0.8	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
TP424_0.5	0.5	7/09/2022	4	<0.3	36	24	67	0.24	23	69	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
TP424_1.5	1.5	7/09/2022	5	<0.3	16	11	23	0.08	3.9	12	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
TP424_2.5	2.5	7/09/2022	5	<0.3	23	14	15	<0.05	0.9	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP427_0.1	0.1	7/09/2022	3	<0.3	11	20	36	0.06	6.3	56	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
TP427_0.5	0.5	7/09/2022	7	<0.3	13	22	140	0.34	3.1	45	<0.5	<1	<1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	-
400QD3(QA101)	TP403_0.5	5/09/2022	3	<0.3	7.2	21	50	1.3	4.1	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400QT3(QA101)	TP403_0.5	5/09/2022	7.3	<0.4	17	31	800	0.6	10	160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400TB5		7/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400TS6		7/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

			Organophosphorous Pesticides						Herbicides	Pesticides				PFAS										Polychlorinated Biphenyls
			Tokuthion	Azinophos methyl	Bolstar (Sulprofos)	Bromophos-ethyl	Chlorfenvinphos	Chlorpyrifos	Dinoseb	Isodrin	Mirex	Parathion	Pirimiphos-methyl	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoate (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Sum of PFAS	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	PCBs (Sum of total)
			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
LOR			0.2	0.2	0.2	0.2	0.2	0.2	20	0.1	0.1	0.2	0.2	0.0016	0.0016	0.0008	0.0016	0.0016	0.08	0.0016	0.005	0.005	0.1
NEPM 2013 EIL Comm./Ind., low pH, CEC, clay content - fresh																							
0-2m																							
NEPM 2013 EIL UR/POS, low pH, CEC, clay content - fresh																							
0-2m																							
NSW 2014 General Solid Waste CT1 (No Leaching)								4															<50
NSW 2014 General Solid Waste SCC1 (with leached)								7.5															<50
NSW 2014 Restricted Solid Waste CT2 (No Leaching)								16															<50
NSW 2014 Restricted Solid Waste SCC2 (with leached)								30						7.2	7.2	72							<50
PFAS NEMP 2.0 Table 2 Health Industrial/Commercial (HIL C)																10				1			
PFAS NEMP 2.0 Table 2 Health Residential min soil access (HIL B)																20				2			
PFAS NEMP 2.0 Table 3 Ecological Direct Exposure - All Land Uses															1	10							
PFAS NEMP 2.0 Table 3 Ecological Indirect Exposure - All Land Uses															0.01								
NEPM 2013 ESL Comm./Ind., Fine Soil																							
0-2m																							
NEPM 2013 ESL UR/POS, Fine Soil																							
0-2m																							
NEPM 2013 HIL, Commercial/Industrial D								2000			100												7[#13]
NEPM 2013 HIL, Recreational C								250			20												1[#13]
NEPM 2013 HIL, Residential B								340			20												1[#13]
NEPM 2013 Soil HSL Residential A&B, for Vapour Intrusion, Sand																							
0-1m																							
1-2m																							
2-4m																							
>4m																							
NEPM 2013 Management Limits, C/I, Fine Soil																							
NEPM 2013 Management Limits, R/P&POS, Fine Soil																							
Field_ID	**Sample_Depth_Range**	**Sampled_Date_Time**																					
BH302_0.1	0.1	29/11/2021	<0.5	<0.5	<0.5	-	<0.5	<0.5	<20	-	-	<0.5	<0.5	-	-	-	-	-	-	-	-	-	<1
BH302_1	1	29/11/2021	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	-	-	-	-	-	-	-	-	-	<0.1
BH302_3.5	3.5	29/11/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH303_0.5	0.5	3/12/2021	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	-	-	-	-	-	-	-	-	-	<0.1
BH303_3.5	3.5	3/12/2021	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	-	-	-	-	-	-	-	-	-	<0.1
BH303_5.0	5	3/12/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH304_0.5	0.5	29/11/2021	<0.5	<0.5	<0.5	-	<0.5	<0.5	<20	-	-	<0.5	<0.5	-	-	-	-	-	-	-	-	-	<1
BH304_3	3	29/11/2021	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	-	-	-	-	-	-	-	-	-	<0.1
BH305A_0.1	0.1	30/11/2021	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	-	-	-	-	-	-	-	-	-	<0.1
BH305A_2.0	2	30/11/2021	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	-	-	-	-	-	-	-	-	-	<0.1
BH306_0.1	0.1	2/12/2021	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	-	-	-	-	-	-	-	-	-	<0.1
BH306_1.5	1.5	2/12/2021	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	-	-	-	-	-	-	-	-	-	<0.1
BH306_5.0	5	2/12/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA01_0.5	0.5	27/04/2022	< 0.2	< 0.2	< 0.2	-	< 0.2	< 0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA01_1	1	27/04/2022	< 0.2	< 0.2	< 0.2	-	< 0.2	< 0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA02_0.3	0.3	27/04/2022	< 0.2	< 0.2	< 0.2	-	< 0.2	< 0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA02_0.8	0.8	27/04/2022	< 0.2	< 0.2	< 0.2	-	< 0.2	< 0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA02_1.6	1.6	27/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH317_0.0-0.2	0-0.2	10/06/2022	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.005	<0.1
BH317_1.0-1.1	1-1.1	10/06/2022	-	-	-	-	-	-	<20	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH318_0.0-0.2	0-0.2	10/06/2022	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	<0.005	0.006	<0.005	-	-	-	0.006	0.006	0.006	<0.1
BH318_0.5-0.7	0.5-0.7	10/06/2022	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	-	-	-	-	-	-	-	-	-	<0.1
BH319_0.0-0.2	0-0.2	10/06/2022	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.005	<0.1
BH319_1.0-1.1	1-1.1	10/06/2022	-	-	-	-	-	-	<20	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH320_0-0.2	0-0.2	10/06/2022	<0.2	<0.2	<0.2	-	<0.2	<0.2	<20	-	-	<0.2	<0.2	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.005	<0.1
BH320_1.0-1.1	1-1.1	10/06/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA401_0.1-0.2	0.1-0.2	31/08/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
HA401_0.4-0.45	0.4-0.45	31/08/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
HA402_0.3-0.5	0.3-0.5	31/08/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	<0.0016	<0.0016	<0.0008	<0.0016	<0.0016	<0.08	<0.0016	-	-	<1
BH402_2.1-2.5	2.1-2.5	31/08/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA404_0.1-0.2	0.1-0.2	31/08/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
HA405_0.1-0.2	0.1-0.2	31/08/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
400QD1	BH405_0.1-0.2	31/08/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400QT1	BH405_0.1-0.2	31/08/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA406_0.1-0.2	0.1-0.2	31/08/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
HA406_0.75-0.9	0.75-0.9	31/08/2022	-	-	-	-	-	-	-	-	-	-	-	<0.0016	<0.0016	<0.0008	<0.0016	<0.0016	<0.08	<0.0016	-	-	-
BH408_0.1-0.2	0.1-0.2	31/08/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
BH408_1.0-1.5	1-1.5	31/08/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH408_2.1-2.4	2.1-2.4	31/08/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH409_0.1-0.2	0.1-0.2	31/08/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	<0.0016	<0.0016	<0.0008	<0.0016	<0.0016	<0.08	<0.0016	-	-	<1
BH409_0.4-0.6	0.4-0.6	31/08/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
HA410_0.1-0.2	0.1-0.2	31/08/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
BH412_0.1-0.2	0.1-0.2	1/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
HA413_0.2-0.3	0.2-0.3	1/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	<0.0016	<0.0016	<0.0008	<0.0016	<0.0016	<0.08	<0.0016	-	-	<1
HA414_0.1-0.2	0.1-0.2	1/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2	<0.2	-	<0.0016	0.0057	0.0015	0.0024	0.0075	<0.08	0.0057	-	-	<2
BH414_1.0-1.1	1-1.1	1/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1
BH415_0.1-0.2	0.1-0.2	1/09/2022	-	<0.2	-	<0.2	-	1	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
HA416_0.1-0.2	0.1-0.2	1/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
400QD2	HA416_0.1-0.2	1/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400QT2	HA416_0.1-0.2	31/08/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA417_0.1-0.2	0.1-0.2	1/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
HA417_0.4-0.5	0.4-0.5	1/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
HA418_0.15-0.25	0.15-0.25	1/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
HA418_0.7-0.8	0.7-0.8	1/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH419_0.5-0.6	0.5-0.6	5/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	<0.0016	<0.0016	<0.0008	<0.0016	<0.0016	<0.08	<0.0016	-	-	<1
BH420_0.5-0.5	0.5-0.6	5/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
BH421_0.5-0.6	0.5-0.6	5/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
BH421_0.9-1.0	0.9-1.0	5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH422_0.4-0.5	0.4-0.5	5/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
BH422_0.8-1.0	0.8-1.0	5/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
BH425M_0.5-0.7	0.5-0.7	5/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
BH425M_1.5-1.6	1.5-1.6	5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH425M_1.8-2.0	1.8-2.0	5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH425M_4.0-4.2	4.0-4.2	5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400TB3		5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400TS4		5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP403_0.1	0.1	7/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	<0.0016	<0.0016	<0.0008	<0.0016	<0.0016	<0.08	<0.0016	-	-	<1
TP403_0.5	0.5	7/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	<0.0016	<0.0016	<0.0008	<0.0016	<0.0016	<0.08	<0.0016	-	-	<1
TP403_2.0	2	5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP423_0.1	0.1	7/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	<0.0016	0.0060	0.0022	<0.0016	0.0021	<0.08	0.0060	-	-	<1
TP423_1.0	1	7/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP424_0.1-0.2	0.1-0.2	7/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
TP424_0.5	0.5	7/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
TP424_1.5	1.5	7/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
TP424_2.5	2.5	7/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP427_0.1	0.1	7/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
TP427_0.5	0.5	7/09/2022	-	<0.2	-	<0.2	-	<0.2	-	<0.1	<0.1	<0.2	-	-	-	-	-	-	-	-	-	-	<1
400QD3(QA101)	TP403_0.5	5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400QT3(QA101)	TP403_0.5	5/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400TB5		7/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400TS6		7/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

			Asbestos										
			Approximate Sample Mass	Asbestos from ACM in Soil (>7mm)	Asbestos from FA & AF in Soil (>2mm to <7mm)	Asbestos from FA & AF in Soil (<2mm)	Asbestos Reported Result	Organic/ Syntehtic Fibres - Comment	Bonded ACM in >7mm Sample	AF/FA in >2mm to <7mm Sample	AF/FA in <2mm Sample	Respirable Fibres - Comment
			g	%w/w	%w/w	%w/w	Comment	Comment	g	g	g	Comment
LOR												
NEPM 2013 EIL Comm./Ind., low pH, CEC, clay content - fresh												
0-2m												
NEPM 2013 EIL UR/POS, low pH, CEC, clay content - fresh												
0-2m												
NSW 2014 General Solid Waste CT1 (No Leaching)												
NSW 2014 General Solid Waste SCC1 (with leached)												
NSW 2014 Restricted Solid Waste CT2 (No Leaching)												
NSW 2014 Restricted Solid Waste SCC2 (with leached)												
PFAS NEMP 2.0 Table 2 Health Industrial/Commercial (HIL C)												
PFAS NEMP 2.0 Table 2 Health Residential min soil access (HIL B)												
PFAS NEMP 2.0 Table 3 Ecological Direct Exposure - All Land Uses												
PFAS NEMP 2.0 Table 3 Ecological Indirect Exposure - All Land Uses												
NEPM 2013 ESL Comm./Ind., Fine Soil												
0-2m												
NEPM 2013 ESL UR/POS, Fine Soil												
0-2m												
NEPM 2013 HIL, Commercial/Industrial D				0.05	0.0001	0.0001						
NEPM 2013 HIL, Recreational C				0.02	0.001	0.001						
NEPM 2013 HIL, Residential B				0.04	0.001	0.001						
NEPM 2013 Soil HSL Residential A&B, for Vapour Intrusion, Sand												
0-1m												
1-2m												
2-4m												
>4m												
NEPM 2013 Management Limits, C/I, Fine Soil												
NEPM 2013 Management Limits, R/P&POS, Fine Soil												
Field_ID	**Sample_Depth_Range**	**Sampled_Date_Time**										
BH302_0.1	0.1	29/11/2021	155	0.0E0	0.0E0	0.0E0	No asbestos detected at the reporting limit of 0.01% w/w.Organic fibre detected.No trace asbestos detected.	Organic fibres detected.	0.0E0	0.0E0	0.0E0	No trace asbestos detected.
BH302_1	1	29/11/2021	263	0.0E0	0.0E0	0.0E0	No asbestos detected at the reporting limit of 0.01% w/w.Organic fibre detected.No trace asbestos detected.	Organic fibres detected.	0.0E0	0.0E0	0.0E0	No trace asbestos detected.
BH302_3.5	3.5	29/11/2021	-	-	-	-	-	-	-	-	-	-
BH303_0.5	0.5	3/12/2021	171	0.0E0	0.0E0	0.0E0	No asbestos detected at the reporting limit of 0.01% w/w.Organic fibre detected.No trace asbestos detected.	Nil	0.0E0	0.0E0	0.0E0	No trace asbestos detected.
BH303_3.5	3.5	3/12/2021	-	-	-	-	-	-	-	-	-	-
BH303_5.0	5	3/12/2021	-	-	-	-	-	-	-	-	-	-
BH304_0.5	0.5	29/11/2021	987	0.0E0	0.0E0	0.0E0	No asbestos detected at the reporting limit of 0.01% w/w.Organic fibre detected.No trace asbestos detected.	Organic fibres detected.	0.0E0	0.0E0	0.0E0	No trace asbestos detected.
BH304_3	3	29/11/2021	784	0.0E0	0.0E0	0.0E0	No asbestos detected at the reporting limit of 0.01% w/w.Organic fibre detected.No trace asbestos detected.	Organic fibres detected.	0.0E0	0.0E0	0.0E0	No trace asbestos detected.
BH305A_0.1	0.1	30/11/2021	101	0.0E0	0.0E0	0.0E0	No asbestos detected at the reporting limit of 0.01% w/w.Organic fibre detected.No trace asbestos detected.	Organic fibres detected.	0.0E0	0.0E0	0.0E0	0.0E0
BH305A_2.0	2	30/11/2021	-	-	-	-	-	-	-	-	-	-
BH306_0.1	0.1	2/12/2021	387	0.0E0	0.0E0	0.0E0	No asbestos detected at the reporting limit of 0.01% w/w.Organic fibre detected.No trace asbestos detected.	Nil	0.0E0	0.0E0	0.0E0	No trace asbestos detected.
BH306_1.5	1.5	2/12/2021	-	-	-	-	-	-	-	-	-	-
BH306_5.0	5	2/12/2021	-	-	-	-	-	-	-	-	-	-
HA01_0.5	0.5	27/04/2022	409				No asbestos detected at the reporting limit of 0.01% w/w. Organic fibre detected. No trace asbestos detected.	Organic fibre detected	-	-	-	No trace asbestos detected.
HA01_1	1	27/04/2022	-	-	-	-	-	-	-	-	-	-
HA02_0.3	0.3	27/04/2022	-	-	-	-	-	-	-	-	-	-
HA02_0.8	0.8	27/04/2022	487				No asbestos detected at the reporting limit of 0.01% w/w. Organic fibre detected. No trace asbestos detected.	Organic fibre detected	-	-	-	No trace asbestos detected.
HA02_1.6	1.6	27/04/2022	-	-	-	-	-	-	-	-	-	-
BH317_0.0-0.2	0-0.2	10/06/2022	97	0.0E0	0.0E0	0.0E0	No asbestos detected at the reporting limit of 0.01% w/w.Organic fibre detected.No trace asbestos detected.	Organic fibres detected.	0.0E0	0.0E0	0.0E0	No trace asbestos detected.
BH317_1.0-1.1	1-1.1	10/06/2022	-	-	-	-	-	-	-	-	-	-
BH318_0.0-0.2	0-0.2	10/06/2022	49	0.0E0	0.0E0	0.0E0	No asbestos detected at the reporting limit of 0.01% w/w.Organic fibre detected.No trace asbestos detected.	Organic fibres detected.	0.0E0	0.0E0	0.0E0	No trace asbestos detected.
BH318_0.5-0.7	0.5-0.7	10/06/2022	-	-	-	-	-	-	-	-	-	-
BH319_0.0-0.2	0-0.2	10/06/2022	122	0.0E0	0.0E0	0.0E0	No asbestos detected at the reporting limit of 0.01% w/w.Organic fibre detected.No trace asbestos detected.	Organic fibres detected.	0.0E0	0.0E0	0.0E0	No trace asbestos detected.
BH319_1.0-1.1	1-1.1	10/06/2022	-	-	-	-	-	-	-	-	-	-
BH320_0-0.2	0-0.2	10/06/2022	127	0.0E0	0.0E0	0.0E0	No asbestos detected at the reporting limit of 0.01% w/w.Organic fibre detected.No trace asbestos detected.	Organic fibres detected.	0.0E0	0.0E0	0.0E0	-
BH320_1.0-1.1	1-1.1	10/06/2022	-	-	-	-	-	-	-	-	-	-
HA401_0.1-0.2	0.1-0.2	31/08/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	Organic fibres detected.	-	-	-	-
HA401_0.4-0.45	0.4-0.45	31/08/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
HA402_0.3-0.5	0.3-0.5	31/08/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	Organic fibres detected.	-	-	-	-
BH402_2.1-2.5	2.1-2.5	31/08/2022	-	-	-	-	-	-	-	-	-	-
HA404_0.1-0.2	0.1-0.2	31/08/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	Organic fibres detected.	-	-	-	-
HA405_0.1-0.2	0.1-0.2	31/08/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	Organic fibres detected.	-	-	-	-
400QD1	BH405_0.1-0.2	31/08/2022	-	-	-	-	-	-	-	-	-	-
400QT1	BH405_0.1-0.2	31/08/2022	-	-	-	-	-	-	-	-	-	-
HA406_0.1-0.2	0.1-0.2	31/08/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	Organic fibres detected.	-	-	-	-
HA406_0.75-0.9	0.75-0.9	31/08/2022	-	-	-	-	-	-	-	-	-	-
BH408_0.1-0.2	0.1-0.2	31/08/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	Organic fibres detected.	-	-	-	-
BH408_1.0-1.5	1-1.5	31/08/2022	-	-	-	-	-	-	-	-	-	-
BH408_2.1-2.4	2.1-2.4	31/08/2022	-	-	-	-	-	-	-	-	-	-
BH409_0.1-0.2	0.1-0.2	31/08/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
BH409_0.4-0.6	0.4-0.6	31/08/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	Organic fibres detected.	-	-	-	-
HA410_0.1-0.2	0.1-0.2	31/08/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
BH412_0.1-0.2	0.1-0.2	1/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	Organic fibres detected.	-	-	-	-
HA413_0.2-0.3	0.2-0.3	1/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	Organic fibres detected.	-	-	-	-
HA414_0.1-0.2	0.1-0.2	1/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	Organic fibres detected.	-	-	-	-
BH414_1.0-1.1	1-1.1	1/09/2022	-	-	-	-	-	-	-	-	-	-
BH415_0.1-0.2	0.1-0.2	1/09/2022	421	0.22	<0.001	<0.001	45x20x3mm cement sheet fragment detected. No respirable fibres detected.	-	6.06	<0.00001	<0.00001	Chrysotile asbetos detected
HA416_0.1-0.2	0.1-0.2	1/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
400QD2	HA416_0.1-0.2	1/09/2022	-	-	-	-	-	-	-	-	-	-
400QT2	HA416_0.1-0.2	31/08/2022	-	-	-	-	-	-	-	-	-	-
HA417_0.1-0.2	0.1-0.2	1/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
HA417_0.4-0.5	0.4-0.5	1/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
HA418_0.15-0.25	0.15-0.25	1/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
HA418_0.7-0.8	0.7-0.8	1/09/2022	-	-	-	-	-	-	-	-	-	-
BH419_0.5-0.6	0.5-0.6	5/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
BH420_0.5-0.5	0.5-0.6	5/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
BH421_0.5-0.6	0.5-0.6	5/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
BH421_0.9-1.0	0.9-1.0	5/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
BH422_0.4-0.5	0.4-0.5	5/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
BH422_0.8-1.0	0.8-1.0	5/09/2022	-	-	-	-	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	-	-	-	-
BH425M_0.5-0.7	0.5-0.7	5/09/2022	620	<0.01	<0.001	<0.001	No asbestos detected at the reporting limit of 0.01% w/w. No respirable fibres detected.	-	<0.001	<0.00001	<0.00001	No asbestos detected.
BH425M_1.5-1.6	1.5-1.6	5/09/2022	-	-	-	-	-	-	-	-	-	-
BH425M_1.8-2.0	1.8-2.0	5/09/2022	-	-	-	-	-	-	-	-	-	-
BH425M_4.0-4.2	4.0-4.2	5/09/2022	-	-	-	-	-	-	-	-	-	-
400TB3		5/09/2022	-	-	-	-	-	-	-	-	-	-
400TS4		5/09/2022	-	-	-	-	-	-	-	-	-	-
TP403_0.1	0.1	7/09/2022	573	<0.01	<0.001	<0.001	No asbestos detected at the reporting limit of 0.01% w/w.	-	<0.001	<0.00001	<0.00001	No asbestos detected.
TP403_0.5	0.5	7/09/2022	492	<0.01	<0.001	<0.001	No asbestos detected at the reporting limit of 0.01% w/w.	-	<0.001	<0.00001	<0.00001	No asbestos detected.
TP403_2.0	2	5/09/2022	-	-	-	-	-	-	-	-	-	-
TP423_0.1	0.1	7/09/2022	395	<0.01	<0.001	<0.001	No asbestos detected at the reporting limit of 0.01% w/w.	-	<0.001	<0.00001	<0.00001	No asbestos detected.
TP423_1.0	1	7/09/2022	471	<0.01	<0.001	<0.001	No asbestos detected at the reporting limit of 0.01% w/w.	-	<0.001	<0.00001	<0.00001	No asbestos detected.
TP424_0.1-0.2	0.1-0.2	7/09/2022	438	<0.01	<0.001	<0.001	No asbestos detected at the reporting limit of 0.01% w/w.	-	<0.001	<0.00001	<0.00001	No asbestos detected.
TP424_0.5	0.5	7/09/2022	529	<0.01	<0.001	<0.001	No asbestos detected at the reporting limit of 0.01% w/w.	-	<0.001	<0.00001	<0.00001	No asbestos detected.
TP424_1.5	1.5	7/09/2022	388	<0.01	<0.001	<0.001	No asbestos detected at the reporting limit of 0.01% w/w.	-	<0.001	<0.00001	<0.00001	No asbestos detected.
TP424_2.5	2.5	7/09/2022	-	-	-	-	-	-	-	-	-	-
TP427_0.1	0.1	7/09/2022	691	<0.01	<0.001	<0.001	No asbestos detected at the reporting limit of 0.01% w/w.	-	<0.001	<0.00001	<0.00001	No asbestos detected.
TP427_0.5	0.5	7/09/2022	-	-	-	-	-	-	-	-	-	-
400QD3(QA101)	TP403_0.5	5/09/2022	-	-	-	-	-	-	-	-	-	-
400QT3(QA101)	TP403_0.5	5/09/2022	-	-	-	-	-	-	-	-	-	-
400TB5		7/09/2022	-	-	-	-	-	-	-	-	-	-
400TS6		7/09/2022	-	-	-	-	-	-	-	-	-	-

				TPH					CRC Care TPH Fractions							BTEX								
				C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	C6-C10	C10-C16	C16-C34 (F3)	C34-C40 (F4)	C10 - C40 (Sum of total)	F1: C6-C10 less BTEX	F2: >C10-C16 less NAPHTHALENE	Naphthalene (VOC)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Total BTEX	Xylene Total	Total Phenols
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	ug/L	µg/L
EQL				10	50	100	100	50	10	50	100	100	50	10	50	0.5	0.5	0.5	0.5	1	0.5	3	1.5	50
ANZG (2018) Freshwater 95% toxicant DGVs																	950	180	80	275	350			
ANZG (2018) Freshwater 99% toxicant DGVs																	600	110			200			
PFAS NEMP (2020) Freshwater 95% Exposure Scenario																								
ANZG (2018) Marine water 95% toxicant DGVs																								
ANZG (2018) Marine water 99% toxicant DGVs																								
PFAS NEMP (2020) Interim Marine 95% Exposure Scenario																								
ADWG 2019 Health																	1	800	300				600	
AS2159-2009 Piling - Design and Installation, Table 6.4.2(c)																								
Non-aggressive																								
Mild																								
Moderate																								
Severe																								
NEPM 2013 GW HSL Commercial/Industrial D, for Vapour Intrusion, Sand																								
2-4m														6000	NL		5000	NL	NL				NL	
4-8m														6000	NL		5000	NL	NL				NL	
>8m														7000	NL		5000	NL	NL				NL	
NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Sand																								
2-4m														1000	1000		800	NL	NL				NL	
4-8m														1000	1000		800	NL	NL				NL	
>8m														1000	1000		900	NL	NL				NL	
Site_ID	**Field_ID**	**Location_Code**	**Sampled_Date_Time**																					
304100230	BH202	BH202	12/01/2022	<20	<50	<100	<100	<100	<20	<50	<100	<100	<100	<20	<50	<10	<1	<1	<1	<2	<1	-	<3	-
304100230	BH303	BH303	12/01/2022	<20	230	<100	<100	230	<20	70	<100	<100	<100	<20	70	<10	<1	<1	<1	<2	<1	-	<3	-
304100230	QC100	BH202 - QC100	12/01/2022	<10	<50	<100	<100	<50	<10	<50	<100	<100	<50	<10	<50	<10	<1	<1	<1	<2	<1	-	-	-
304100230	GWBH201-2	BH201	16/09/2022	<40	<50	<200	<200	-	<50	<60	<500	<500	<320	<50	<60	<0.5	<0.5	0.6	<0.5	<1	<0.5	<3	<1.5	<50
304100230	GWBH202-2	BH202	16/09/2022	<40	<50	<200	<200	-	<50	<60	<500	<500	<320	<50	<60	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<3	<1.5	<50
304100230	GWBH303-2	BH303	20/09/2022	<40	<50	<200	<200	-	<50	<60	<500	<500	<320	<50	<60	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<3	<1.5	<50
304100230	GWQD1-2	BH201 - GWQD2-2	16/09/2022	<40	-	-	-	-	<50	-	-	-	-	<50	-	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<3	<1.5	-
304100230	GWQT1-2	BH201 - GWQT2-2	16/09/2022	<20	<50	<100	<100	<100	<20	<50	<100	<100	<100	<20	<50	<10	<1	<1	<1	<2	<1	-	<3	-
304100230	GWQD1-2	BH303 - GWQD2-2	20/09/2022	<40	<50	<200	<200	-	<50	<60	<500	<500	<320	<50	<60	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<3	<1.5	<50
304100230	GWQT1-2	BH303 - GWQT2-2	20/09/2022	<20	<50	<100	<100	<100	<20	<50	<100	<100	<100	<20	<50	<10	<1	<1	<1	<2	<1	-	<3	<100

	Metals															
	Arsenic	Arsenic (Filtered)	Cadmium	Cadmium (Filtered)	Chromium (III+VI)	Chromium (III+VI) (Filtered)	Copper	Copper (Filtered)	Lead	Lead (Filtered)	Mercury	Mercury (Filtered)	Nickel	Nickel (Filtered)	Zinc	Zinc (Filtered)
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	1	1	0.2	0.1	1	1	1	1	1	1	0.1	0.1	1	1	5	5
ANZG (2018) Freshwater 95% toxicant DGVs	24	24	0.2	0.2	4.4 (Cr VI)	4.4 (Cr VI)	1.4	1.4	3.4	3.4	0.6	0.6	11	11	8	8
ANZG (2018) Freshwater 99% toxicant DGVs			0.06	0.06							0.06	0.06	8	8		
PFAS NEMP (2020) Freshwater 95% Exposure Scenario																
ANZG (2018) Marine water 95% toxicant DGVs																
ANZG (2018) Marine water 99% toxicant DGVs																
PFAS NEMP (2020) Interim Marine 95% Exposure Scenario																
ADWG 2019 Health	10	10	2	2	50 (Cr VI)	50 (Cr VI)	2000	2000	10	10	1	1	20	20		
AS2159-2009 Piling - Design and Installation, Table 6.4.2(c)																
Non-aggressive																
Mild																
Moderate																
Severe																
NEPM 2013 GW HSL Commercial/Industrial D, for Vapour Intrusion, Sand																
2-4m																
4-8m																
>8m																
NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Sand																
2-4m																
4-8m																
>8m																

Site_ID	Field_ID	Location_Code	Sampled_Date_Time															
304100230	BH202	BH202	12/01/2022	4	<1	<0.2	<0.2	<1	<1	4	3	<1	<1	<0.1	<0.1	6	5	20	18
304100230	BH303	BH303	12/01/2022	1	<1	0.2	0.2	2	<1	8	2	4	<1	<0.1	<0.1	17	14	47	31
304100230	QC100	BH202 - QC100	12/01/2022	3	3	<0.1	<0.1	<1	<1	5	4	<1	<1	<0.5	<0.5	6	5	17	16
304100230	GWBH201-2	BH201	16/09/2022	-	<1	-	<0.1	-	<1	-	1	-	<1	-	<0.1	-	24	-	17
304100230	GWBH202-2	BH202	16/09/2022	-	3	-	<0.1	-	<1	-	2	-	<1	-	<0.1	-	50	-	36
304100230	GWBH303-2	BH303	20/09/2022	-	<1	-	<0.1	-	<1	-	<1	-	<1	-	<0.1	-	15	-	24
304100230	GWQD1-2	BH201 - GWQD2-2	16/09/2022	-	<1	-	<0.1	-	<1	-	1	-	<1	-	<0.1	-	23	-	17
304100230	GWQT1-2	BH201 - GWQT2-2	16/09/2022		<1		<0.2		<1		<1		<1		<0.1		21		15
304100230	GWQD1-2	BH303 - GWQD2-2	20/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
304100230	GWQT1-2	BH303 - GWQT2-2	20/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

				PAH												Organophosphorous Pesticides						Pesticides
				Naphthalene	2-methylnaphthalene	1-Methylnaphthalene	Phenanthrene	Benzo(a)pyrene	Benzo(a)pyrene TEQ (WHO)	PAHs (Sum of total)	Chlordane	DDT	Endrin	g-BHC (Lindane)	Heptachlor	Toxaphene	Azinophos methyl	Chlorpyrifos	Diazinon	Dimethoate	Fenitrothion	Malathion	Parathion
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				0.01	0.1	0.1	0.01	0.00001	5	0.01	0.01	0.01	0.01	0.01	0.01	0.002	1	10	1	1	1	1	1
ANZG (2018) Freshwater 95% toxicant DGVs				16				0.1			0.08	0.01	0.01	0.2	0.09	0.0002	0.02	0.01	0.01	0.15	0.2	0.05	0.004
ANZG (2018) Freshwater 99% toxicant DGVs				2.5							0.03	0.006	0.02	0.07	0.01	0.0001	0.01	0.00004	0.00003	0.1	0.1	0.002	0.0007
PFAS NEMP (2020) Freshwater 95% Exposure Scenario																							
ANZG (2018) Marine water 95% toxicant DGVs																							
ANZG (2018) Marine water 99% toxicant DGVs																							
PFAS NEMP (2020) Interim Marine 95% Exposure Scenario																							
ADWG 2019 Health								0.01															
AS2159-2009 Piling - Design and Installation, Table 6.4.2(c)																							
Non-aggressive																							
Mild																							
Moderate																							
Severe																							
NEPM 2013 GW HSL Commercial/Industrial D, for Vapour Intrusion, Sand																							
2-4m				NL																			
4-8m				NL																			
>8m				NL																			
NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Sand																							
2-4m				NL																			
4-8m				NL																			
>8m				NL																			
Site_ID	**Field_ID**	**Location_Code**	**Sampled_Date_Time**																				
304100230	BH202	BH202	12/01/2022	<1			<1	<0.001	-	<1	<2	<0.2	<0.2	<0.2	<0.2	<0.005	<2	<2	<2	<2	<2	<2	<2
304100230	BH303	BH303	12/01/2022	<1			<1	<0.001	-	<1	<2	<0.2	<0.2	<0.2	<0.2	<0.005	<2	<2	<2	<2	<2	<2	<2
304100230	QC100	BH202 - QC100	12/01/2022	<1			<1	<0.001	<5	-	-	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-
304100230	GWBH201-2	BH201	16/09/2022	0.04	0.01	<0.01	<0.02	<0.01	<0.012	<0.1	<0.01	<0.01	<0.02	<0.05	<0.02	-	<0.05	<0.01	<0.01	<0.15	<0.2	<0.05	<0.01
304100230	GWBH202-2	BH202	16/09/2022	0.03	0.01	<0.01	<0.02	<0.01	<0.012	<0.1	<0.01	<0.01	<0.02	<0.05	<0.02	-	<0.05	<0.01	<0.01	<0.15	<0.2	<0.05	<0.01
304100230	GWBH303-2	BH303	20/09/2022	<0.02	0.02	0.01	0.02	<0.01	<0.012	<0.1	<0.01	<0.01	<0.02	<0.05	<0.02	-	<0.05	<0.01	<0.01	<0.15	<0.2	<0.05	<0.01
304100230	GWQD1-2	BH201 - GWQD2-2	16/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
304100230	GWQT1-2	BH201 - GWQT2-2	16/09/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
304100230	GWQD1-2	BH303 - GWQD2-2	20/09/2022	0.03	0.03	0.03	0.02	<0.01	<0.012	0.1	<0.01	<0.01	<0.02	<0.05	<0.02	-	<0.05	<0.01	<0.01	<0.15	<0.2	<0.05	<0.01
304100230	GWQT1-2	BH303 - GWQT2-2	20/09/2022	<0.001	-	-	<0.001	<0.001	-	<0.001	<2	<0.2	<0.2	<0.2	<0.2	<0.005	<2	<2	<2	<2	<2	<2	<2

				Polychlorinated Biphenyls		PFAS		SVOCs	Volatile Organic Compounds														
				Arochlor 1242	Arochlor 1254	PFOS	PFOA	EPN	1,1,2-trichloroethane	1,1-dichloroethene	1,2-dichloroethane	Carbon tetrachloride	Chloroform	Dichloromethane	Trichloroethene	Vinyl chloride	1,2-dibromoethane	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene	Bromobenzene	Chlorobenzene	Total VOCs
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				1	1			1	1	1	1	1	5	5	1	5	1	1	1	1	1	1	10
ANZG (2018) Freshwater 95% toxicant DGVs				0.6	0.03				6500									160	260	60			
ANZG (2018) Freshwater 99% toxicant DGVs				0.3	0.01				5400									120	160	40			
PFAS NEMP (2020) Freshwater 95% Exposure Scenario						0.13	220																
ANZG (2018) Marine water 95% toxicant DGVs																							
ANZG (2018) Marine water 99% toxicant DGVs																							
PFAS NEMP (2020) Interim Marine 95% Exposure Scenario						0.13	220																
ADWG 2019 Health										30	3	3		4	50	0.3	1		1500	40	1	300	
AS2159-2009 Piling - Design and Installation, Table 6.4.2(c)																							
Non-aggressive																							
Mild																							
Moderate																							
Severe																							
NEPM 2013 GW HSL Commercial/Industrial D, for Vapour Intrusion, Sand																							
2-4m																							
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NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Sand																							
2-4m																							
4-8m																							
>8m																							
Site_ID	**Field_ID**	**Location_Code**	**Sampled_Date_Time**																				
304100230	BH202	BH202	12/01/2022	<5	<5	-	-	<2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
304100230	BH303	BH303	12/01/2022	<5	<5	-	-	<2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
304100230	QC100	BH202 - QC100	12/01/2022	<2	<2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
304100230	GWBH201-2	BH201	16/09/2022	<1	<1	<0.002	0.003	-	<0.5	<0.5	<0.5	<0.5	9.5	<5	<0.5	<0.3	<0.5	<0.5	<0.5	<0.3	<0.5	<0.5	10
304100230	GWBH202-2	BH202	16/09/2022	<1	<1	0.013	0.061	-	<0.5	<0.5	0.7	<0.5	<0.5	<5	<0.5	<0.3	0.7	<0.5	<0.5	<0.3	<0.5	<0.5	<10
304100230	GWBH303-2	BH303	20/09/2022	<1	<1	<0.002	<0.002	-	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<0.3	<0.5	<0.5	<0.5	<0.3	<0.5	<0.5	<10
304100230	GWQD1-2	BH201 - GWQD2-2	16/09/2022	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	9.4	<5	<0.5	<0.3	<0.5	<0.5	<0.5	<0.3	<0.5	<0.5	10
304100230	GWQT1-2	BH201 - GWQT2-2	16/09/2022	-	-	-	-	-	<1	<1	<1	<1	8	<1	<5	<0.05	<1	<1	<1	<1	<1	<1	-
304100230	GWQD1-2	BH303 - GWQD2-2	20/09/2022	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
304100230	GWQT1-2	BH303 - GWQT2-2	20/09/2022	<5	<5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX

C

WASTE TRACKING TEMPLATE

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Table 15-1 Example Waste Tracking Template

Waste Classification Certificate Reference	Waste Category	Site Area	Stockpile ID	Volume (T)	Date Disposed	Truck Rego	Disposal Facility	EPL	Date Received	Tonnage Received

About Cardno

Cardno is a professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].

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