Powerhouse Ultimo Revitalisation

Infrastructure NSW

Remedial Action Plan

JBS&G 64391 | 160,738

17 July 2024

We acknowledge the Traditional Custodians of Country throughout Australia and their connections to land, sea and community.

We pay respect to Elders past and present and in the spirit of reconciliation, we commit to working together for our shared future.

Caring for Country The Journey of JBS&G
Artist: Patrick Caruso, Eastern Arrernte

Table of Contents

List of Tables

List of Figures

Appendices

Abbreviations

Term	Definition
ACM	Asbestos Containing Material
AEC	Area of Environmental Concern
AHD	Australian Height Datum
ASS	Acid Sulfate Soil
BaP	Benzo(a)pyrene
Bgs	Below ground surface
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
COC	Chain of Custody
COPC	Contaminants of Potential Concern
CLM Act	Contaminated Land Management Act 1997
CSM	Conceptual Site Model
DGI	Data Gap Investigation
DP	Deposited Plan
DQI	Data Quality Indicators
DQO	Data Quality Objectives
DSI	Detailed Site Investigation
EIL	Ecological Investigation Level
ESL	Ecological Screening Level
ENM	Excavated Natural Material
EPA	Environment Protection Authority
EPL	Environment Protection Licence
HIL	Health Investigation Levels
HSL	Health Screening Levels
JBS&G	JBS&G Australia Pty Ltd
LTEMP	Long Term Environmental Management Plan
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended in 2013
NSW	New South Wales
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
POEO Act	Protection of the Environment Operations Act 1997
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance/Quality Control
R&H SEPP	State Environmental Planning Policy (Resilience and Hazards) 2021
RAP	Remedial Action Plan
RPD	Relative Percentage Difference

Term	Definition
RRE	Resource Recovery Exemption
RRO	Resource Recovery Order
SAQP	Sampling Analytical and Quality Plan
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalence Quotient
TRH	Total Recoverable Hydrocarbons
TWA	Trade Waste Agreement
VENM	Virgin Excavated Natural Material
VOC	Volatile Organic Compound
WHS	Work Health and Safety

1. Introduction

1.1 Background

JBS&G Australia Pty Ltd (JBS&G) was engaged by Infrastructure NSW (INSW, the client) to provide environmental consultancy services in relation to a Remedial Action Plan (RAP) to support a Development Application (DA) for the Powerhouse Ultimo Revitalisation project (the site). The site is located at The Powerhouse Museum, 500 Harris Street, Ultimo and is defined as Lot 1 in Deposited Plan (DP) 770031, Lot 1 DP781732, Part of Lot 1 DP631345, Lot 3 DP631345 and Lot 37 DP822345. The site has an area of approximately 1.7 ha. The site location and layout are presented on **Figures 1** and **2**, respectively.

The site has been subject to previous environmental investigations including a Preliminary Site Investigation (PSI, DP 2022[1]) and Detailed Site Investigation (DSI, JBS&G 2024[2]), which identified that remediation/management is required to address minor TRH impacts above adopted site assessment criteria and where it was considered there is potential risk to ecological receptors and underground infrastructure. Additionally, characterisation/assessment of residual soils is required following bulk excavation of surplus soils to facilitate construction works as part of the proposed redevelopment.

The DSI (JBS&G 2024) recommended that a RAP be developed in conjunction with the detailed design to manage surplus material, closeout data gaps beneath the existing buildings, ensure potential landscape growing medium meet ecological criteria, and address unexpected finds, including asbestos and odourous soils should they be encountered during the development works.

This RAP has been prepared with reference to relevant guidelines made or endorsed by the NSW Environment Protection Authority (EPA) inclusive of NEPC (2013[3]) and EPA (2020[4]), EPA (2017[5]) and 'Chapter 4 Remediation of land' of *State Environmental Planning Policy (Resilience and Hazards) 2021* (R&H SEPP).

1.2 Objectives

The objectives of this RAP are to:

- Characterise and document the known/potential extent of environmental impact within the site via presentation of a conceptual site model (CSM);
- Identify the remedial strategy(ies)/framework to be adopted by an assessment of remedial options and development objectives; and
- Document the procedures and standards to be followed in order to remove the risks posed by potentially contaminated soils to make the site suitable for the proposed commercial land use, while ensuring the protection of human health and the surrounding environment.

1.3 Overview of Proposed Development

The Powerhouse Ultimo Revitalisation is a transformative investment by the NSW Government to establish a world-class museum that will significantly contribute to an important and developing part of Sydney. The renewed Powerhouse Museum in Ultimo will deliver a dynamic applied arts and applied science program,

[1] *Preliminary Site Investigation* (Contamination), Powerhouse Ultimo Renewal, Powerhouse Ultimo, 500 Harris Street, Ultimo, Department of Enterprise, Investment and Trade, Douglas Partners, May 2022 (DP 2022).
[2] Detailed Site Investigation – Powerhouse Ultimo Revitalisation, 500 Harris Street, Ultimo, NSW. Prepared by JBS&G Australia Pty Ltd for Infrastructure NSW, Ref: 64391/150826 Rev 1, 23 February 2024 (JBS&G 2024)
[3] *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended 2013, National Environment Protection Council (NEPC 2013)
[4] *Consultants Reporting on Contaminated Land – Contaminated Land Guidelines.* NSW EPA 2020 (EPA 2020)
[5] *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd Edition*). NSW Environment Protection Authority 2017 (EPA 2017)

presenting exhibitions that showcase the Powerhouse collection, international exclusive exhibitions and programs that support the creative industries. The DA seeks consent for the design, construction and operation of the proposed Powerhouse Ultimo. Specifically, approval is sought for the following:

- Site preparation works, including site services and infrastructure works, tree removal, earthworks, remediation and the erection of site protection hoardings and fencing.
- Demolition of existing structures on the site, including:
    - Harris Street forecourt.
    - Structures in the forecourt entrance at the Goods Line, including the café.
    - Internal demolition of non-heritage elements of the Ultimo Powerhouse building
- Construction and use of a new museum spaces along the Harris Street frontage, including the following uses:
    - Loading dock and other back of house spaces.
    - Library and education spaces.
    - Creative industry studios.
- Conservation and adaptive reuse of the existing Ultimo Powerhouse and Ultimo Post Office heritage items for museum purposes.
- Alterations to the Wran Building spaces to upgrade the auditorium and exhibition spaces.
- Construction of a new public open spaces including:
    - At the south-eastern corner of the site to connect with the Ultimo Goods Line.
    - An internal courtyard garden wrapped by the building fronting Harris Street.
    - A creative courtyard between the Post Office and Wran Buildings.

2. Site Condition & Surrounding Environment

2.1 Site Identification

The site location is shown on **Figure 1**. The site layout and associated cadastral boundaries are shown on **Figure 2**. The site details are summarised in **Table 2.1** and described in detail in the following sections.

Table 2.1: Summary Site Details

Lot/DP	Lot 1 DP770031, Lot 1 DP781732, Part of Lot 1 DP631345, Lot 3 DP631345 and Lot 37 DP822345
Address	500 Harris Street, Ultimo, NSW
Local Government Authority	City of Sydney
Site Zoning	MU1: Mixed Use
Current Use	Powerhouse Museum, café, offices and educational facilities
Previous Use	Power Station
Proposed Use	Powerhouse Museum, café, offices and educational facilities
Approximate MGA Coordinates (GDA94 - MGA56)	E: 333503 N: 6249873
Area of the Site	Approximately 1.7 ha

2.2 Site Description

As detailed in JBS&G (2024), an inspection of accessible site areas was completed by an appropriately qualified and experienced JBS&G environmental consultant on 19 January 2023 and during the intrusive investigation on 16, 17 and 20 February 2023. Various features/structures of the site and adjacent areas described herein are shown on **Figure 2**.

Building footprints covered most of the site. External ground surfaces were paved or sealed with concrete/asphalt hardstand.

The site includes two heritage-listed buildings, being the 'Ultimo Powerhouse' (c.1899-1905) and the 'Former Ultimo Post Office including interior' (c.1901), both of which are listed on the State Heritage Register under the *Heritage Act 1997*. The 1988 museum building (Wran Building) fronts Harris Street in the west of site.

The Ultimo Powerhouse and Wran Building are used for museum exhibits and associated offices, education facilities and amenities. Tiered and connected basements were present beneath all buildings and were observed to be surfaced with concrete in good condition. No cracks, staining or evidence of contamination were identified on the ground surface.

A forecourt was present in the southwestern corner of the site, which acted as the main public entrance to the site. The forecourt is constructed over a basement. A temporary garden had been established in the centre of the forecourt.

A former café building was present at the south-eastern extent of the site. Immediately north of the café was a courtyard which had been closed to public access. Most of the area was paved, with some areas of rubber matting beneath playground equipment. Raised garden boxes were also observed in the area with large trees. During the intrusive investigation it was observed that the surfaces were underlain by a concrete slab.

A former tram line passed through the courtyard, and continued south of the café into an open, asphalt surfaced area on the southwestern corner of the site. This area was pedestrian accessible.

Macarthur Street extended into the southern length of the site and led to the open area in the southwest. A garden bed was present at a vehicle access point on Macarthur Street. The garden bed contained a tree and ground cover plants in good condition and mulched surfaces.

No odours were noted and no visible staining, asbestos containing material (ACM), or other indicators of contamination were observed on accessible ground surfaces at the site.

2.3 Surrounding Land Use

Surrounding land-uses at the time of site inspection are described following:

- William Henry Street to the north; Harris Street to the west, and Mary Ann Street to the south.
- Commercial buildings including cafes, pubs, restaurants and offices. Ian Thorpe Aquatic Centre was located immediately north of William Henry Street. The former tram sheds (Harwood Building) which form part of the Ultimo Powerhouse Museum were located south of the site.
- Some residential townhouses.
- Transport infrastructure including Light Rail, the former Ultimo Goods line, and local streets/roads.

2.4 Topography

Review of topographic information obtained from Google Earth Pro (Google Earth, 2020[6]) indicated that site has an elevation that ranges from 16 m (northwest point of site) to 6 m (eastern length) Australian Height Datum (AHD) and generally slopes downwards to the northeast to east.

A review of historical maps[7][8] indicates the land to the east of the site formerly formed part of Darling Harbour, and has been the subject of staged reclamation.

DP (2022) reported the site and surrounding land sloped downwards towards the reclaimed land and Darling Harbour as the most proximal waterbody.

2.5 Geology and Soil

DP (2022) reported that the site was underlain by Hawkesbury Sandstone in the western half and stream alluvial and estuarine sediment in the eastern half. Hawkesbury Sandstone comprises medium to coarse grained quartz sandstone, very minor shale and laminite lenses. Stream alluvial and estuarine sediment comprises silty to peaty quartz sand, silt, and clay with ferruginous and humic cementation in places and common shell layers.

DP (2022) reported that the site is present within the Gymea Soil landscape groups where natural soils are formed from the erosion of rock.

Fill encountered within the current site boundary was characterised by brown silty sand and yellow-brown sand to a maximum depth of 1.3 m bgs. Inclusions of igneous and sandstone gravels, coal, cement and tile fragments. Fill material was underlain by natural sandy clay and sandstone.

2.6 Hydrology

DP (2022) reported that groundwater flow at the site is anticipated to be towards the north-east, in the general direction of Darling Harbour. Stormwater at the site is expected to enter the local stormwater system.

---

[6] Google Earth Pro, accessed 15 February 2021, (Google Earth, 2021)
[7] https://pyrmonthistory.net.au/darling-harbour
[8] *Reclamation of Sydney Estuary, 1788-2002*, Australian Geographer, Vol 40, No. 3, G. F. Birch et al, September 2009

Review of SIX Map[9] indicated that Darling Harbour was approximately 470 m northeast of the site. The bays form part of the greater Sydney Harbour waterbody.

2.7 Hydrogeology

DP (2022) reported that there are no registered groundwater bores within 400 m of the site. A search of registered groundwater borehole information was undertaken on the Water NSW[10] website. Five registered bores were located within a 1 km radius of the centre of the site. The relevant information from the wells is summarised in **Table 2.2**.

Table 2.2: Registered Groundwater Bore Search Summary

Bore ID	Use	Standing Water Level (m bgs)	Bore Depth (m)	Direction & Distance from Site	Lithology
GW109646	Monitoring Bore	5.93 (WBZ[1] 6.3 m – 8.2 m)	8.2	South – 560 m	0-0.8 m: fill (with demo waste inclusions) 0.8-2.8 m: silty clay 2.8-5.0 m: clayey sand 5.0-8.0 m: silty sandstone 8.0-8.2 m: sandstone
GW109648	Monitoring Bore	5.23 (WBZ[1] 5.2 m – 6.2 m)	6.2	South – 570 m	0-2.9 m: fill 2.9-4.9 m: silty clay 4.9-5.8 m: silty sandstone 5.8-6.2 m: sandstone
GW109649	Monitoring Bore	2.95 (WBZ[1] 3.2 m – 6.2 m)	7.2	South – 620 m	0-4.8 m: fill 4.8-5.9 m: silty sandstone 5.9-7.2 m: Sandstone
GW109501	Monitoring Bore	2.30	6.00	South – 730 m	-
GW109502	Monitoring Bore	2.18	6.40	South – 800 m	-

1. WBZ: Water Bearing Zone

A review of the data for bores in similar geological settings and topography as the site suggests shallow perched groundwater may be present at between 3 and 6 m depth, at the residual soil and sandstone interface. Groundwater flow is inferred as likely to follow topography in a generally north to northeast direction.

A groundwater monitoring event (GME), including sampling of the installed monitoring well and one existing well, was undertaken on 23 February 2023 as reported in JBS&G (2024). Depth to groundwater was reported as varying between 3.3 to 4.0 m bgs.

2.8 Acid Sulfate Soils

A review of the 1:25 000 scale Botany River Acid Sulfate Soil (ASS) Risk Map (DLWC 1997[11]) indicated that the site is located within an area of 'no known occurrence' of acid sulfate soil materials.

[9] *Six Maps website, https://maps.six.nsw.gov.au/* accessed 15 February 2021.
[10] *Water NSW website, https://realtimedata.waternsw.com.au/, accessed 15 February 2023*
[11] *Botany Bay River Acid Sulfate Soil Risk Map* (Edition 2), NSW Department of Land and Water Conservation (DLWC 1997)

2.9 Meteorology

A review of average climate data for the nearest relevant Bureau of Meteorology monitoring location (Sydney Airport AMO (ANSTO[12])), indicates the site is located within the following meteorological setting:

- Average minimum temperatures vary from 7.4 ^{o}C in July to 19.1 ^{o}C in February;
- Average maximum temperatures vary from 17.2 ^{o}C in July to 26.7 ^{o}C in January;
- The average annual rainfall is approximately 1093.4 mm with rainfall greater than 1 mm occurring on an average of 96.1 days per year; and
- Monthly rainfall varies from 59.8 mm in September to 124.7 mm in March, with the wettest periods occurring on average in February to June.

[12] Commonwealth of Australia, 2013 Bureau of Meteorology, http://www.bom.gov.au/climate/averages/tables/cw_066037.shtml, Prepared at Thu 02 Feb 2023

3. Site History and Previous Environmental Assessments

3.1 Site History

Historically, the site appears to have been used for commercial and industrial purposes including power generation and glass, paper and maize manufacturers/processors, from at least the early 1920s. The Powerhouse was operational between 1899 and 1963. A service station is understood to have operated in the 1960s/1970s at a location adjacent Harris Street, south of the Post Office.

The site was acquired by The Trustees of the Museum of Applied Arts and Sciences by 1988 and was reopened as the Powerhouse Museum in that same year.

The surrounding land appears to have undergone a similar site history and is currently used for residential and commercial (e.g. retail, restaurants, office space, etc) purposes.

Based on the range of sources and the general consistency of the historical information, as well as historical aerial photographs, it is considered that the historical assessment has an acceptable level of accuracy with respect to the potentially contaminating activities historically occurring at the site. These appear to relate predominantly to use of the land for commercial/industrial purposes, demolition of former structures and introduction of fill to create site levels.

3.2 Previous Investigations

The following sections provide a summary of the information and site characterisation data presented within contamination assessment reports. These reports include historical information relating to investigations conducted at the time.

Historical sample locations are presented on **Figure 3** and historical analytical summary tables are included in **Appendix B**.

3.2.1 Preliminary Site Investigation (DP 2022)

Douglas Partners (DP) was engaged to undertake a PSI for the Powerhouse Ultimo Renewal project to assess the contamination status of the site. It is noted that the investigation included the southern portion of the overall Powerhouse Museum property (i.e. Lot 1 DP651345 and the former tram sheds south of the site (Lot 3 DP216854)), which have been excluded from the current site area.

The investigation included a desktop review and limited soil sampling (BH101, BH102, BH106, BH107 and BH201). Groundwater sampling was also undertaken from locations south of the current site boundary. The previous sampling locations are shown on **Figure 3**.

Fill was observed to be up to 1.3 m in depth within the current site boundary, with silty sand and sand, which commonly contained anthropogenic materials.

Soil samples were selected for analysis for potential contaminants including eight metals, TRH, benzene, toluene, ethylbenzene and xylenes (BTEX), PAH, organochlorine pesticides (OCPs), organophosphorus pesticides (OPPs), polychlorinated biphenyls (PCB), phenols, volatile organic compounds (VOCs) and asbestos. Groundwater samples were analysed for eight metals, TRH, BTEX, PAH, OCP, OPP, PCB, total phenols, ammonia and VOCs.

Elevated concentrations of PAH and TRH were detected in two soil samples (BH102 at 0.5m and BH106 at 1.0m) within the current site boundary, above the adopted assessment criteria. An elevated concentration of ammonia above the adopted assessment criteria was reported in groundwater collected at one of the offsite wells (MW104). Remaining analytes were either not detected above the laboratory limit of reporting (LOR), or were reported in the soil and groundwater samples at concentrations below the adopted site assessment criteria.

It was considered that the results indicated remediation or management of contamination would be required for site development. It was recommended that a DSI be prepared to determine site suitability and remediation or management requirements to address identified site contamination.

It was considered that the site could be made suitable for the proposed Powerhouse Ultimo Renewal development.

3.2.2 Historical reports summarised by DP (2022)

3.2.2.1 Museum of Applied Arts and Sciences Relocation Study, 1978

A summary of *Powerhouse: a study of the relocation of the Museum of Applied Arts and Sciences, in a development of the Ultimo Power Station and the Ultimo Tramway Depot, Sydney* (NSW Government Architect's Office, 1978) was presented.

Site drilling was carried out to establish the nature of the foundation material and the level of bedrock. Sandstone was located at an average of 4 m below the ground level.

The Ultimo Power Station was the original source of electricity for the Sydney tramway system. The original building dates from 1899, with later additions in 1916. A major reconstruction begun in 1927 and was completed in 1931. The station ceased operation in circa 1960 and was damaged during subsequent demolition, salvage operations, decay and vandalism. The power station consisted primarily of two adjacent halls. The western hall (Turbine Hall) contained the engine room and turbine room, with an office annex at the northern end and a switch house at the southern end. The eastern hall was originally the Boiler house and was accessible via the old railway track diversion from the Darling Harbour Goods Yard lines. The main floor level was penetrated in a number of areas to a deep basement level below.

Between the power station and Harris Street a number of one and two storey commercial buildings, a petrol service station and the Ultimo Post Office were present. The lease to Ampol at the southern section of the western length of the current site was to expire in February 1979.

At 496-502 Harris Street (presumably the western part of the site, now part of 500 Harris Street), there was an office and warehouse building of three levels, including first floor offices, a ground floor warehouse area and basement. Adjoining this area were various older-style warehouses and workshops.

3.2.2.2 Conservation Management Plan, 2002

Pertinent information from *Conservation Management Plan for The Powerhouse Museum* (Architectural Projects Pty Ltd, 2002) was provided.

The location of the Powerhouse near the head of Darling Harbour gave it an adequate supply of salt water for condensers and proximity to the goods yards for coal supply and ash disposal.

In 1980, the NSW government decided to develop the site for the Powerhouse Museum. The Power Station was refurbished and the (The Wran Building) constructed in the western length of the site. The Wran Building was opened in 1988.

The former Ultimo Post Office, built by 1901 was adapted to house a childcare centre (at the time of preparing the Conservation Management Plan).

3.2.2.3 Powerhouse Museum Asbestos Survey, 2014

Hibbs & Associates Pty Ltd reported on an asbestos survey in September 2014 (Hibbs 2014). No friable asbestos was encountered during the inspection and no identified asbestos material (bonded asbestos) required short to medium term remedial works.

3.2.3 Detailed Site Investigation (JBS&G 2024)

JBS&G was engaged to undertake a DSI for the Powerhouse Ultimo Revitalisation project. The scope of works included desktop review of readily available site history and site condition records; an intrusive investigation including six soil sampling locations (BH01 to BH06), soil vapour sampling at four locations (SV02, SV04 to SV06) within buildings, and groundwater sample collection from two locations (BH06 and BH105); analysis of selected samples for contaminants of potential concern (COPC); and comparison the data against relevant EPA endorsed criteria. It is noted that the intrusive investigation was hindered due to basement footprints, services and slab thickness and as such, fewer sample locations were advanced than that proposed in the sampling, analysis and quality plan (SAQP).

Based on the investigation completed, the following findings were made:

- Fill material was encountered at all sample locations and was characterised by light/dark brown and yellow brown sand, dark brown and grey/white clayey sand, brown silty clay, dark brown/black gravelly clay, orange/grey/yellow mottled and brown/dark brown sandy clay, and dark brown/grey/orange clay;
- The following results were reported for the soil investigation:
    - Asbestos was detected below the site assessment criteria at one location (BH03_1.4 – 1.5). Given the varied industrial history of the site and the various fill types encountered, it was considered likely that ACM would be present in fill materials sporadically across the site. Although the concentration was detected below the site assessment criteria, there is a potential risk to workers health during soil disturbance works. Isolated fragments of bonded ACM, whilst potentially not a concern from a long-term health exposure assessment perspective, will require management from a Work Health and Safety (WHS) perspective during future ground disturbance at the site.
    - Concentrations of TRH were reported above the ecological criteria (BH02_0.7_0.8 and BH06_0.5_0.6) and management limits (BH02_0.7_0.8) at two locations. The exceedances were detected in soils where proposed gardens/green spaces are proposed. It is considered there is potential risk to ecological receptors and underground infrastructure.
    - Remaining concentrations of COPC in soil were reported below the adopted site assessment criteria.
- The groundwater investigation did not identify the presence of significant contamination. Reported concentrations of contaminants were less than criteria or reported at levels that do not present a risk to ongoing commercial/industrial use of the site. Low level TRH concentrations were detected at BH06, where hydrocarbon odours and staining were observed during soil sampling;
- The soil vapour investigation did not identify the presence of significant contamination. Reported concentrations of contaminants were less than the adopted assessment criteria;
- The investigation results were generally consistent with that reported by DP (2022).
- The acid trail and sulfate concentrations indicate that the natural soils are generally not ASS, with some potential for PASS. Management of PASS may be required where soils are to be disturbed below the water table; and
- Preliminary results indicate that should soil require off-site disposal it would be classified as General Solid Waste (GSW).

It was concluded that the site can be made suitable for the proposed development, from a contamination perspective, subject to the management of the identified contamination in soil.

It was recommended that a Remedial Works Plan (RWP) be developed to support the project to manage surplus material, closeout data gaps beneath the existing buildings, ensure growing medium in landscaped

areas meet ecological criteria, and address any unexpected finds, including asbestos and odourous soils should they be encountered during the development works.

3.2.4 Geotechnical Investigation (JKG 2024)

A geotechnical investigation was completed at the site by JK Geotechnics in March 2024 (JKG 2024[13]) and included the advancement of 12 boreholes across the site, with 3 converted into groundwater wells, and 4 test pits installed along the western and southern site boundaries to inspect existing structure footings. JKG 2024 did not include the sampling or assessment of site soils from a contamination perspective, but did provide additional information of the underlying soil condition at the site.

Fill was reported to predominantly comprise sand or silty sand and was encountered in all of the boreholes from below the existing pavement, or from surface to depths between 0.18 m (TP317) and 2.9m (BH309), noting that BH301 and the test pits were all terminated on obstructions or concrete slabs in fill. Inclusions of sandstone, ironstone and igneous gravels and cobbles were encountered in the fill, as well as sandstone boulders in BH303 and BH314. Concrete, brick, terracotta, metal, plastic and asbestos fragments (BH309 only), as well as ash and organic material, were observed in the fill.

13

4. Conceptual Site Model (CSM)

A brief CSM was prepared for the site and included with JBS&G (2024).

4.1 Potential Areas of Environmental Concern

Based on previous site investigations, the site history and observations of site conditions during the PSI (DP 2022) and DSI (JBS&G 2024), areas of environmental concern (AEC) have been identified and are presented in **Table 4.1**.

Table 4.1: Areas of Environmental Concern and Associated Contaminants of Potential Concern

Area of Environmental Concern (AEC)	Primary Contaminants of Potential Concern (COPC)
Use of land for commercial/industrial purposes (i.e. coal ash or slag from previous operations, former railway, former switch house, former service station, former workshops)	Total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCBs), heavy metals, organochlorine pesticides (OCPs), volatile organic compounds (VOCs), and asbestos
Demolition of former structures	Heavy metals, OCPs, PCBs, and asbestos
Fill materials of unknown origin	TRH/BTEX, PAHs, PCBs, heavy metals, OCPs, per- and poly-fluoroalkyl substances (PFAS) and asbestos

4.2 Potentially Contaminated Media

Potentially contaminated media present at the site includes:

- Surface/fill soils;
- Natural soils/bedrock;
- Groundwater;
- Soil vapour.

Fill and surface soils are considered to be potential impacted media. There is potential that fill material may have been used at the site for levelling activities, and surface soils may have been impacted by historical activities including demolition of former structures and historical commercial and industrial land-uses. There is potential that some ash and/or slag from the powerhouse operations may have been used as fill or been placed on surface soils during the power station's operation. Additionally, contamination may have been sourced from former transformers and capacitors in the former switch house. Contamination by volatile compounds may have occurred due to the proximity of the railway, workshop activities and the historical service station. Trams may have also used asbestos (brake pads).

Based on the potential leachability of contaminants within fill material/surface soils and the historical use of the site, vertical migration of contamination from the fill materials/surface soils into the underlying natural soils/rock may have occurred. As such, the natural site soils are considered to be a potentially contaminated medium.

The site is largely sealed or covered by building footprints. Surface water interaction with fill materials and potential contamination is considered to be limited. As such, surface water is not considered to be a potentially contaminated medium.

Given the reported geology (**Section 2.5**), there is potential for site contamination to impact shallow groundwater, where water infiltration occurs. In the event that leachable contaminants are present within soils, there is potential for groundwater impacts.

4.3 Potential for Migration from Site

Contaminants generally migrate from site AECs via a combination of wind (blown dust/fibres), rainwater infiltration, groundwater migration, vapour convection/diffusion and surface water runoff. The potential for contaminants to migrate is a combination of:

- The nature of the contaminants (solid/liquid and mobility characteristics);
- The extent of the contaminants (isolated or widespread);
- The location of the contaminants (surface soils or at depth); and
- The site topography, geology, hydrology and hydrogeology.

The potential contaminants of concern identified as part of the site history review and site inspection are potentially present in solid form (e.g. heavy metals, asbestos, ash/slag, etc.) or liquid form (e.g. chemicals/pesticides/fuels/oils etc).

Given the sealed nature of the site there is low potential for wind-blown dust migration of contaminants including potential for airborne asbestos fibres.

There is low to moderate potential for infiltration of water and subsequent migration through the soil profile to groundwater, as the site ground conditions are either sealed with hardstand or paving.

There are potential risks of groundwater contamination related to upgradient off-site uses including historical commercial/industrial area.

There is the potential for migration of vapour into buildings, adjacent basements or service pits from on-site volatile contaminants is possible based on the historical storage and use of chemicals in areas of the site.

4.4 Receptors and Exposure Pathways

Potential receptors of environmental impact within the site which will need to be addressed with respect to potential risks to current and/or future site user include:

- Current users of the site who may potentially be exposed to COPC through direct contact with impacted soils and/or inhalation of dusts/fibres/vapours associated with impacted soils. It is anticipated the site will remain predominantly if not wholly sealed and direct contact/ingestion of contaminants in soil/groundwater or from wind-blown dusts/fibres from site soils, will be unlikely for site users, with potentially complete exposure pathways likely to be limited to vapour migration from soil/groundwater via intrusion into building spaces;
- Excavation / construction / maintenance workers conducting activities at the site, who may potentially be exposed to COPC through direct contact with and/or ingestion of impacted soils present within excavations and/or inhalation of dusts/fibres/vapours associated with impacted soils or with impacted groundwater during excavation works at the site;
- Future workers and recreational users (i.e. users / visitors to the museum) who may potentially be exposed to COPC through direct contact with or ingestion of impacted soils in garden areas, and/or inhalation of dusts/fibres/vapours associated with impacted media; and
- Flora and fauna on the site within future landscaped areas.

4.5 Preferential Pathways

For the purpose of this assessment, preferential pathways have been defined as natural and/or man-made pathways that result in the preferential migration of COPC as either solid (sediments, dust, etc) or liquid (surface water).

Man-made preferential pathways are likely present throughout the site, generally associated with areas of previously disturbed natural ground present beneath the existing ground surface and unconsolidated fill materials, such as in service trenches. Fill materials and disturbed natural soil are anticipated to have a higher permeability than the underlying natural soils and/or bedrock.

Based on the COPCs identified in soil, groundwater and soil vapour, the potential exposure pathways for the site include:

- Oral and dermal pathways from impacted soils and groundwater (either through beneficial groundwater re-use [unlikely] or made accessible via excavation);
- Inhalation of airborne contaminants (including airborne asbestos fibres);
- Inhalation of vapour migrating from impacted soils and groundwater, although given the lack of volatile contaminants previously reported, this is unlikely; and
- Contaminant uptake via vegetation (flora) or bioaccumulation within fauna.

4.6 Data Gaps

Due to site constraints at the time of the DSI (JBS&G 2024), a number of data gaps have been identified at the site in relation to the proposed bulk excavation plan (included as **Appendix A**) that may require further assessment in order to appropriately characterise the site and refine the extent of remediation required. These data gaps are related to site soils in previously inaccessible areas, specifically:

- Southeast portion of the site within the footprint of the former Café building;
- Southern portion of the site within the Switch House footprint and proposed new building ramp;
- Southwest portion of the site, underlying the existing Level 1 footprint of the Wran Building and the external Level 2 courtyard; and
- Western portion of the site within the Wran Building footprint, in the proposed location of basement expansion and ground floor expansion.

It is also noted that data gaps exist underlying the basement levels of the Boiler House, Turbine Hall, Engine House, Switch House and Wran Building footprints, however, based on the proposed redevelopment, no excavation works are to be undertaken within these areas of the site and the existing concrete hardstand is to remain.

5. Remedial Options

5.1 Guidelines and Legislation

The RAP has been prepared with reference to the following guidelines and legislation:

- *'Chapter 4 Remediation of Land' State Environmental Planning Policy (Resilience and Hazards) 2021* (R&H SEPP);
- *Sydney Local Environmental Plan 2012,* NSW Departments of Planning and Environment (Sydney LEP 2012)
- *Contaminated Land Guidelines, Sampling design part 1 – application*, NSW EPA, 2022 (EPA 2022a);
- *Contaminated Land Guidelines, Sampling design part 2 – interpretation*, NSW EPA, 2022 (EPA 2022b);
- *Contaminated Land Management: Consultants Reporting on Contaminated Land,* NSW EPA, May 2020 (EPA 2020);
- *Contaminated Land Management: Guidelines for NSW Site Auditor Scheme (3rd Edition)*, October 2017 NSW EPA (EPA 2017);
- *National Environment Protection (Assessment of Site Contamination Measure) Measure 1999, as amended 2013,* National Environment Protection council (NEPC 2013);
- *Waste Classification Guidelines. Part 1: Classifying Waste*, NSW EPA, November 2014 (EPA 2014a);
- *Work Health and Safety Act 2011* (WHS Act); and
- *Work Health and Safety Regulation 2017* (WHS Reg.).

5.2 Remedial Objectives

Remediation is required at the site to address the following:

- Fill material at the site containing concentrations of TRHs exceeding ecological and management limit criteria; and
- Aesthetic issues associated with strong hydrocarbon odours and anthropogenic materials within fill.

The objective of the remediation is to remove/manage potential risks posed by the identified contamination issues, such that the site is made suitable for future proposed development. It is a further objective to undertake works, in accordance with applicable guidelines and legislation, in a manner that is consistent with the principles of ecologically sustainable development (ESD).

5.3 Extent of Remediation

Based on the findings of the previous investigations (DP 2022 and JBS&G 2024), the anticipated extent of the proposed remedial works encompasses the fill material within the southeast portion of the site to a depth range of 0.6 m to 1.2 m bgs, which would remove the identified TRH impacts at BH02 and BH06 and aesthetic issues associated with BH06. This is consistent with the proposed bulk excavation plans for the proposed redevelopment (**Appendix A**).

In addition to this, a program of further soil characterisation sampling and analysis is required to support offsite disposal for areas where surplus fill/soils is to be excavated. The final extent of remediation will be informed by the further soil characterisation, as well as any potential remediation works to address unexpected finds (**Section 8**) that may be encountered during construction works.

5.4 Remedial Options Assessment

EPA (2017) adopts the NEPC (2013) ASC NEPM preferred remediation hierarchy as follows:

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

if the above are not practicable,

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

or,

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

In addition, when deciding which option to choose, consideration is also required to be given to the sustainability (environmental, economic and social) aspects of each option to ensure an appropriate balance between the benefits and effects of undertaking remedial/management options.

In cases where no readily available or economically feasible method is available for remediation, it may be possible to adopt appropriate regulatory controls or develop other forms of remediation.

The remedial options are evaluated in **Table 5.1** below.

Table 5.1: Remedial Options

Remedial Option	Applicability	Assessment
Option 1: On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level.	TRH Impacted Fill The fill materials within the southeast portion of the site are limited to hydrocarbon impacts and there is the potential for onsite bioremediation through land farming could occur in accordance with the NSW EPA (2014b) Best Practice Note: Landfarming, (April 2014). Bioremediation occurs where contaminants are chemically broken-down by the metabolic processes of micro-organisms into less toxic or non-toxic forms. However, this remedial option can lead to the generation of odours and requires a relatively large area. Due to the majority of existing structures being retained, there will be insufficient space onsite during development for this to be practicable.	Potential option. Given the volume of material, restricted space and time it may take to remediate fill/soils to a level that they do not represent an unacceptable risk and/or contribute to groundwater impacts, this method is not practical but is feasible.
Option 2: Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site.	TRH Impacted Fill As above (Option 1), however, additional time, energy and costs are incurred to take soils off the site and return them to the site, in addition to there being no/limited currently licensed facilities in close proximity of the site to undertake soil treatment	Not a suitable option.

Remedial Option	Applicability	Assessment
Option 3: Consolidation and isolation of the soil on-site by containment within an appropriately designed cell.	TRH Impacted Fill A feasible option to contain residual TRH impact following bulk excavation works, however, hydrocarbon COPCs that can leach requires more complex containment design and potential ongoing monitoring of potential leachate migration.	Potential option. Appropriate design would be required if residual fill materials are found to be impacted with TRH following bulk excavation works.
Option 4: Removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill	TRH Impacted Fill There are currently suitably licensed waste facilities in the Sydney Metropolitan region capable of accepting the identified contaminants within fill materials.	**Preferred option.** The preferred option given site/space constraints and no ongoing management which may restrict the proposed future development.

Should further impacted material (i.e. not identified in the previous investigations) be identified as part of an unexpected find during future construction works, the remedial options screening matrix in **Table** 5.1 will be required to be reviewed. Notwithstanding, it is anticipated that any impacts will be relatively isolated and could be appropriately managed through controlled excavation and offsite disposal or onsite containment (where contaminants are relatively inert and do not pose a risk to groundwater or at significant levels within soil vapour).

6. Remediation Plan

The remedial scope of works is provided in the following sections.

6.1 Approvals, Licences and Notifications

6.1.1 Protection of the Environment Operations Act 1997 (POEO 1997)

The proposed remediation/validation activities are not required to be licensed under the *Protection of the Environment Operation Act 1997*, which is based on the following:

- The proposed remediation works will not treat more than 1,000 m^3 per year of contaminated soil received from off-site.
- The proposed remediation works will not involve the treatment of contaminated soil originating on-site with the capacity: (i) to incinerate more than 1,000 m^3 per year of contaminated soil, or (ii) to treat (otherwise than by incineration) and store more than 30,000 m^3 of contaminated soil, or (iii) disturb an aggregate area of 3 hectares of contaminated soil.

6.1.2 State Environment Planning Policy (Resilience and Hazards) 2021 (R&H SEPP)

With reference to Chapter 4 Remediation of Lan of the R&H SEPP, the remediation works are considered to be Category 2 Remediation Works as the remediation/development does not satisfy any trigger for Category 1 Remediation Works.

Category 2 works to not require consent, however, development consent for the remedial works will be granted as part of the overall project consent approval through the State Significant Development approval process.

Notification of remediation works will be required to be given to council at least 30 days prior to commencement, and council requires notification within 30 days from completion of remediation works, consistent with R&H SEPP requirements and City of Sydney Council's Contaminated Land Policy.

6.1.3 Protection of the Environment Operations (Waste) Regulation 2014

The regulations make requirements relating to non-licensed waste activities and waste transporting. The proposed works on the site are not required to be licensed. Section 48 of the Regulation requires that wastes are stored in an environmentally safe manner. It is also stipulated that vehicles used to transport waste must be appropriately licensed and covered when loaded with impacted materials. For transport activities following 1 July 2016 this regulation also details additional tracking requirements for vehicles carrying Special (asbestos) waste if material is identified to contain asbestos following waste classification activities.

Provision is provided in the Regulation and EPA (2014a) guidelines for the NSW EPA to approve the immobilisation of contaminants in waste (if required with unexpected finds).

The proximity principle from POEO Waste Regulation states that it is an offense for waste to be transported more than 150 km from its place of generation.

6.1.4 Waste Classification Guidelines (EPA 2014a)

All wastes generated and proposed to be disposed off-site shall be assessed, classified and managed in accordance with this guideline.

6.1.5 Work Health and Safety Act 2011 and Work Health and Safety Regulation 2017

All remediation works should be undertaken in accordance with requirements of the *Work Health and Safety Act 2011 (WHS Act)* and *Work Health and Safety Regulation 2017 (WHS Regulation)*. The information and data

provided in this RAP should be considered by the remedial contractor in preparation of their health and safety plans for the remedial works (refer to **Section 9.2**).

6.2 Site Establishment

All safety and environmental controls are to be implemented as the first stage of remediation works. These controls will include, but not be limited to:

- Locate and isolate all required utilities in the proximity of the works (where possible);
- Assess need for and implement any necessary traffic controls;
- Work area security fencing;
- Site signage and contact numbers;
- Sediment fencing (attached to security fencing) where necessary; and
- Stormwater runoff and sediment controls (e.g. silt fences and hay bales) where necessary.

Environmental controls are outlined in **Section 9.1**.

6.3 Excavation and Off-site Disposal of Surplus Materials

The proposed development will include the bulk excavation and removal of fill materials to an approximate depth of 0.6 m bgs in the northwest portion of the site and 0.6-1.2 m bgs in the southeast portion of the site. Additionally, excavation and removal of assumed natural sandstone materials is required for the expansion of the basement and ground floor footprints of the Wran Building.

Materials surplus to development requirements are proposed to be excavated and removed of off-site and classified in accordance with EPA (2014a) or an appropriate exemption as created under the *Protection of the Environment Operations (Waste) Regulation 2014* (EPA 2014b).

The remediation contractor must be aware of and conduct all waste disposal in accordance with all relevant regulations (i.e. disposal to facility lawfully able to accept such wastes). All waste tracking documentation including disposal dockets must be maintained by the remediation contractor and must be provided to the environmental consultant/the client for inclusion in the validation report.

The material will be excavated under the supervision of the environmental consultant with the material stockpiled on hardstand/durable plastic, placed in a skip bin or alternatively directly loaded onto a haulage vehicle for off-site disposal.

Management of any identified unexpected finds in fill or PASS/ASS during excavation should follow requirements described in **Section 8**.

6.4 Site Charaterisation of Residual Fill Materials

Due to site constraints at the time of the DSI (JBS&G 2024), fill conditions at the site have not been fully characterised, however the contamination identified does not exceed the adopted health based assessment criteria (HIL-D & HSL-D). Additionally, the previous investigations assessed soils via boreholes, which limits the visual information that can be obtained.

Based on the bulk excavation plan for the proposed development, fill materials are proposed to remain *in-situ* within the northwest and southeast portions of the site in the location of proposed landscape/courtyard areas. Additionally, there is the potential for fill materials to be encountered during the bulk excavation for the expansion of the basement and ground floors of the Wran Building.

As such, the fill/soil materials retained *in-situ* external to the proposed extend of bulk excavation will be subject to a program of further site characterisation comprising visual inspection, sampling and analysis to

ensure they are suitable to remain under the proposed commercial land use without the requirement for ongoing environmental management.

Samples will be collected via test pitting through *in-situ* fill/soil. The test pit at each sample location will supplement existing data by enabling greater visual assessment of the present fill material. Characterisation samples will be collected at an initial near-surface depth and then at 0.5 m intervals until the depth of natural soils to ensure characterisation of the full depth of material present on-site or until natural material samples report contaminant levels consistent with natural material/background concentrations, whichever is the shallower.

Asbestos characterisation shall be inclusive of field quantification of bonded asbestos and sampling of soils for the presence of asbestos fibres / asbestos fines. Samples will also be collected and analysed for heavy metals, TRH, BTEX, PAHs, and PCBs. Toxic characteristic leaching procedure (TCLP) will also be conducted on select samples, primarily heavy metals and PAHs, to understand the leachability of the contaminants present, as well as to support the preliminary waste classification of fill materials.

The number of sample locations will be determined in accordance with the densities outlined in EPA 2022a.

Impacted material, if present, within areas outside of the proposed extent of bulk excavation works can readily be remediated via removal (to the extent practicable) from the site to a facility lawfully able to accept the material or alternatively via onsite containment (where contaminants are relatively inert and do not pose a risk to groundwater or at significant levels within soil vapour). All materials requiring off-site disposal are required to be classified in accordance with EPA 2014a.

6.5 Containment of Contaminated Fill

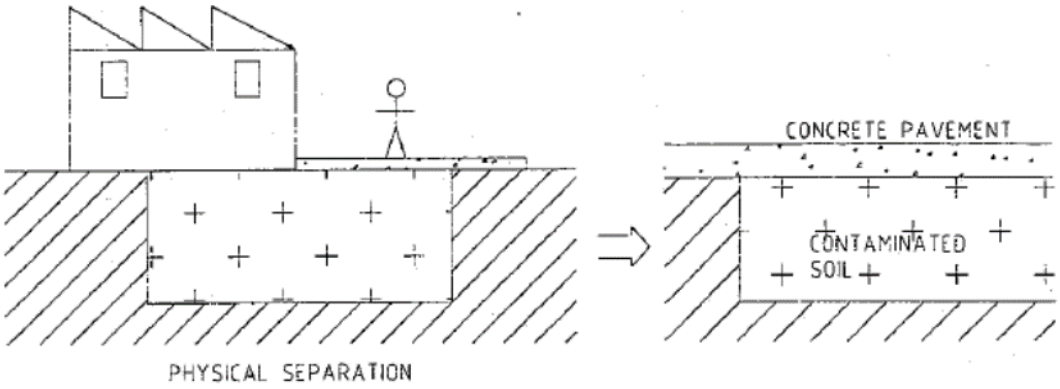
6.5.1 Overview

In the event that contamination is identified within the *in-situ* residual fill materials and unable to be excavated and disposed offsite, the contaminated fill may be able to be retained on-site via containment with the implementation of a permanent physical barrier. Where applicable, the following applies to the retention of contaminated fill contained on-site:

- The extent of impacted soils requiring remediation shall be confirmed via additional site characterisation activities (**Section 6.4**);
- Hardstand over the area requiring remediation shall be broken out and disposed in accordance with EPA (2014a);
- A minimum soil cover thickness of 0.5 m in landscaped or mass planting/shallow landscaped areas and 1.5 m in tree pit zones which is underlain by a visual “marker layer” in unpaved areas, i.e., planter boxes in landscaped areas etc.; or
- Permanent concrete floor/ground slabs as underlain by a visual “marker layer”, i.e., underlying buildings, roads, pathways; or
- Top (concrete) of pile foundations (no marker layer required for below pile foundations).

A conceptual sketch, sourced from ANZECC 1999[14], is shown following:

[14] *Guidelines for the Assessment of On-site Containment of Contaminated Soil,* Australian and New Zealand Environment and Conservation Council, September 1999. (ANZECC 1999).



The marker layer shall consist of a bright orange-coloured non-woven polyester continuous filament or PET (such as nonwoven geotextiles) or similar with a minimum density of approximately 150 grams per square metre (or equivalent). The marker layer must:

- Be easily recognisable within soils (i.e., bright orange in colour);
- Be durable as a long-term marker layer (i.e., > 140 grams per square metre); and
- Maintain integrity during remedial/civil works such as capping layer insulation and road/building construction.

Additionally, the marker layer must meet geotechnical and civil specifications where required.

The specific details of the marker layer are required to be included in the site validation report and Environmental Management Plan (EMP[15]) documents in addition to surveyed plans showing the extent of the capped area.

Leachable material is not proposed to be placed beneath the groundwater table.

6.5.2 Specific Capping Arrangements

The following capping procedures will be applied to each of the potential exposure scenarios across the site, as may occur with the finalised site development plans:

- Beneath permanent concrete structures installation of a marker layer over contaminated fill material and permanent concrete slab as the physical barrier;
- Permanent hardstand structures (i.e., concrete slabs, pile caps or asphaltic concrete or similar, footpaths, but not bricks or pavers) – installation of a marker layer overlying potentially contaminated material followed by sub-grade material validated as environmentally suitable materials for human exposure and then the permanent structure (e.g., exterior concrete footpaths, asphaltic roads, etc.);
- Mass planting / shallow landscaping areas – installation of the marker layer at a minimum depth of 500 mm below the final finished site levels, with a capping layer consisting of environmentally suitable materials for potential human and/or ecological exposure;
- New tree pit zones / deep landscaping zones – installation of the marker layer at a minimum depth of 1.5 m below the final finished site levels, with a capping layer consisting of environmentally suitable materials for potential human and/or ecological exposure, noting that the maker layer should extend the depth required for installation of the new tree's existing root ball or otherwise consistent with the anticipated root zone of the deep landscaping area; and/or

[15] An EMP will be required if contaminated soils at concentrations above the adopted health criteria, are retained on site.

- Within underground services trenches / services – service infrastructure will require remediation to 150 mm below the depth of services, with a marker layer and capping layer installed consisting of environmentally suitable materials for potential human and/or ecological exposure.

Material above the marker layer extending to the final finished ground level will be required to be an environmentally suitable material for human and/or ecological exposure (as appropriate) as discussed further in **Section 7.6.4**.

Validation of the interim and permanent capping arrangements will be required as outlined in **Section 6.5,** including inspections by the environmental consultant, a survey plan prepared by a registered surveyor showing the level and lateral extent of the impacted soils, marker layer, and capping in relation to the site boundaries.

6.6 Material Importation

Based on the scope of remedial works described herein, suitable materials are required to be imported to site.

Prior to importation of all material, appropriate assessment of such materials must be completed to demonstrate the material is both fit for purpose and suitable from a contamination viewpoint. In accordance with EPA requirements, the extent of assessment will be determined by the type of material proposed to be imported.

Imported materials relating to remediation works are limited to Virgin Excavated Natural Materials (VENM), Excavated Natural Materials (ENM), or any other suitable material granted an applicable EPA Exemption under the Protection of the Environment Operations (Waste) Regulation.

Where material proposed to be imported is VENM, an assessment must demonstrate that the material is compliant with the definition of VENM as presented in the POEO Act 1997, adopting in the minimum requirements for characterisation of fill material as presented in EPA (2022a).

Where material proposed to be imported is ENM under the Resource Recovery Framework (Order/Exemption), the material must firstly be demonstrated by the supplier as suitable for use in accordance with the requirements of the Order via provision of a statement of compliance.

In addition to the testing completed by the supplier, the specific material proposed to be imported may require an additional compliance assessment prior to approval to import. The additional assessment is required to ensure that the incoming material does not pose an unacceptable risk to human health and/or environment at the placement site and is therefore suitable for use. It is anticipated that such assessment activities will include visual inspections, representative sampling and laboratory analysis of material to demonstrate the material meets the requirements of this RAP. As for VENM assessments, it is considered suitable to define such requirements on a specific site basis given the potential variability of project site requirements.

Material tracking records in addition to the import assessment report are required to be included in the validation report for the site.

6.7 Validation

Validation of the remedial works will be conducted by the environmental consultant to demonstrate the remediation/management objectives have been achieved and to document the final condition of the site at the completion of remediation works (including importing of materials at time of validation) such that conclusions may be drawn on the end use suitability of the site. Details of the validation program are provided in **Section 7**.

6.8 Site Disestablishment

On completion of the remediation works all plant/equipment and safety/environmental controls shall be removed from the site by the appointed remediation contractor. All equipment used during remediation

works will need to be appropriately decontaminated or disposed of as waste by the remediation contractor, in accordance with relevant waste regulations.

.

7. Validation Plan

7.1 Overview

Validation data is required to be collected to verify the effectiveness of the remedial works and document the final site conditions as being suitable for the proposed future use(s).

The following sections establish the DQOs to be adopted during validation of the site remediation works.

7.2 Data Quality Objectives

Data Quality Objectives (DQO's) have been developed for the site validation and are discussed in the following sections.

7.2.1 State the Problem

The site, which has been previously used for a range of industrial and commercial purposes within a historically urbanised area and was previously redeveloped into the Powerhouse Museum in 1988.

Previous investigations have identified TRH impacted fill materials that exceed the adopted ecological criteria and management limits in the southeast portion of the site and associated aesthetic issues requiring remediation / management for the site to be considered suitable for the commercial/industrial land use.

During remediation activities, sufficient validation of site activities is required to demonstrate that the identified risks to site users, and aesthetic issues, have been adequately managed to render the site suitable for the indicated land use.

Groundwater is not considered to present an exposure risk at the site as discussed in **Section 3**.

7.2.2 Identify the Decision

The following decisions are required to be made during the validation works:

- Has contaminated soil been removed from the site, or is otherwise managed as per a long-term containment strategy to not pose a potential health or aesthetic risk to future site users?
- Have aesthetic issues been addressed by the completed remediation works?
- Have the site remediation activities been undertaken in compliance with the RAP including waste classification and off-site disposal of material?
- Have imported materials been suitably characterised prior their importation to site?
- Is the site suitable for the proposed future land use?

During the remediation activities, sufficient validation of site activities is required to demonstrate that the identified risks to future user(s) of the site have been adequately managed to render the site suitable for the indicated land use.

7.2.3 Identify Inputs to the Decision

The inputs to the decision are:

- Previous investigation data;
- Field observations in relation to inspection of all excavation bases, walls and stockpiles for odours, sheen, discolouration, and other indicators of potential contamination;
- Soil analysis data collected from the additional site characterisation of residual fill materials;

- Waste classification and material characterisation data obtained during assessment of fill material prior to and during remediation works;
- Field observations, sampling and analytical data for imported materials;
- Field observations, sampling and analytical data of any unexpected finds;
- Disposal dockets and relevant documents in relation to appropriate disposal of material to be removed from site as part of the remediation works (landfill dockets, beneficial reuse / recycling dockets, trade waste disposal, etc.);
- Relevant guideline criteria for validation and waste classification; and
- Data quality indicators (DQIs) as assessed by quality assurance / quality control (QA/QC).

7.2.4 Define the Study Boundary

The lateral study boundaries are limited to the cadastral and site boundaries, as shown on **Figure 2**.

7.2.5 Develop a Decision Rule

The decision rules adopted to answer the decisions identified in **Section 7.2.2** are discussed below in **Table 7.1**.

Table 7.1: Summary of Decision Rules

Decision Required to be Made	Decision Rule
1. Has contaminated soil been removed from the site, or is otherwise managed as per a long-term containment strategy to not pose a potential health or aesthetic risk to future site users?	If validation data is available at each location where unacceptable contamination impacts were present to validate that impacted soils have been excavated sufficiently to cause removal of all unacceptable contamination. AND Contaminated soils have been disposed off-site OR Contaminated soils have been transferred to a containment cell which has been capped to prevent access to impacted soils and a long-term EMP are in place. Then the answer is **Yes**. Otherwise, the answer is **No** and further works are required to control soil contamination hazards on the site.
2. Have aesthetic issues been addressed by the completed remediation works?	If there are any remaining unacceptable odours, soil inclusions or soil discolouration, the answer to the decision will be **No**. Otherwise, the answer to the decision will be **Yes**.
3.Have the site remediation activities been undertaken in compliance with the RAP including waste classification and off-site disposal of material?	Qualitative assessment of the works in relation to the RAP and regulatory approvals will be undertaken during and following the completion of remediation activities. If there are no outstanding requirements with respect to the regulatory approvals, the decision will be **Yes**. Otherwise, the answer to the decision will be **No**.

Decision Required to be Made	Decision Rule
4. Have imported materials been suitably characterised prior their importation to site?	Analytical data sets and inspection data will be reviewed for each proposed material type/source against established definitions for acceptable material (i.e. VENM, resource recovery exemptions, etc) and EPA endorsed criteria as established in the RAP as validation criteria. If the complete data set for the applicable material meet the requirements relevant to the material type, the answer to the decision is **Yes** and material may be imported to site. If the data set exceeds the adopted criterion, the answer to the decision is **No** and the material cannot be imported to site for use in development activities.
5. Is the site suitable for the proposed future land use?	If there are no potentially unacceptable risks to human health and the environment remaining onsite then the answer is **Yes**. Otherwise, the answer is **No**.

7.2.6 Specify Limits of Decision Error

This step is to establish the decision maker's tolerable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data. Data generated during this project must be appropriate to allow decisions to be made with confidence.

Specific limits for this project have been adopted in accordance with the appropriate guidance from the NSW EPA including NEPC (2013), appropriate indicators of data quality (DQIs used to assess QA/QC) and standard procedures for field sampling and handling.

The pre-determined DQIs established for the project are discussed below in relation to precision, accuracy, representativeness, comparability, completeness and sensitivity (PARCCS parameters), and are shown in **Table 6.2**.

- **Precision** - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD[16]) of duplicate samples.
- **Accuracy** - measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness** –expresses the degree to which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy.
- **Comparability** - expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; ensuring analysing laboratories use consistent analysis techniques and reporting methods.

16 $$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where C0 is the analyte concentration of the original sample
Cd is the analyte concentration of the duplicate sample

- **Completeness** – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study.
- **Sensitivity** – expresses the appropriateness of the chosen laboratory methods, including the limits of reporting, in producing reliable data in relation to the adopted criteria.

If any of the DQIs are not met, further assessment of the data set will be required in order to determine whether the non-conformance has significant effects on the usefulness of the data. Corrective action to correct an adverse impact on the reliability of the dataset may include but is not limited to, the request for further information from samplers and/or analytical laboratories, downgrading of the quality of the data or re-collection of the data.

Table 7.2: Summary of Data Quality Indicators

Data Quality Objectives	Frequency	Data Quality Indicator
Precision		
Blind duplicates (intra laboratory)	1 / 20 primary samples	1-10x LOR – no limit; 10x-30x LOR - <50 % relative percent difference (RPD)[1] >30x LOR - <30 % RPD
Blind duplicates (inter laboratory)	1 / 20 primary samples	
Laboratory duplicates	1 / 20 primary samples	
Accuracy		
Surrogate spikes	All organic samples	70-130 %
Laboratory control samples	1 per lab batch	70-130 %
Matrix spikes	1 per lab batch	70-130 %
Representativeness		
Sampling appropriate for media and analytes	All samples	-[2]
Samples extracted within holding times.	All samples	Soil: organics (14 days), inorganics (6 months)
Trip spike	1 per sampling event	70-130% recovery
Rinsate blank	1 per sampling event	<LOR
Method blank	1 per lab batch	<LOR
Laboratory Blank	1 per lab batch	<LOR
Comparability		
Standard operating procedures for sample collection & handling	All Samples	All samples
Standard analytical methods used for all analyses	All Samples	NATA accredited methods
Consistent field conditions, sampling staff and laboratory analysis	All Samples	All samples[2]
Limits of reporting appropriate and consistent	All Samples	All samples[2]
Completeness		
Sample description and COCs completed and appropriate	All Samples	All samples[2]
Appropriate documentation	All Samples	All samples[2]
Satisfactory frequency and result for QC samples	All QA/QC samples	95% compliance
Data from critical samples is considered valid	-	Critical samples valid

Data Quality Objectives	Frequency	Data Quality Indicator
Sensitivity		
Analytical methods and limits of recovery appropriate for media and adopted Site assessment criteria	All samples	LOR ≤ site assessment criteria

[1] If the RPD between duplicates is greater than the pre-determined data quality indicator, a judgment will be made as to whether the excess is critical in relation to the validation of the data set or unacceptable sampling error is occurring in the field.

[2] A qualitative assessment of compliance with standard procedures and appropriate sample collection methods will be completed during the DQI compliance assessment.

7.2.7 Optimise the Design for Obtaining Data

The purpose of this step is to identify a resource-effective field validation sampling design that generates data that are expected to satisfy the decision performance criteria, as specified in the preceding steps of the DQO process. The output of this step is the sampling design that will guide the development of the field sampling and analysis plan. This step provides a general description of the activities necessary to generate and select data collection designs that satisfy decision performance criteria.

The remediation validation and subsequent laboratory analysis program as outlined in the following sections will need to be implemented during site remediation activities to demonstrate the successful completion of works in compliance with the RAP goals. The validation/characterisation sampling and analytical program for the site is outlined in **Table 7.3** following.

Table 7.3: Characterisation/Remediation Validation Program

Item	RAP Sampling Frequency		Analytical Suite
Export of Materials			
Classified in accordance with EPA (2014) Waste Guidelines	Soils requiring classification for off-site disposal will be sampled by the environmental consultant as per the sampling density for stockpiled materials in EPA (2022a)		Heavy metals, TRH, PAH, BTEX, PCB, Asbestos (presence/ absence)
Materials Importation			
Imported VENM	Minimum of 5 samples per source site/material type up to 10,000 m^3 then 1 sample per 1,000 m^3 thereafter		TRH/BTEX, PAH, Heavy Metals, OCP/PCBs, Asbestos (NEPM protocol: 500 mL)
Quarried natural materials (e.g. blue metal, sandstone, shale)	Confirmation that the material is quarried rock (consistent with VENM) prior to importation, and visual confirmation.		Source site inspection required
Recycled materials including 'quarry' products that are recycled.	Letter demonstrating compliance with the EPL from the source facility and supplemented with analytical data at a density of 3 samples per material type/batch up to 2,000 m^3 then 1 sample per 500 m^3 thereafter		TRH/BTEX, PAH, Heavy Metals, Asbestos (NEPM protocol: 500 mL)
Imported ENM	As per the order/exemption		As per the order/exemption + asbestos (500 mL)
Contaminated Fill			
Stockpile Footprints (if no plastic present)	1 per 25 m^2 (5 m grid)	N/A	TRH and PAH
Unexpected Find	1 per 25 m^2	1 per 5 m lineal	As appropriate, depending on the location and characteristics of the unexpected find

Fill Characterisation	Residual *in-situ* fill materials requiring characterisation will be sampled by the environmental consultant as per the systematic sampling density in EPA (2022a)	TRH/BTEX, PAH, Heavy Metals, Asbestos (NEPM protocol: 500 mL)

The nominated sampling densities and analytical program have considered sample density guidance provided in EPA made and endorsed guidelines.

7.3 Soil Sampling Methodology

7.3.1 Validation of Excavations

Samples shall be collected by an environmental consultant from near surface depths of excavation walls and bases either directly by hand using new nitrile gloves between samples, or with the aid of a hand trowel. Where used, the hand trowel will be thoroughly decontaminated using phosphate free detergent and distilled water between each sampling location.

Samples will be collected and place in laboratory supplied glass jars. A chain-of-custody form will be completed and forwarded with the samples to the testing laboratory. The validation samples will be transferred to a chilled ice box for sample preservation prior to and during shipment to the testing laboratory.

During the collection of soil samples, features such as seepage, discolouration, staining, odours and other indicators of contamination will be noted on the field documentation.

Soil validation samples shall be analysed by a primary laboratory which shall be NATA accredited for the required analyses. The secondary (check) laboratory responsible for analysing a certain proportion and type of QA/QC samples shall also be NATA accredited for the required analyses. Both laboratories will also be required to meet the environmental consultant's own internal quality assurance requirements.

7.3.2 Stockpile Sampling

For stockpile sampling, material will be obtained from a minimum depth of 0.3 m into the surface of the stockpile at the time of sampling ensuring the centre of the stockpile is observed and sampled as required to ensure representative samples are collected. Appropriate decontamination activities shall be followed following the collection of each sample.

During the collection of soil samples, features such as seepage, discolouration, staining, odours and other indications of contamination will be noted on the field documentation.

7.3.3 Sampling for Asbestos Assessment

Bulk soil samples (minimum 10 L) will be collected and weighed in the field. Collected bulk sample will be sieved in the field (≤7mm passing) and separated fragments retained and weighed in the field, or spread out on contrasting plastic. The asbestos concentration as ACM in soil will be calculated in accordance with NEPC (2013) and WA DOH (2021) and based on the weight of collected fragment/s (assuming 15% asbestos content) divided by the weight of the collected 10 L soil sample, providing a w/w %. Validation criteria will be adopted in accordance with NEPC (2013) for the permissible land use.

A separate 500 mL soil sample will be collected from the same location as a bulk sample, labelled and sent to the laboratory for asbestos analysis according to NEPM (2013) protocol.

7.3.4 Waste Classification and Imported Materials

Soil sampling will be conducted by the environmental consultant for waste classification and imported materials characterisation only. The soil sampling method shall be determined by the environmental consultant as consistent with the observations of subject materials appropriate to generate representative samples.

During the collection of soil samples, features such as seepage, discolouration, staining, odours and other indications of contamination shall be noted on field reporting sheets / field logs.

7.4 General Sampling Requirements

7.4.1 Sample Handling

Collected samples will be immediately transferred to sample containers of appropriate composition (glass jars for chemical analysis, laboratory-supplied bottles for specific analytes for water samples, and plastic bags for asbestos). Sample labels recorded: job number; sample identification number; and date of sampling.

Sample containers will be transferred to a chilled ice box for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form will be completed and forwarded with the samples to the testing laboratory.

7.4.2 Duplicate and Triplicate Sample Preparation and QA/QC Requirements

Field duplicate and triplicate samples for the characterisation/validation assessment will be obtained during sampling using the procedures outlined at a frequency outlined in **Table 7.2**. The primary sample will be divided laterally into three samples with minimal disturbance to reduce the potential for loss of volatiles and placed in three clean glass jars and / or plastic bags.

All sample containers will be filled completely with no headspace to reduce the potential for loss of volatiles and separately labelled as the primary, duplicate and triplicate samples before being placed in the same chilled esky for laboratory transport.

Trip spike, storage blank and rinsate samples will be collected as per **Table 7.2**.

7.4.3 Sampling Equipment Decontamination

The following procedure will be used to clean non-disposable equipment, including the trowel, pick etc., prior to the collection of each sample:

- Scrubbing with a wire brush to remove gross contamination;
- Pressure spray with Decon 90 detergent and potable water mix;
- Pressure spray rinse with potable water; and
- Air drying.

Rinsate samples will be obtained during the field decontamination procedures at regular intervals during characterisation/validation sampling activities. Each rinsate sample will be obtained by rinsing the trowel with laboratory grade demineralised water following the decontamination procedure. The water sample will be appropriately preserved and stored with the site samples prior to transport to the laboratory for chemical analysis.

7.5 Laboratory Analyses

All laboratories must be National Association of Testing Authorities (NATA) registered for the relevant analyses required for the remediation and validation works program. Additionally, the laboratories are to meet the environmental consultant's internal QA/QC requirements.

7.6 Validation Criteria

As per the decision process for assessment of urban development site (EPA 2017), a set of health and ecological validation criteria derived from NEPC (2013) for the proposed land use. From a contamination perspective, 'information and education facilities' are considered to be commercial land use. Given the proposed ongoing commercial use of the site, collected data will be compared to criteria for commercial land

use. A coarse-grained soil texture was adopted for relevant criteria given the occurrence of predominantly sandy natural soils and sand-based fill at the site.

7.6.1 Soil Validation Criteria

Laboratory results from validation soil samples will be compared against adopted health-based and ecological criteria listed in NEPC (2013) for commercial/industrial land use in alignment with the proposed use of the site as an information and education facility:

- NEPC (2013) Health-based Investigation Levels (HILs) for commercial/industrial land use (HIL- D);
- NEPC (2013) Health Screening Levels (HSLs) for petroleum hydrocarbons considering potential for vapour intrusion, coarse grained soil for commercial/industrial land use (HSL D) land use at 0.0-1.0 m depth;
- NEPC (2013) site specific Ecological Investigation Levels (EILs) derived through the added contaminant limits for commercial/industrial land use;
- NEPC (2013) Management Limits for TRH, coarse grained soils for commercial/industrial land use;
- NEPC (2013) Ecological Screening Levels (ESLs) for TRH fractions, BTEX and benzo(a)pyrene in coarse grained soil for commercial/industrial land use; and
- Where there are no NSW EPA endorsed thresholds the laboratory LOR has been adopted as an initial screening value for the purposes of this validation assessment.

Refence will be made to NEPC (2013) under a commercial/industrial setting to establish what constitutes an aesthetics issue.

7.6.2 Application of Soil Assessment Criteria

For soils to be considered as meeting the health/ecological based validation criteria (i.e., not posing an unacceptable risk), the following criteria will be adopted:

Either:

- All contaminant concentrations were less than the adopted site criteria,

Or:

- The upper 95% confidence limit on the average concentration for each analyte (calculated for samples collected from consistent soil horizons, stratigraphy or material types) was below the adopted criterion;
- No single analyte concentration exceeded 250% of the adopted criterion; and
- The standard deviation of the results was less than 50% of the criterion.

Analytical results for asbestos in soils will be directly compared to the site criteria. No statistical assessment for asbestos in soils will be undertaken.

In addition to the numerical criteria, the following observations will also supplement the validation process:

- Soils shall not emit recognisable odours, be discoloured because of contamination or have any significant additional aesthetic concerns with respect to future site users (i.e. inclusive of metallic wastes or potential asbestos containing materials).

7.6.3 Off-site Disposal

Contaminated soils requiring disposal off-site shall be assessed in accordance with EPA (2014) *Waste Classification Guidelines Part 1: Classifying Waste*. Refer to **Table 7.3**.

7.6.4 Imported Materials

In accordance with current EPA policy, only material that does not represent an environmental or human health risk at the receiving site may be considered for resource recovery. Imported materials will only be accepted to the site if they meet the restrictions placed on these materials and meet the definition of:

- Quarried natural materials;
- VENM as defined in as defined in EPA (2014) Waste Classification Guidelines and the Protection of the Environment Operations Act (1997) Schedule 1;
- Excavated Natural Material (ENM) as defined in the ENM RRO/RRE; or
- Recycle materials as per relevant RRO/RRE.

All materials imported onto the site are required to be accompanied by appropriate documentation that has been verified by the environmental consultant.

Sampling of materials as per relevant RRO/RRE (recycled products) is required to be undertaken by the facility prior to import. In addition, where materials are proposed for beneficial reuse under a relevant RRO/RRE (i.e. imported to the site), fill material will need to be further assessed by the environmental consultant for land use suitability.

7.7 Validation Reporting

At the completion of the remedial works, a validation report will be prepared in general accordance with the *Consultants Reporting on Contaminated Land* guidelines (EPA 2020), documenting the works as completed. The report will contain information including:

- Details of the remediation works conducted;
- Information demonstrating that the objectives of this RAP have been achieved, in particular the validation sample results and assessment of the data against both the pre-defined DQO and the remediation acceptance (validation) criteria;
- Any variations to the strategy undertaken during the implementation of the remedial works;
- Results of all environmental monitoring undertaken during the course of the remedial works;
- Details of any environmental incidents occurring during the course of the remedial works and the actions undertaken in response to these incidents;
- Verification of regulatory compliance;
- Details on waste classification, tracking and off-site disposal including landfill dockets;
- Details of importation of material, including compliance with importation protocols;
- Photographic records of applicable remediation works; and
- Clear statement of the suitability of the site with respect to proposed land uses with references for ongoing management (if applicable).

The report will serve to document the remediation works for future reference.

7.8 Long Term Environmental Management Plan

An LTEMP may be needed to address the retention of contaminated soils (should asbestos or other contaminants above the health criteria be retained). The LTEMP will be required to be prepared for the site to notify the occurrence of these contaminated soils, and control potential exposures to these soils as may occur with future sub-surface works.

The LTEMP will be required to be prepared in accordance with "*Preparing Environmental Management Plans for Contaminated Land – Practical Note*" (EPA 2022c[17]) and include the following elements:

- A statement of the objectives of the LTEMP – i.e; to ensure continued suitability of the site following remediation.
- Clear reason and purpose for the LTEMP;
- Identification of residual environmental contamination issues at the site that require ongoing management/monitoring to meet the LTEMP objectives, including the type of contamination and location within the site (including a survey plan prepared by a registered surveyor). Is contained soils are impacted with asbestos, this shall further consist of an Asbestos Register.
- Documentation of environmental management measures which have been implemented to address the identified environmental issues at the site.
- Description of responsibilities for implementing various elements of the provisions contained in the LTEMP including enforceability and notifications.
- Timeframes for implementing the various control/monitoring, etc. elements outlined in the LTEMP. Noting this LTEMP will mostly be passive and will only require management/controls if the capping and marker layers are breached during excavation/maintenance works.
- Corrective action procedures to be implemented where LTEMP assessment criteria are breached.

The LTEMP shall require to be finalised with the preparation of the Validation Report at the completion of the remedial works.

17 Preparing Environmental Management Plans for Contaminated Land – Practical Note NSW EPA January 2022 (EPA 2022)

8. Contingency Plan

A review of the proposed contamination-related aspects of the works associated with development of the site has been undertaken and has identified a number of potential risks that required the development of contingencies to ensure that the objectives of this RAP are met.

8.1 Unexpected Finds Protocol

The possibility exists for hazards to be present at the site other than those identified and expected based on previous investigations.

Environmental sampling is based on chemical analytes identified as a potential concern during a documented process of reviewing historical site activities. However, ground conditions between sampling points may vary, and further hazards may arise from unexpected sources and/or in unexpected locations. The nature of any additional hazards that may be present at the site are generally detectable through visual or olfactory means, for example:

- Areas of previously unidentified ACM on the ground surface or within fill material;
- Uncontrolled filling, such as in eroded drainage lines;
- Drums or underground tanks;
- Chemical bottles; and
- Odorous or unusual coloured soils;

As a precautionary measure to ensure the protection of the workforce and surrounding community, if any of the abovementioned substances are identified (or any other unexpected potentially hazardous substance), the procedure summarised in **Flowchart 7.1** and detailed in the following sections is to be followed.

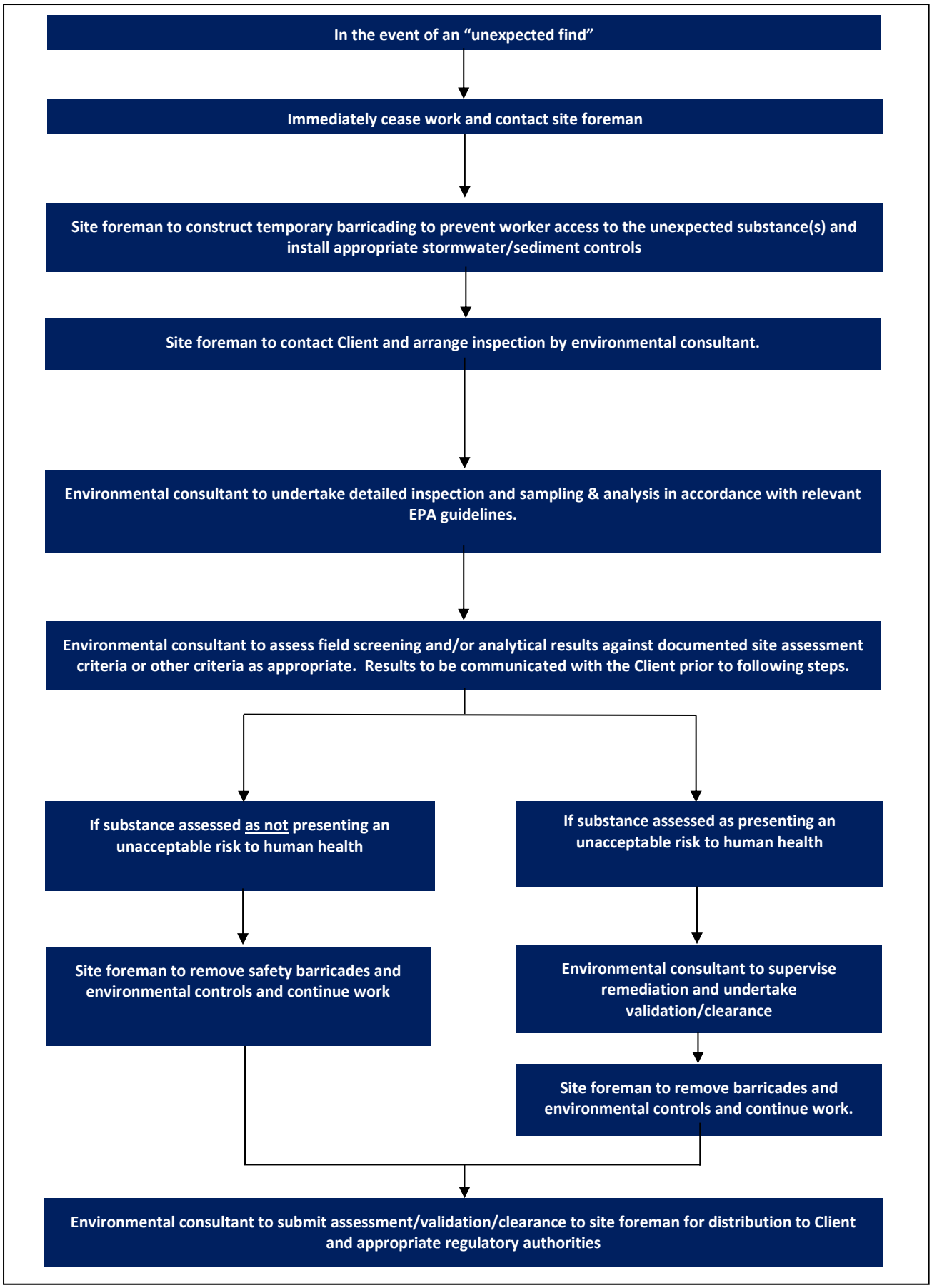
An enlarged version of an unexpected finds protocol, suitable for use on-site, should be posted in the Site Office and referred to during the Site-Specific Induction by the Principal Contractor.

The sampling strategy for each 'unexpected find' shall be designed by a suitably qualified Environmental Consultant, in accordance with guidelines made or endorsed by EPA. The strategy will, however, be aimed at determining the nature of the substance – that is, is it hazardous and, if so, is it at concentrations that pose an unacceptable risk to human health or the environment.

The sampling frequency of the identified substance / materials shall meet the requirements of the NSW EPA (2022a).

The assessment criteria shall be determined by the Environmental Consultant, with the subject material to at least meet the criteria nominated in **Section 7.6**, and additional criteria (as necessary) obtained from published national guidance documents.

Flowchart 8.1 – Unexpected Finds Protocol



8.2 Contingency Scenarios

8.2.1 Change in Development Plans

In the event that the development plans are changed from those available at the time of preparation of this RAP, particularly where significant amendment of the extent of permanent paving at the site and/or alterations to the landscape and basement designs, consideration of the suitability of the proposed remedial strategy will be required.

8.2.2 Material Storage Breach

In the event that any materials storage containment controls are breached, and contaminated stockpiled materials have escaped (or have the potential to escape), then the management controls shall be rectified and investigations undertaken to review the adequacy of the controls and any improvements implemented.

8.2.3 Complaints

Due to the nature of the activities and type of contaminants identified at the site there is a potential for complaints to be received from members of the public, relating to environmental emissions including:

- Dust emissions arising from soil excavation, material handling and transport;
- Odour emission associated with the excavation and exposure of odours material;
- Noise and vibration from excavation and truck movements; and
- Soil impact to local roads associated with poor cleaning practices of site vehicles.

Monitoring of all potential environmental emissions shall be undertaken as detailed in **Sections 9** and **10** and appropriate actions taken to further control emissions following receipt of a complaint. Such additional controls may include the following actions:

- Disturbance of soils during meteorologically favourable periods (minimal wind conditions) only; and / or
- Increasing environmental controls including covering and / or wetting down soils which are generating dust.

8.2.4 Lack of Available Space

The proposed remedial works have the potential to be hindered by available temporary storage space for excavated materials.

In the event that temporary storage of excavated materials becomes difficult, works should cease until an appropriate management plan can be developed to appropriately manage and store excavated materials safely until such time as they can be appropriately managed.

8.2.5 Severe Weather

Weather should be monitored on a daily basis via checking an internet-based weather service provider. Should severe weather be forecast, especially strong winds, works shall stop until safe to re-commence. All site management controls shall be implemented to the extent practicable as outlined in **Section 9** prior to any severe weather events.

8.2.6 Acid Sulfate Soil Occurrence

In the event that bulk excavation works expose materials with physical properties indicative of PASS/ASS, materials will be subject to characterisation by a qualified environmental consultant. Fill/soil will be field screened and subject to laboratory analysis (where required) to determine if specific management of the

materials is required. Should ASS be identified, an appropriate Acid Sulfate Soil Management Plan (ASSMP) should be developed for the site.

Any ASS-related works will be completed in accordance with ASSMAC (1998).

9. Other Remediation Documents

9.1 Environmental Management

9.1.1 Preparation of a Remediation Environmental Management Plan

Prior to the commencement of remediation works, a REMP shall be prepared by the remediation contractor which documents the environmental monitoring and management measures required to be implemented during the remediation and construction-related activities associated with the construction of the site.

The REMP shall address each of the nominated items in **Section 9.1.2**. Additional environmental management requirements may be required as part of development consent.

9.1.2 Required Elements/Procedures

An assessment of the proposed activities and the associated elements required to be incorporated into the REMP is provided in **Table 8.1**. The REMP is required to address each of the required elements and procedures in full detail and to include detailed monitoring processes and procedures, corrective actions and reporting requirements.

Table 9.1: Required Elements of the REMP

Element	Specific Minimum Requirements to be included in REMP
1. Dust Control	Provisions for dust control if required.
2. Flora and Fauna	As appropriate.
3. Heritage/Archaeological	In accordance with relevant heritage/archaeological studies.
4. Visual Impacts	Visual monitoring at site boundary
5. Emergency Response	As appropriate. Procedures required for spill incident response including material storage breach.
6. Noise Control	Hours of operation, consistent with the consent conditions.
7. Traffic	Controls on vehicle movements on public roads. Controls on transport of impacted materials.
8. Protection of Adjoining Structures	As appropriate.
9. Odour Control	Procedures for management of potentially odorous works.
10. Handling of Contaminated Soil and Groundwater	Soil and water management (stockpiling, site access, excavation pump out, reinstatement).
11. Soil Storage/Placement Areas	Soil and water management (stockpiling, site access, excavation pump out, reinstatement). Bunding. Heavy vehicle/personnel decontamination. Site drainage requirements, incorporating clean/dirty areas and modifications to existing surface water and drainage controls beneath retained pavements. Monitoring as required.
12. Sediment Control	Bunding. Collection/treatment/handling impacted sediments.
13. Operation of Site Office	As appropriate.
14. Decontamination of Heavy Equipment	As appropriate.

Element	Specific Minimum Requirements to be included in REMP
15. Environmental Monitoring	Monitoring of dusts, noise, odour and fibres. Monitoring as required for vibration and water releases. Inspection checklists and field forms.
16. Environmental Criteria	Soil criteria as presented in this RAP
17. Material Classification	As detailed in this RAP.
18. Community Relations Plan	Specific communication protocols, incorporating nomination of specific contact persons & details and requirements for communications/response register.
19. Incident Reporting	As appropriate, including standard form/checklist.
20. Security and Signage	Secure site perimeter. Site boundary signage.
21. Training	As appropriate.
22. Contact Details	Company/personnel details, including names/phone numbers for: - Principal Contractor - Environmental Consultant - Remediation Contractor - WH&S Compliance - Environmental Compliance
23. Stockpiling	All stockpiles of soil or other materials shall be placed away from drainage lines gutters or stormwater pits or inlets. All stockpiles of soil or other materials likely to generate dust or odours shall be covered. All stockpiles of chemically contaminated soil shall be stored in a secure area and be covered if remaining for more than 24 hours. All stockpiles of asbestos-contaminated soils shall be kept damp and covered to minimise potential fibre release, and if left for more than 24 hours, be stored in a secure area.
24. Waste Management	All waste materials classified in accordance with the RAP are required to be disposed of at a licensed waste facility that are lawfully able to accept such materials. Material tracking in the form of disposal dockets will be required for the purposes of satisfying the validation report.

9.1.3 Certification

Prior to the commencement of remediation works, the remediation contractor is required to have the REMP endorsed as acceptable by the environmental consultant or the client.

9.1.4 Hours of Site Operation/Duration of Works

Remediation works shall be completed in accordance with the permissible hours of work and noise as nominated in of the Development Consent.

The appointed remediation contractor will be required to include a proposed schedule of remediation works within the REMP submitted for endorsement as discussed above.

9.2 Health and Safety

9.2.1 Work Health and Safety Management Plan

A WHSP shall be prepared by the remediation contractor prior to the commencement of remediation works. The plan shall contain procedures and requirements that are to be implemented as a minimum during the works.

The objectives of the WHSP are:

- To apply standard procedures that minimise risks resulting from the works;
- To ensure all employees are provided with appropriate training, equipment and support to consistently perform their duties in a safe manner; and
- To have procedures to protect other site workers and the general public.

These objectives will be achieved by:

- Assignment of responsibilities;
- An evaluation of hazards;
- Establishment of personal protection standards, mandatory safety practices and procedures;
- Monitoring of potential hazards and implementation of corrective measures; and
- Provision for contingencies that may arise while operations are being conducted at the site.

9.2.2 Asbestos Works

Should asbestos-related remedial works be required, perimeter asbestos in air monitoring will be conducted at each applicable remedial works area boundary when soil with asbestos is being disturbed. Air monitoring will be conducted on a daily basis at relevant locations whilst disturbance of asbestos contaminated areas takes place. All associated works shall be undertaken in accordance with the WHS Regulation, SafeWork NSW (2022) *Code of Practice: How to Safely Remove Asbestos*, and SafeWork NSW (2022) *How to Manage and Control Asbestos in the Workplace*.

Air monitoring will be conducted during any ground disturbance activities associated with asbestos remedial works to verify that implementation of appropriate control measures has been successful at managing the risk of air borne fibre generation. Air monitoring will be undertaken in accordance with the requirements of the National Occupational Health and Safety Commission (NOHSC) Asbestos Code of Practice and Guidance Notes, in particular the *Guidance note for the estimation of airborne asbestos dust* [NOHSC 3002:2005].

9.2.3 Additional Consideration of Chemical Contaminants

As a precautionary measure, the WHSP should include the requirement for the plan to be revised in the event of an unexpected find of contaminated material during remediation and/or construction.

When working with contaminated materials in general, care needs to be taken to ensure that the contamination is not introduced to the worker via ingestion, inhalation or absorption. The WHSP must detail the PPE and decontamination requirements to be followed to control the risks posed by potential exposure to chemical contaminants at/within the site.

10. Conclusions and Recommendations

10.1 Conclusions

Overall, it is considered that the proposed actions outlined in this RAP conform to the requirements of the *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd Edition)* (EPA 2017) because they are: technically feasible; environmentally justifiable; and consistent with relevant laws policies and guidelines endorsed by NSW EPA.

Subject to the successful implementation of the measures described in this RAP it is concluded that the site can be made suitable for the intended commercial land use and that the risks posed by contamination can be managed in such a way as to be adequately protective of human health and the environment.

10.2 Recommendations

It is recommended that the processes outlined in this RAP be implemented and that the following documentation be developed and implemented to ensure the risks and impacts during remediation works are controlled in an appropriate manner:

- A REMP, to document the monitoring and management measures required to control the environmental impacts of the remediation works and ensure the validation protocols are being addressed; and
- A WHSP to document the procedures to be followed to manage the risks posed to the health of the remediation workforce.

Upon completion of the remediation works, a Validation Report is required to be prepared to verify remedial works were completed in accordance with the RAP.

11. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties. The report has been prepared specifically for the client for the purposes of the commission, and no warranties, express or implied, are offered to any third parties and no liability will be accepted for use or interpretation of this report by any third party.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose. This report should not be amended in any way without prior approval by JBS&G, or reproduced other than in full including all attachments as originally provided to the client by JBS&G.

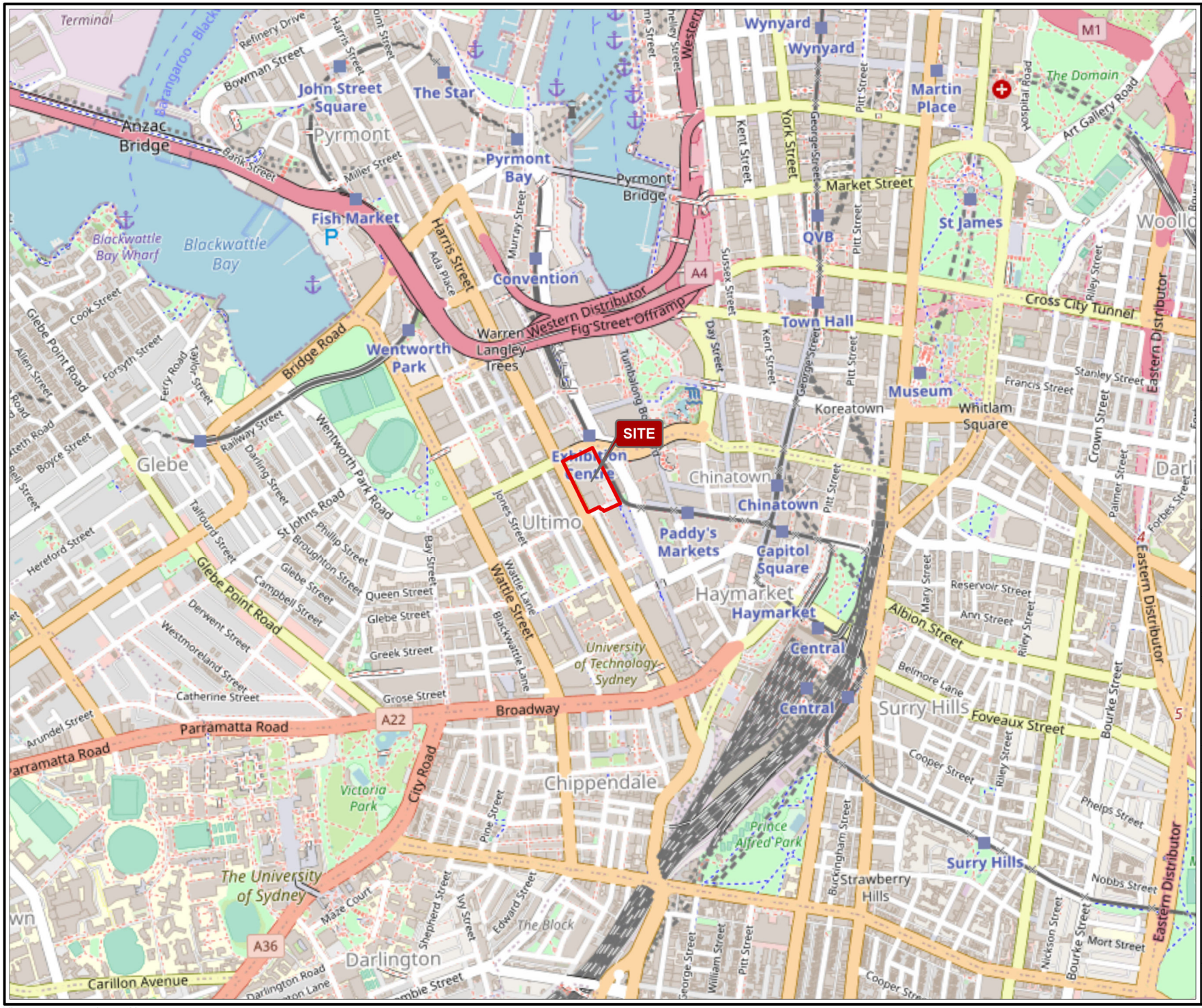
Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements or agreed scope of work.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

Figures



Legend

Approximate Site Boundary

JBS&G

Job No: 64391

Client: Infrastructure NSW

Version: R02 Rev A	Date 16/03/2023
Drawn By: PA	Checked By: SS

Scale 1:15,000

0 140 280

metres

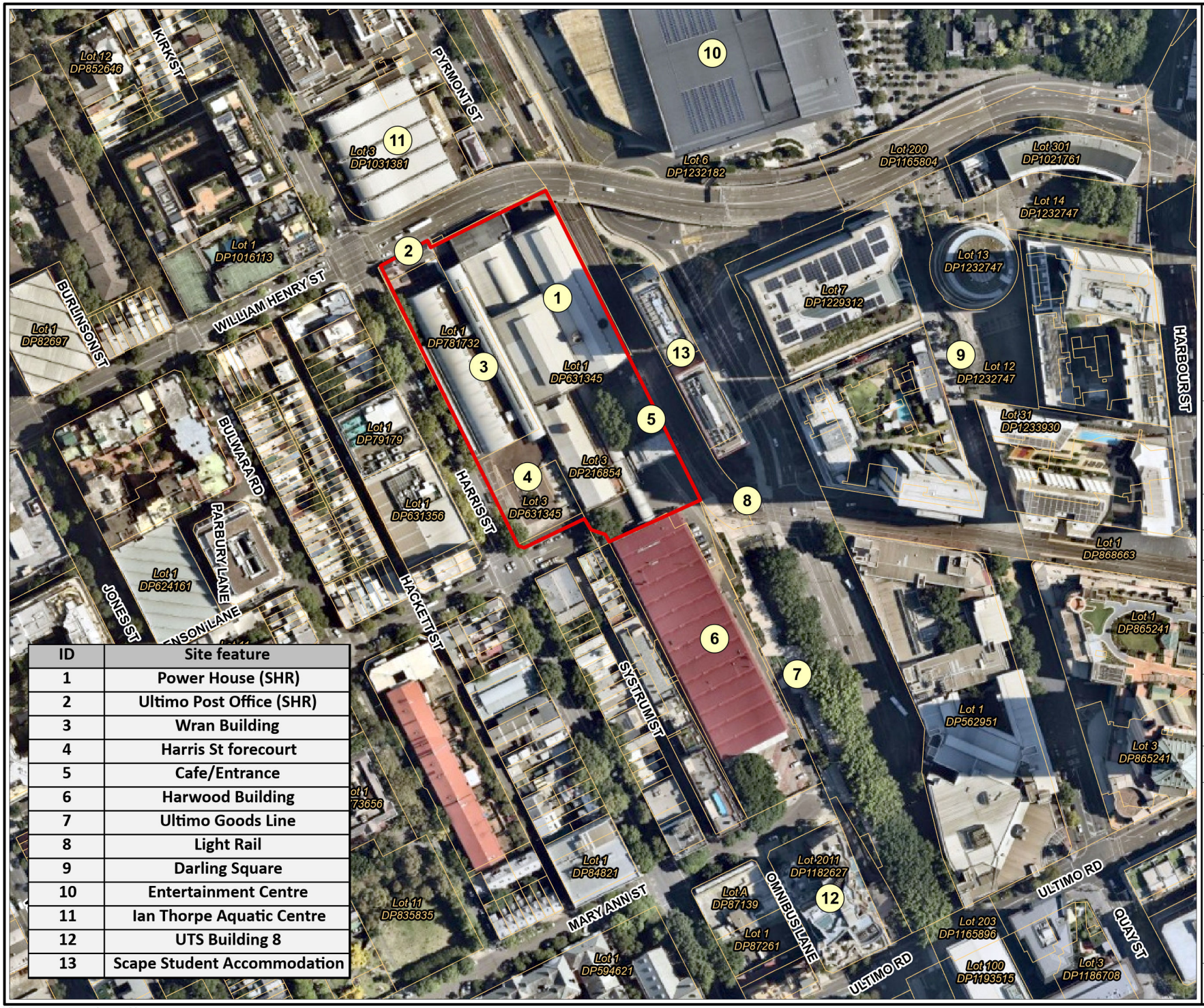
Coord. Sys. GDA 1994 MGA Zone 56

Powerhouse Museum
500 Harris Street, Ultimo
NSW

SITE LOCATION

FIGURE 1

File Name: 64391_Powerhouse_Ultimo_R02_RevA



ID	Site feature
1	Power House (SHR)
2	Ultimo Post Office (SHR)
3	Wran Building
4	Harris St forecourt
5	Cafe/Entrance
6	Harwood Building
7	Ultimo Goods Line
8	Light Rail
9	Darling Square
10	Entertainment Centre
11	Ian Thorpe Aquatic Centre
12	UTS Building 8
13	Scape Student Accommodation

Legend

Approximate Site Boundary

NSW Cadastre (2022)

JBS&G

Job No: 64391

Client: Infrastructure NSW

Version: R02 Rev A | Date 16/03/2023

Drawn By: PA | Checked By: SS

Scale 1:2,700

0 25 50

metres

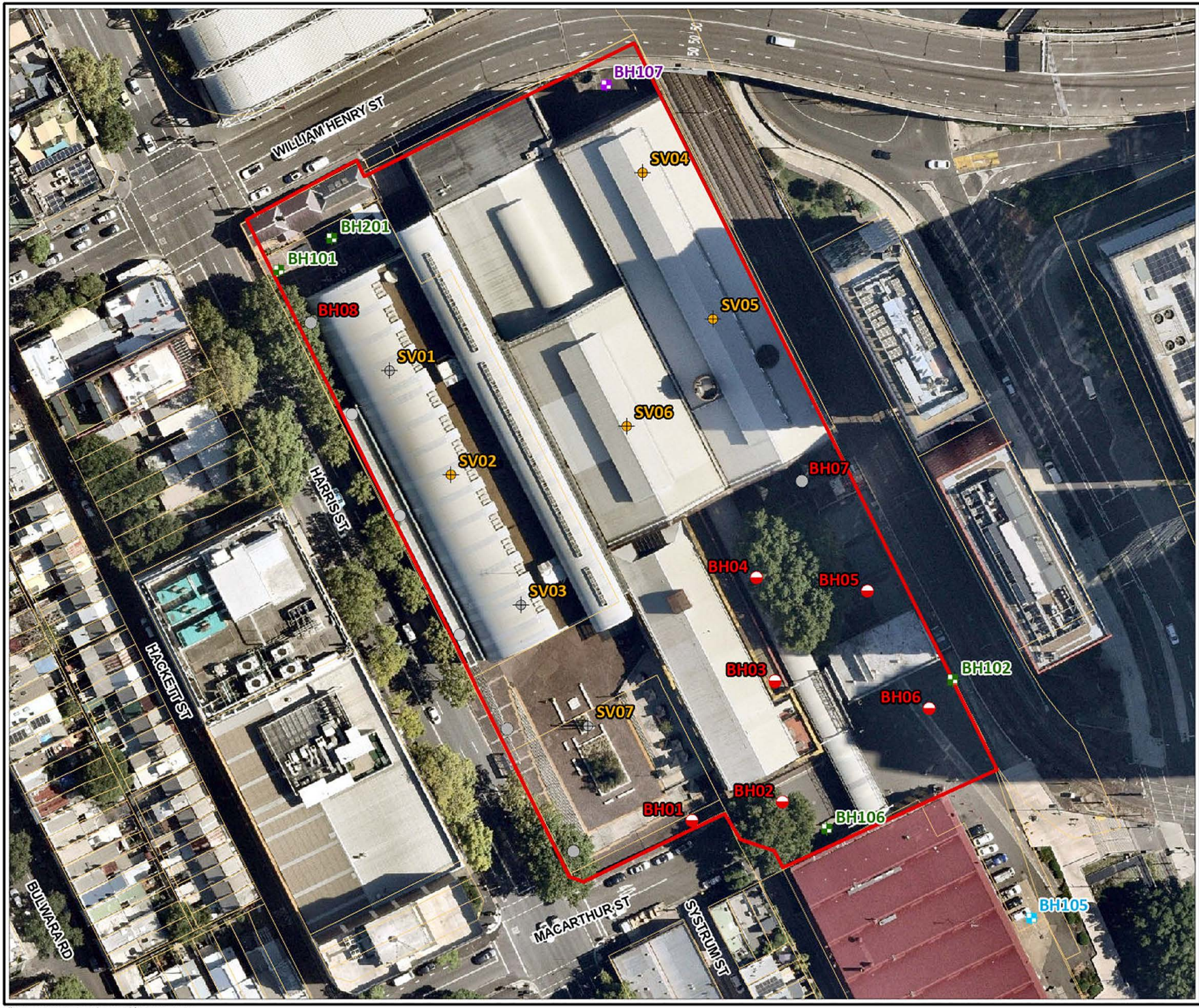
Coord. Sys. GDA 1994 MGA Zone 56

Powerhouse Museum
500 Harris Street, Ultimo
NSW

SITE LAYOUT

FIGURE 2

File Name: 64391_Powerhouse_Ultimo_R02_RevA
Reference: Nearmap - www.nearmap.com (Capture Date: 09/01/2023)



Legend

Approximate Site Boundary

NSW Cadastre (2022)

Historical Sample Locations (DP 2022)

Borehole

Borehole / Groundwater Monitoring Well

Hand Auger Bore

Sample Locations (JBS&G)

Borehole

Soil Vapour

Abandoned soil bore location, potential underlying basement

Soil Vapour

SV01 and SV03: Abandoned - concrete slab too thick

SV07: Refusal on hard surface

JBS&G

Job No: 64391

Client: Infrastructure NSW

Version: R02 Rev A | Date 16/03/2023

Drawn By: PA | Checked By: SS

Scale 1:1,150

0 10 20

metres

Coord. Sys. GDA 1994 MGA Zone 56

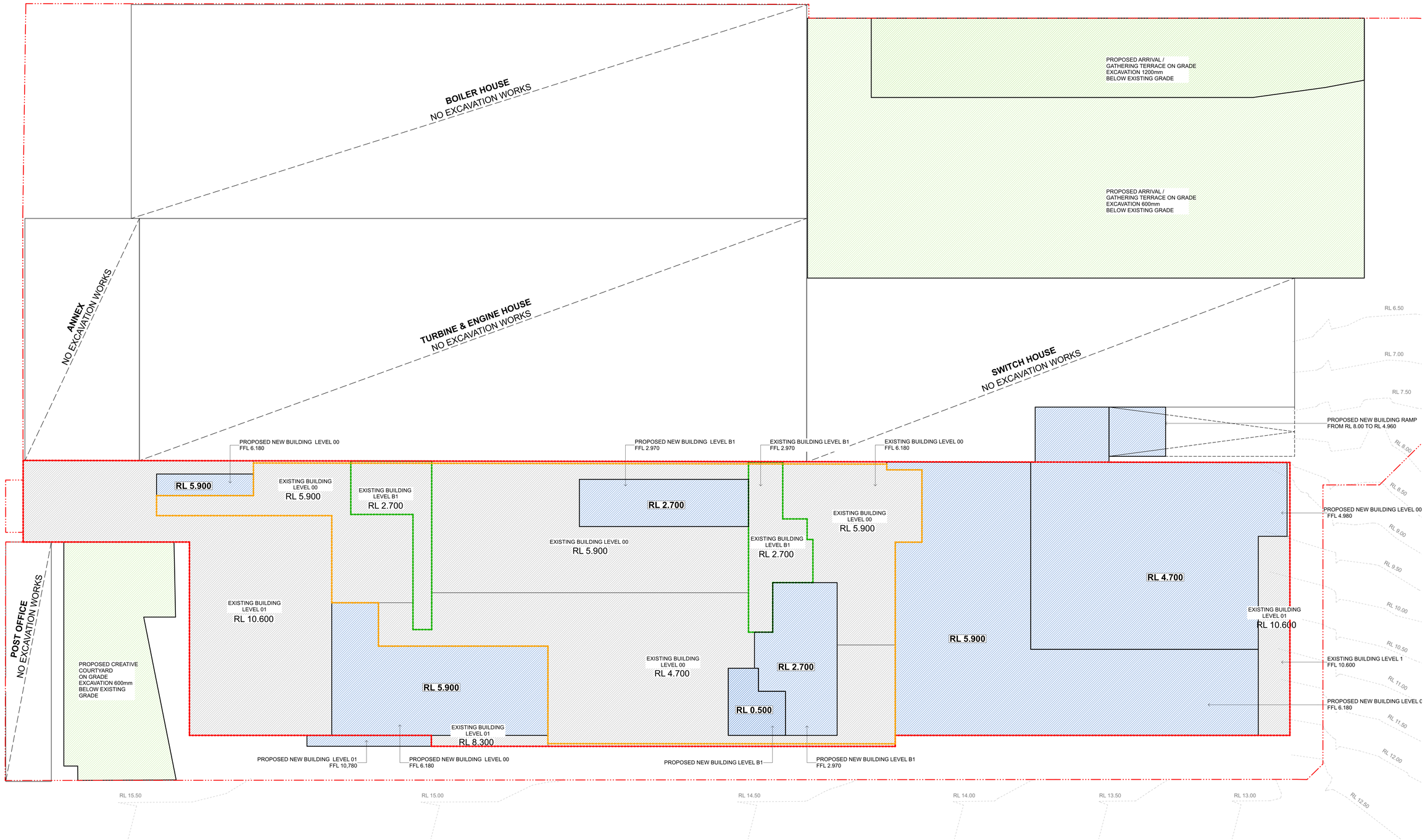
Powerhouse Museum
500 Harris Street, Ultimo
NSW

SAMPLE LOCATIONS

FIGURE 3

File Name: 64391_Powerhouse_Ultimo_R02_RevA
Reference: Nearmap - www.nearmap.com (Capture Date: 09/01/2023)

Appendix A Proposed Bulk Excavation Plan



NOTES

DO NOT SCALE OF DRAWINGS

Nominated Architects
Zone C+B: Durbach Block Jaggers - David Jaggers, NSWARB 9999
Zone A+D: Architectus - Ray Brown, NSWARB 6359

Do not scale drawings. Verify all dimensions on site

issue	amendment	date
A	Issue for SSDA	14.02.2024

0 2 5 10

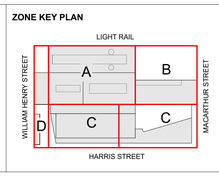
checked	scale 1:1, 1:200 @B1
drawn AKR/JP	project no 1744

Legend
Bulk Earthworks

- Existing Excavation
- New Excavation
- Excavation for Public Realm Works
- Existing Level 01 Extent
- Existing Level 00 Extent
- Existing Level B1 Extent

RL X.XXX Relative Level (To Sea Level) of Excavation

ZONE KEY PLAN



ZONES A + D
Lead Architect
Architectus
Level 18, 25 Martin Place
Sydney NSW 2000
T (02) 8252 8400
Sydney@architectus.com.au

architectus™
Gadigal Country
Level 18, 25 Martin Place
Sydney NSW 2000
T(02) 8252 8400
sydney@architectus.com.au
ABN 90 131 245 684

ZONES C + B
Lead Architect
Durbach Block Jaggers
Level 2, 9 Roslyn St
Potts Point NSW
2011 Australia
T 61 2 8297 3500
durbachblockjaggers.com

Emerging Architect
Youssofzay + Hart
Office 210, 3A Joynton Ave
Zetland NSW 2017
Ph +61 2 9518 0124
youssofzayhart.com.au

durbach block jaggers
Level 2, 9 Roslyn Street
Potts Point NSW 2011
02 8297 3500
durbachblockjaggers.com

Nominated Architects:
Neil Durbach NSW Reg. No 5850
David Jaggers NSW Reg. No 9999

project
Powerhouse Ultimo Revitalisation Project
500 Harris Street Ultimo NSW 2007 Australia

drawing
BULK EXCAVATION PLAN

drawing no.	issue
A.DA0080	**Rev A**

14/02/2024 5:45 pm

Appendix B Historical Analytical Tables

Table A: Historical Soil Data Summary
Project Number: 64391
Project Name: Powerhouse Ultimo

	Metals & Metalloids								TRHs (NEPC 2013)							BTEX						Polycyclic Aromatic Hydrocarbons																	
	Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc	C6-C10	C10-C16	C16-C34	C34-C40	C10-C40 (Sum of total)	F1 (C6-C10 minus BTEX)	F2 (C10-C16 less Naphthalene)	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(a)pyrene TEQ	Benzo(b+j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (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	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
EQL	2	0.4	5	5	5	0.1	5	5	20	50	100	100	100	20	50	0.1	0.1	0.1	0.1	0.2	0.3	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	0.5
NEPM 2013 Site Specific EIL - Comm/Ind (0-2m)	160[#8]		400[#9]	330[#10]	1800[#11]		550[#12]	1400[#13]																												370			
NEPM 2013 Table 1B(6) ESLs for Comm/Ind, Coarse Soil (0-2m)											1700[#14]	3300[#14]		215[#15]	170[#16]	75[#14]	135[#14]	165[#14]			180[#14]					1.4[#14]													
NEPM 2013 Table 1A(1) HILs Comm/Ind D Soil	3000[#1]	900	3600[#2]	240000	1500[#3]	730[#4]	6000	400000																			40[#5]												4000[#6]
NEPM 2013 Table 7 Comm/Ind D Soil HSL for Asbestos in Soil																																							
NEPM 2013 Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand																																							
0-1m														260[#29]	NL[#30]	3[#31]	NL[#31]	NL[#31]			230[#31]															NL[#31]			
1-2m														370[#29]	NL[#30]	3[#31]	NL[#31]	NL[#31]			NL[#31]															NL[#31]			
2-4m														630[#29]	NL[#30]	3[#31]	NL[#31]	NL[#31]			NL[#31]															NL[#31]			
>4m														NL[#29]	NL[#30]	3[#31]	NL[#31]	NL[#31]			NL[#31]															NL[#31]			
NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil									700[#17]	1000[#17]	3500	10000																												
Sample Name	**Lab Report Number**	**Date**																																					
BH01_0.3-0.4	966824	20/02/2023	3.2	<0.4	7.5	5	5.1	<0.1	<5	15	<20	<50	<100	<100	<100	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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
BH01_0.9-1.0	966824	20/02/2023	2.3	<0.4	32	79	8.6	<0.1	7.9	39	<20	<50	<100	<100	<100	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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
BH02_0.2_0.3	965288	16/02/2023	7.2	<0.4	18	27	51	0.2	13	51	<20	<50	230	<100	230	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.5	<0.5	<0.5	1	0.5	1.4	0.8	0.9	0.8	2.4	<0.5	2.3	<0.5	0.6	<0.5	<0.5	2.3	12
BH02_0.7_0.8	965288	16/02/2023	2.4	<0.4	6.1	18	360	0.5	<5	390	<20	2300	4900	470	7670	<20	2300	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.5	<0.5	1.5	1.2	0.8	1.6	0.7	0.7	0.8	1.4	<0.5	2.6	1.2	<0.5	1.1	5.5	2.4	20
BH02_1.4_1.5	965288	16/02/2023	5	<0.4	17	82	62	0.2	7	68	<20	<50	240	200	440	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	0.6	1.8
BH02_1.6_1.7	965288	16/02/2023	<2	<0.4	<5	<5	12	<0.1	<5	7.5	<20	<50	59	<100	229	<20	59	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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	<0.5
BH02_2.4_2.5	965288	16/02/2023	6.9	<0.4	19	290	550	<0.1	11	20	<20	<50	1900	390	2290	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	1.2	<0.5	<0.5	<0.5	0.8	1.1	4
BH03_1.4-1.5	966824	20/02/2023	6.1	<0.4	7.1	30	110	<0.1	<5	360	<20	<50	<100	<100	<100	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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	<0.5
BH03_2.9-3.0	966824	20/02/2023	2.8	<0.4	12	<5	15	<0.1	<5	19	<20	<50	<100	<100	<100	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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	<0.5
BH04_0.4-0.5	966824	20/02/2023	6.5	<0.4	<5	<5	<5	<0.1	<5	<5	<20	<50	<100	<100	<100	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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	<0.5
QA20230220	317017	20/02/2023	6	<0.4	2	1	2	<0.1	1	7	<25	<50	<100	<100	<50	<25	<50	<0.2	<0.5	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.5	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05
QC20230220	966824	20/02/2023	6.6	<0.4	<5	<5	<5	<0.1	<5	<5	<20	<50	<100	<100	<100	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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	<0.5
BH04_2.4-2.5	966824	20/02/2023	<2	<0.4	9	<5	<5	<0.1	<5	<5	<20	<50	<100	<100	<100	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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	<0.5
BH04_3.4-3.5	966824	20/02/2023	<2	<0.4	13	5.5	9.8	<0.1	<5	<5	<20	<50	<100	<100	<100	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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	<0.5
BH05_0.6-0.7	966824	20/02/2023	2.9	<0.4	8.1	130	14	<0.1	7.7	52	<20	<50	<100	<100	<100	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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	<0.5
BH06_0.5_0.6	965288	16/02/2023	5	2.4	9.1	69	330	0.5	14	520	<20	730	3000	470	4200	<20	730	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	0.8	0.7	<0.5	0.8	<0.5	1.6	5.7
BH06_1.1_1.2	965288	16/02/2023	4.6	<0.4	7.2	15	60	0.5	<5	60	<20	65	460	<100	525	<20	65	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.5	<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	<0.5	0.7	1.3
BH06_1.9_2.0	965288	16/02/2023	2.6	<0.4	15	<5	9.2	<0.1	<5	5.6	<20	<50	<100	<100	<100	<20	<50	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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	<0.5
BH06_3_3.1	965288	16/02/2023	<2	<0.4	<5	<5	8.6	0.1	<5	16	<20	270	450	<100	720	<20	270	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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	0.5
BH06_4.4_4.5	965288	16/02/2023	2.9	<0.4	13	<5	14	0.1	<5	38	<20	240	380	<100	620	<20	240	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<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	<0.5
BH101 0.1	DP 2022	22/10/2019	<4	<0.4	8	21	100	<0.1	7	72	<25	<50	<100	<100	-	<25	<50	<0.2	<0.5	<1	-	-	<3	-	-	-	-	0.1	<0.5	-	-	-	-	-	-	-	-	<0.1	-	-	1
BH102 0.5	DP 2022	22/10/2019	7	0.8	12	130	170	0.3	13	360	<25	63	640	200	-	<25	63	<0.2	<0.5	<1	-	-	<3	-	-	-	-	1.2	1.8	-	-	-	-	-	-	-	-	0.2	-	-	12
BH106 0.1	DP 2022	28/10/2019	<4	<0.4	11	44	15	0.1	86	41	<25	<50	<100	100	-	<25	<50	<0.2	<0.5	<1	-	-	<3	-	-	-	-	0.2	<0.5	-	-	-	-	-	-	-	-	<0.1	-	-	1.4
BH106 1.0	DP 2022	28/10/2019	7	<0.4	15	45	99	0.4	29	120	<25	<50	100	<100	-	<25	<50	<0.2	<0.5	<1	-	-	<3	-	-	-	-	0.91	1.3	-	-	-	-	-	-	-	-	<0.1	-	-	7.7
BH106 2.0	DP 2022	28/10/2019	<4	<0.4	14	3	7	<0.1	3	8	<25	<50	<100	<100	-	<25	<50	<0.2	<0.5	<1	-	-	<3	-	-	-	-	0.1	<0.5	-	-	-	-	-	-	-	-	0.1	-	-	1.4
BH201 0.9-1.0	DP 2022	15/11/2019	<4	<0.4	8	9	25	0.2	2	23	<25	<50	<100	<100	-	<25	<50	<0.2	<0.5	<1	-	-	<3	-	-	-	-	0.2	<0.5	-	-	-	-	-	-	-	-	<0.1	-	-	1.5
BH201 1.4-1.5	DP 2022	15/11/2019	9	<0.4	19	54	38	0.1	5	100	<25	<50	<100	<100	-	<25	<50	<0.2	<0.5	<1	-	-	<3	-	-	-	-	<0.05	<0.5	-	-	-	-	-	-	-	-	<0.1	-	-	<0.05

Env Stds Comments

#1:Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Shedule B7).
#2:Trigger Value adopted from Chromium (VI)
#3:Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be considered where appropriate.
#4:Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be present.
#5:Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its BaP TEF (ref Table 1A(1)) & summing
#6:Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) & napthalene (should meet relevant HSL)
#7:PCBs: HIL refers to non-dioxin like PCBs only. Where PCB source is known, or suspected at a site, a site-specific assessment of exposure to all PCBs (inc dioxin like PCBs) should be undertaken
#8:Aged values apply to arsenic contamination present in soil > 2 years. Refer Schedule B5c for < 2 years.
#9:Trigger Value taken for Chromium (III), Clay Content of 2%
#10:Trigger Value taken for pH 10
#11:Aged values apply to lead contamination present in soil > 2 years. Refer Schedule B5c for < 2 years.
#12:Trigger Value taken for CEC 26
#13:Trigger Value taken for pH 10 and CEC 26
#14:ESLs are of low reliability.
#15:ESLs are of moderate reliability. To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#16:ESLs are of moderate reliability. To obtain F2 subtract napthalene from the >C10 - C16 fraction.
#17:Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2
#18:Commercial/industrial D includes premises such as shops, offices, factories and industrial sites.
#19:Only applies where the FA and AF are able to be quantified by gravimetric procedures (refer Section 4.10). This screening level is not applicable to free fibres.
#29:Derived soil HSL exceeds soil saturation concentration. To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#30:Derived soil HSL exceeds soil saturation concentration. To obtain F2 subtract naphthalene from the >C10-C16 fraction
#31:Derived soil HSL exceeds soil saturation concentration

Table A: Historical Soil Data Summary
Project Number: 64391
Project Name: Powerhouse Ultimo

	Polychlorinated Biphenyls								Organochlorine Pesticides																							Asbestos					
	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	PCBs (Sum of total)	4,4-DDE	a-BHC	b-BHC	d-BHC	g-BHC (Lindane)	Aldrin	Dieldrin	Aldrin + Dieldrin	Chlordane	DDT	DDD	DDT+DDE+DDD	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	Heptachlor	Heptachlor Epoxide	Hexachlorobenzene	Methoxychlor	Toxaphene	Approximate Sample Mass	Asbestos from ACM in Soil	Asbestos from FA & AF in Soil	ACM - Comment	FA- Comment	AF - Comment	Respirable Fibres - Comment
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	g	% (w/w)	% (w/w)	Comment	Comment	Comment	Comment
EQL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.05	0.05	0.05	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	0.05	0.05	0.05	0.5							
NEPM 2013 Site Specific EIL - Comm/Ind (0-2m)																		640																					
NEPM 2013 Table 1B(6) ESLs for Comm/Ind, Coarse Soil (0-2m)																																							
NEPM 2013 Table 1A(1) HILs Comm/Ind D Soil								7[#7]								45	530			3600				100			50		80	2500	160							
NEPM 2013 Table 7 Comm/Ind D Soil HSL for Asbestos in Soil																																	0.05[#18]	0.001[#19]				
NEPM 2013 Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand																																							
0-1m																																							
1-2m																																							
2-4m																																							
>4m																																							
NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil																																							
Sample Name	**Lab Report Number**	**Date**																																					
BH01_0.3-0.4	966824	20/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<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	<0.05	<0.05	<0.5	515	0	0	Nil	Nil	Nil	Nil
BH01_0.9-1.0	966824	20/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<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	<0.05	<0.05	<0.5	462	0	0	Nil	Nil	Nil	Nil
BH02_0.2_0.3	965288	16/02/2023	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<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	<0.5	<0.5	<10	-	-	-	-	-	-	-
BH02_0.7_0.8	965288	16/02/2023	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<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	<0.5	<0.5	<10	483	0	0	Nil	Nil	Nil	Nil
BH02_1.4_1.5	965288	16/02/2023	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<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	<0.5	<0.5	<10	391	0	0	Nil	Nil	Nil	Nil
BH02_1.6_1.7	965288	16/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<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	<0.05	<0.05	<0.5	563	0	0	Nil	Nil	Nil	Nil
BH02_2.4_2.5	965288	16/02/2023	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<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	<0.5	<0.5	<10	286	0	0	Nil	Nil	Nil	Nil
BH03_1.4-1.5	966824	20/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<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	<0.05	<0.05	<0.5	944	0.007	0	Chrysotile asbestos detected in bituminous material	Nil	Nil	Nil
BH03_2.9-3.0	966824	20/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<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	<0.05	<0.05	<0.5	761	0	0	Nil	Nil	Nil	Nil
BH04_0.4-0.5	966824	20/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<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	0.06	<0.5	598	0	0	Nil	Nil	Nil	Nil
QA20230220	317017	20/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-
QC20230220	966824	20/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<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	<0.05	<0.05	<0.5	-	-	-	-	-	-	-
BH04_2.4-2.5	966824	20/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<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	<0.05	<0.05	<0.5	548	0	0	Nil	Nil	Nil	Nil
BH04_3.4-3.5	966824	20/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<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	<0.05	<0.05	<0.5	817	0	0	Nil	Nil	Nil	Nil
BH05_0.6-0.7	966824	20/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<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	<0.05	<0.05	<0.5	-	-	-	-	-	-	-
BH06_0.5_0.6	965288	16/02/2023	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<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	<0.5	<0.5	<10	-	-	-	-	-	-	-
BH06_1.1_1.2	965288	16/02/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH06_1.9_2.0	965288	16/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<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	<0.05	<0.05	<0.5	381	0	0	Nil	Nil	Nil	Nil
BH06_3_3.1	965288	16/02/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH06_4.4_4.5	965288	16/02/2023	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<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	<0.05	<0.05	<0.5	-	-	-	-	-	-	-
BH101 0.1	DP 2022	22/10/2019	-	-	-	-	-	-	-	<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	0	Nil	-	-	-
BH102 0.5	DP 2022	22/10/2019	-	-	-	-	-	-	-	<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	0	Nil	-	-	-
BH106 0.1	DP 2022	28/10/2019	-	-	-	-	-	-	-	<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	0	Nil	-	-	-
BH106 1.0	DP 2022	28/10/2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	Nil	-	-	-
BH106 2.0	DP 2022	28/10/2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH201 0.9-1.0	DP 2022	15/11/2019	-	-	-	-	-	-	-	<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	0	Nil	-	-	-
BH201 1.4-1.5	DP 2022	15/11/2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Env Stds Comments
#1:Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Shedule B7).
#2:Trigger Value adopted from Chromium (VI)
#3:Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be considered where appropriate.
#4:Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be present.
#5:Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its BaP TEF (ref Table 1A(1)) & summing
#6:Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) & napthalene (should meet relevant HSL)
#7:PCBs: HIL refers to non-dioxin like PCBs only. Where PCB source is known, or suspected at a site, a site-specific assessment of exposure to all PCBs (inc dioxin like PCBs) should be undertaken
#8:Aged values apply to arsenic contamination present in soil > 2 years. Refer Schedule B5c for < 2 years.
#9:Trigger Value taken for Chromium (III), Clay Content of 2%
#10:Trigger Value taken for pH 10
#11:Aged values apply to lead contamination present in soil > 2 years. Refer Schedule B5c for < 2 years.
#12:Trigger Value taken for CEC 26
#13:Trigger Value taken for pH 10 and CEC 26
#14:ESLs are of low reliability.
#15:ESLs are of moderate reliability. To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#16:ESLs are of moderate reliability. To obtain F2 subtract napthalene from the >C10 - C16 fraction.
#17:Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2
#18:Commercial/industrial D includes premises such as shops, offices, factories and industrial sites.
#19:Only applies where the FA and AF are able to be quantified by gravimetric procedures (refer Section 4.10). This screening level is not applicable to free fibres.
#29:Derived soil HSL exceeds soil saturation concentration. To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#30:Derived soil HSL exceeds soil saturation concentration. To obtain F2 subtract naphthalene from the >C10-C16 fraction
#31:Derived soil HSL exceeds soil saturation concentration

Document Distribution

Rev No.	Copies	Recipient	Date
A	1 x Electronic	Tom Kennedy tom@gtkconsulting.com.au	17/07/2024

Document Status

Rev No.	Author	Reviewer	Approved for Issue		
		Name	Name	Signature	Date
A	Stuart Lumsden	Seth Molinari	Seth Molinari	Draft for client review	17/07/2024

www.jbsg.com.au

JBS&G

Adelaide

Kaurna Country | 100 Hutt St,
Adelaide, SA 5000
T: 08 8431 7113

Brisbane

Turrbal/Yuggera Country | Level 37,
123 Eagle Street, Brisbane, QLD 4000
T: 07 3211 5350

Bunbury

Wardandi Country | 177 Spencer
Street Bunbury, WA 6230
T: 08 9792 4797

Canberra

Ngunnawal Country | Level 1, The Realm
18 National Circuit Barton, ACT 2600
T: 02 6198 3278

Darwin

Larrakia Country | Suite G1, Level 1,
48-50 Smith Street, Darwin NT 0800
T: 08 8943 0600

Hobart

Muwununa/Nuenon Country | L2, 137
Liverpool Street, Hobart TAS 7000
T: 03 6208 3700

Melbourne

Wurundjeri Country | Level 19,
31 Queen Street, Melbourne VIC 3000
T: 03 9642 0599

Newcastle

Awabakal/Worimi Country | 61 / 63
Parry Street Newcastle West, NSW 2302
T: 02 8245 0300

Perth

Whadjuk Country | Allendale Square,
Level 9, 77 St Georges Terrace, WA 6000
T: 08 9380 3100

Sydney

Gadigal Country | Level 1,
50 Margaret Street, Sydney, NSW 2000
T: 02 8245 0300

Wollongong

Dharawal Country | Suite 1A, 280 - 286
Keira Street, Wollongong, NSW 2500
T: 02 4225 2647