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HICKORY CONSTRUCTIONS REDFERN PTY LTD AND BRIDGE HOUSING LIMITED

Remediation Action Plan

600-660 Elizabeth Street, Redfern (Redfern Place), NSW

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Draft	Draft	15 February 2024	-
1	Revision based on client comments.	27 February 2024	GT
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3	Revised version based on auditor and client comments.	14 June 2024	GT/SL/PB
4	Revised version based on new architectural plans.	21 June 2024	GT/SL

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Executive Summary

EI Australia (EI) was engaged by Hickory Construction Redfern Pty Ltd & Bridge Housing Limited ('the client') to prepare a Remediation Action Plan (RAP) for the property located at 600-660 Elizabeth Street, Redfern (Redfern Place), NSW ('the site') to be implemented before/during its redevelopment.

This report accompanies a detailed State Significant Development Application that seeks approval for a mixed-use development at 600-660 Elizabeth Street, Redfern (Redfern Place). The development proposes four buildings comprising community facilities, commercial/office, affordable/social/specialist disability housing apartments and new public links and landscaping.

The project site comprises Lot 1 in DP 1249145. It has an area of approximately 10,850 m^2. Part of the site currently accommodates the existing Police Citizens Youth Club (PCYC) (to be demolished and replaced). The remaining portion of the site is vacant with remnant vegetation.

The SSDA seeks approval for redevelopment of the site, including:

- *Demolition of existing buildings.*
- *Tree removal.*
- *Bulk earthworks including excavation.*
- *Construction of a community facility building known as Building S1.*
- *Construction of two residential flat buildings (known as Buildings S2 and S3) up to 14 and 10 storeys respectively, for social and affordable housing.*
- *Construction of a five-storey mixed use building (known as Building S4) comprising commercial uses on the ground level and social and specialist disability housing above.*
- *Construction of one basement level below Buildings S2, S3 and part of S4 with vehicle access from Kettle Street.*
- *Site-wide landscaping and public domain works including north-south and east-west pedestrian through-site link.*

For a detailed project description refer to the Environmental Impact Statement prepared by Ethos Urban.

To address the Secretary's Environmental Assessment Requirements (SEARs), which are listed in **Table 1-1**, in support of the SSDA.

This RAP follows on from previous investigations completed at the site, which have identified bonded asbestos-impacted, TRHs and PAH soils at multiple locations, actual acid sulfate soil (AASS) and potential acid sulfate soil (PASS) across the site. Remediation is required in order to render the site suitable for the proposed development.

Exceedances of the adopted water criteria were detected in groundwater samples in relation to aluminium at monitoring wells MW21 and BH502M. The reported concentrations exceeded the freshwater and marine water quality criteria that would be applicable for dewatering discharge to the municipal stormwater system. Any groundwater extracted during site dewatering works will require appropriate treatment for dissolved aluminium, turbidity and acidic pH, before it can be discharged into the local stormwater system.

The groundwater data gaps identified during previous investigation phases were considered closed at the time of writing this plan.

The purpose of this RAP is to support the corresponding development application with City of Sydney Council and Department of Planning and Environment (SSD-51274973). Under SEAR Condition 17 *Contamination and Remediation*, specific conditions were outlined regarding the RAP and to establish a sequential process for the remediation and validation works required at the site, while complying with the *State Environmental Planning Policy* (Resilience and Hazards) (2021).This RAP should also be submitted to the independent NSW EPA accredited auditor appointed to the site ('the Site Auditor'), in this case Ms Kylie Lloyd of Zoic Environmental Pty Ltd (now Geosyntec Consultants Pty Ltd).

The preferred remedial approach involves the excavation of impacted materials, followed by their waste classification and off-site disposal according to NSW EPA (2014a) *Waste Classification Guidelines*. It is envisaged that the remediation works will be implemented in stages, as follows:

- **Stage 1** – Preliminaries and site establishment;
- **Stage 2** – Pre and post-demolition inspections;
- **Stage 3** – Data Gap Investigation
  - Police and Community Youth Clubs (PCYC) building and sporting facilities; and
  - Setback areas.
- **Stage 4** - Remedial excavations of hotspots, bulk excavation and waste classification; and
- **Stage 5** – Preparation of a Site Validation Report (SVR).

This RAP provides protocols for the appropriate management of any unexpected finds that may be discovered during the course of the remediation works (**Section 7.6**). In addition, should any phase of the validation assessment identify residual contamination requiring additional remediation, the procedures described under the validation plan (**Section 8**) will be implemented until the remediation goals have been achieved and the site is deemed suitable for its proposed use.

In conclusion, EI considers that the site can be made suitable for its proposed use through the implementation of the site remediation and validation processes described in this RAP.

1. Introduction

1.1 Background

EI Australia (EI) was engaged by Hickory Construction Redfern Pty Ltd & Bridge Housing Limited ('the client') to prepare a Remediation Action Plan (RAP) for the property located at 600-660 Elizabeth Street, Redfern (Redfern Place), NSW ('the site'), to be implemented before/during its redevelopment.

The site is located 2.4 km south of the Sydney central business district, within the local government area (LGA) of City of Sydney Council, as shown in **Figure 1, Appendix A**. It is further identified as Lot 1 in DP 1249145 and covers a total area of approximately 10,850 m^2, as depicted in **Figure 2, Appendix A**. At the time of drafting this plan, the property consisted of a grassed reserve in its northern part and a brick building and recreational (sporting) facilities in the south.

This report accompanies a detailed State Significant Development Application that seeks approval for a mixed-use development at 600-660 Elizabeth Street, Redfern (Redfern Place). The development proposes four buildings comprising community facilities, commercial/office, affordable/social/specialist disability housing apartments and new public links and landscaping.

The project site comprises Lot 1 in DP 1249145. It has an area of approximately 10,834 m^2. Part of the site currently accommodates the existing Police Citizens Youth Club (PCYC) (to be demolished and replaced). The remaining portion of the site is vacant with remnant vegetation.

The SSDA seeks approval for redevelopment of the site, including:

- *Demolition of existing buildings.*
- *Tree removal.*
- *Bulk earthworks including excavation.*
- *Construction of a community facility building known as Building S1.*
- *Construction of two residential flat buildings (known as Buildings S2 and S3) up to 14 and 10 storeys respectively, for social and affordable housing.*
- *Construction of a five-storey mixed use building (known as Building S4) comprising commercial uses on the ground level and social and specialist disability housing above.*
- *Construction of one basement level below Buildings S2, S3 and part of S4 with vehicle access from Kettle Street.*
- *Site-wide landscaping and public domain works including north-south and east-west pedestrian through-site link.*

For a detailed project description refer to the Environmental Impact Statement prepared by Ethos Urban.

To address the Secretary's Environmental Assessment Requirements (SEARs), which is listed in **Table 1-1**, in support of the SSDA;

Table 1-1 Secretary's Environmental Assessment Requirements

SEARS Requirement	Relevant Section of Report
17. Contamination and Remediation *In accordance with Chapter 4 of SEPP (Resilience and Hazards) 2021, assess and quantify any soil and groundwater contamination and demonstrate that the site is suitable (or will be suitable, after remediation) for the development.*	Remediation Works – **Section 6.0**

This RAP follows on from previous environmental investigations completed for the site (**Section 3.1**), which have identified asbestos (bonded), TRHs and PAH impacted fill soils at various locations, posing unacceptable risks to potential human receptors on the site.

A groundwater investigation has identified exceedances of aluminium, turbidity and pH to the remediation acceptance criteria (RAC) (**Section 4.2**).

Since the proposed basement is expected to intercept groundwater levels, risk mitigation protection measures will be required to be implemented during and after the building construction.

Site dewatering will trigger the need for a dewatering management plan (DMP), to satisfy Council and Water NSW dewatering permit and licensing requirements. The purpose of this RAP is to support the corresponding development application with City of Sydney Council and Department of Planning and Environment (SSD-51274973). Under SEAR Condition 17 *Contamination and Remediation*, specific conditions were outlined regarding the RAP and to establish a sequential process for the remediation and validation works required at the site, while complying with the *State Environmental Planning Policy* (Resilience and Hazards) (2021)

1.2 Proposed Development

Based on the supplied plans (**Appendix B**), the proposed development will involve the demolition of all existing structures, followed by the construction of multiple, apartment buildings, ranging from two- to fourteen-storey high, overlying a partial basement facility and a new community facility (PCYC).

The basement will cover part of the site footprint, with a finished floor level (FFL) at 29.00 metres Australian Height Datum (mAHD), requiring soil excavations down to depths of 2 to 3 metres below ground level (mBGL). As confirmed by the client, a tanked (water tight) basement will be constructed for the proposed development. Areas of retained soils are proposed to the north, south, east and central portions of the site.

The total amount of soil expected to be disturbed during the basement construction was estimated to be about 9,606 m^3, assuming an area of 4,803 m^2 excavated to an average depth of 2 mBGL. (**Appendix A**, **Figure 2**).

Notes:

- Locally deeper excavations could be required for footings, lift overrun pits, crane pads and service trenches, creating a greater amount of spoil.
- The groundwater table occurs between 1.2 and 2.1 mBGL, indicating that dewatering will be required during the basement construction phase. A tanked basement will be constructed for the proposed development.

1.3 Objectives of the RAP

The main objective of this RAP is to set the remediation objectives and detail the processes required to remediate the site, with the following sub-objectives:

- To provide details on the contaminant sources and site impacts;
- To demonstrate that the proposed remediation strategy for the site is environmentally justifiable, practical and technically feasible, and there are no unacceptable risks to onsite and off-site receptors;
- To define the remediation acceptance criteria (RAC) to render the site suitable for its proposed land uses;
- To provide guidance on the risk mitigation against potential off-site migration of contaminants (including migration via existing utilities such as the sewer, stormwater and other subsurface pipes or service trenches); and
- To demonstrate that the plans for site management during remediation consider health, safety and environmental contingent actions that may be warranted should unexpected finds be discovered during the site remediation and validation processes.

1.4 Scope of Works

The above objectives were achieved by the completion of the following tasks:

- Review of the available data relevant to the remediation of the site, provided by previous investigation reports;
- Review of the literature on remediation technologies relevant to the site;
- Evaluation of available remediation options and selection of the most appropriate remedial strategy (or combination of strategies) for the site;
- Provision of information so that remedial works may be carried out in accordance with relevant laws and regulations;
- Provision of information to assist the contractor in preparation of a Work Health and Safety Plan (WHSP) and other site management/planning documents;
- Waste classification and material tracking to be completed during the remediation works; and
- Development of a Sampling and Analysis Quality Plan (SAQP) for hotspot delineation and post-remedial validation.

1.5 Regulatory Framework

The following legislation and guidelines were considered during the preparation of this RAP:

Legislation

- *Contaminated Land Management Act 1997* (CLM Act);
- *Water Management Act 2000* (Water Act);
- *Protection of the Environment Operations Act 1997* (POEO Act) and associated regulations, including the *Waste Regulation 2014*;

- *State Environmental Planning Policy (Resilience and Hazards) (2021)*;
- Sydney Local Environmental Plan 2012; and
- *Work Health and Safety Act 2011* (WHS Act) and associated regulations and codes of practice.

Guidelines

- *NSW EPA Waste Classification Guidelines* (NSW EPA, 2014a);
- *NSW EPA Guidelines for the NSW Site Auditor Scheme* (NSW EPA, 2017);
- *NSW EPA Consultants reporting on contaminated land, Contaminated Land Guidelines* (NSW EPA, 2020a);
- *NSW EPA Assessment and management of hazardous ground gases, Contaminated Land Guidelines* (NSW EPA, 2020b)*;*
- *NSW EPA Guidelines for the implementation of the POEO (underground petroleum storage systems) Regulation 2019* (NSW EPA, 2020c);
- *NSW EPA Sampling Design Guidelines* (NSW EPA, 2022a; NSW EPA, 2022b);
- *National Environment Protection (Assessment of Site Contamination) Amendment Measure* (NEPC, 2013); and
- *Western Australia Department of Health Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (WADOH, 2009).

1.6 Deviations from this RAP

During the course of the program, it may become necessary to vary the sequence and/or details of the site remediation and validation works to meet site constraints. If so, these changes must be properly documented and subject to approval, as required under the *Consultants reporting on contaminated land guidelines* (NSW EPA, 2020a).

Performing remedial works without the supervision of a qualified environmental engineer/scientist may lead to project delays and extra costs, due to additional investigation requirements imposed by an independent consultant, or the if appointed a site Auditor, to confirm the environmental status of the site.

In worst case scenarios, waste materials removed from the site without proper characterisation and/or tracking, may lead to regulatory action and potential penalties, as described under the *Waste Regulation 2014* and the *Contaminated Land Management Act 1997*.

2. Site Description

2.1 Property Identification, Location, and Physical Setting

The site identification details and associated information are presented in **Table 2-1**.

Table 2-1 Site Identification

Attribute	Description
Street Address	600-660 Elizabeth Street, Redfern, NSW.
Location Description	Located 2.4km south of Sydney CBD, the site is rectangular in shape and occupied by a grassed reserve in its northern part and a brick building and recreational (sporting) facilities in the south.
Site Coordinates	Northern-eastern corner of site (GDA2020-MGA56): ▪ Easting: 334288.581; ▪ Northing: 6248056.932. (Source: http://maps.six.nsw.gov.au)
Site Area	Approximately 1.085 hectares (10,850m^2)
Lots and DP	Lot 1 in DP 1249145
State Survey Marks	Four State Survey (SS) marks are situated surrounding the site and in close proximity: ▪ SS16640D, approx. 116m to the south-west of the site, located in the western footpath of Elizabeth Street; ▪ PM46923F, approx. 180m to the south-east of the site, located in the eastern footpath of Morehead Street; ▪ SS16641D, approx. 140m to the north-east of the site, located in the southern footpath of Kettle Street; and ▪ PM46922D, approx. 144m north-east of the site, located in the northern footpath of Kettle Street. (Source: http://maps.six.nsw.gov.au).
LGA	City of Sydney Council
Current Zoning	R1 – General residential (Sydney Local Environmental Plan (LEP) 2012)
Current Land Uses	Northern area – parkland; and Southern Area – Police and Community Youth Clubs (PCYC) building and sporting facilities.
Current Site Ownership	Homes NSW Bridge Housing are representing Homes NSW as the site owner and developer

2.2 Surrounding Land Use

The site is situated within a predominantly residential area, as described in **Table 2-2**. The local sensitive receptors within close proximity to the site are also identified.

Table 2-2 Local Land Uses

Direction Relative to Site	Land Use Description

Direction Relative to Site	Land Use Description
North	Kettle Street, followed by residential brick buildings.
South	Phillip Street, followed by commercial premise and residential properties.
East	Walker Street, followed by residential properties.
West	Elizabeth Street, followed by Redfern oval.

2.3 Regional Setting

The topography, (hydro)geology and soil landscape information are summarised in **Table 2-3**.

Table 2-3 Regional Setting

Attribute	Description
Topography	The site is generally flat, with elevations varying from 31.00 to 32.70 mAHD (EMM, 2020).
Site Drainage	Site drainage is likely to be consistent with the general slope of the site. It includes pit and pipe drainage systems, leading to the municipal stormwater system in Elizabeth Street.
Regional Geology	Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map Sydney 1:100,000 Geological Series Sheet 9130 (DMR 1983) indicates the site to be underlain by Cainozoic Holocene (Qhd) dune deposits, which typically comprise medium to fine-grained “marine” sand with podsols. The dune deposits are underlain by Hawkesbury Sandstone, which forms the regional bedrock and typically comprises medium to coarse-grained quartz sandstone, with very minor shale and laminate lenses.
Soil Landscape	The Soil Conservation Service of NSW Sydney 1:100,000 Soil Landscapes Series Sheet 9130 (2nd Edition) indicates the residual landscape is likely to be the Tuggerah (tg) aeolian landscape. This landscape type typically comprises gently undulating to rolling coastal dune fields. Soils are generally deep (> 2.0 m), with podzols on dunes and humus podzol intergrades on swales. These soils are noted to be highly permeable and are associated with permanently high water tables. They also present a very high erosion hazard.
Acid Sulfate Soil (ASS) Risk	In accordance with the Sydney Local Environmental Plan 2012 Acid Sulfate Soils Map – Sheet ASS_010, the site falls within a category classified as Class 5, which do not typically contain Acid Sulfate Soils (ASS). With reference to the *Botany Bay Acid Sulfate Soil Risk Map* (1:25,000 scale, Murphy, 1997), the subject land lies within the map class description of ‘*No Known Occurrence*.’ In such cases, ASSs are not known or expected to occur and “land management activities are not likely to be affected by ASS materials”. However, based on previous investigation findings (**Section 3.1**), the risk of ASS or PASS presence at the site was considered to be high, and further ASS assessment was therefore considered warranted.
Typical Soil Profile	The general site lithology encountered during the previous investigations was a layer of fill (down to 1.5 mBGL), overlying natural clay/ sand soils.
Nearest Surface Water Feature	Sheas Creek, located 1.08 km to the south-west of the site.
Depth to Groundwater	Groundwater depths encountered during the previous investigations ranged between 1.2 and 2.1 mBGL.

Attribute	Description
Groundwater Bore Records	A search of WaterNSW was completed on 28 February 2023, revealing one registered bore within a 500m radius of the site. The registered bore was authorised for recreation use only and is located within the Redfern Oval, approximately 180 m west of the site.
Groundwater Flow Direction	Groundwater flow direction is inferred (on the basis of surveyed well data) to be in a south-westerly direction, towards Sheas Creek.

3. Site Characterisation

3.1 Previous Investigations

A number of previous investigations have been completed for the site, which were documented under the following reports:

- AECOM (2018) *Draft - Phase 1 Environmental Site Assessment and Geotechnical Desktop Study*, Ref. 60568920_Phase1 ESA & Geotech Desktop_20180522_B, 22 May 2018;
- DP (2019) *Hazardous Building Materials (HBM) Survey*, prepared by Douglas Partners Pty Ltd, Ref. 99510.01, December 2019;
- DP (2020) *Geotechnical Investigation*, prepared by Douglas Partners Pty Ltd, Ref. 99510.00, January 2020;
- DP (2020 - 2022) *Asbestos Assessment*, comprising 5 separate reports, prepared by Douglas Partners Pty Ltd, Ref. Project 99510.01.R001 - R005.Rev0., between 14/04/2020 and 2/12/2022;
- EMM (2020) *Stage 2 Contamination Assessment*, Ref. J190730 RP1, 29 May 2020;
- JBS&G (2022) *Material Assessment*, Ref. 59618/145,427, 28 June 2022;
- EI (2023a) Additional Geotechnical Investigation; 600-660 Elizabeth Street, Redfern NSW; EI Report E25947.G04, dated 15 March 2023;
- EI (2023b) Additional Site Investigation; 600-660 Elizabeth Street, Redfern NSW; EI Report E25947.E03_Rev0, dated 31 March 2023;
- EI (2023c) Groundwater Take Assessment, Proposed Residential Development; 600-660 Elizabeth Street, Redfern NSW; EI Report E25947.G12, dated 15 November 2023; and
- EI (2023d) Groundwater Monitoring Report No. 1; 600-660 Elizabeth Street, Redfern NSW; EI Report E25947.G11.01, dated 15 November 2023.
- EI (2024) *Acid Sulfate Soils Management Plan*; 600-660 Elizabeth Street, Redfern NSW; EI Report E25947.E14_Rev2, dated 9 May 2024.

A summary of the findings obtained from these reports is presented in **Table 3-1**.

Table 3-1 Summary of Previous Investigations

Project Task	Findings
Phase 1 Environmental Site Assessment and Geotechnical Desktop Study (AECOM, 2018)	
Objectives	• Identify the potential for soil and groundwater contamination at the Site; and • Provide recommendations for further assessment required to support the redevelopment of the site for new social housing.
Scope of works	The scope of works included: • Review of available drawings / plans / reports relating to the site. • A search of the NSW EPA contaminated land records for the site and surrounding area. • A search of WorkCover dangerous goods records. • Review of local council records, including the Council Section 149 certificate for the site

Project Task	Findings
	• Review of historical lands title records. • Review of historical aerial photographs to identify the presence of any potentially contaminating land uses within and surrounding the site. • Review of published maps (geology, hydrogeology, soil and topography) of the area to gain an understanding of surface and subsurface conditions. • Search and review of information readily available throu-gh the internet (e.g. historic parish maps and online historical information). • Completion of an Office of Water registered groundwater bore database review to identify groundwater bores within the area. • Assessment of areas where potentially contaminating land uses occurred within or in the vicinity of the site. • Review of previous investigations relevant to the site provided by LAHC.
Findings	• Site used primarily for residential and/or commercial/light industrial purposes, while the surrounding area has been used for commercial/industrial (typically north, south and west of the Site), residential (surrounding the Site) and recreational (east of the Site) purposes. • Potential sources of contamination on surrounding commercial properties, use of fill material of unknown origin, asbestos-containing materials within building structures, historical use of lead based paints on the interior and exterior of the building. The site appears to have been subject to historical sources of potential contamination, and residual impacts to site soils may still present.
Stage 2 Contamination Assessment (EMM,2020)	
Objectives	To provide contamination data in order to characterise soil, fill and groundwater conditions for site suitability and waste classification purposes.
Scope of works	• Review of available information regarding the soils, geology and hydrogeology in the vicinity of the Site; • Drilling of 21 boreholes, 3 of which were completed as groundwater monitoring wells, and associated sampling works; • Laboratory analysis of selected soil and groundwater samples for contaminants of potential concern; and Preparation of a report presenting the investigation findings, including a conceptual site model and appropriate recommendations in accordance with relevant legislative guidelines.
Conclusions	• The results indicated that the Site is underlain by shallow fill material and a naturally occurring peat layer, which contain concentrations of total recoverable hydrocarbons (TRH) and B(a)P greater than the assessment criteria for the proposed high density residential, retail and commercial land uses. In addition, ACM was detected in shallow fill in the south-west corner of the Site, and the presence of actual or potential acid sulfate soils was identified across most of the Site. • In order to make the Site suitable for the proposed future land use, development of a remediation strategy and associated environmental management measures is required. EMM notes that as part of the development, bulk excavation of subsurface material is proposed to allow for the construction of basement level car parking. This component of the development should be incorporated into the remedial strategy.
Recommendations	EMM recommended the following: • Preparation of a remediation action plan (RAP) detailing options for remediation and/or management and a recommended preferred strategy to render the Site suitable for the proposed future land uses; • The RAP should: o detail requirements for the appropriate treatment, management and offsite disposal of soils; o detail validation requirements to be implemented to demonstrate successful completion of the remedial works (including bulk excavation); o consider previous investigation findings; and o detail the requirement (if any) for future/ongoing monitoring or

Project Task	Findings
	management. • Preparation of an Acid Sulfate Soil Management Plan for the management of identified potential acid sulfate soils; • Preparation of a Construction Environmental Management Plan for the management of contamination (and any unexpected finds) during construction; and Preparation of an Asbestos Management Plan for the management of identified asbestos.
Material Assessment, (JBS&G, 2022)	
Objectives	To inform the potential management options with respect to off-site disposal of soils that will be excavated during the construction of the proposed basement. Specifically, to assess whether the natural peat and sand materials at the site meet the disposal requirements of EPL 11147, relevant to the proposed receiving site Dunmore Sand and Soil" facility.
Findings	Based on their findings, JBS&G reported that the source of TRH detections within natural peat materials are biogenic in nature based on the following lines of evidence: • No petroleum hydrocarbon odours or staining were observed within the materials during the current or previous investigations at any sampling location. In addition, there was no evidence (sheen or odours) of hydrocarbon impacts within groundwater sampled from monitoring wells screened across the peat materials. • Silica gel clean-up of select soil samples in which elevated total TRH fractions (TRH C10-C40) were reported resulted in substantial reductions (to largely below detection limits)of the reported TRH fractions. EI noted however, that TRH concentrations were still present in silica gel clean-up tests indicating that anthropogenic impacts in relation to petroleum hydrocarbons were also present in the natural soils. • Aromatic and aliphatic speciation of select soil samples in which elevated total TRH fractions were reported indicated that the TRH comprises solely of aliphatic fractions while Australian diesel and petroleum products typically comprise of 20% aromatic TRH fractions (CRCCARE 2011). • The reported TRH concentrations in site groundwater collected from the peat formation were largely below detection limits, or where detected, significantly reduced via silica gel clean-up analysis. • The peat was/has been observed to comprise organic materials with natural inclusions such as roots. • Consistent with previous investigations, shallow gravelly fill materials were reported to comprise non-ASS, natural peat materials were reported to primarily comprise of PASS and the underlying natural sand materials were reported to comprise a mixture of non-ASS and PASS. As such, it is considered that there is now sufficient data to inform which soils will be required to be managed with respect to mitigating environmental risks associated with PASS during future redevelopment activities. • The natural peat and sand materials at the site were considered to meet the disposal requirements of EPL 11147 to allow for the disposal of these materials to the DSS facility.
Recommendations	Based on the field screening results JBS&G considered that if the PASS materials be excavated and delivered to the disposal facility within a period of 8 hours, the pH of the soils will likely remain above a pH of 5.5. However, it was noted that this is highly contingent on the appropriate management of soils prior to excavation (e.g. appropriate dewatering activities) as well as during excavation and off-site disposal. Preparation of an ASSMP was recommended to detail PASS management requirements prior to site development works, in order to mitigate oxidation / acid generation during excavation and transport.

Project Task	Findings
	Additional sampling / analysis was also recommended within the southern portion of the site (PCYC area) when access becomes available to address spatial data gaps in this area to confirm geological and contamination conditions.
Additional Site Investigation (EI, 2023b)	
Objectives	• To confirm groundwater quality and to inform water treatment requirements for construction dewatering discharge planning; • To extend sampling and analysis coverage for soil characterisation in relation to asbestos and other chemical parameters, • To provide a preliminary assessment of potential deep soil areas in relation to relevant land use suitability criteria for high rise residential settings with limited soils access; and • To outline a suitable contingency procedure for the appropriate management of asbestos, should it be encountered during the basement construction works.
Scope of Works	• Searches and U/G magnetometer search for services and review of existing underground services on site; • Review of previous environmental reports and the existing environmental data set; • Field investigation: o Detailed site walkover inspection; o Drilling of three test boreholes and 19 tests pits distributed across the site; o Multiple level soil sampling within fill and natural soils, at the new test bore and test pit locations; o Installation of three groundwater monitoring bores constructed as groundwater monitoring piesometers at strategically targeted locations across the site; o A single groundwater monitoring event at three existing and the three recently installed monitoring wells; • Laboratory analysis of selected soil and groundwater samples for relevant analytical parameters including asbestos, and analyses for the assessment of acid sulfate soils; • Data Analysis and Reporting.
Findings	<u>Fill Soils (to be disposed offsite)</u> • *General Solid Waste (Non-putrescible)* / *Special Waste (Asbestos Waste):* fill at and around location TP414; • *General Solid Waste (Non-putrescible) and Scheduled Waste*: in fill at and around TP409 and TP412; and • *General Solid Waste (Non-putrescible)* greater than CT1: fill at remaining locations inside of basement footprint, subject to any unexpected finds during bulk excavation, which would be managed in accordance with an Unexpected Finds Protocol (UFP), to be developed prior to commencement of works. The UFP is typically part of the site-specific Remedial Action Plan (RAP). <u>Natural Soils down to 2m BGL (to be disposed offsite)</u> Laboratory results for all natural soil samples indicated the presence of PASS; therefore, the waste classification of the dark, peaty sand and clay soils for offsite disposal purposes would be: • *General Solid Waste (Non-putrescible)* and PASS: Natural soils at all locations to a basement excavation level (BEL) of 2.0m BGL. An Acid Sulphate Soil Management Plan (ASSMP) will be required to inform the required controls for proper management of PASS (and any ASS that may be identified during bulk excavations), before the start of excavation works. All ASS and PASS must be managed in accordance with the ASSMP, to prevent

Project Task	Findings

acid formation during the site works and the transportation of the soils to the licensed waste disposal facility.

Natural Soils Deeper than 2m BGL within the basement footprint area

Natural soils which will remain onsite beneath the excavated basement, compared against the adopted land use criteria, Most concentrations of the laboratory results were found to comply with the adopted SILs with the following exceptions:

- TRH-F3 impacted fill at BH01, BH02, BH03, BH06, BH10, BH13, BH14, BH17, BH03A, BH05A, BH06A, TP01, TP02, MW11, and MW21 exceeded the NEPC (2013) EIL/ESL (ecological) criteria.

As the basement will be constructed with concrete, the ecological exceedances are not considered to warrant remediation, provided groundwater impacts do not change. ASS criteria are not relevant if the soils beneath the basement are not disturbed, provided groundwater extracted during site dewatering is treated appropriately to achieve compliant water quality for stormwater discharge, with the required permits (City of Sydney and Water NSW) in place.

Fill and Natural Soils outside of the basement footprint area

Most concentrations of the laboratory results for samples of the fill and natural soils located outside of the basement footprint were found to comply with the adopted SILs with the following exceptions:

- Asbestos was identified in fill sample at BH19 (0.5 m BGL), MW20 (0.5m BGL) and at BH503 (0.9 – 1.6 m BGL). These locations will require a long-term environmental management plan, unless the areas are remediated to comply with the NEPC (2013) HIL B residential criteria;
- Elevated lead in excess of the residential and ecological criteria was previously found at MW20 (0.5 m BGL), BH19 (0.5 m BGL) and BH503 (0.9-1.0 m BGL);
- Carcinogenic PAHs as B(a)P in fill sample at BH502M for the depth interval 0.4 – 0.5 m BGL, exceeded the NEPC (2013) HIL B residential criteria;
- TRH-F3 in fill samples at MW20 (4 m BGL), BH502M (0.4 – 0.6 m BGL), and BH15 (0.2 – 2.5 m BGL), exceeded their corresponding NEPC (2013) EIL/ESL ecological criteria. As silica gel clean-up tests indicated the presence of elevated petroleum hydrocarbons, remedial action is warranted for these areas. Of the samples identified only locations BH502M and BH15 had TRH-F3 impacted soils within plant root depths (i.e. < 0.5m); therefore, soil remediation is only considered necessary at these locations to a depth of 0.5 m BGL.

Fill and natural soils will require remediation to make the impacted areas suitable for the proposed residential land use. Assuming a remedial strategy involving excavation and appropriate offsite disposal, the soils would be classified as follows:

- *General Solid Waste (Non-putrescible) / Special Waste (Asbestos Waste):* fill at and around location BH19;
- *Restricted Solid Waste / Special Waste (Asbestos Waste*): fill at and around location MW20 and BH503; and
- *General Solid Waste (Non-putrescible)* greater than CT1: fill at locations BH15 and BH502M.

Groundwater

- The groundwater field data indicated that site groundwater conditions were acidic (pH: 4.78 to 6.3) and relatively fresh (EC: 220 to 636 µS/cm) in regards to water salinity.
- No visible sheens or volatile organic odours were detected during

Project Task	Findings
	groundwater sampling at monitoring well locations, with the exception of a weak sulfur odour at MW21. This was considered to be indicative of the peaty natural soil layer, which was the shallow aquifer for the area. • Groundwater flow was inferred to be south-west towards Sheas Creek, which flows to the tidally influenced Alexandra Canal. • Laboratory pH results were also shown to be acidic in groundwater sampled at all monitoring wells, reflecting the field-based water quality tests, with elevated sample turbidity reported for the groundwater sample at the existing well MW21. • The turbidity result at MW21 may be due to incomplete well development after well installation, or improper placement of annular filter materials; notwithstanding, these results indicate the need for water treatment during construction dewatering, which is expected to be necessary as groundwater depths were reported between 1.2 m and 2.1m BGL • It was noted that additional metals may leach out of site soils during the dewatering programme as PASS I present across the site. • All concentrations for PAH, BTEX, Petroleum Hydrocarbons, Total Phenols and Total Cyanide were below laboratory detection limits and the adopted GILs. • Aluminium at locations GW_BH502M and GW_MW21 exceeded the marine and fresh criteria. • pH at locations GW_BH502M, GW_BH504M, GW_BH505M, GW_MW11, GW_MW20 and GW_MW21 exceeded the marine and fresh criteria. • Turbidity at location GW_MW21 exceeded the marine criteria • It is noted however, that petroleum hydrocarbons may become an issue for groundwater quality during site dewatering and basement excavation, as results for natural peaty soils showed the presence of total recoverable hydrocarbons.
Recommendations	• PCYC building demolition should be preceded by the appropriate handling and management of any hazardous building materials that were identified within the HBM (DP, 2019) and EI (2023) Hazardous Building Materials Survey Data Gap Inspection report. • The RAP should include an unexpected finds protocol (UFP) which should be developed to guide the site management team during the basement excavation process, for the appropriate assessment and management of any unexpected contaminated or hazardous materials that may be encountered during works involving ground disturbance. • A data gap closure investigation involving soil sampling and analysis for characterisation in relation to relevant contaminant parameters, including asbestos, is to be conducted within the PCYC building footprint area post building demolition. Following pavement demolition and removal of demolition wastes, an inspection of the exposed soil surface should be performed within the former PCYC area by a suitably qualified environmental consultant to inspect for hazardous material debris and if identified, such finds must be managed in accordance with the UFP. • It would be prudent to include step-out sampling points north, south, east and west of the asbestos, lead, mercury and benzo(α)pyrene impacted fill, to enable delineation analysis for determination of the lateral and vertical extent of the Asbestos Waste and Restricted Solid Waste materials. This would provide the basis for isolation of impacted soils to minimise material volumes for offsite disposal under these waste categories. • When the development concept is finalised, the existing environmental data set should be reviewed for all proposed deep soil areas to assess whether adequate soil characterisation has been completed in accordance with the current NSW EPA sampling guidelines. Should additional sampling coverage be required to meet minimum sampling density requirements, this should be included in the data gap closure investigation. • The data gap closure investigations must include the preparation of a separate Waste Classification Report for each type of waste category of materials to be disposed from the site, in compliance with NSW EPA (2014a).

Project Task	Findings
	• A site-specific remedial action plan (RAP) must be prepared by a suitably qualified and experienced environmental consultant to document all remedial works required at the site, review feasible alternative remedial approaches, detail the preferred site remediation strategy, identify required permits and approvals and establish the waste management and site validation assessment process.
Acid Sulfate Soil Management Plan (EI, 2024)	
Objectives	The objective of Acid Sulfate Soil Management Plan (ASSMP) is to provide the framework for the management and monitoring of Acid Sulfate Soils (ASSs) during the proposed development, focusing on the bulk excavation stage.
Scope	• Review of relevant topographic, (hydro)geological and soil landscape information, including the relevant ASS planning and risk maps; • A review of the previous environmental investigations relating to the site; • Description of the procedures to treat and dispose ASSs, when encountered on-site, including the minimisation and control of acid leachates; • Determination of monitoring measures for soils and surface / ground waters; and • Description of contingency procedures to be implemented in the case of failure of management procedures.
Management Plan	All records associated with ASS investigation, management and monitoring shall be maintained by the appointed environmental consultant for the duration of the project. Such records will comprise, though are not limited to: • Further ASS assessment results, as determined by any waste classification analysis; • Field records of ASS monitoring, such as daily field pH screening results on stockpiled materials or truck loads leaving the site, excavation surfaces, application of lime, groundwater level and pH level monitoring; • Records of ASS transportation, including truck registers, and waste dockets issued by the receiving landfill facility; and • Environmental incident reports in cases of non-conformance and subsequent mitigation measures adopted. A file should be established on-site, to store all hard copy records associated with the management and monitoring of PASS for the project. All analysis and monitoring information shall also be stored electronically to permit ease of access and data interpretation. During ASS management, regard must be given to the needs of the following organisations: • New South Wales Environment Protection Authority (EPA), concerning their requirements with respect to the various contamination control issues associated with the project and the detail required in the ASS management plan; • EPA accredited site auditor (if required); • WaterNSW, for dewatering conditions and permit; and • City of Sydney Council, for Development Application compliance and the handling requirement for ASS situations.

3.2 Conceptual Site Model

In accordance with NEPC (2013*) Schedule B2 - Guideline on Site Characterisation*, EI developed a conceptual site model (CSM), as part of the investigation phase, assessing

plausible linkages between potential contaminations sources, migration pathways and receptors.

3.2.1 Subsurface Conditions

The general site lithology encountered during the previous investigations was a layer of fill (down to depths of 1.5 mBGL), overlying natural sand / clay soils. More details are provided in **Table 3-2** and borehole logs prepared by EMM (2020), JBS&G (2022) and EI (2023b) are attached in **Appendix C**.

Table 3-2 Generalised Subsurface Profile

Layer	Description	Average depth to top and bottom of layer (mBGL)
Hardstand	Concrete pavement (limited to the PCYC area in the southern portion of the site)	0.1 - 0.25
Fill	SAND; fine to medium and medium to coarse grained, brown/grey/yellow, with sub-angular to angular gravels, with glass, ceramic tiles, brick, metal, concrete, slag, wood fragments, with roots, dry to moist, no odour. Slag was observed at TP412_0.5-0.6m, TP414_0.5-0.6m and TP416_0.5-0.6m Gravelly SAND; medium to coarse grained, yellow/grey, with glass, ceramic tile, brick and sandstone fragments, dry to moist, no odour.	0.1 – 1.5
Natural	Organic Clay: dark brown, with organic (decomposing plants) material, low plasticity clay, with sulfur odour. CLAY; low plasticity, dark brown, with roots, sulfur odour, moist to wet.	1.5 – 2.0
	SAND; fine grained, grey/ brown/ beige and wet.	2.1 – 8.0 (13.82 mBGL at BH503)

3.2.2 Existing Site Contamination

The contamination identified on site is summarised in **Table 3-3**. More details are provided in **Appendix C, Table C2a** (EMM (2020)), **Table C2b** (JBS&G (2022)), **Table C2c** (EI (2023b)) and **Table C3** (all combined historical data).

Table 3-3 Contamination identified on site

Sampled By	Sample location and depth (mBGL)	Contaminants of Potential Concern (COPC)	Exceeded Criteria (NEPC, 2013)
Building footprint			
EMM (2020)	BH19_0.5; and MW20_0.5	Asbestos	Asbestos (presence)

EMM (2020)	BH01_2.5; BH02_2.5; BH03_2.5; BH05_1.2 ; and BH19_0.5	PAH	HIL B
EMM (2020)	MW20_0.5	TRH (F1)	HSL A/B
EMM (2020)	BH01_2.5; BH02_2.5; and QC100 duplicate of BH02_2.5	TRH (F3)	Management Limits
EI (2023b)	TP405_0.1-0.2; and	PAH	HIL B
EI (2023b)	TP404_1.9-2.0; and	TRH (F3)	Management Limits
Basement Footprint and Tank Excavation area			
EMM (2020)	BH08_2.0; BH10_2.5, BH13_0.5; BH13_1.5; BH13_2.5 MW11_3.5 MW21_1.3;	PAH	HIL B
EMM (2020)	BH08_2.0, BH13_1.5; BH13_2.5; MW21_1.3; QC103 duplicate of MW21_1.3;	TRH (F3)	Management Limits
JBS&G (2022)	BH06A_2.75-2.85; TP02_1.75-1.85; QA04 duplicate of TP02_1.75-1.85; TP02_2.0-2.1.; TP02_2.5-2.6.	TRH (F3)	Management Limits
EI (2023b)	TP414_0.1-0.2; BH503_0.9-1.0; and BH503_1.5-1.6.	Asbestos	Asbestos (Chrysotile asbestos found in approx 4x3x2mm cement sheet fragment.); Asbestos (Chrysotile asbestos found in approx 10x3x2mm bituminous material); and (Chrysotile asbestos found in approx 10x6x3mm bituminous material)

EI (2023b)	TP408_0.1-0.2. TP414_0.5-0.6; BH501M_0.3-0.45	PAH	HIL B
EI (2023b)	TP409_1.9-2.0; TP412_1.9-2.0; TP414_1.9-2.0; TP415_1.9-2.0;and TP416_1.9-2.0;	TRH (F3)	Management Limits
Deep soil zone (Landscape area)			
EMM (2020)	BH06_2.2; BH15_0.2; BH15_1.5;	TRH (F3)	EIL/ESL and/or Management Limits
EMM (2020)	BH06_2.2; BH15_0.2; BH15_1.5;	PAH	HIL B
JBS&G (2020)	BH03A_2.9-3.0	TRH (F3)	EIL/ESL and Management Limits
EI (2023b)	BH502M_0.4-0.6; TP406_1.9-2.0; TP407_1.9-2.0 TP413_1.0-1.1; and TP419_1.9-2.0.	TRH (F3)	EIL/ESL and/or Management Limits
EI (2023b)	BH502M_0.4-0.6	PAH	HIL B
Groundwater			
EI (2023b)	GW_BH502M	Aluminium and low pH	ANZG (2018)
EI (2023b)	GW-MW21	Aluminium, low pH and high turbidity	ANZG (2018)
EI (2023b)	GW_BH504M; GW_BH505M; GW-MW11; and GW-MW20.	Low pH	ANZG (2018)

Figure 6, Appendix A shows the top and bottom depths of the peat layer (underlying an anthropogenic fill material sand and gravelly sand, overlying natural peat (0.9-1.8 m BGL), then clay (1.4+ m BGL)) across the basement footprint based on the findings from the previous site investigation (EI, 2023b).

It is understood that within the northern portion of the basement footprint, the peat layer was first detected at approximately 0.9-1.4 mBGL and within the southern portion of the basement footprint, the peat layer was first detected from approximately 0.9-1.8 mBGL.

The total amount of soil expected to be disturbed during basement construction is 9,606m^3, assuming an area of 4,803m^2. Therefore, the amount of PASS requiring management (i.e. lime

treatment) is predicted to be approximately 4, 803m^3, assuming a 1.0m average thickness of natural (organic / peaty) soils. These soils will requires offsite disposal and will likely be classified as General Solid Waste (non-putrescible)/ Potential Acid Sulfate Soils (PASS). Soils outside the basement footprint requiring excavation must be chemically assessed and waste classified for off-site disposal purposes, in accordance with NSW EPA (2014a).

In light of the above information, the contaminants of potential concern (COPCs) and quality parameters requiring remedial action are:

- In soil: asbestos (bonded), PAH and TRH (F1 and F3).
- In Groundwater: aluminium, turbidity and pH.

TRH-F3 exceedances

EI considers that the TRH- F3 exceedances to the NEPC (2013) Management Limits identified within the peat layer, within the landscape and building footprint areas, do not pose risks to human or ecological receptors for the following reasons:

- There were no observed indicators of LNAPL (Light Non-Aqueous Phase Liquid) identified during any of the investigation works;
- It is unlikely that any services will be installed in the depths where the exceedances were found (peat layer, between approximately 1.5 and 2.0 mBGL);
- Recent studies have shown that TRH (F3a) compounds (C16-C22) are predominantly biogenic in nature (Hooper *et al*, 2023). All chromatograms presented in **Appendix D** are showing concentration peaks above their respective C22 time detection marks;
- The contamination does not pose any aesthetical concerns as it is not visible from the surface; and
- There are no expected fire or explosive hazards associated with the depth of the impacts.

PAH exceedances

EI considers that the PAH exceedances within the peat layer, within the landscape and building footprint areas, do not pose risks to human or ecological receptors for the following reasons:

- Low PAH leachability (TCLP) results were reported (**Tables C2a and C2c** in **Appendix C**);
- Slag was observed on the site (PAHs in slag are unlikely to be mobile);
- The exceedances were observed in the peat layer, between approximately 1.5 and 2.0 mBGL. It is unlikely that any services will be installed at those depths. This further mitigates potential risks posed to future intrusive workers;
- The 95% UCL for PAH Carcinogenic b(α)p in soils located in the setback area of the site was 4.265 mg/kg (**Table C2c**, in **Appendix C**), which only slightly exceeded the corresponding SIL (4 mg/kg); and
- Bulk excavation is proposed for the site, meaning impacted soils will be removed and disposed off-site during the redevelopment works.

Groundwater exceedances

In regards to the risks posed to receptors by the identified groundwater impacts, these can be addressed during the site dewatering works. A dewatering management plan (DMP) will be required, to satisfy Council and Water NSW dewatering permit and licensing requirements. Any groundwater extracted during site dewatering works will require appropriate treatment for

dissolved aluminium, turbidity and acidic pH, before it can be discharged into the local stormwater system

3.2.3 Sources, Exposure Pathways and Receptors

Identified contamination sources, exposure pathways and human and environmental receptors that were considered relevant for this RAP are summarised in **Table 3-4**.

Table 3-4 Conceptual Site Model

Media	Source	COPCs / Parameters	Sensitive Receptor	Exposure Pathway	Complete Source-Pathway-Receptor (SPR) Linkage?
Soil	Fill of unknown quality and origin (potentially impacted).	TRH, BTEX, PAH, asbestos, acid sulfate soils (ASS)	Site workers during demolition and construction Future site users Future intrusive workers Biota in areas to be landscaped (soils to be retained)	Dermal Contact Ingestion Inhalation of Vapours Inhalation of Dust Root Uptake	**Potentially complete.** However, the use of personal protective equipment (PPE) by construction and demolition workers is mandatory by SafeWork NSW.
	Historical weathering and demolition of structures, as well as the future demolition of the existing building.	Asbestos	Site Workers during demolition and construction Future site users Future intrusive workers	Inhalation of Dust	**Potentially complete.** Asbestos impacted area, PAH and TRH Hotspots material will be disposed offsite, the removal would render the site suitable for future use without the need for ongoing monitoring.
Groundwater	Runoff infiltrating from surface. Acid sulfate soils (ASS) reducing groundwater pH and mobilising metals.	Aluminium, turbidity and low pH	Site Workers during construction	Dermal Contact Ingestion	
			Biota in downgradient water bodies	Biota Uptake	**No.** Sheas Creek is more than 500 metres away from the site.

3.2.4 Data Gaps

The following identified data gaps will still require closure:

- Delineation of the vertical and lateral extent of asbestos, PAH and TRH-impacted soils at the locations listed in **Table 6-1** will be required for remediation purposes. This task will be completed once all existing slabs are removed from the site. The delineation dataset will also be used for additional waste classification purposes, to help classify the waste to be removed from the site.
- The areas comprising the existing PCYC building and the future deep soil zones have not yet been characterised, due to the restricted access during the investigation campaigns. These areas will require additional soil investigation by intrusive sampling and analysis, once the building demolition is complete; and
- Final classification of the waste materials and surplus soils to be removed from the site, as per NSW EPA (2014a), will be required. This task will be completed during the excavation works.

4. Remediation Goal and Criteria

4.1 Remediation Goal

The remediation goal is to render the site suitable for its proposed residential uses, in line with *SEPP 2021* and Council's contaminated land policies.

4.2 Remediation Acceptance Criteria

The following remediation acceptance criteria (RAC) are proposed for the site, as outlined in **Table 4-1**. These were selected from available Tier 1 guidelines approved, endorsed or made statutory to the NSW EPA, with due consideration to the exposure scenario, pathways and potential receptors identified for the site.

Table 4-1 Remediation Acceptance Criteria

Description	Rationale
Soils within the basement footprint areas	**Health-based Investigation and Screening Levels (HILs/HSLs)** NEPC (2013) *HIL-B* criteria for residential sites with minimal soil access and *HSL-D* thresholds for vapour intrusion in commercial and industrial settings (to assess potential human health impacts into basement car parking from residual vapours resulting from petroleum, BTEX and naphthalene), was adopted for proposed basement footprint areas within basement. **Waste Classification Guidelines** Soils were assessed against the NSW EPA (2014a) CT1, CT2, SCC1, SCC2, TCLP1 and TCLP2 criteria for preliminary waste classification purposes. Also, the DAWR (2018) action criteria are applicable to any ASS and PASS identified during the waste classification process.
Soils within building footprint area	**Health-based Investigation HILs** The NEPC (2013), Schedule B1, Table 1A (1) *HIL-B* and *HSL-A/B* criteria for residential sites with minimal soil access, was adopted for proposed building footprint areas without basement. **Asbestos Health Based Screening Levels (HSLs)** No visible asbestos for finished excavation surface soils. HSL-B: For bonded ACM. 0.001% w/w for friable asbestos in soil. Also, the DAWR (2018) action criteria are applicable to any ASS and PASS identified during the waste classification process.
Deep Soil Areas (north, south and east of the basement)	**Health-based Investigation HILs** The NEPC (2013) *HIL-B* thresholds for residential sites with minimal soil access were adopted for the remaining proposed landscape garden areas that are outside the proposed basement footprint area. **Ecological-based Investigation and Screening Levels (EILs/ESLs)** The NEPC (2013) Schedule B1, Tables 1B(3), 1B(4), 1B(5) and 1B(6), EILs and ESLs for urban residential and public open space were adopted for proposed landscaping areas to assess the potential impacts to plants. The CRC Care (2017) high reliability ecological guideline for benzo(α)pyrene in urban residential and public open space settings are not endorsed by NSW EPA. However, the criteria will be adopted as

Description	Rationale
	appropriate to assess for protection of terrestrial ecosystems. Also, the DAWR (2018) action criteria are applicable to any ASS and PASS identified during the waste classification process.

4.3 Proposed Extent of Remediation Required

The proposed extent of the remediation required is detailed in the following sub-sections.

4.3.1 Basement footprint area

Within this area, excavation and offsite disposal of all fill soil materials will be required.

- Fill soils around TP414 will extend down to a depth of 1.4 mBGL and will cover an area of 25 m²; and
- The remaining fill soils within the basement footprint will cover an area of 4,607 m² and extend down to a depth of 1.4 mBGL.

Fill soils impacted with OCP, TRH and PAHs in vicinity to TP409, TP412 and MW21 will be excavated and dispose offsite as part of the proposed basement construction works.

Natural soils, extending down to a depth of 2 mBGL and covering an area of 4,607 m^2 will also require offsite disposal, likely to be classified as General Solid Waste (non-putrescible)/ Potential Acid Sulfate Soils (PASS).

4.3.2 Setback (Landscape) Areas

Remediation outside the basement footprint will be required in the vicinity of the following hotspot locations:

- BH502M (TRH and PAH exceedances) extending to a depth of 1.6 mBGL and covering an area of 90 m².

4.3.3 Building Footprint Areas

Remediation within the basement footprint will be required in the vicinity of the following hotspot locations:

- MW20, located in the boundary of the setback area and the tank excavation area;
- BH503, located within the tank excavation area (where TRH and asbestos exceedances were reported), extending to a depth of 1.8 mBGL and covering an area of 60 m²; and
- BH19, located in the boundary of the setback area and the tank excavation area (where PAH and asbestos exceedances were reportetd), extending to a depth of 1.5 mBGL and covering an area of 25 m²;

5. Remediation Technology

5.1 Regulatory Overview

Under the NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Amendment Measure*, the preferred hierarchy for site remediation and/or management is:

- On-site treatment of the contamination so that it is destroyed or the associated risk is reduced to an acceptable level;
- 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.

When deciding which option to choose, the sustainability (environmental, economic, and social) of each should be considered, in terms of achieving an appropriate balance between the benefits and effects of undertaking the method.

For this site, a number of remediation options were reviewed to examine the suitability of each method, the surrounding properties, geological and hydrogeological limitations and the following considerations:

- Development requirements (residential);
- Ability of remedial method to treat contamination with respect to material and infrastructure limitations;
- Remedial timeframes;
- Defensible method to ensure the site is remediated to appropriate levels / validation criteria (RAC); and
- Regulatory compliance.

5.2 Remediation Technologies Review

Various soil remediation options were reviewed with regards to the surrounding land uses, as well as the (hydro) geological limitations. Each of the available remediation technologies is summarised in terms of its suitability in **Table 5-1**.

Table 5-1 Remedial Technology Review - Soils

Remediation Methodology	Description	Advantages	Disadvantages	Suitability
No Action	'No Action' can be considered if: ▪ There is no measurable contamination (i.e. contaminant concentrations are below adopted criteria); or ▪ Exposure is unlikely and contaminants are not mobile.	No remediation costs. Creates minimal disturbance to the site.	Would pose limitations on land use options. May require an Environmental Management Plan (EMP) and ongoing monitoring.	**Not Suitable** – As exceedances were detected during the previous investigations and there is potential for exposure to receptors. Furthermore, asbestos contamination cannot be addressed by this remediation option.
On-site bioremediation	Excavated soils are thoroughly broken down and aerated, mixed with reagents to help microorganism populations grow, stockpiled and aerated above ground.	Cost effective if soils are reused on site. Lower disposal costs (if any). Limited requirement to import fill material to site.	Material handling area required. Longer remediation timeframes. Potential for odour problems.	**Not suitable** – Asbestos contamination cannot be addressed by this remediation option.
In situ treatment	*In situ* treatment of impacted soils within the vadose and saturated zones using forced advection or abiotic injection methods, such as soil vapour extraction, in situ chemical oxidation, etc.	Minimal disturbance (no excavation). Cost effective for large scale site remediation of lighter petroleum hydrocarbons. Potential to simultaneously remediate soil and groundwater (if impacted).	High establishment costs (equipment and installation). Potential for odour and/or health and safety problems. Requires detailed design and pilot trials.	**Not suitable** – Method designed for widespread by hydrocarbon impacts. Furthermore, asbestos contamination cannot be addressed by this remediation option.
Consolidation and/or capping	Risk minimisation approach, where impacted soils are managed on-site by capping the ground surface with geotextiles and/or a clean, impermeable layer of fill material.	Effectively removes risk to human health by eliminating exposure pathways.	Requires detailed capping design. Would pose limitations on land use. Typically requires an EMP.	**Potentially suitable** – For the areas impacted only by asbestos. Will require approval by site owners and Council. Will also require an EMP for the land.
Excavation and off-site disposal	Excavate impacted materials. Transport directly to a licensed landfill facility. Reinstate site with imported clean fill material.	Fast, as the impacted material can be removed immediately. Reduced vapour/odour issues as impacted materials removed from site. Minimal design and management costs.	High costs associated with the disposal of waste soils and importation of clean backfill). Requires waste classification prior to disposal, keeping of thorough waste records, waste tracking and reporting. Sustainability issues related with disposal to landfill.	**Suitable** – It would render the site suitable for future use without the need for ongoing monitoring.
Natural attenuation	Allowing the contaminants to biodegrade naturally while	Minimal disturbance (no excavation). Sustainable and cost-effective	Longer remediation timeframes. Potential for further impacts on the	**Not Suitable** – As receptors might be already exposed to risks. Furthermore,

Remediation Methodology	Description	Advantages	Disadvantages	Suitability
	systematically monitoring the contamination plume behaviour.	remediation method.	groundwater aquifer and nearby environmental receptors. Typically requires an EMP.	asbestos contamination cannot be addressed by this remediation option.
Implementation of vapour intrusion risk mitigation protection measures, as per NSW EPA (2020b).	Installation of protection measures such as: slabs, vapour membranes, mechanical ventilation, passive sub slab ventilation, etc to mitigate the vapour intrusion risks posed to receptors using the basement and/or other indoor spaces.	No contaminant mass removal from the aquifer required. Effectively removes risk to human health by eliminating exposure pathways. Minimal disturbance (no excavation).	High costs. Typically requires an EMP. Requires detailed design. Would pose limitations on land use.	**Not suitable** – There is no vadose zone between the bottom of the basement slab and the groundwater level.

5.3 Preferred Remediation Option

Based on the available remedial technologies assessed in **Table 5-1**, the proposed site development, the potential risks to human health and the environment, as well as the relative cost effectiveness of feasible remedial techniques, the preferred remedial option selected for the site is:

- Excavation and off-site disposal.

This option will comprise the remedial excavation of all impacted soils, followed by their off-site disposal to licensed waste facilities.

All wastes shall be transported to appropriate, NSW EPA-licensed facilities, after formal classification. All excavated (remediation) areas shall be validated by base and wall soil sampling. Where required, the site will be reinstated with validated, imported (or recovered) excavated natural materials.

On-site consolidation (encapsulation) and/or capping of impacted materials will be considered a secondary option, where economic constraints dictate.

5.4 Remediation Works Category, Consent and Planning

5.4.1 Consent Requirements

In accordance with the *State Environmental Planning Policy* (Resilience and Hazards) (2021), the category of the remediation works defines whether consent is required prior to commencement. Under *SEPP 2021*, works where there is the potential for significant environmental impact are classed as *Category 1*. *Category 2* works pose a low potential for environmental impact and do not therefore require prior consent. For this assessment, a Secretary's Environmental Assessment Requirement (SEAR) was issued to obtain approval for a State Significant Development Application (SSDA) related to the site development.

The determination assessment for the site is outlined in **Table 5-2**.

Table 5-2 Remediation Works Category Determination

Significant Environment Impact	Yes/No	Category
Designated Development or State Significant Development	Yes	1
Critical or threatened species habitat	No	2
Impact on threatened species, populations, ecological communities or their habitats	No	2
In area identified environmental significance such as scenic areas, wetlands (see list*)	No	2
Comply with a policy made under the contaminated land planning guidelines by the council	Yes	2
Is work ancillary to designated development	Yes	2

Notes: * Environmental significance list -coastal protection, conservation or heritage conservation, habitat area, habitat protection area, habitat or wildlife corridor, environment protection, escarpment, escarpment protection or escarpment preservation, floodway, littoral rainforest, nature reserve, scenic area or scenic protection, or wetland.

5.4.2 Control Plans

All works must be in accordance with *Sydney Development Control Plan (DCP) 2012* and any specific consent conditions issued for the development.

5.4.3 Planning Requirements

The appointed site contractor must prepare a site-specific Work Health and Safety Plan (WHSP) and Construction Environmental Management Plan (CEMP) for the project, covering

human / environmental health and safety issues, as well as all measures required under Council's Development Application (DA) approval and DCPs.

As asbestos removal will be required, an asbestos management plan (AMP) should also be drafted and the appointed contractor must be appropriately licensed to perform such works.

Where asbestos removal is required, the following must be adhered to:

- Safework NSW should be notified in accordance with the WHS Regulation and the Codes of Practice prior to any asbestos removal works; and
- The contractor must be appropriately licenced to perform such works.

  Asbestos removal works must be completed in accordance with the following legislations:

  - NSW Government (2017) *Work Health and Safety Regulation,* 1 November 2017;
  - NSW Government (2011) *Work Health and Safety Act 2011,* 1 January 2012;
  - SafeWork NSW (2019) Code of Practice: How to Manage and Control Asbestos in the Workplace, August 2019; and
  - SafeWork NSW (2019) Code of Practice: How to Safely Remove Asbestos, August 2019.

5.4.4 Dewatering Treatment (if required)

During the remediation and excavation works, should dewatering be required, a site Dewatering Management Plan should be prepared. Any dewatering works may require approval under the *Water Management Act 2000* and *Protection of the Environment Operations Act 1997 (POEO Act)*. Treatment of the extracted groundwater might be necessary prior to discharge. Appropriate discharge sources should be considered:

- Sydney Water requirements for discharge of contaminated water to sewer; and/or
- Council requirements for discharge of groundwater to stormwater system.

6. Remediation Works

6.1 Remediation Sequence

Site characterisation revealed the presence of fill soils impacted by asbestos (bonded), PAH and TRHs impacted.

The site remediation works will therefore include (though not necessarily be limited to):

- **Stage 1** – Preliminaries and site establishment;
- **Stage 2** – Pre and post-demolition inspections;
- **Stage 3** – Data Gap Investigation
  - PCYC building and sporting facilities; and
  - Setback areas.
- **Stage 4** - Remedial excavations of hotspots, bulk excavation and waste classification; and
- **Stage 5** – Preparation of a Site Validation Report (SVR).

During site remediation and development works, any PASS/AASS material will be managed as per ASSMP (EI, 2024). Should additional impacted soils be encountered or unexpected finds be discovered during the course of the remediation program, or should any phase of the validation identify residual, gross contamination requiring additional remediation, then the procedures described under the Unexpected Finds Protocol (**Section 7.6**) and/or the validation plan (**Section 8**) will be implemented, until the remediation goals have been achieved and the site is deemed suitable for the intended land use.

6.2 Stage 1 – Preliminaries and Site Establishment

6.2.1 Council Notification

Notice will be given to Council at least 30 days prior to the commencement of remediation works as outlined in **Section 5.4.1**. A list of all required work permits will be obtained from Council and arrangements are to be made to obtain the necessary approvals from the relevant regulatory authorities.

6.2.2 Site Preparation and Planning

The site should be prepared in accordance with the general requirements of the site management details outlined in **Section 7**. Before site works commence, the site contractor will prepare site specific plans including a work health and safety plan (WHSP), construction environment management plan (CEMP) and an asbestos management plan (AMP).

It will also be necessary to establish environmental controls, site access, security, fencing and any required warning signage prior to works commencement.

A Project Plan should also be developed to outline engineering design for excavation support (if required), water treatment requirements and design (if required), staging of excavation works, stockpiling, waste stabilisation, waste material loading, traffic management and waste tracking.

The Project Plan should incorporate a staging plan that outlines the basic stages of the remediation works. The staging plan should include, but not be limited to:

- Staging of areas to be excavated;

- Areas designated for waste segregation, screening and storage (stockpiling), amenities, soil and groundwater treatment (if required);
- Truck movements to allow loading to mitigate impacts to surrounding land users and council infrastructure; and
- Details of any required environmental management measures such as, dust control.

6.2.3 Remediation Workshop

As part of the site preparation phase, a remediation workshop should be conducted with the appointed contractor(s) to further develop required remedial measures, excavation plans, waste classifications, and environmental management requirements. It would be appropriate for the appointed environmental consultant to be present at the workshop to provide guidance in relation to environmental management measures to be applied during the remediation and site validation activities.

6.3 Stage 2 – Pre and Post-Demolition Inspections

A Hazardous Building Materials (HBM) Survey was completed by Douglas Partners in 2019 (DP, 2019). However, a more comprehensive pre-demolition Hazardous Materials Survey (HMS) must be conducted at the site once the buildings are unoccupied and decommissioned, to enable further identification and delineation of hazardous building materials present at the site.

The removal of any hazardous material should be completed by a suitably qualified contractor. Building demolition should be in accordance with Australian Standard AS2601-2001 and wherever possible, waste should be segregated into metal, wood and brick / concrete. Once removal is complete, a clearance inspection should be conducted by a competent and certified professional to confirm that no hazardous materials remain on site.

Following the removal of all site features (including pavements), a site walkover is to be conducted by a qualified and experienced environmental consultant to assess any visual signs of contamination, such as supplementary asbestos contamination on surface fill soils, buried building waste (potentially containing asbestos) and foreign materials.

Partial retention of hardstand pavement is recommended to be used as a base for stockpiled soil awaiting classification and offsite disposal, in order to limit the likelihood of cross-contamination to underlying soil. When removed, the surface of the soil should be visually assessed. This activity will be certified by a licenced asbestos assessor (LAA), confirming that the area is ‘free of asbestos’ (or otherwise). A copy of the Clearance Certificate will be included in the site validation report. No soil excavated from building footprint / paved areas can be deemed as ‘free of asbestos’ without completion of this walkover and corresponding clearance, confirming no asbestos materials remain within those parts of the site.

6.4 Stage 3 – Data Gap Investigation

The areas comprising the existing PCYC building and the future deep soil zones have not yet been characterised, due to the restricted access during the investigation campaigns. These areas will require additional soil investigation by intrusive sampling and analysis, once the building demolition is complete.

During this step of the investigation, test pit sampling will be conducted according to NSW EPA (2022a; 2022b). Each pit will be advanced (vertically) to the commencement of natural soils as presented in **Figure 4, Appendix A**.

A ground-penetrating radar (GPR) survey should also be conducted across the PCYC building after demolition, to verify any subsurface infrastructure that might be present on site.

The results of this additional characterisation campaign can be later used for the formal waste classification process (Stage 4, **Section 6.5**), in accordance with NSW EPA (2014a) and NEPC (2013).

More details on the data gap investigation methodology are provided in **Table 8-1**.

6.5 Stage 4 – Remedial Excavations of Hotspots, Bulk Excavation and Waste Classification

6.5.1 Remediation of hotspots

The following methodology is hereby proposed to remediate these areas:

- A 5m x 5m area should be excavated around each identified hotspots (**Figure 2, Appendix A**), removing the entire fill layer. The excavated materials are to be stockpiled separately from all other site fill/soils, or loaded directly onto licensed transport vehicles, to enable disposal in accordance with NSW EPA (2014a).
- During excavation of the fill layer, care should be taken not to mix them with the potentially ASS-impacted layers underneath (including natural peat layers).
- Validation samples should be collected from the base of the excavated test pits, as well as from the walls (north, east, south and west), to delineate the extent of the hotspots contamination as well as visual / olfactory observations and soil headspace screening for volatile organic compounds (VOCs) using a calibrated photo-ionisation detector (PID).
- Asbestos sampling and analysis will be adopting the bulk analysis method described in NEPC (2013).
- All work must be conducted in accordance with the SafeWork NSW and NSW EPA regulatory requirements, guidelines and protocols enforced at the time of works;
- Removal of asbestos impacted material from the site shall only be carried out by experienced asbestos contractors holding the appropriate SafeWork NSW and NSW EPA licenses, consents and approvals. All loads must be transported with a copy of the relevant Waste Classification Report for the waste load.
- Sampling frequency will be in accordance with that outlined in **Table 8-1**.
- All analyses will be performed by NATA-accredited environmental analytical laboratories.
- If exceedances of the adopted criteria are reported, the excavation area should be stepped out 2.5 m in the exceedance direction(s) ('chase out'). New wall and base samples will then be collected and the process will repeat until no exceedances are identified.

6.5.2 Removal of remaining fill soils within the basement footprint

- Upon verification that the hotspots have been effectively remediated, the remaining site-wide fill will be excavated, as per the plans of the proposed (basement) development.
- Again, similarly to the works to be done around the hotspots, care should be taken not to mix them with the potentially ASS-impacted layers underneath (including natural peat layers).

6.5.3 Bulk Excavation

Fill soil management

Bulk excavation will be required to construct the single level basement covering part of the site area (**Section 1.2**). Material handling and management procedures will be implemented as detailed in **Section 7.2** for any excavated material. Any material designated for off-site disposal

must be classified in accordance with NSW EPA (2014a). Previous investigation results can also be utilised for classification purposes.

The waste classification procedure is described below:

- Stockpiled materials designated for waste classification will be collected at a rate of one sample per each 25 m^3 (minimum of three samples) up to 250 m^3. For stockpiles exceeding 250 m^3 but less than 2,500 m^3, a minimum of 10 samples is required and 95% UCL statistical calculations of contaminant concentrations may be used for classification.
- The analytical suite for waste classification will include six priority metals (arsenic, cadmium, chromium, lead, mercury and nickel), TPH, BTEX, PAH, OCP, OPP, PCB and asbestos (10L samples for quantification analysis according to NEPC (2013)), with TCLP testing (as required) and any additional COPCs that may be identified during the site remediation works.
- A Waste Classification report detailing the interpreted soil waste classification will be prepared for each stockpile (NSW EPA, 2014a), to enable appropriate off-site disposal.
- Stockpiles from different remediation areas and different soil profiles shall be kept separate. Stockpiles should be placed on either intact hardstand pavement or high density polyethylene (HDPE) plastic liner and limited to a maximum height of 2m. Stockpiles should be surrounded by star pickets and marking tape, or other suitable material, to clearly delineate boundaries. Stockpiles shall be lightly conditioned by water sprinkler to prevent dust blow and/or covered with tarp if longer duration is required. Where stockpiles are to remain onsite for a period >24 hours, silt fences or hay bales should be erected around each stockpile to prevent losses from surface erosion (runoff).
- Surplus fill and natural soil to be disposed off-site must be classified according to NSW EPA (2014a).
- Waste Classification reports must be issued by the environmental consultant according to the assessed classification and quantity prior to off-site disposal.
- It is the responsibility of the appointed Site Manager to make arrangements for the Environmental Consultant to assess the need for additional sampling and analysis, to classify any additional spoil that is produced during the construction process.
- The earthworks contractor must identify suitably licenced waste landfill premises for disposal of waste materials and confirm that the premises will accept the waste in accordance with its Environmental Protection License (EPL).
- Waste classified soils for disposal shall be loaded onto NSW EPA-licensed waste vehicles for transport to the designated landfill premises.
- Waste transport contractors must carry a copy of the relevant Waste Classification with every transported load.
- The waste must be transferred to the designated premises in accordance with applicable legislation.
- The earthworks contractor must supply the individual waste dockets for each waste load to the environmental consultant via the Site Manager, in a timely manner. The waste dockets will be later required for validation reporting purposes.
- Additional waste classification may be necessary for suspicious materials which exhibit odours or appear stained or discoloured. The discovery of such soils should be treated as “unexpected finds” and will trigger application of the Unexpected Finds Protocol provided in **Section 7.6**. In this situation, the Environmental Consultant should be immediately consulted for evaluation and waste characterisation of the materials.

- A site log shall be maintained by the contractor for each discrete excavation (numbered locations) to enable the tracking of disposed loads against on-site origin and location of the materials.
- Transport of contaminated material should be via a clearly designated haul route from the site to the landfill premises that minimises exposure to sensitive communities. The proposed waste transport route should be notified to Council and truck dispatch shall be logged and recorded by the contractor for each load leaving the site.
- Each waste load should be disposed to a licensed waste facility authorised to accept the waste, in accordance with the relevant Waste Classification Reports, and documentation (waste dockets) confirming disposal must be maintained for reporting purposes.
- Environmental controls must be implemented to prevent exposure to workers and the public and are described further in **Section 7** of this RAP.

Removal of asbestos materials from the site shall only be carried out by recognised asbestos contractors holding the appropriate SafeWork NSW and NSW EPA licenses, consents and approvals.

Natural Soil Management

Excavation of natural soils (potentially containing ASS) shall proceed as follows:

- The exposed surfaces shall be inspected by a qualified environmental consultant and a representative of the receiving landfill facility, prior to commencing excavation.
- Any excavation works (including during piling works) should be conducted as per procedures detailed in the ASSMP prepared for the site (EI, 2024).
- Disposal of ASS material should take place to a licenced facility as soon as possible, after lime treatment and/or waste classification certification. Transportation shall be by licensed tipper trucks. The receiving facility must be licensed with the NSW EPA to accept (treated) ASS.

Estimated waste volumes are presented inError! Reference source not found., based on the currently identified hotspots and on the overall excavation works proposed for the development. These volumes might change during the works, depending on the chase-out works required, actual soil density and unexpected analytical results.

Table 6-1 Waste Classification Estimates (including hotspot areas)

Material Type / Locations	Preliminary Waste Classification	Comments / Volume Calculations	Estimated In-situ Volume (m^3)
Within Basement footprint – Hotspot Remediation & Bulk Excavated Materials Disposal			
Fill Soils			
Fill soil around TP414	*General Solid Waste (non-putrescible) / Asbestos Waste*	Fill depth 1.4m x 25 m^2	35
Remainder of fill soil material within the basement footprint	*General Solid Waste (non-putrescible)(<CT1)*	1.4m x 4,682m^2	6,554
Natural Soils			
Natural materials down to the average excavation depth of 2.0	*General Solid Waste (non-putrescible) / PASS*	0.6m x 4,607m^2	2,764

Material Type / Locations	Preliminary Waste Classification	Comments / Volume Calculations	Estimated In-situ Volume (m^3)
mBGL			
Within Setback/Landscape Areas – Remediation required at hotspot locations			
Fill at BH502 – TRH and PAH impacted hotspot	*General Solid Waste (non-putrescible)(<CT1)*	Fill depth 1.6m x $90m^2$	144
Within Boundary of Building Footprint Areas – Remediation required at hotspot locations			
Fill at MW20 and BH503	*Restricted Solid Waste / Asbestos Waste*	Fill depth 1.8m x $60m^2$	108
Fill at BH19	*General Solid Waste (non-putrescible) / Asbestos Waste*	Fill depth 1.5m x $25m^2$	77.5

6.5.4 Disposal of Contaminated Material and Waste Tracking

All contaminated materials excavated and removed from the site shall be disposed at an appropriately licensed landfill facility. Copies of all necessary approvals shall be provided to the environmental consultant prior to any contaminated material being removed from the site.

Material tracking should include information on material description, source location, estimated volume, waste classification, disposal destination, disposal date, transporter's details supported by appropriate disposal dockets. All information shall be documented by the contractor including copies of weighbridge dockets, trip tickets and consignment disposal confirmation (where appropriate). Such information must be provided to the environmental consultant for later reporting purposes.

6.6 Stage 5 – Preparation of a Site Validation Report (SVR)

Validation assessment is required to confirm:

- The suitability of soil within remedial excavations; and
- The suitability of backfill soil that may be imported to reinstate any excavated areas.

Details of the required validation activities are presented in **Section 8**.

All results shall be presented in a Site Validation Report (SVR), prepared by the Environmental Consultant in accordance with NSW EPA (2020a). The report will document all aspects of the remediation and site validation program, include an assessment of the environmental data for remaining site soils against the adopted remediation acceptance criteria and provide a clear conclusion that the site has been remediated to a suitable standard for the proposed land uses.

Further details on what will be included in the SVR are provided in **Section 8.4**.

6.7 Remedial Contingencies

It is anticipated that the proposed remedial technology will be effective in dealing with the identified contamination. However, remedial contingencies may be required should the scenarios detailed in **Table 6-2** arise.

Table 6-2 Remedial Contingencies

Scenario	Remedial Contingencies/Actions Required

Scenario	Remedial Contingencies/Actions Required
Highly contaminated soils not identified during previous investigations are encountered, particularly at site boundaries	Work to be suspended until the Environmental Consultant can further assess impacted soils/ materials and associated risks. Follow the unexpected finds protocol as detailed in **Section 7.6** of this RAP.
Abandoned underground storage tanks (USTs) are encountered at the site	Systems to be removed and the excavations appropriately validated and backfilled by experienced contractor. Tank removal works reported by appropriate environmental consultant in accordance with NSW EPA (2020c) *Guidelines for the implementation of the POEO (underground petroleum storage systems) Regulation 2019* and Australian Standard AS4976 (2008). Follow the unexpected finds protocol as detailed in **Section 7.6**.
Additional asbestos wastes are encountered	Work to be suspended and asbestos work removed by a suitably qualified contactor, in accordance with SafeWork NSW regulations. Follow the unexpected finds protocol as detailed in **Section 7.6**.
Residual soil impacts remain on-site	Review/assess soil conditions. Carry out site specific second tier risk assessment (if required). Review/assess potential vapour hazard. If there is a vapour risk additional remedial measures may be required such as installation of a vapour barrier or passive or active vapour extraction system. Amendment to RAP required.
Contaminated groundwater (including LNAPL or DNAPL) encountered	Review groundwater conditions on site (if required) and determine need for further investigation/remediation and/or longer-term management plan. Any dewatering may require approval under the *Water Management Act 2000*. Remedial options may include natural attenuation, extraction, bio-remediation, phase-separated hydrocarbons (PSH) recovery using active pumping (including hydraulic control), installation of a groundwater permeability barrier, in situ oxidation or stabilisation. Amendment to RAP required.
Groundwater contaminant plume is identified and is migrating off-site, or there are increases in concentration due to increased infiltration	Review contaminant increase and analytes. Review active remediation alternatives (if necessary). Ensure down-gradient monitoring is undertaken. Carry out fate and transport modelling (if required) and assess the need for further action. Amendment to RAP required.
Contamination is identified near heritage items or significant trees (if identified)	Stop work. Review contaminant concentrations and risks to heritage items / flora. Assess human health and environmental risks if contamination remains in place. Review natural attenuation options.
Changes in proposed excavation depth or lateral extent	Review remediation works for the site.
Changes in proposed land use(s) at the site	Review remediation works for the site.

7. Site Management

7.1 Responsibilities and Contacts

The responsibilities for the various parties involved with the remediation program are outlined in **Table 7-1**.

Table 7-1 Site Management Responsibilities

Responsible Party	Details/Contacts	Responsible for:
Project Manager	Principal Contractor to be confirmed	▪ Overall management of the site remedial activities.
Property Owner and Site Contractor	Hickory Constructions Redfern Pty Ltd and/or Principal Contractor	▪ Notification of site conditions to the NSW EPA under the duty to report contamination under the *Contaminated Land Management Act 1997.* ▪ Registration of details of Site Audit Statement (Auditor engaged). ▪ Implementation of and compliance with the RAP. ▪ Notification to contractors of the existence of RAP. ▪ Provision of copies of the RAP.
Environmental Management Coordinator (EMC) / Remediation Supervisor	Hickory Constructions Redfern Pty Ltd (and/or Principal Contractor) and Environmental Consultant	▪ Ensuring site remediation works are carried out in an environmentally responsible manner. ▪ Liaison between the appointed Environmental Consultant and Council, providing regular updates and informing of any problems encountered. ▪ Ensuring all environmental protection measures are in place and functioning correctly during site remediation works. ▪ Reporting any environmental issues to owner.
Environmental Consultant	To be confirmed before remedial works are started	▪ Preparation of the RAP. ▪ On-site management and guidance of the remedial works. ▪ Coordination of validation works, documentation, notifications and permits required to conduct remedial works to a standard suitable of obtaining approval from the NSW EPA. ▪ Completing validation sampling and monitoring as requested by the Remediation Contractor and dictated by the RAP. ▪ Liaison between remediation contractor and the client. ▪ Preparation and submission of supporting documentation for Site Auditor review.
Earthworks or Remediation Contractor	Engaged by Hickory Constructions Redfern Pty Ltd and/or Principal Contractor	▪ Ensuring all operations are carried out as identified in the RAP (remediation), as directed by the Project Manager and EMC. ▪ Inducting all employees, subcontractors and authorised visitors on procedures with respect to site works, WHS and environmental management procedures. ▪ Reporting any environmental issues to EMC. ▪ Maintaining site induction, site visitor and complaint registers. ▪ Ensuring that fugitive emissions and dust potentially leaving the confines of the site are suitably

Responsible Party	Details/Contacts	Responsible for:
		controlled and minimised. ▪ Ensuring that water containing any suspended matter or contaminants is minimised, does not leave the site and is suitably controlled, so as not to pollute the environment. ▪ Ensuring that vehicles are cleaned and secured so that no mud, soil or water is deposited on any public roadways or adjacent areas. ▪ Ensuring that noise and vibration levels at the site boundaries comply with the legislative requirements. ▪ Preparation of site-specific plans including WHSP, CEMP and AMP as stated in **Section 7.3**.
Local Council	City of Sydney Council	▪ Ensuring requirements of Development Consent and other planning instruments are met. ▪ Registration of details of a Site Audit Statement (if a requirement) on Planning Certificate.
Qualified Independent Consultant – NSW Accredited Site Auditor	Engaged by Hickory Constructions Redfern Pty Ltd and/or Principal Contractor	▪ Review of RAP, Site Validation Report. ▪ Preparation of Site Audit Statement and Site Audit Report. ▪ Review of updates, revisions or amendments as applicable. ▪ Provide interim audit advice of consultant or client submissions. ▪ Conduct inspections during remedial works.

7.2 Materials Handling and Management

Table 7-2 summarises the measures that should be implemented in respect of materials handling during remedial and excavation works at the site.

Table 7-2 Materials Handling and Management Requirements

Item	Description/ Requirements
Earthworks contractors	Excavation of fill materials should be completed by a suitably qualified contractor to ensure: ▪ All employees and contractors are aware of the environmental and health and safety requirements to be adhered to. ▪ There is no discernible release of dust into the atmosphere as a consequence of the works. ▪ There is no discernible release of contaminated soil into any waterway as a consequence of the works. ▪ There are no pollution incidents, health impacts or complaints. ▪ All site-specific management plans such as CEMP and AMP should be followed.
Stockpiling of materials	All stockpiles will be maintained as follows: ▪ Stockpiles must be located on sealed surfaces such as sealed concrete, asphalt, or high density polyethylene. ▪ Should stockpiles be placed on bare soils, which may occur adjacent to remediation areas, bare soil should be lined with builder's plastic before stockpile placement in locations that do not pose any environmental risk, and covered with builder's plastic. ▪ Excavated soils should be stored in an orderly and safe condition (≤2m height). ▪ Stockpiles should be battered with sloped angles to prevent collapse. ▪ Stockpiles should be covered after being lightly conditioned by water sprinkler to prevent dust blow and control odours. ▪ Air emissions to be controlled by using a hydrocarbon mitigation agent, such as

Item	Description/ Requirements
	BioSolve®, Pinkwater®, Anotech® or an equivalent product selected by the contractor, in combination with the fine mist spraying. ▪ Should the stockpile remain *in situ* for over 24 hours, silt fences or hay bales should be erected around each stockpile to prevent losses from surface erosion (runoff). ▪ Stockpiles shall be strategically located to mitigate environmental impacts while facilitating material handling requirements.
Loading of material	Loading of stockpiles / materials will be as follows: ▪ Transport of contaminated material off the site is to be via a clearly distinguished haul route. ▪ Measures shall be implemented to ensure that no contaminated material is spilled onto public roadways or tracked off-site on vehicle wheels. Such measures should include the use of a wheel washing/cleaning facility, placed before the egress point on the site, and should be able to handle all vehicles and plant operating on-site. ▪ Residue from the cleaning facility should be collected and either dewatered on site in a contained / bunded area, or disposed as a slurry to an approved facility. Such residue will be deemed contaminated unless proven otherwise.
Transport of materials	Prior to being assigned to an appropriate waste disposal facility, all waste fill/soils will be classified in accordance with the NSW EPA (2014a) *Waste Classification Guidelines*. If prior immobilisation treatment of the waste soils is required, disposal consent will be obtained from the NSW EPA prior to spoil transport. ▪ All trucks transporting soils from the site are to be covered with tarpaulins (or equivalent). ▪ All haulage routes for trucks transporting soil, materials, equipment and machinery shall comply with all road traffic rules, minimise noise, vibration and odour to adjacent premises, utilise state roads and minimise use of local road. ▪ All deliveries of soil, materials equipment or machinery should be completed during the approved hours of remediation and exit the site in a forward direction. ▪ Removal of waste materials from the site shall only be carried out by a recognised contractor holding the appropriate NSW EPA licenses, consents and approvals. ▪ Waste materials must be transported less than 150km from the source (POEO 1997, Waste 2014) and landfills are required to be licensed for the category of waste they are scheduled to receive. Additional conditions apply to material that is classified as Hazardous Waste.
Material tracking	Materials excavated from the site should be tracked from the time of excavation until disposal. Tracking of the excavated materials should be completed by recording the following: ▪ Origin of material (Source location); ▪ Material type (description);Approximate volume; ▪ Disposal date; ▪ Disposal destination; ▪ Truck registration number; and ▪ Transporter details. Disposal locations will be determined by the remediation contractor. Disposal location, waste disposal documentation (weighbridge dockets) and the above listed information should be provided to the remediation consultant for reporting purposes. The NSW EPA 2015 Asbestos and Waste Tyres Guidelines state that consignors and transporters of Asbestos Waste, and facilities receiving these wastes, must use "WasteLocate" to provide information to the NSW EPA regarding their movement within NSW. Further information about the "WasteLocate" system is available online from the NSW EPA Website at: https://wastelocate.epa.nsw.gov.au/.
Material visual inspection prior to validation sampling.	Following the completion of remedial works as specified within this RAP, the following applies: ▪ A suitably qualified environmental consultant should undertake a visual inspection of the work area. If visual observations indicate contamination, the earthworks contractors should rectify any issues arising from the inspection (i.e. further

Item	Description/ Requirements
	excavation or 'chasing out' until soils show no evidence of contamination based on visual inspection and/or odours). ▪ Following satisfactory completion of the visual inspection, validation sampling of soils should be completed. Validation sampling is discussed in **Section 8**. Only following satisfactory validation will remedial works be deemed as completed.

7.3 Environmental Management

All remediation work must be undertaken with due regard to the minimisation of environmental effects and meet all statutory environmental and safety requirements. The WHSP, CEMP and AMP must therefore address the issues identified in **Table 7-3**. Based on the proposed development, dewatering will likely be required.

Table 7-3 Environmental Management Requirements

Category	Preventive/Corrective Measures
Demolition (including Asbestos Management)	Appropriate measures shall be taken to ensure that demolition works are completed in accordance with SafeWork NSW Standards and Codes of Practice. Any asbestos identified should be managed in accordance with SafeWork NSW Codes of Practice and Australian Standards. Clearance inspection advised to verify removal of demolition waste including fall out to ground surface.
Site Stormwater Management and Control	Appropriate measures shall be taken to ensure that potentially contaminated water does not leave the site. Such measures should include, but not be limited to: ▪ Diversion and isolation of any stormwater from any contaminated areas; ▪ Provision of sediment traps including geotextiles or hay bales; and ▪ Discharge of any water to drains and water bodies must meet the appropriate effluent discharge consent condition under the *Protection of the Environmental Operations Act 1997*.
Soil Management	Appropriate measures shall be taken to ensure soils are excavated using an appropriate methodology to reduce nuisance dust and odours from leaving the boundary, and soils are disposed of in accordance with the NSW Government *Protection of the Environment Operations (Waste) Regulation 2014*.
Dust and Odour	Control of dust and odour during the course of the remediation works shall be maintained by the contractor to ensure no nuisance dust or odours are received at the site boundary according to requirements of the Sydney DCP. Action levels and specific control measures would be described in the site CEMP and may include, but not necessarily be limited to the following: ▪ Site wide water spraying, as and when appropriate, to eliminate wind-blown dust; ▪ Use of mist sprays, and/or sprinklers on stockpiles, fill screening areas and loaded fill to lightly condition the material; ▪ Use of tarpaulin or tack-coat emulsion or sprays to prevent dust blow from stockpiles or from vehicle loads; ▪ Covering of stockpiles or loads with polythene or geotextile membranes; ▪ Restriction of stockpile heights to 2m above surrounding site level; ▪ Ceasing works during periods of inclement weather such as high winds or heavy rain; and ▪ Regular checking of the fugitive dust and odour issues to ensure compliance with the CEMP requirements, undertaking immediate remedial measures to rectify any cases of excessive dust or odour (e.g. use of misting sprays or odour masking agent). It is advised that all site workers use adequate dust masks during soil excavation and that machine operators remain within an enclosed, air conditioned cabin.
Noise and Vibration	Noise and vibration will be restricted to reasonable levels. All plant and machinery used on site will be noise muffled to ensure emissions do not breach statutory levels

Category	Preventive/Corrective Measures
	as defined within the Sydney DCP.
Hours of Operation	Working hours will be restricted to those specified in the site-specific DA conditions.
Community Engagement	Community engagement should be carried out in accordance with NEPC (2013). Prior to the commencement of any remediation works at the site, every owner and occupier of any land located either wholly or partly within 100m of the boundary of the premises (including local council and the RMS) should be notified at least 30 days in advance. The notice should include: ▪ Advice of demolition and excavation work to be carried out on the premises; ▪ State the time and date such work is to commence; ▪ Indicate that the works are being conducted to minimise any risk of site contamination impacting on off-site receptors; ▪ Provide appropriate site signage at an easily readable location on the site fencing, including site contact name and phone number to be contacted should any matter arise; and ▪ Provide contact information and procedure for registering any complaints.
Incident Management and Community Relations	While various environmental management and occupational safety plans will be developed to protect human health and the environment, incidents may occur which pose a risk to the various stakeholders. To mitigate these risks and ensure that a suitable response is carried out quickly, a response plan to any incident that may occur on site should be prepared and various responsibilities assigned. The site health and safety plan and environmental management plan should document these procedures and responsibilities, and incident contact numbers should be maintained in an on-site register. All other relevant emergency contact numbers such as Police, Fire Brigade, and Hospital should be listed in the Health and Safety Plan and posted on-site for easy access.

7.4 Contingency Plan for Environmental Incidents

A contingency plan to deal with incidents that could arise during the proposed remediation works must form part of the site-specific plans: WHSP, CEMP and AMP. Refer to **Table 7-4** for a selection of potential issues that may require specific management. The Unexpected Finds Protocol (**Section 7.6**) should also be followed should an incident occur.

Table 7-4 Contingency Management

Anticipated Problems	Preventive/Corrective Measures
Chemical / Fuel Spill	Stop work, notify above site project manager. Use accessible soil or appropriate absorbent material on site to absorb the spill (if practicable). Stockpile the impacted material in a secure location, sample and determine the appropriate disposal/treatment option.
Excessive Dust	Use water sprays to suppress the dust or stop site activities generating the dust until it abates.
Excessive Noise	Identify the source, isolate the source if possible, modify the actions of the source or erect temporary noise barriers if required.
Excessive Odours / Vapours	Stage works to minimise odours/vapours. If excessive organic odours/vapours are being generated, stop works and monitor ambient air across site for organic vapours with a Photo-ionisation Detector (PID) and odours at site boundaries. Implement control measures including respirators for on-site workers, use of odour suppressants, wetting down of excavated material. No nuisance odours shall be detected at any site boundary as part of the remedial works. Should odour emissions be detected at or beyond the site boundary, it is recommended, as part of the CEMP and community consultation, that the Remediation Contractor and the Project Manager notify the owners and occupiers of premises adjoining and across the road from the

	site regarding potential odour issues. Notification should be in writing. In the notification, as well as on street signage, provide contact details of the site personnel for anyone who may be concerned by odour emission during the remediation. Temporarily pause site works to allow for excess odour to subside to a level acceptable by off-site receptors, should it be necessary, after implementation of the above-listed control measures. Record logs for volatile emissions and odours. Such records should be kept on-site and made available for inspection on request. In regard to off-site impact from petroleum vapour, odour is generally detected at concentrations much lower than what will constitute a health-based risk. Measures listed above for odour control (**Table 7-3**) may also be applied for vapour control.
Excessive Rainfall	Ensure sediment and surface water controls are operating correctly. If possible divert surface water away from active work areas or excavations.
Water in Excavations	Collect samples and assess against relevant POEO requirements to enable disposal options to be formulated.
Leaking Machinery or Equipment	Stop the identified leak (if possible). Clean up the spill with absorbent material. Stockpile the impacted material in a secure location, sample and determine the appropriate disposal/treatment option.
Failure of Erosion or Sedimentation Control Measures	Stop work, repair failed control measure.
Unearthing Unexpected Materials, Fill or Waste	Stop activities, contact the site project manager. Follow the unexpected finds protocol as detailed in **Section 7.6** of this RAP. Prepare a management plan if required, to address the issue.
Identification of Cultural or Building Heritage Items	Stop work and notify site project manager. Follow the unexpected finds protocol as detailed in **Section 7.6** of this RAP. Prepare action or conservation plan as required.
Equipment Failures	Ensure that spare equipment is on hand at site, or that the failed equipment can be serviced by site personnel or a local contractor.
Complaint Management	Notify Client, Project Managers and Environmental Consultant (if required) following complaint. Report complaint as per management procedures. Implement control measures to address reason of complaint (if possible). Notify complainant of results of remedial actions.

7.5 Work Health and Safety Plan

As required by the NSW *Work Health and Safety Act 2011* and associated regulations, a WHSP should be prepared, to manage the health and safety of site workers and nearby residents, and address such issues as site security, exclusion zones, excavation safety, vibration, noise, odour and dust levels. The plan should address the risks during the remediation works and cover site specific requirements associated with the contaminants present within the site soils and groundwater.

The site officer responsible for implementing health and safety procedures should induct all site personnel so that they are aware of and comply with, the requirements of this document. It is the contractor's responsibility, with assistance from client/owner(s) of the site to ensure that all other permits, approvals, consents or licences are current. The following hazards and mitigation measures relevant to the remedial works are summarised in **Table 7-5.**

Table 7-5 Remedial Hazards

Anticipated Problems	Preventive/Corrective Measures
Chemical Hazards	Contaminated sites have chemical compounds, substances or materials that may present a risk to human health and the environment. Chemicals of concern and

Anticipated Problems	Preventive/Corrective Measures
	associated risks are as detailed within the Conceptual Site Model, within **Section 3.2**. The site specific WHSP should set out controls to mitigate any potential risks.
Physical Hazards	The following hazards are associated with conditions that may be created during site works: ▪ Heat exposure; ▪ Buried services; ▪ Noise, vibration and dust; ▪ Electrical equipment; and ▪ The operation of heavy plant equipment.
Personal Protective Equipment and Monitoring	Personnel should, wherever possible, avoid direct contact with potentially contaminated material. Workers are to ensure that surface waters or groundwater is not ingested or swallowed and that direct skin contact with soil and water is avoided. Standard PPE with the addition of disposable P2 dust masks as specified for the contractor will be sufficient for the prescribed remedial works. Standard PPE includes: ▪ Long sleeve shirt and trousers; ▪ Steel-toe footwear; ▪ Safety glasses (as required); ▪ Helmet (as required); ▪ Hi-vis vest/clothing (as required).

Asbestos Air Monitoring

Asbestos Air Monitoring is not required for non-friable ACM, however is recommended to assess the effectiveness of control measures during removal. Asbestos air monitoring must be conducted in accordance with the *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres* [NOHSC: 3003 (2005)] and analysed by a NATA-accredited laboratory. The criteria and actions that will apply to this project are summarised in **Table 7-6.**

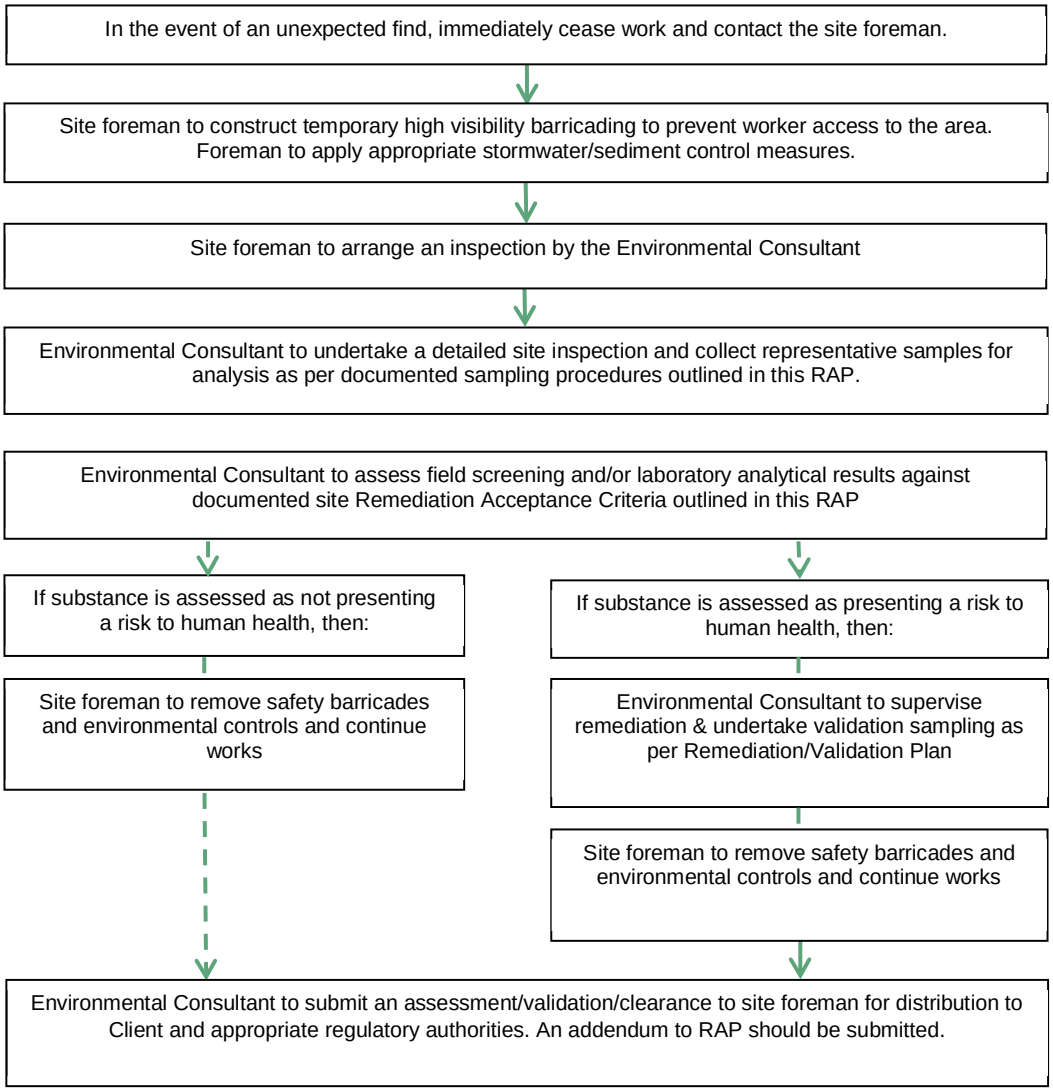
Table 7-6 Asbestos Criteria for Air Monitoring

Control Level (fibres/mL)	Control / Action
< 0.01	No Action. Continue with existing control measures.
≥0.01	Asbestos Consultant to notify Project Manager of results as soon as practicable. Project Manager to notify/engage a Licensed Asbestos Removal Contractor. Asbestos Consultant and Project Manager to review current control measures and improve, where applicable. This may include improved work practices, use of further control measures (e.g. plastic screening or wet wiping techniques) or changing the work methodology.
≥0.02	Asbestos Consultant to notify Project Manager of results as soon as practicable. Asbestos Consultant to advise Licensed Asbestos Removal Contractor to stop work immediately. Asbestos Consultant to conduct investigations to establish cause of problem. Asbestos Consultant to advise Licensed Asbestos Removal Contractor on necessary works to rectify problem. Asbestos air monitoring to be continued by Asbestos Consultant. Contractors will be allowed to return to works area after results are <0.01 fibres/mL.

7.6 Unexpected Finds Protocol

Should unexpected finds be encountered, the approach in **Table 7-7** should be followed. Should any significant unexpected finds be encountered, they must be reported to the Auditor.

Table 7-7 Unexpected Finds Protocol



8. Validation Strategy

Validation sampling is required to confirm that the material remaining or retained for reuse at the site is suitable for the proposed use. Validation will be achieved when either:

- All requirements of the RAP are confirmed as completed; and
- All concentrations of the contaminants of concern within material retained at the site are below the adopted validation criteria; or
- When the 95% upper confidence limit (95% UCL) of the average concentration for each analyte within retained material is below the adopted validation criteria.

The sampling and analysis quality plan (SAQP) will be crucial to the site validation phase. It must ensure that the data collected are representative and provide a robust basis for site decisions.

8.1 Validation Sampling Methodology

Validation sampling will be undertaken following the removal of identified contaminated material to ensure that the vertical and lateral extent of the contamination has been defined, as outlined in **Table 8-1**. Should additional contamination be identified, it would be "chased out" where appropriate until material exceeding the validation criteria has been removed. Soil sampling and handling of the collected samples will be as described in **Table 8-2**.

Table 8-1 Validation Sampling Design

Remediation Area	Sampling Density	Chemicals of Concern
Soil within PCYC building and the future deep soil zones (Data Gap Investigation – **Section 6.4**)	As per NSW EPA (2022a) – Table 2	Priority metals, TRH, BTEX, PAH, OCP/OPP, PCB, asbestos and ASS.
Hotspot areas	Wall – 1 sampling location per wall or per 5m length of excavation wall Base – 1 sample per 25m^2 Visual inspection of exposed surface for ACM (bonded asbestos).	Asbestos, PAH and TRHs. (plus any additional chemicals of concern identified during remedial programs).
Validation of lime treated soil for waste classification	Stockpiled materials designated for waste classification will be collected at a rate of one sample per each 25 m^3 (minimum of three samples) up to 250 m^3. For stockpiles exceeding 250 m^3 but less than 2,500 m^3, a minimum of 10 samples is required.	pH and pH peroxide, selected samples will proceed with further sPOCAs analysis (if required)
Stockpile footprint (if stockpiles created)	Any soil material stockpiled on-site for off-site disposal (not pre-classified), will be sampled for waste classification purposes at a rate of one per 25m^3 (with a minimum of 3 samples for stockpiles <25m^3) For stockpiles exceeding 250m^3 but less than 2500m^3, collect minimum 10 samples. Calculate and 95% UCL of contaminant concentrations for	Priority metals, TRH, BTEX, PAH, CVOCs, OCP, OPP, PCB and asbestos

Remediation Area	Sampling Density	Chemicals of Concern
	comparison to criteria (note: UCL calculations are not applicable to asbestos).	
Imported soil materials (soil and landscape material)	If material is required to be sourced from off-site to reinstate excavations, it will be certified suitable for the intended use. Excavated Natural Material (ENM) certificates should comply with the Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014. If the material is not VENM, ENM or if no suitable certification can be supplied by the source then the material should be characterised as per NSW EPA (2022a). Any Imported materials will be required to demonstrate compliance with the relevant Resource Recovery Exemptions (RRE) and Resource Recovery Orders (RRO) with materials from recycled waste streams to be tested for asbestos at a minimum. Should any mulch be imported during the course of the audit, it will be expected to comply with the requirements of the NSW EPA Contaminated Mulch management Plan 2024.	Priority metals, TRH, BTEX, PAH, OCP, OPP, PCB and asbestos

Excavation of identified contaminated material shall continue until the analytical results indicate compliance with the criteria (i.e. either the concentrations of all contaminants are within the criteria, or the 95% upper confidence limit (UCL) of the average concentration for each detected parameter is within the corresponding criterion). If results indicate that additional excavation is necessary, the excavation shall be extended until the excavation surface samples indicate that the location is validated as meeting the criteria for each respective contaminant.

Table 8-2 Validation Sample Collection and Handling Procedures

Action	Description of Required Works
Sample Collection	Soil validation sampling will be directly from the exposed (excavated) surface, or from the material brought to the surface by the backhoe / excavator bucket. Sampling data shall be recorded to comply with routine chain of custody requirements.
Sampling, Handling, Transport and Tracking	▪ The use of stainless-steel or disposable (one time use) equipment. ▪ All sampling equipment (including hand tools or excavator parts) to be washed in a 3% solution of phosphate free detergent (Decon 90), followed by a rinse with potable water prior to each sample being collected. ▪ Direct transfer of the sample into new glass jars, bottles, vials or plastic bags is preferred, with each plastic bag individually sealed to eliminate cross contamination during transportation to the laboratory. ▪ Label sample containers with individual and unique identification including Project No., Sample No., depth, date and time of sampling. ▪ Place sample containers into a chilled, enclosed, and secure container for transport to the laboratory.

Action	Description of Required Works
	▪ Provide chain of custody documentation to ensure that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to the laboratory.
Sample Containers and Holding Times	▪ Metals - 250g glass jar / refrigeration 4^{o}C / 6 months (maximum holding period). ▪ TRH/BTEX/CVOC - 250g glass jar / refrigeration 4^{o}C / 14 days (maximum holding period). ▪ PAH/OCP/OPP - 250g glass jar / refrigeration 4^{o}C / 14 days (maximum holding period). ▪ Asbestos - up to a 10 Litre resealable plastic (polyethylene) bag / no refrigeration / indefinite holding time.
Field QA/QC	Quality assurance (QA) and quality control (QC) procedures will be adopted throughout the field sampling program, to ensure sampling precision and accuracy, which will be assessed through the analysis of 10% field duplicate/replicate samples. Appropriate sampling procedures will be undertaken to prevent cross contamination, in accordance with EI's Standard Operating Procedures Manual. This will ensure: ▪ Standard operating procedures are followed; ▪ Site safety plans are developed prior to works commencement; ▪ Split duplicate field samples are collected and analysed; ▪ Samples are stored under secure, temperature-controlled conditions; ▪ Chain of custody documentation is employed for the handling, transport and delivery of samples to the contracted environmental laboratory; and ▪ Contaminated soil, fill or groundwater originating from the site area is disposed in accordance with relevant regulatory guidelines. In total, field QA/QC will include one in 10 samples to be analysed as intra-laboratory, blind field duplicates, one in 20 samples to be analysed as inter-laboratory, split field duplicates, as well as one VOC trip blank, one VOC spike sample per sample batch and one equipment wash blank (rinsate blank) per sample day.
Laboratory Quality Assurance and Quality Control	The contract laboratory will conduct in-house QA/QC procedures involving the routine analysis of: ▪ Reagent blanks; ▪ Matrix spike and surrogate recoveries; ▪ Laboratory duplicates; ▪ Calibration standards and blanks; ▪ Control standards; and ▪ Statistical analysis of each QC measure.
Achievement of Data Quality Objectives	DQOs (**Table 8-3**) are to be achieved and an assessment of the overall data quality should be presented in the final validation report, in accordance with the NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme*.

8.2 Data Quality Objectives

In accordance with the USEPA (2006) *Data Quality Assessment* and the NSW EPA (2017) *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme* (3rd Edition), data quality objectives (DQO) will be defined by the EI team to determine the appropriate level of data quality needed for the specific requirements of the project. The DQO process to be applied for the proposed remediation is documented in **Table 8-3**.

Table 8-3 Data Quality Objectives

Step	Description
State the Problem	The proposed redevelopment will involve the demolition of the existing site structures, followed by the construction of multiple residential flat buildings ranging from two- to fourteen-storey high, overlying a partial basement carpark and a new community facility (PCYC) (**Section 1.2**). Previous investigations (**Section 3.1**) indicated fill soils impacted by asbestos PAH and TRHs and groundwater impacted by aluminium, high turbidity and low pH. Following the demolition of the existing buildings on site, a data gap investigation (PCYC building, sporting facilities and Setback areas) will be conducted. If any contamination is identified, delineation and remediation of the identified hotspots will be required. The tasks and procedures described in this RAP are to be undertaken, to achieve the remediation goal of rendering the site suitable for proposed land uses.
Identify the Decision	Based on the remediation objectives outlined in **Section 1.3**, the following decisions need to be made: ▪ Has the nature and extent of soil and groundwater impacts on-site been defined? ▪ Does the level of impact, coupled with the fate and transport of identified contaminants, represent an unacceptable risk to identified human and/or environmental receptors on or off-site?; and ▪ Will further remediation and/or environmental management be required before the site is suitable for the intended land use?
Identify Inputs to the Decision	Inputs to the decision-making process will include: ▪ Findings from previous site investigations; ▪ Details of the proposed site use; ▪ Understanding of current site use and historic activities that have occurred, including potential off-site sources of contamination; ▪ Geological and hydrogeological data relevant to the area; ▪ Field observations for the presence of visual/olfactory contamination indicators; ▪ Contaminant concentrations in soil and groundwater samples confirming effective removal of identified impacts; and ▪ Confirmation that data quality indicators (DQIs) were achieved for sample collection and handling, as well as field and laboratory QC samples.
Define the Boundary of the Remediation / Validation	**Lateral** – Works will be limited to the site boundaries (**Figure 2**, **Appendix A**). **Vertical** – From existing ground surface, underlying fill and natural soil horizons, to the base of contaminated soil and/or excavation level. **Temporal** – Results will be valid on the day samples are collected and will remain valid if no changes to site use occur, and contamination (if present) does not migrate from off-site sources.
Develop a Decision Rule	The decision rules for validation are: ▪ Is the site suitable for the proposed land use? *If the concentrations of contaminants that remain are below the adopted remediation acceptance criteria for the intended land use (**Table 4-1**), then the site will be deemed suitable for the proposed development.* ▪ Is additional information required to determine the suitability of the site for its proposed use? *Should additional information be required, as determined by the updated CSM, then appropriate recommendations will be provided.* Decision criteria for analytical data are defined by the DQIs in **Table 8-4**.

Step	Description
Specify Acceptable Limits on Decision Errors	Specific limits for this project will be in accordance with NEPC (2013), appropriate DQIs for assessing useability of the data and EI standard procedures for field sampling and handling. To assess the useability of data, pre-determined DQIs for accuracy, precision, representativeness and completeness will be applied (presented in **Table 8-4**). If any of the DQIs are not met, further assessment will be necessary to determine whether the non-conformance will significantly affect data useability. Corrective actions may include requesting further information from samplers and/or analytical laboratories, downgrading of the quality of the data and/or re-collection of samples.
Optimise the Design for Obtaining Data	Written instructions will be issued, to guide personnel during the fieldwork activities. Remediation works are to be performed as per **Section 6**. Validation sampling to be completed as per **Section 8** methodology. All sampling procedures will be implemented to optimise data collection and achieve the DQOs. Review of the results will be undertaken to determine if further excavation and/or additional sampling are warranted. Additional investigations would be warranted where concentrations are found to exceed remediation criteria endorsed by the NSW EPA, relevant to the proposed land use(s).

8.3 Data Quality Indicators

To ensure that the validation data (including any additional assessment data) are of an acceptable quality, the results will be evaluated against the DQIs outlined in **Table 8-4**.

Table 8-4 Data Quality Indicators

QA/QC Component	Data Quality Indicator(s)
Precision A quantitative measure of the variability (or reproducibility) of data	Data precision assessed by reviewing the performance of blind field duplicate sample sets, through calculation of relative percentage differences (RPD). Data precision deemed acceptable if RPDs found to be less than 30%. RPDs that exceed this range are considered acceptable where: ▪ Results were less than 10 times the limits of reporting (LOR); ▪ Results were less than 20 times the LOR and the RPD was less than 50%; or ▪ Heterogeneous materials or volatile compounds were encountered.
Accuracy A quantitative measure of the closeness of reported data to the “true” value	Data accuracy assessed through the analysis of: ▪ Split field duplicate sample sets; ▪ Field and method blanks, analysed for the analytes targeted in the primary samples; ▪ Matrix spike sample sets; and ▪ Laboratory control samples.
Representativeness The confidence (expressed qualitatively) that data are representative of each medium present onsite	To ensure the data produced by the laboratory is representative of conditions encountered in the field, the following measures will be taken: ▪ Blank samples run in parallel with field samples, to confirm there were no unacceptable instances of laboratory artefacts; ▪ Review of relative percentage differences (RPD) values for field and laboratory duplicates to provide an indication that the samples were generally homogeneous, with no unacceptable instances of significant sample matrix heterogeneities; and ▪ The appropriateness of collection methodologies, handling, storage and preservation techniques assessed to ensure/confirm there was minimal opportunity for sample interference or degradation (i.e., volatile loss during transport due to incorrect preservation / transport methods).
Completeness A measure of the amount of useable data from a data	Analytical data sets acquired during the investigation evaluated as complete upon confirmation that: ▪ Standard operating procedures (SOPs) for sampling protocols adhered to;

QA/QC Component	Data Quality Indicator(s)
collection activity	and ▪ Copies of all chain of custody (COC) documentation are included and found to be properly completed. Consideration of whether the proportion of "useable data" generated in the data collection activities was sufficient for the purposes of the land use assessment.
Comparability The confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event	Issues of comparability of separate data sets are reduced through adherence to SOPs and regulator-endorsed or published guidelines and standards on each data gathering activity. In addition the data are to be collected by experienced samplers and NATA-accredited laboratory methodologies will be employed for sample analysis.

8.4 Validation Reporting

Once validation assessment as listed in **Section 8.1** is achieved, all results shall be presented in a Site Validation Report, which will document all desk study findings, fieldwork, laboratory analyses, conceptual site model, the implementation of the RAP, investigation methodologies and results, data quality assessment, and conclusions and recommendations. It will be prepared in accordance with requirements described in:

- NSW EPA (2020a) *Consultants Reporting on Contaminated Land: Contaminated Land Guidelines, Table 2.6 Site Remediation and Validation*; and
- NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme*.

The site validation report should also:

- Provide a clear concluding statement that the site has been remediated to a suitable standard for the proposed development; and
- Be submitted for Council and/or a Site Auditor at the completion of the remediation program.

9. Conclusion

This RAP has been prepared to inform the remediation works to be conducted at the property located at 600-660 Elizabeth Street, Redfern (Redfern Place), NSW.

The objectives of this RAP, as outlined in **Section 1.3**, have been addressed and the preferred remedial approach involves the excavation of impacted materials, followed by waste classification and off-site disposal according to the NSW EPA (2014a) *Waste Classification Guidelines*. It is envisaged that the remediation works will be implemented in stages, as follows:

- **Stage 1** – Preliminaries and site establishment;
- **Stage 2** – Pre and post-demolition inspections;
- **Stage 3** – Data Gap Investigation
  - PCYC building and sporting facilities; and
  - Setback areas.
- **Stage 4** - Remedial excavations of hotspots, bulk excavation and waste classification; and
- **Stage 5** – Preparation of a Site Validation Report (SVR).

This RAP provides protocols for the appropriate management of any unexpected finds that may be discovered during the course of the remediation works (**Section 7.6**). In addition, should any phase of the validation assessment identify residual contamination requiring additional remediation, the procedures described under the validation plan (**Section 8**) will be implemented until the remediation goals have been achieved and the site is deemed suitable for its proposed use.

In conclusion, EI considers that the site can be made suitable for its proposed use through the implementation of the site remediation and validation processes described in this RAP.

10. Limitations

This RAP has been prepared for the exclusive use of Hickory Construction Redfern Pty Ltd & Bridge Housing Limited (the client), being the only intended beneficiaries of our work. The scope of the RAP is limited to that agreed with our client.

No other party should rely on the document without the prior written consent of EI, and EI undertakes no duty, or accepts any responsibility or liability, to any third party who purports to rely upon this document without EI's approval.

EI has used a degree of care and skill ordinarily exercised in similar investigations by reputable members of the environmental industry in Australia as at the date of this document. No other warranty, expressed or implied, is made or intended. Each section of this RAP must be read in conjunction with the whole of this RAP, including its appendices and attachments.

The methods and conclusions presented in this RAP are based on a limited investigation of conditions, with specific sampling locations chosen to be as representative as possible under the given circumstances.

EI's professional opinions are reasonable and based on its professional judgment, experience, training and results from analytical data. EI may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified by EI.

EI's professional opinions contained in this document are subject to modification if additional information is obtained through further investigation, observations, or validation analysis and analysis during remedial activities. In some cases, further sampling and analysis may be required, which may result in a further RAP with different conclusions.

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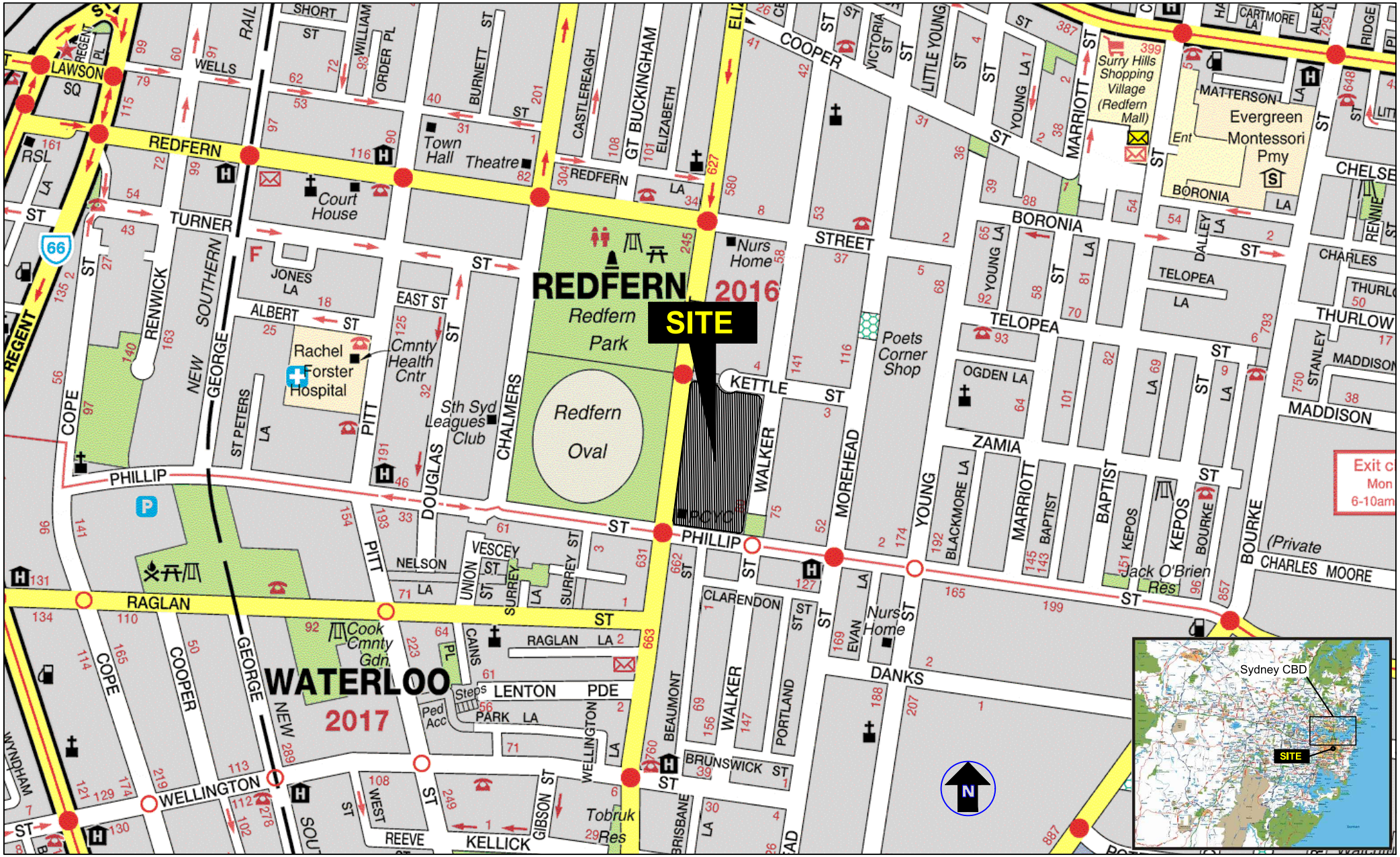
Abbreviations

ACM	Asbestos-Containing Materials
AMP	Asbestos Management Plan
AS	Australian Standard
AASS	Actual Acid Sulfate Soils
ASS	Acid Sulfate Soils
B(α)P	Benzo(α)Pyrene (a PAH compound)
BH	Borehole
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CEMP	Construction Environmental Management Plan
CLM	Contaminated Land Management
COC	Chain of Custody
CSM	Conceptual Site Model
CVOC	Chlorinated Volatile Organic Compounds (a sub-set of the VOC suite)
DA	Development Application
DCP	Development Control Plan
DNAPL	Non-Aqueous Phase Liquid
DQI	Data Quality Indicator
DQO	Data Quality Objective
DSI	Detailed Site Investigation
EMC	Environmental Management Coordinator
EMP	Environmental Management Plan
ENM	Excavated Natural Material
NSW EPA	NSW Environment Protection Authority
FFL	Finished Floor Level
TRH-F1	C_6-C_{10} TRH fraction, less sum of BTEX concentrations
TRH-F2	>C_{10}-C_{16} TRH fraction, less naphthalene
TRH-F3	>C_{16}-C_{34} TRH fraction
TRH-F4	>C_{34}-C_{40} TRH fraction
HDPE	High Density Polyethylene
HIL	Health-based Investigation Level
HSL	Health-based Screening Level
JKE	JK Environments
LDPE	Low Density Polyethylene
LEP	Local Environmental Plan
LGA	Local Government Area
LNAPL	Light Non-Aqueous Phase Liquid (also referred to as PSH)
LOR	Limit of Reporting (of laboratory analytical method)
m	Metres
mAHD	Metres Australian Height Datum
mBGL	Metres Below Ground Level
NATA	National Association of Testing Authorities, Australia
NEPC	National Environmental Protection Council
NEPM	National Environmental Protection Measure
NSW	New South Wales
OCP	Organochlorine Pesticides
OPP	Organophosphate Pesticides
PASS	Potential Acid Sulfate Soil
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Poly-Chlorinated Biphenyls
PFAS	Per- and Poly-Fluoroalkyl Substances

PID	Photo-ionisation Detector
POEO	Protection of the Environment Operations Act
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit (limit of detection for laboratory method)
PSH	Phase-Separated Hydrocarbons (also referred to as LNAPL / DNAPL)
QA/QC	Quality Assurance / Quality Control
RAC	Remediation Acceptance Criteria
RAP	Remediation Action Plan
RPD	Relative Percentage Difference
RRE	Resource Recovery Exemptions
RRO	Resource Recovery Orders
SAQP	Sampling and Analysis Quality Plan
SEPP	State Environmental Planning Policy
SOP	Standard Operating Procedure
SRA	Sample Receipt Advice
SEARs	Secretary's Environmental Assessment Requirements
SSDA	State Significant Development Application
SV	Soil Vapour
SVME	Soil Vapour Monitoring Event
SWL	Standing Water Level
TCLP	Toxicity Characteristics Leaching Procedure
TEQ	Toxicity Equivalent Quotient
TRH	Total Recoverable Hydrocarbons (non-specific petroleum hydrocarbon fractions)
UCL	Upper Confidence Limit of the Mean
UPSS	Underground Petroleum Storage System
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VENM	Virgin Excavated Natural Material
VOC	Volatile Organic Compounds
WHSP	Work Health and Safety Plan

Appendix A - Figures



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Drawn:	A.N.
Approved:	NK
Date:	10-3-23
Scale:	Not To Scale

Hickory Constructions Pty Ltd

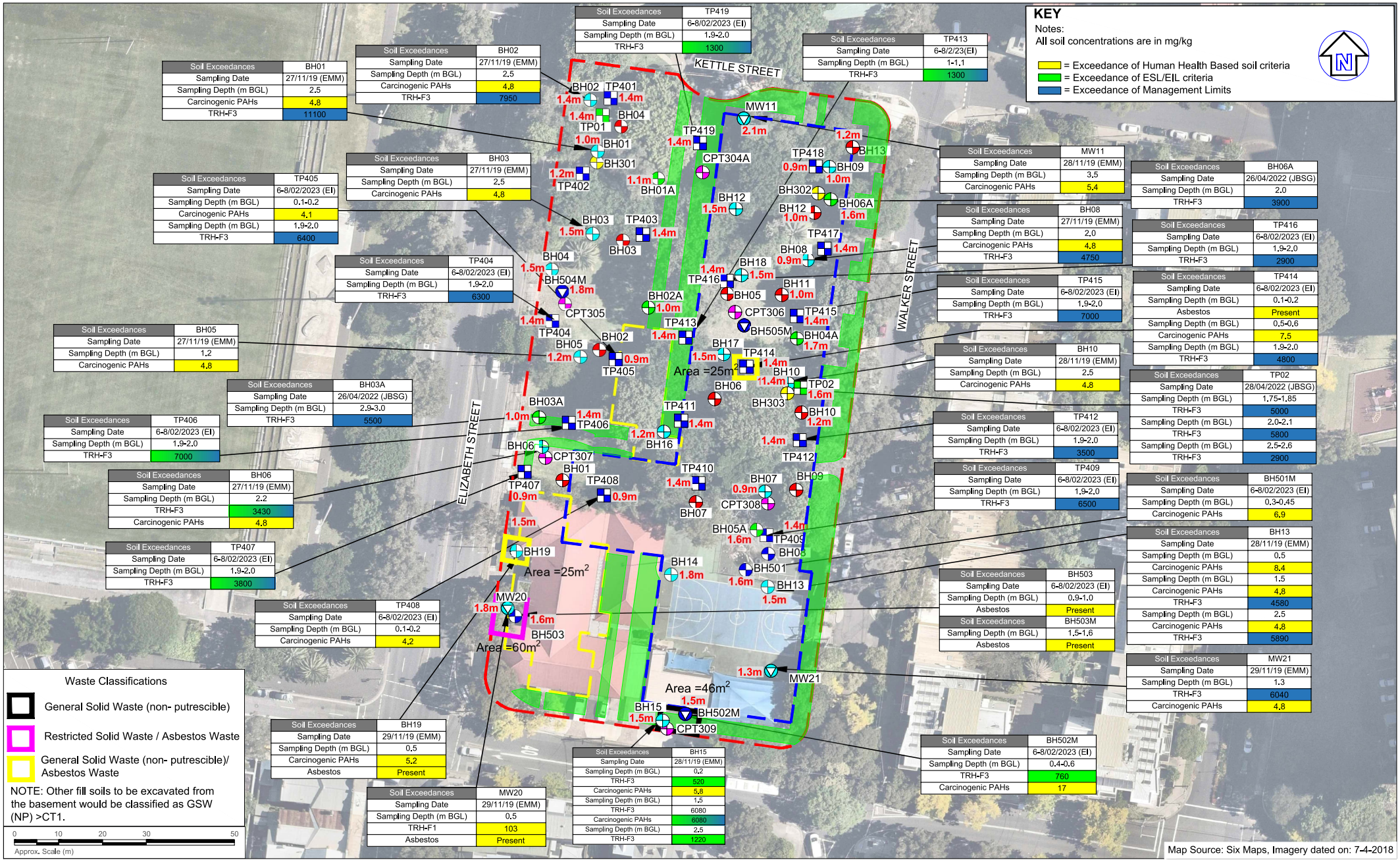
Remediation Action Plan

600-660 Elizabeth Street, Redfern NSW

Site Locality Plan

Figure: 1

Project: E25947.E06



LEGEND (Note: All locations are approximate)

- Site boundary
- Proposed basement footprint concept
- Proposed deep soil area
- Test pit location
- Borehole/monitoring well locaiton
- Borehole location
- Previous CPT location (DP, 2020)
- 1.6m Depth to top of natural peat layer
- Flood storage and OSD tank excavation area
- Previous borehole location (DP, 2020)
- Previous borehole location (EMM, 2020)
- Previous monitoring well location (EMM, 2020)
- Previous borehole location (JBS&G, 2020)
- Previous borehole location (JBS&G, 2022)
- Previous test pit location (JBS&G, 2022)

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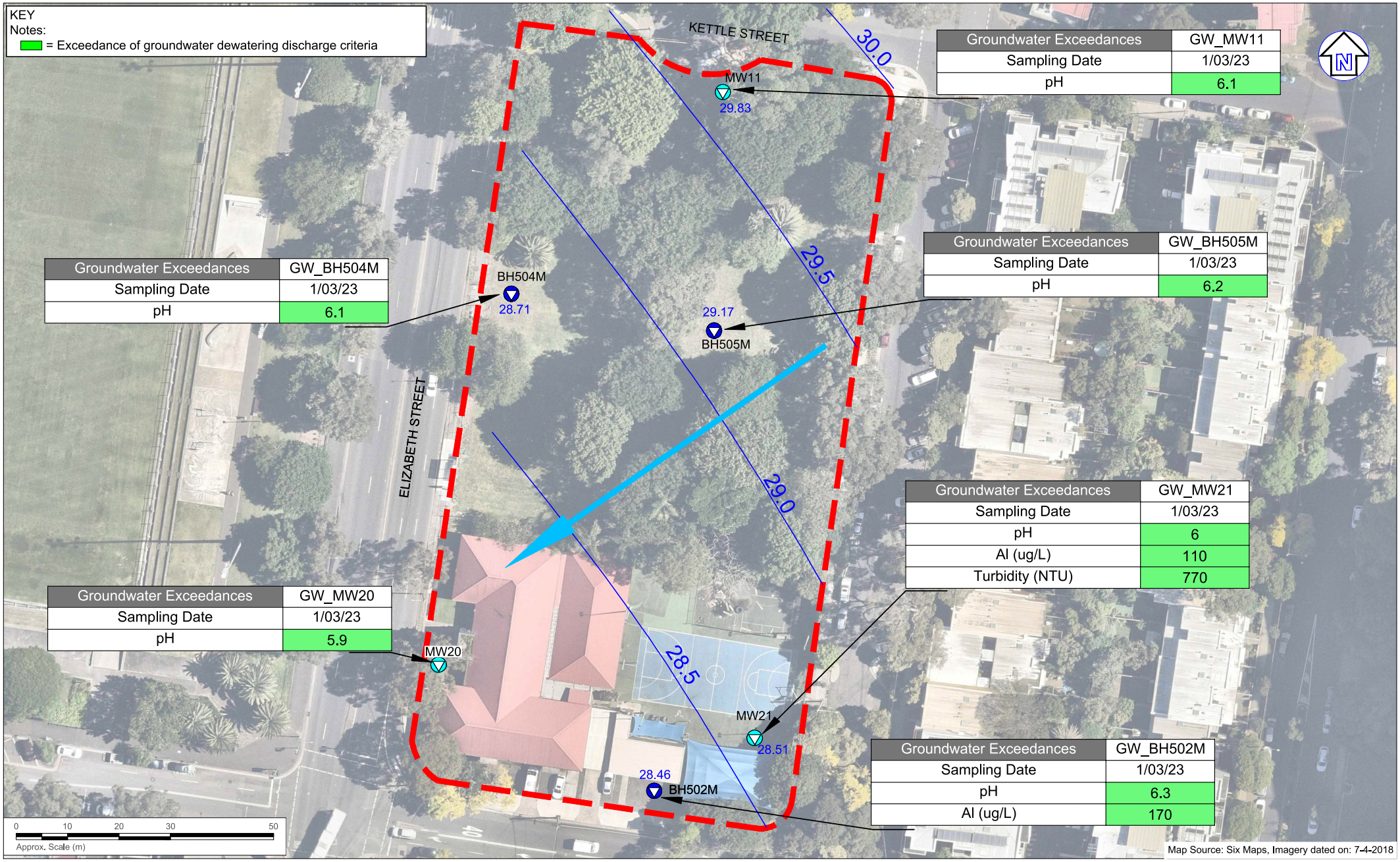
Approved:	-
Date:	20-6-24

Hickory Constructions Pty Ltd
Remediation Action Plan
600-660 Elizabeth Street, Redfern NSW
Soil Exceedance Plan

Figure: 2

Project: E25947.E06_Rev0



Groundwater Exceedances	GW_MW11
Sampling Date	1/03/23
pH	6.1

Groundwater Exceedances	GW_BH504M
Sampling Date	1/03/23
pH	6.1

Groundwater Exceedances	GW_BH505M
Sampling Date	1/03/23
pH	6.2

Groundwater Exceedances	GW_MW21
Sampling Date	1/03/23
pH	6
Al (ug/L)	110
Turbidity (NTU)	770

Groundwater Exceedances	GW_MW20
Sampling Date	1/03/23
pH	5.9

Groundwater Exceedances	GW_BH502M
Sampling Date	1/03/23
pH	6.3
Al (ug/L)	170

LEGEND **(Note: All locations are approximate)**

- Site boundary
- Monitoring well location
- Previous monitoring well location (EMM, 2020) with RWL in mAHD
- Groundwater level contour with RWL(mAHD) based on well head RL extrapolation from spot survey plan.
- Inferred groundwater flow direction

Note:

29.0 Number next to each monitoring well presents RWL in mAHD as measured during EI GME on 1 March 2023.

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Hickory Constructions Pty Ltd
Remediation Action Plan
600-660 Elizabeth Street, Redfern NSW

Groundwater Exceedances Plan

Figure: 3

Project: E25947.E06_Rev0

LEGEND **(Note: All locations are approximate)** 1.4m Depth to top of natural peat layer

- Site boundary
- Proposed basement footprint concept
- Proposed landscape area
- Test pit location
- Borehole/monitoring well locaiton
- Borehole location
- Previous CPT location (DP, 2020)
- Proposed test pit location
- Previous borehole location (DP, 2020)
- Previous borehole location (EMM, 2020)
- Previous monitoring well location (EMM, 2020)
- Previous borehole location (JBS&G, 2020)
- Previous borehole location (JBS&G, 2022)
- Previous test pit location (JBS&G, 2022)
- Flood storage and OSD tank excavation area
- Data Gap Area - Previous building footprint

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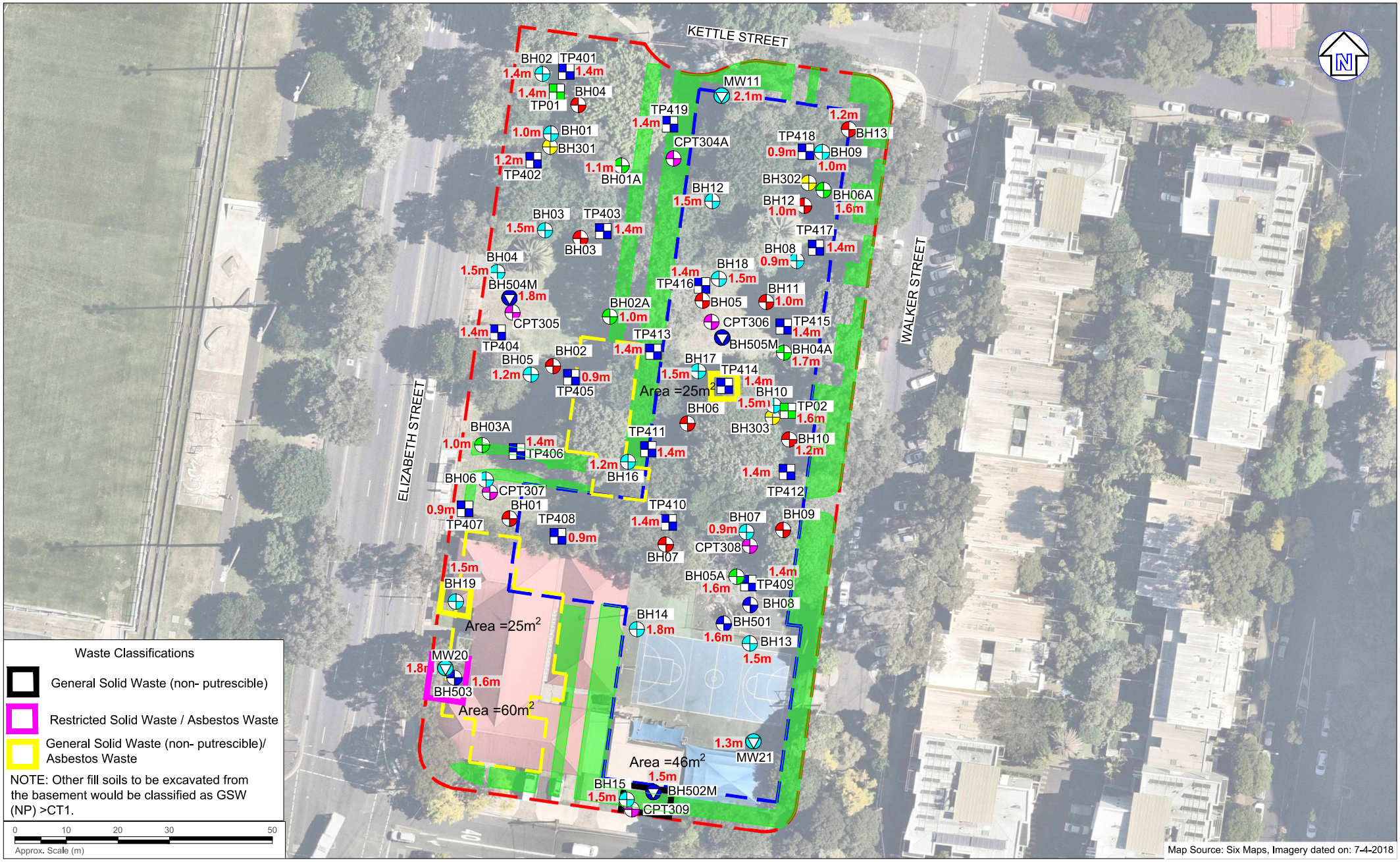
Approved:	-
Date:	20-6-24

Hickory Constructions Pty Ltd
Remediation Action Plan
600-660 Elizabeth Street, Redfern NSW

Proposed Sampling Location Plan

Figure: 4

Project: E25947.E06_Rev0



LEGEND **(Note: All locations are approximate)** 1.6m Depth to top of natural peat layer

- Site boundary
- Proposed basement footprint concept
- Proposed deep soil area
- Test pit location
- Borehole/monitoring well locaiton
- Borehole location
- Previous CPT location (DP, 2020)
- Flood storage and OSD tank excavation area
- Previous borehole location (DP, 2020)
- Previous borehole location (EMM, 2020)
- Previous monitoring well location (EMM, 2020)
- Previous borehole location (JBS&G, 2020)
- Previous borehole location (JBS&G, 2022)
- Previous test pit location (JBS&G, 2022)

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Date:	20-6-24

Hickory Constructions Pty Ltd
Remedial Extent
600-660 Elizabeth Street, Redfern NSW
Proposed Sampling Location Plan

Figure: 5

Project: E25947.E06_Rev0

LEGEND **(Note: All locations are approximate)**

- Site boundary
- Proposed basement footprint concept
- Proposed deep soil area
- Test pit location
- Borehole/monitoring well locaiton
- Borehole location
- Previous CPT location (DP, 2020)
- Previous borehole location (DP, 2020)
- Previous borehole location (EMM, 2020)
- Previous borehole location (JBS&G, 2020)
- Previous borehole location (JBS&G, 2022)
- Previous test pit location (JBS&G, 2022)
- Previous monitoring well location (EMM, 2020)
- 1.6m — Depth to top of natural peat layer
- 1.5m-2.5m — Depth to top - bottom of natural peat layer
- Flood storage and OSD tank excavation area

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Approved:	-
Date:	20-6-24

Hickory Constructions Pty Ltd
Depth of Natural Peat and Natural Clay
600-660 Elizabeth Street, Redfern NSW
Proposed Sampling Location Plan

Figure: 6

Project: E25947.E06_Rev0

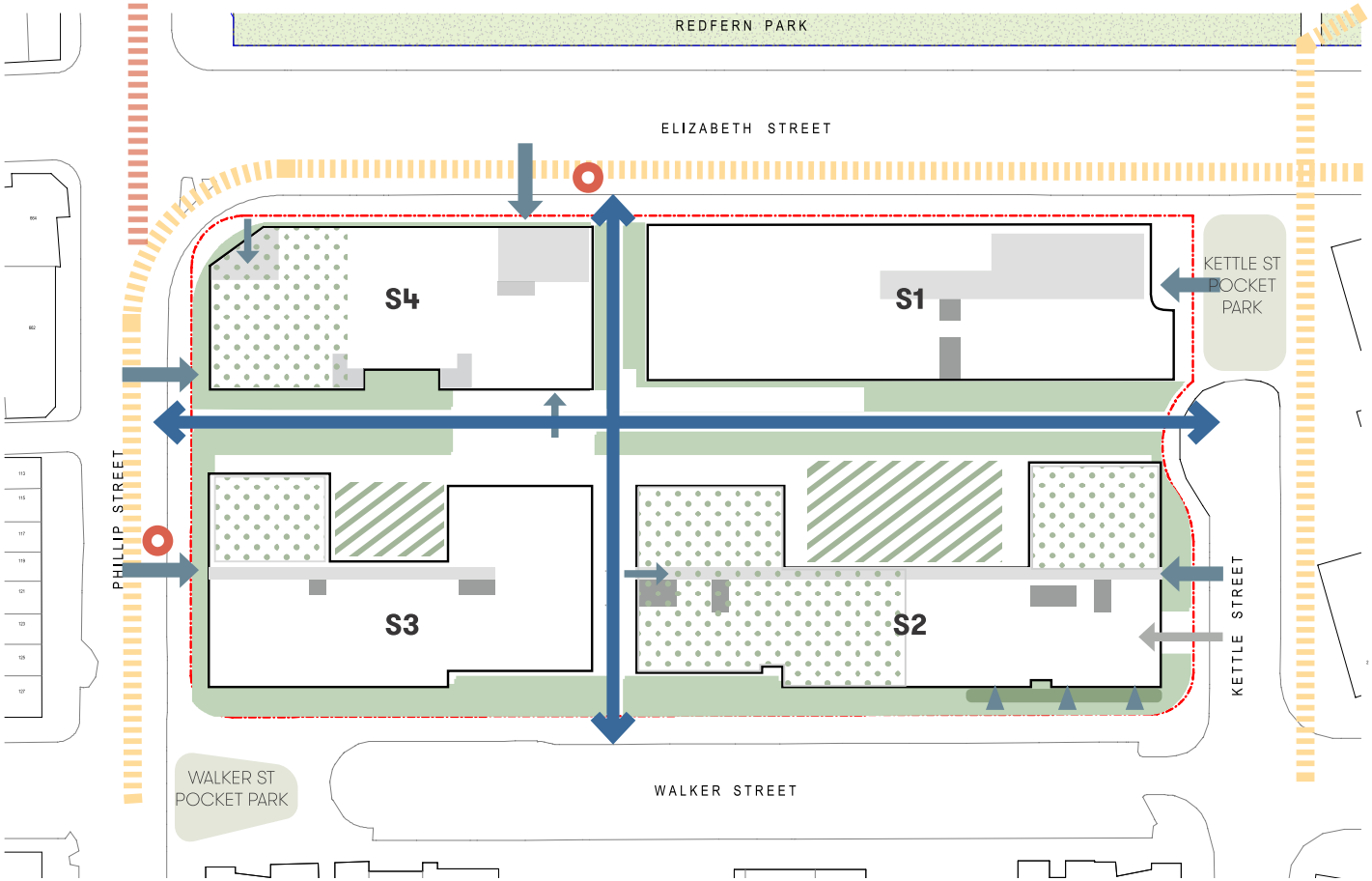
Appendix B - Proposed Development Plans

03 Built Form and Urban Design

SITE PLAN

THE DIAGRAM SHOWS THE PROPOSED MASTERPLAN AND THE HIERARCHY OF LANDSCAPE SPACES INCLUDING:

- Site layout which providing through-site links as recommended in the Design Guide to ensure visual permeability through the site.
- Multiple central courtyard space providing legible landscape spaces for public movement through the site and communal resident use.
- Street facing residential entries for S2, S3 and S4.
- At grade entries into PCYC, Commercial and Community spaces.
- Rooftop communal resident spaces on S2, S3 and S4
- Private terrace entries to S2 Walker St dwelling where required
- Vehicle Entry on Kettle St with basement carparking, waste collection and deliveries.

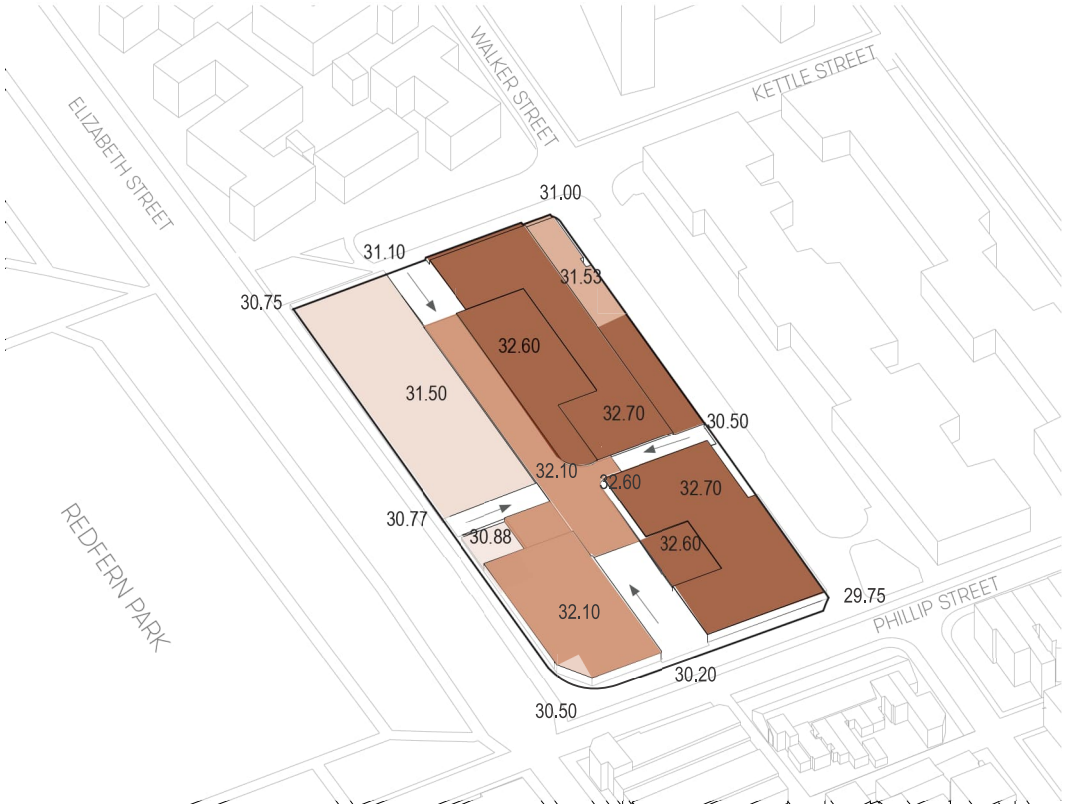


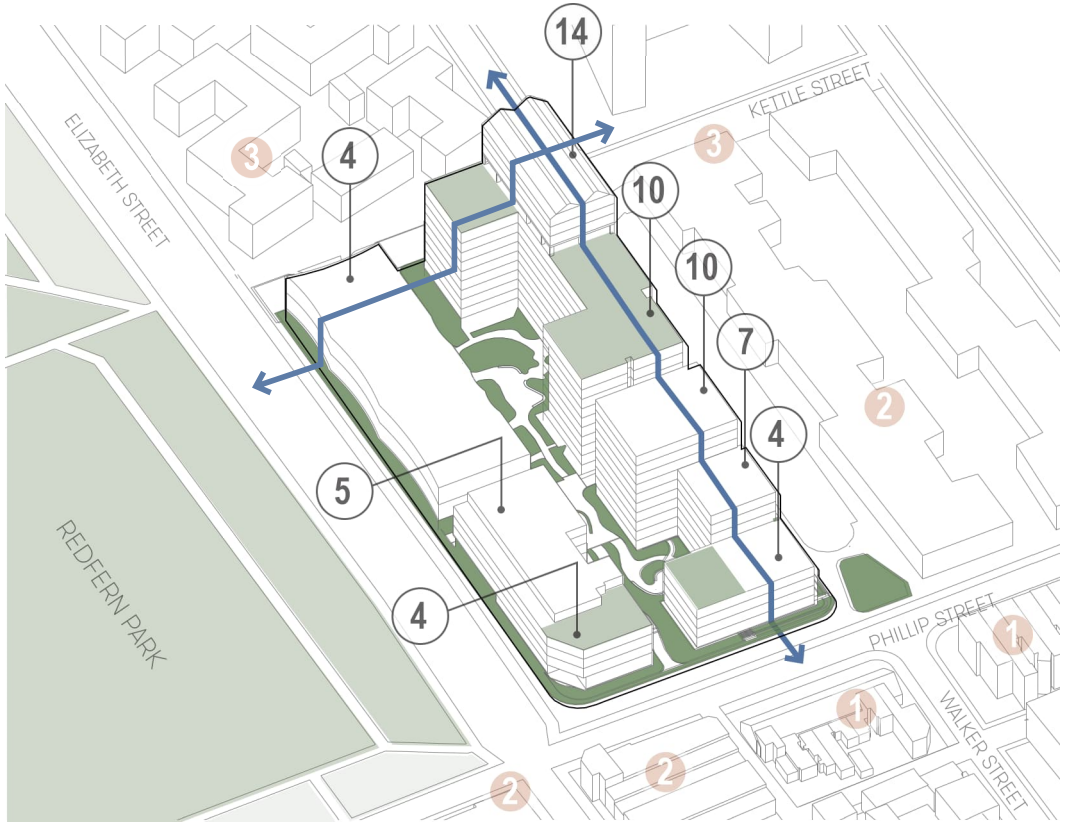
CoS Cycling Priority Street
CoS Pedestrian & Cycle Network
Public Pedestrian Link
Primary Entry
Secondary Entry
Private Entry
Bus Stop
Vehicle Entry
Building Core
Building Circulation
Communal Open Space
Private Open Space
Deep Soil
Rooftop Garden

Scale 1 : 750
0 30m

03 Built Form and Urban Design

LEVELS AND MASSING





MOVEMENT LEVELS STUDY

- Ground floor residential areas and all connections to the basement set at the 32.70 PMF FPL.
- Commercial and community uses sit between the 1% AEP and PMF as advised by the flooding engineer.
- Central courtyard level set at 32.1 to allow for ease of movement between building levels and the street interfaces.

RL 32.70 / 32.60
RL 32.20 / 32.10
RL 31.90
RL 31.50
RL 30.80

MASSING STUDY

- Overall form steps down from north to south towards the residential scale of Phillip Street
- Overall form steps down from east to west to ensure sun access to Redfern Park.
- Consistent height along Elizabeth and Phillip St responds to the adjacent urban context
- Central landscape between buildings provides public and resident space amenity, with additional communal amenity located on rooftops of S2, S3 and S4.

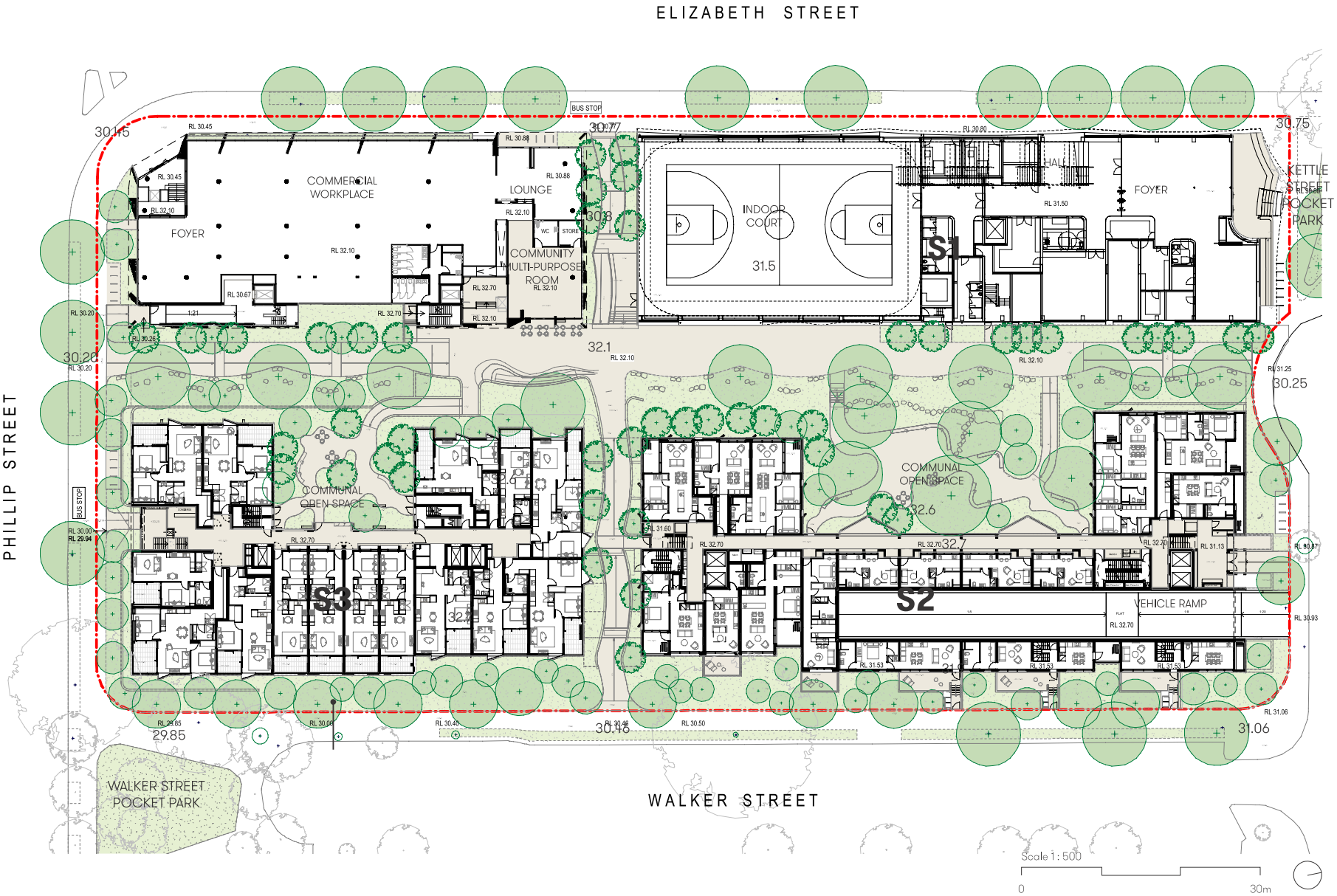
X Surrounding Building Heights
(X) Building Height in Storeys

03 Built Form and Urban Design

GROUND PLAN

KEY ELEMENTS IN THE GROUND PLAN INCLUDE:

- Central landscape space sitting 1-1.6m above street level providing access and activation to the internal facades of the development.
- Ramped through site links provide clear and legible pedestrian movement through the site.
- Clear residential entries on Kettle St and Phillip St, and PCYC entry on Kettle St.
- PCYC Multi courts located at southern end of S1 with large areas of glazing to activate the central courtyard space
- Activate entrances on all corners of S4 to activate the through site links and central courtyard space
- Vehicle entry on Kettle St with a long ramp with peak at PMF to access basement.
- Refer to Aspect's design report for further detail on the landscape response.

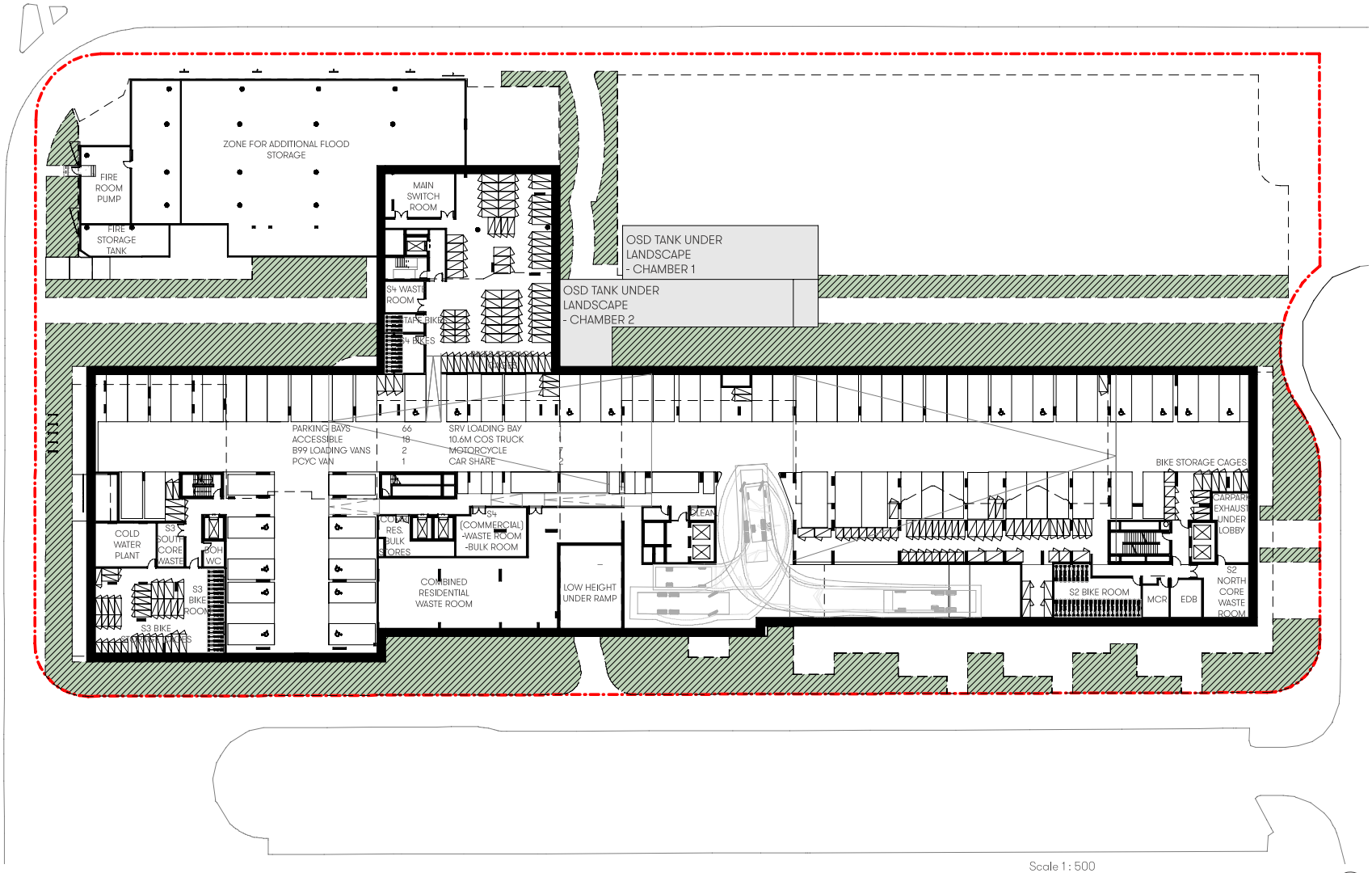


03 Built Form and Urban Design

BASEMENT PLAN

KEY ELEMENTS IN THE BASEMENT PLAN INCLUDE:

- 66 car parking spaces including 18 for adaptable apartments.
- Vehicle entry on Kettle St with a long ramp with peak at PMF to access basement.
- Loading for two trucks (10.6m CoS Waste and SRV) and 3 vans accommodated in basement
- Waste collection in basement with waste rooms provide adjacent to loading area.
- Bicycle storage and/or storage cages provided for every unit, and S1/S4 staff.
- Services located in basement where possible to provide active ground frontages.
- Flood storage located under S4 to mitigate flood impacts of the development
- OSD and Rainwater tanks located under central landscape zone.
- Deep soil target achieved, refer to Aspect report for calculation.



Deep soil

03 Built Form and Urban Design

3D OVERVIEW

The precinct forms a diverse and cohesive village. A variety of architectural expressions provides variety, whilst a considered material palette and a cohesive ground plane establishes commonality between buildings.

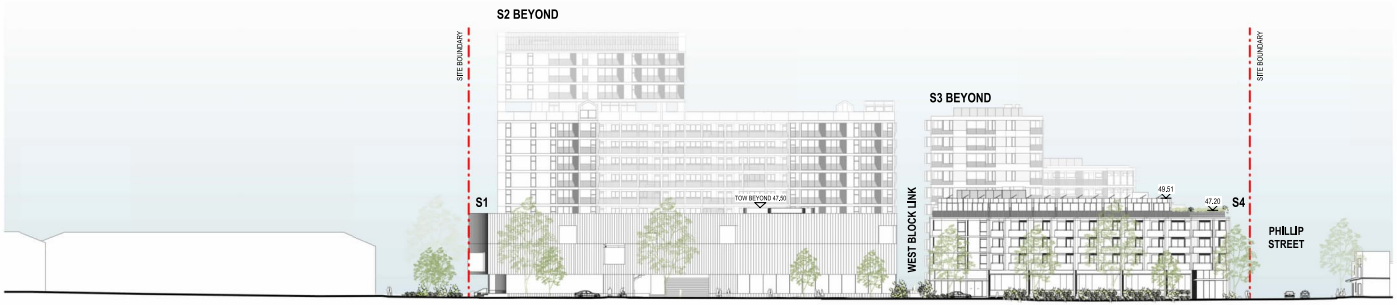
Design of all buildings is responsive to site context including the character, scale and grain of existing surrounding buildings.

Refer to sections 04, 05, 06 and 07 of the report for detailed descriptions each building.

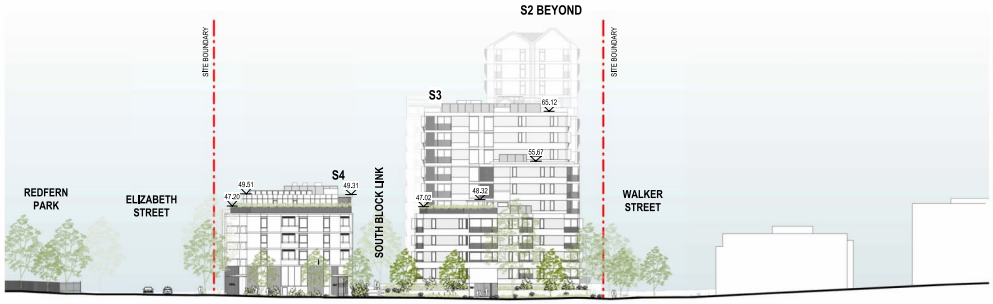
03 Built Form and Urban Design

ELEVATIONS

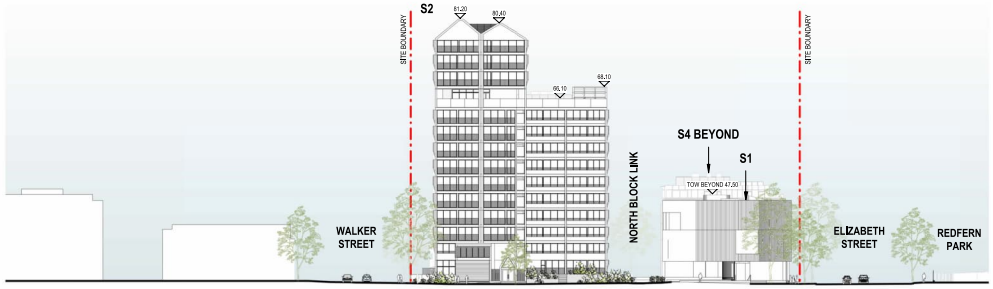
WALKER STREET ELEVATION



ELIZABETH STREET ELEVATION



PHILLIP STREET ELEVATION



KETTLE STREET ELEVATION