



Site Audit Report

0503-2103

165 -169 Holden Street  
Ashbury NSW

27 May 2021

60565/137967 (Rev 0)

JBS&G Australia Pty Ltd

Site Audit Report  
0503-2103

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## NSW Site Auditor Scheme

# Site Audit Statement

A site audit statement summarises the findings of a site audit. For full details of the site auditor's findings, evaluations and conclusions, refer to the associated site audit report.

This form was approved under the *Contaminated Land Management Act 1997* on 12 October 2017.

For information about completing this form, go to Part IV.

### Part I: Site audit identification

Site audit statement no. **0503-2103**

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This site audit is a:



statutory audit



~~non-statutory audit~~

within the meaning of the *Contaminated Land Management Act 1997*.

#### Site auditor details

(As accredited under the *Contaminated Land Management Act 1997*)

Name **Andrew Lau**

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Company **JBS&G**

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Address **Level 1, 50 Margaret Street**

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**Sydney NSW**

Postcode **2000**

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Phone **02 8245 0300**

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Email **alau@jbsg.com.au**

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#### Site details

Address **165 – 169 Holden Street**

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**Ashbury NSW**

Postcode **2193**

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## Property description

(Attach a separate list if several properties are included in the site audit.)

**Part Lot 1 DP 115504 and part Lot 1 DP 911478**

Local government area **Canterbury Bankstown**

Area of site (include units, e.g. hectares) **2,540 m<sup>2</sup> (approximately)**

Current zoning **SP2 – Infrastructure: Water Supply System**

## Regulation and notification

To the best of my knowledge:

☐ ~~the site is~~ the subject of a declaration, order, agreement, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*, as follows: (provide the no. if applicable)

☐ Declaration no. \_\_\_\_\_

☐ Order no. \_\_\_\_\_

☐ Proposal no. \_\_\_\_\_

☐ Notice no. \_\_\_\_\_

☒ **the site is not** the subject of a declaration, order, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*.

To the best of my knowledge:

☐ ~~the site has been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*~~

☒ the site **has not** been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*.

## Site audit commissioned by

Name **Amy Dobson**

Company **Sydney Water Corporation**

Address **Level 13, 1 Smith Street**

**Parramatta NSW**

Postcode **2150**

Phone **0411 306 656**

Email [amy.dobson@sydneywater.com.au](mailto:amy.dobson@sydneywater.com.au)

**Contact details for contact person** (if different from above)

Name **As Above**

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Phone

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Email

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**Nature of statutory requirements** (not applicable for non-statutory audits)

☐ ~~Requirements under the *Contaminated Land Management Act 1997*  
(e.g. management order; please specify, including date of issue)~~

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☐ ~~Requirements imposed by an environmental planning instrument  
(please specify, including date of issue)~~

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☐ ~~Development consent requirements under the *Environmental Planning and Assessment Act 1979* (please specify consent authority and date of issue)~~

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☒ Requirements under other legislation (please specify, including date of issue)  
Council requirements to meet Gateway Determination for planning proposal  
(Ref: PP-2020-465 (PP\_2020\_CBANK\_001\_00)) to amend the Canterbury Local  
Environmental Plan 2012 as it applies to 165-169 Holden Street, Ashbury to rezone  
part of the land from SP2 Infrastructure (Water Supply System) to R2 Low Density  
Residential, amend the curtilage of the heritage listed Ashfield Reservoir, and introduce  
a maximum height control to part of the land.

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## Purpose of site audit

☐ ~~A1 To determine land use suitability~~

~~Intended uses of the land:~~ \_\_\_\_\_

OR

~~A2 To determine land use suitability subject to compliance with either an active or passive environmental management plan~~

~~Intended uses of the land:~~ \_\_\_\_\_

OR

(Tick all that apply)

☐ ~~B1 To determine the nature and extent of contamination~~

☒ **B2 To determine the appropriateness of:**

☐ ~~an investigation plan~~

☒ a remediation plan

☐ ~~a management plan~~

☐ ~~B3 To determine the appropriateness of a **site testing plan** to determine if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*~~

☐ ~~B4 To determine the compliance with an approved:~~

☐ ~~voluntary management proposal or~~

☐ ~~management order under the *Contaminated Land Management Act 1997*~~

☒ **B5 To determine if the land can be made suitable for a particular use (or uses) if the site is remediated or managed in accordance with a specified plan.**

Intended uses of the land: R2 low density residential (at the date of completion of this audit)

## Information sources for site audit

Consultancies which conducted the site investigations and/or remediation:

**Progressive Risk Management Pty Ltd**

Titles of reports reviewed:

- *Remediation Action Plan, Ashbury Reservoir, 165-169 Holden Street, Ashbury NSW.* Progressive Risk Management Pty Ltd, reference P034963.001, Version F, dated May 2021 (PRM 2021).

Other information reviewed, including previous site audit reports and statements relating to the site:

- *Combined Stage 1 and 2 Detailed Site Investigation Sydney Water Ashfield Reservoir, 165 – 169 Holden Street, Ashbury, NSW, 24 July 2015.* 2201679B-CLM-RPT-1021 Rev C. (Parsons Brinckerhoff 2015);
- *Hazardous Building Material Pre-Demolition Audit, Ashbury Water Reservoir WS0003 165-169 Holden Street, Ashbury NSW, P033623.001/C0151, November 2017.* Revision 3: Final. (Progressive Risk Management 2017);
- *Hazardous Building Materials Removal Plan, Ashbury Water Reservoir WS0003 165-169 Holden Street, Ashbury NSW, P033623.002/C0151, February 2018.* Revision 3: Final. (Progressive Risk Management 2018a).
- *Sampling, Analysis and Quality Plan, Ashbury Water Reservoir WS0003 165-169 Holden Street, Ashbury NSW, P033725.003/C0151, August 2018.* Rev 0, Final (Progressive Risk Management 2018b);
- *Hazardous Ground Gas and Groundwater Assessment, Ashbury Reservoir 165 – 169 Holden Street, Ashbury NSW, P033725.004/C0151, February 2019.* Version B Final. (Progressive Risk Management, 2019a);
- *Data Gap Analysis: Ashbury Reservoir, 165 – 169 Holden Street, Ashbury NSW, P033725.001, 17/06/2019.* Version 5 Final. (Progressive Risk Management 2019b);
- *Summary of Contamination Condition Part of Ashbury Reservoir, 165 – 169 Holden Street, Ashbury NSW, P033725.005/C0151, 17/06/2019.* Version B. (Progressive Risk Management 2019c).
- *Site Audit Report 0503-1805 165-169 Holden Street Ashbury NSW, 16 August 2019, 54448/122753 (Rev 0).* (JBS&G Australia Pty Ltd 2019).

### Site audit report details

Title **Site Audit Report 0503-2103, 165 – 169 Holden Street, Ashbury NSW**

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Report no. **60565/137967 (Rev 0)**

Date **27 May 2021**

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## Part II: Auditor's findings

Please complete either Section A1, Section A2 or Section B, not more than one section.  
(Strike out the irrelevant sections.)

- Use **Section A1** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **without the implementation** of an environmental management plan.
- Use **Section A2** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **with the implementation** of an active or passive environmental management plan.
- Use **Section B** where the audit is to determine:
  - (B1) the nature and extent of contamination, and/or
  - (B2) the appropriateness of an investigation, remediation or management plan<sup>1</sup>, and/or
  - (B3) the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or
  - (B4) whether the terms of the approved voluntary management proposal or management order have been complied with, and/or
  - (B5) whether the site can be made suitable for a specified land use (or uses) if the site is remediated or managed in accordance with the implementation of a specified plan.

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<sup>1</sup> For simplicity, this statement uses the term 'plan' to refer to both plans and reports.



## Section A1

### ~~I certify that, in my opinion:~~

The ~~site is suitable~~ for the following uses:

~~(Tick all appropriate uses and strike out those not applicable.)~~

- ☐ ~~Residential, including substantial vegetable garden and poultry~~
  - ☐ ~~Residential, including substantial vegetable garden, excluding poultry~~
  - ☐ ~~Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~
  - ☐ ~~Day care centre, preschool, primary school~~
  - ☐ ~~Residential with minimal opportunity for soil access, including units~~
  - ☐ ~~Secondary school~~
  - ☐ ~~Park, recreational open space, playing field~~
  - ☐ ~~Commercial/industrial~~
  - ☐ ~~Other (please specify):~~
- 

### **OR**

- ☐ ~~I certify that, in my opinion, the site is not suitable for any use due to the risk of harm from contamination.~~

Overall comments:

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## Section A2

### ~~I certify that, in my opinion:~~

~~Subject to compliance with the **attached** environmental management plan<sup>2</sup> (EMP), the site is suitable for the following uses:~~

~~(Tick all appropriate uses and strike out those not applicable.)~~

- ☐ ~~Residential, including substantial vegetable garden and poultry~~
  - ☐ ~~Residential, including substantial vegetable garden, excluding poultry~~
  - ☐ ~~Residential with accessible soil, including garden (minimal home grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~
  - ☐ ~~Day care centre, preschool, primary school~~
  - ☐ ~~Residential with minimal opportunity for soil access, including units~~
  - ☐ ~~Secondary school~~
  - ☐ ~~Park, recreational open space, playing field~~
  - ☐ ~~Commercial/industrial~~
  - ☐ ~~Other (please specify):~~
- 

### ~~EMP details~~

~~Title~~

---

~~Author~~

---

~~Date~~

---

~~No. of pages~~

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### ~~EMP summary~~

~~This EMP (attached) is required to be implemented to address residual contamination on the site.~~

~~The EMP: (Tick appropriate box and strike out the other option.)~~

- ☐ ~~requires operation and/or maintenance of **active** control systems<sup>3</sup>~~
- ☐ ~~requires maintenance of **passive** control systems only<sup>3</sup>.~~

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<sup>2</sup> Refer to Part IV for an explanation of an environmental management plan.

<sup>3</sup> Refer to Part IV for definitions of active and passive control systems.

## Site Audit Statement

Purpose of the EMP:

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Description of the nature of the residual contamination:

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Summary of the actions required by the EMP:

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How the EMP can reasonably be made to be legally enforceable:

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How there will be appropriate public notification:

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Overall comments:

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## Section B

Purpose of the plan<sup>4</sup> which is the subject of this audit:

Provide a framework for remediation and detail how the site can be made suitable for the most sensitive proposed future uses under the R2 low density residential zoning (at the date of completion of this audit).

### I certify that, in my opinion:

(B1)

- ☐ ~~The nature and extent of the contamination **has** been appropriately determined~~  
☐ ~~The nature and extent of the contamination **has not** been appropriately determined~~

AND/OR (B2)

- ☒ The investigation, remediation or management plan **is** appropriate for the purpose stated above  
☐ ~~The investigation, remediation or management plan **is not** appropriate for the purpose stated above~~

AND/OR (B3)

- ☐ ~~The site testing plan:~~  
☐ ~~**is** appropriate to determine~~  
☐ ~~**is not** appropriate to determine~~  
~~if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*~~

AND/OR (B4)

- ☐ ~~The terms of the approved voluntary management proposal\* or management order\*\* (strike out as appropriate):~~  
☐ ~~**have** been complied with~~  
☐ ~~**have not** been complied with.~~

~~\*voluntary management proposal no.~~

~~\*\*management order no.~~

AND/OR (B5)

- ☒ The site **can be made suitable** for the following uses:  
(Tick all appropriate uses and strike out those not applicable.)  
☐ ~~Residential, including substantial vegetable garden and poultry~~  
☐ ~~Residential, including substantial vegetable garden, excluding poultry~~

<sup>4</sup> For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

- ☒ Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry
- ☒ Day care centre, preschool, primary school
- ☐ ~~Residential with minimal opportunity for soil access, including units~~
- ☐ ~~Secondary school~~
- ☐ ~~Park, recreational open space, playing field~~
- ☐ ~~Commercial/industrial~~
- ☒ Other (please specify): All permissible uses within the R2 Low Density Residential zone (at the date of completion of this audit) under the *Canterbury Local Environmental Plan 2012*.

IF the site is remediated/~~managed~~\* in accordance with the following plan (**attached**):

\*Strike out as appropriate

Plan title	<b>Remediation Action Plan Ashbury Reservoir, 165-169 Holden Street,</b>		
	<b>Ashbury NSW</b>		
Plan author	<b>Progressive Risk Management</b>		
Plan date	<b>12 May 2021</b>	No. of pages	<b>59</b>

~~SUBJECT to compliance with the following condition(s):~~

Overall comments:

- The proposed remediation and validation works are considered to have met the requirements of the *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd Edition)* (EPA 2017).
- There is no evidence of migration of contaminants from the site which is likely to result in any unacceptable risks to surrounding human or ecological receptors.
- Appropriate supervision of the remediation works is to be undertaken by an appropriately qualified and experienced site contamination practitioner.
- Following the completion of remediation and validation works, a validation report is required to be prepared in accordance with relevant EPA requirements confirming the suitability of the site for all permissible uses within the R2 Low Density Residential zone (at the date of completion of this audit).
- The RAP (PRM 2021) prepared for the site addressed the identified contamination issues; with the remediation approach documented in the RAP checked by the auditor and found to be: technically feasible; environmentally justifiable given the nature and extent of the identified contamination; and consistent with relevant laws, policies and guidelines.
- A Site Audit Statement and Site Audit Report confirming the suitability of the site for the proposed land use is required upon completion of the remediation and validation works.

## Part III: Auditor's declaration

I am accredited as a site auditor by the NSW Environment Protection Authority (EPA) under the *Contaminated Land Management Act 1997*.

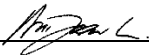
Accreditation no. **0503**

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### I certify that:

- I have completed the site audit free of any conflicts of interest as defined in the *Contaminated Land Management Act 1997*, and
- with due regard to relevant laws and guidelines, I have examined and am familiar with the reports and information referred to in Part I of this site audit, and
- on the basis of inquiries I have made of those individuals immediately responsible for making those reports and obtaining the information referred to in this statement, those reports and that information are, to the best of my knowledge, true, accurate and complete, and
- this statement is, to the best of my knowledge, true, accurate and complete.

I am aware that there are penalties under the *Contaminated Land Management Act 1997* for wilfully making false or misleading statements.

Signed 

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Date 27 May 2021

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## Part IV: Explanatory notes

To be complete, a site audit statement form must be issued with all four parts.

### How to complete this form

#### Part I

Part I identifies the auditor, the site, the purpose of the audit and the information used by the auditor in making the site audit findings.

#### Part II

Part II contains the auditor's opinion of the suitability of the site for specified uses or of the appropriateness of an investigation, or remediation plan or management plan which may enable a particular use. It sets out succinct and definitive information to assist decision-making about the use or uses of the site or a plan or proposal to manage or remediate the site.

The auditor is to complete either Section A1 or Section A2 or Section B of Part II, **not** more than one section.

#### Section A1

In Section A1 the auditor may conclude that the land is *suitable* for a specified use or uses OR *not suitable* for any beneficial use due to the risk of harm from contamination.

By certifying that the site is *suitable*, an auditor declares that, at the time of completion of the site audit, no further investigation or remediation or management of the site was needed to render the site fit for the specified use(s). **Conditions must not be** imposed on a Section A1 site audit statement. Auditors may include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

#### Section A2

In Section A2 the auditor may conclude that the land is *suitable* for a specified use(s) subject to a condition for implementation of an environmental management plan (EMP).

##### *Environmental management plan*

Within the context of contaminated sites management, an EMP (sometimes also called a 'site management plan') means a plan which addresses the integration of environmental mitigation and monitoring measures for soil, groundwater and/or hazardous ground gases throughout an existing or proposed land use. An EMP succinctly describes the nature and location of contamination remaining on site and states what the objectives of the plan are, how contaminants will be managed, who will be responsible for the plan's implementation and over what time frame actions specified in the plan will take place.

By certifying that the site is suitable subject to implementation of an EMP, an auditor declares that, at the time of completion of the site audit, there was sufficient information satisfying guidelines made or approved under the *Contaminated Land Management Act 1997*

(CLM Act) to determine that implementation of the EMP was feasible and would enable the specified use(s) of the site and no further investigation or remediation of the site was needed to render the site fit for the specified use(s).

Implementation of an EMP is required to ensure the site remains suitable for the specified use(s). The plan should be legally enforceable: for example, a requirement of a notice under the CLM Act or a development consent condition issued by a planning authority. There should also be appropriate public notification of the plan, e.g. on a certificate issued under s.149 of the *Environmental Planning and Assessment Act 1979*.

#### *Active or passive control systems*

Auditors must specify whether the EMP requires operation and/or maintenance of active control systems or requires maintenance of passive control systems only. Active management systems usually incorporate mechanical components and/or require monitoring and, because of this, regular maintenance and inspection are necessary. Most active management systems are applied at sites where if the systems are not implemented an unacceptable risk may occur. Passive management systems usually require minimal management and maintenance and do not usually incorporate mechanical components.

#### *Auditor's comments*

Auditors may also include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

## **Section B**

In Section B the auditor draws conclusions on the nature and extent of contamination, and/or suitability of plans relating to the investigation, remediation or management of the land, and/or the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or whether the terms of an approved voluntary management proposal or management order made under the CLM Act have been complied with, and/or whether the site can be made suitable for a specified land use or uses if the site is remediated or managed in accordance with the implementation of a specified plan.

By certifying that a site *can be made suitable* for a use or uses if remediated or managed in accordance with a specified plan, the auditor declares that, at the time the audit was completed, there was sufficient information satisfying guidelines made or approved under the CLM Act to determine that implementation of the plan was feasible and would enable the specified use(s) of the site in the future.

For a site that *can be made suitable*, any **conditions** specified by the auditor in Section B should be limited to minor modifications or additions to the specified plan. However, if the auditor considers that further audits of the site (e.g. to validate remediation) are required, the auditor must note this as a condition in the site audit statement. The condition must not specify an individual auditor, only that further audits are required.

Auditors may also include **comments** which are observations in light of the audit which provide a more complete understanding of the environmental context to aid decision-making in relation to the site.



### **Part III**

In **Part III** the auditor certifies their standing as an accredited auditor under the CLM Act and makes other relevant declarations.

### **Where to send completed forms**

In addition to furnishing a copy of the audit statement to the person(s) who commissioned the site audit, statutory site audit statements must be sent to

- the **NSW Environment Protection Authority**:  
[nswauditors@epa.nsw.gov.au](mailto:nswauditors@epa.nsw.gov.au) or as specified by the EPA

AND

- the **local council** for the land which is the subject of the audit.

SSM 137859 - SSM 137858

177°43'12" 182.240 (MGA GROUND)  
177°43'35" - 182.25 (SURVEY)

SSM 137858 - SSM 137857

186°35'40" 139.954 (MGA GROUND)  
186°35'40" 139.95 (SURVEY)

SSM 137857 - SSM 137856

179°59'43" 120.962 (MGA GROUND)  
179°59'20" 120.97 (SURVEY)

SSM 137858 - CNR (A)

190°24'30" 113.385

SSM 137857 - CNR (B)

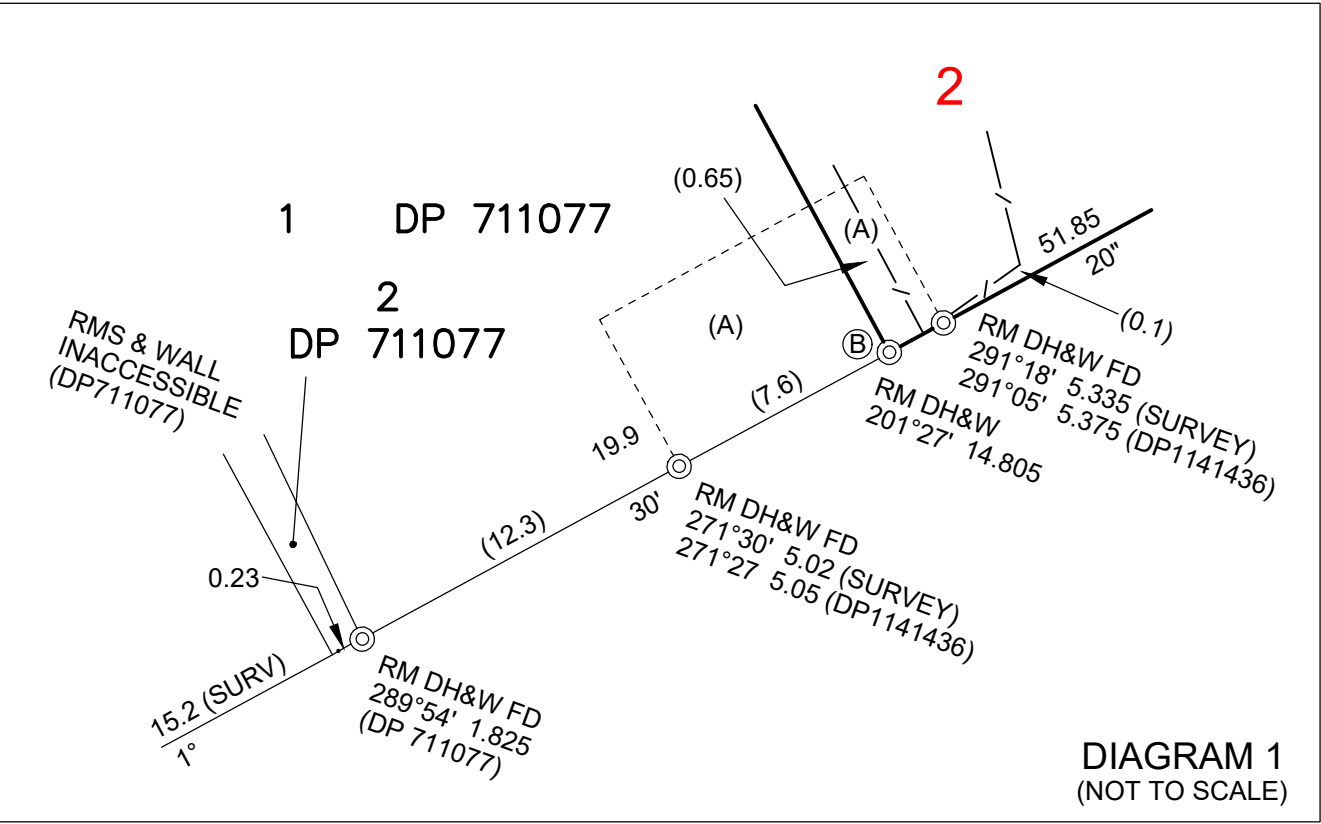
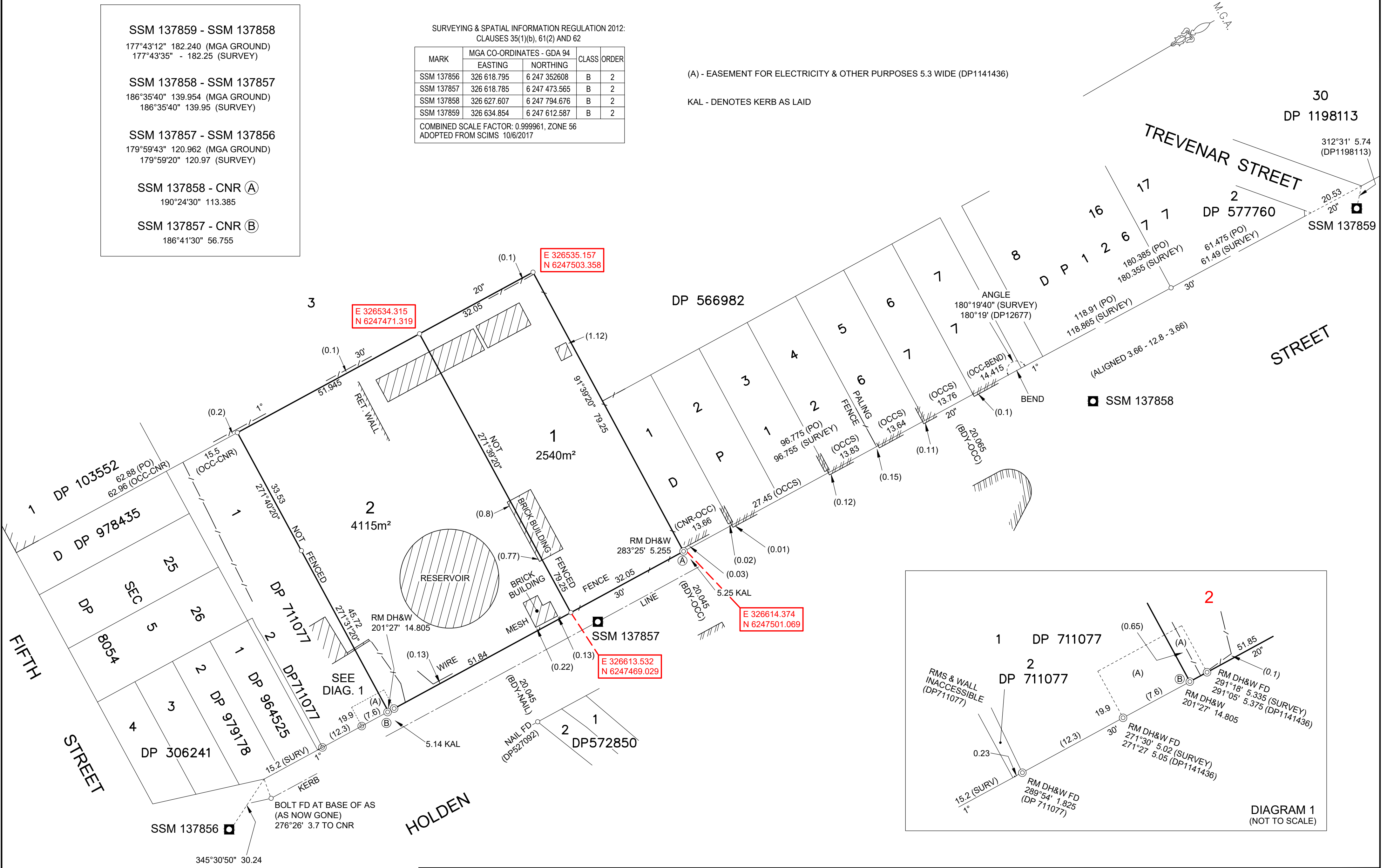
186°41'30" 56.755

SURVEYING & SPATIAL INFORMATION REGULATION 2012:  
CLAUSES 35(1)(b), 61(2) AND 62

MARK	MGA CO-ORDINATES - GDA 94		CLASS	ORDER
	EASTING	NORTHING		
SSM 137856	326 618.795	6 247 352608	B	2
SSM 137857	326 618.785	6 247 473.565	B	2
SSM 137858	326 627.607	6 247 794.676	B	2
SSM 137859	326 634.854	6 247 612.587	B	2
COMBINED SCALE FACTOR: 0.999961, ZONE 56 ADOPTED FROM SCIMS 10/6/2017				

(A) - EASEMENT FOR ELECTRICITY & OTHER PURPOSES 5.3 WIDE (DP1141436)

KAL - DENOTES KERB AS LAID



SURVEYOR:

Name: MATTHEW WILLIAM CLEARY

Date: 29/5/2017

Reference: 118234504\_02

PLAN OF SUBDIVISION OF LOT 1 IN DP911478 AND  
LOT 1 IN DP115504

L.G.A: CANTERBURY - BANKSTOWN

Locality: CANTERBURY

Reduction Ratio: 1:600

Lengths are in metres.

REGISTERED

DP OR SP NUMBER



## **Remediation Action Plan**

Asbury Reservoir, 165-169 Holden Street, Ashbury NSW

Sydney Water

P034963.001| Version F

May 2021



## Document Control

Project Details:	
Project Name:	Remediation Action Plan
Site:	Ashbury Reservoir, 165-169 Holden Street, Ashbury NSW.
Client Name:	Sydney Water Corporation.
Project Reference	P034963.001/C0151

Report Version:					
Version Date:	Review Process:			Issued to:	Summary of changes from previous version:
	Prepared:	Reviewed:	Approved:		
Version A 17/02/2021	ECM	JPC	JPC	Sydney Water Corporation	Original draft of report
Version B 26/02/2021	ECM	JPC	JPC	Sydney Water Corporation	Updated draft addressing client comments
Version C 07/04/2021	ECM	JPC	JPC	Sydney Water Corporation and JBS&G (Auditor)	Updated draft for auditor review
Version D 28/04/2021	ECM	JPC	JPC	Sydney Water Corporation and JBS&G (Auditor)	Final report addressing auditor comments
Version E 04/05/2021	ECM	JPC	JPC	Sydney Water Corporation and JBS&G (Auditor)	Minor amendments to Section 3.1 and Figures.
Version F 12/05/2021	ECM	JPC	JPC	Sydney Water Corporation and JBS&G (Auditor)	Minor amendments to Section 3.1, Figures and update to Appendix B.

Report Review:					
Report Version:		Version F			
Prepared by:		Technical Review by:		Authorised for Issue by:	
					
Name:	E. McAndrew	Name:	Jonathan Coffey	Name:	Jonathan Coffey
Position:	Consultant	Position:	Technical Manager; CEnvP (SC)	Position:	Technical Manager; CEnvP (SC)
Date:	12/05/2021	Date:	12/05/2021	Date:	12/05/2021



# Executive Summary

## Introduction and Background

Progressive Risk Management (PRM) were engaged by Sydney Water Corporation (the client) to prepare a Remediation Action Plan (RAP) for part of Ashbury Reservoir, located at 165 – 169 Holden Street, Ashbury NSW (the site). The site location is provided in **Figure 1** and the site layout in **Figure 2**.

The site is proposed to be rezoned from the current SP2 infrastructure (Water Supply) zoning to R2 low density residential zoning (R2) under Canterbury Local Environmental Plan (LEP) (2012). The permissible uses under R2 include (but are not limited to) various residential land uses, centre-based childcare facilities, open space/ recreation land uses and commercial land uses.

Site investigations completed between 2015 and 2019 identified wide-spread fill material containing elevated concentrations of heavy metals (copper, lead and zinc), total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAH) and asbestos.

With respect to soil quality/fill material, the data obtained during the previous investigations concluded that the site was not suitable for R2 zoning in its current condition.

## Objectives

The objective of this RAP is to provide a framework for remediation to detail how the site can be made suitable the most sensitive proposed future site use under R2 (i.e. residential with accessible soils and childcare centres).

## Scope of RAP

This RAP presents the remediation approach and framework to make the site suitable for the most sensitive land uses allowable under R2 (i.e. residential with accessible soils and childcare centres). Based on the extent of contamination identified at the site and identified data-gaps (i.e unknown fill quality underneath existing building footprints), the preferred remediation option is considered to be the excavation and offsite disposal of the identified contamination followed by site validation.

However, if the site was proposed to be redeveloped to a less sensitive use permissible under R2 (i.e open space/recreational land use, commercial land use etc), alternate remediation options may be appropriate for the site. Any such alternative remediation options/approach would be required to be detailed in a new RAP approved by Council and a NSW Environment Protection Authority (EPA) accredited site auditor.

## Conclusions

It is considered that following full implementation of this RAP, including validation sampling and reporting, the site will be remediated to a standard suitable for the most sensitive land uses allowable under R2 (i.e. residential with accessible soils and childcare centres).

All remediation works are required to be supervised, validated and reported by a suitably qualified consultant, and must be audited by a NSW EPA accredited site auditor and include a site audit statement detailing the findings of the audit.

This Executive Summary should be read in conjunction with the report from which it originated in its entirety.

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Appendix A: Imported Materials Protocol

Appendix B: Site Survey

# 1. Introduction

Progressive Risk Management (PRM) were engaged by Sydney Water Corporation (the client) to prepare a Remediation Action Plan (RAP) for part of Ashbury Reservoir, located at 165 – 169 Holden Street, Ashbury NSW (the site). The site location is provided in **Figure 1** and the site layout in **Figure 2**. A survey of the site area (provided by Sydney Water) is included in **Appendix B**.

The site is proposed to be rezoned from the current SP2 infrastructure (Water Supply) zoning to R2 low density residential zoning (R2) under Canterbury Local Environmental Plan (LEP) (2012). The permissible uses under R2 include (but are not limited to) various residential land uses, centre-based childcare facilities, open space/ recreation land uses and commercial land uses.

Site investigations completed between 2015 and 2019 identified wide-spread fill material containing elevated concentrations of heavy metals (copper, lead and zinc), total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAH) and asbestos. Anthropogenic inclusions in the fill also exceeded the adopted aesthetic criteria for the most sensitive proposed future site use under R2 (i.e. residential with accessible soils and childcare centres).

With respect to soil quality/fill material, the data obtained during the previous investigations concluded that the site was not suitable for R2 zoning in its current condition.

## 1.1. Objectives

The objective of this RAP is to provide a framework for remediation to detail how the site can be made suitable the most sensitive proposed future site use under R2 (i.e. residential with accessible soils and childcare centres).

## 1.2. Scope of Works

In order to fulfil the project objectives, the scope of works for the RAP comprises the following:

- Outline the applicable legislation and planning approvals.
- Review of relevant previous investigations and other environmental reports.
- Evaluation of potential remediation options.
- Identify areas of the site that require remediation and validation; areas that require further characterisation and how validation of the site will be achieved.
- Development of an unexpected finds procedure for potential unexpected finds of contamination.
- Provision of remediation methodologies including procedures and policies which enable the remediation works to be conducted, whilst minimising risk to human health and the environment.
- Establish remediation goals and validation criteria that will enable the site to be considered suitable for the residential land use without posing an unacceptable risk to human health or the environment.
- Detail the validation sampling, reporting and quality requirements to be implemented to support the final validation of the site.
- Consideration of contingency plans to respond to site incidents associated with the remediation, which may pose risk to human health and the environment.



### 1.3. Background Reports

The following reports have been reviewed as part of the preparation of this RAP:

- ADE Consulting Group (2018) Geotechnical Investigation, 165-169 Holden Street, Ashbury NSW.
- JBS&G (2019) Site Audit Report 165-169 Holden Street, Ashbury NSW (reference: 54448/122753).
- Parsons Brinckerhoff (2015) Combined Stage 1 and 2 Detailed Site Investigation: Sydney Water Ashfield Reservoir, 165-169 Holden Street ref: 2201679B-CLM-RPT-1021 RevC (PB, 2015).
- Progressive Risk Management (2018) Data Gap Analysis: 165-169 Holden Street, Ashbury NSW ref: P033725.001 Rev4\_Final (PRM, 2018).
- Progressive Risk Management (2019) Hazardous Ground Gas and Groundwater Assessment: 165-169 Holden Street, Ashbury NSW ref: P033725.004 (VerB\_Fina) (PRM, 2019a).
- Progressive Risk Management (2019) Letter Report: Summary of Contamination Condition, Part of Ashbury Reservoir, 165-169 Holden Street, Ashbury NSW ref: P033725.005 (VerB\_Final) (PRM, 2019b).

## 2. Regulatory Frameworks

This RAP is designed to assist in fulfilling the general obligation to ensure protection of the environment and the health and safety of workers, contractors and residents accessing the site now and in the future.

### 2.1. Relevant Guidance

Specific legislative requirements, guidelines, industry approved standards and Codes of Practice which were utilised in the preparation of this document are as follows:

#### **National Framework:**

- National Environment Protection Council (1999, Revised 2013) National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 – Schedule B1 Guideline on Investigation levels for Soil and Groundwater (NEPC, 2013).

#### **State Legislation:**

- Contaminated Land Management Act (CLM Act) 1997.
- Environmental Planning and Assessment Act (EP&A Act) 1979.
- Protection of the Environment Operations Act (POEO Act) 1997.
- Protection of the Environment Operations (Waste) Regulations (POEO) 2014.
- Waste Avoidance and Resource Recovery Act 2001.
- NSW Work Health and Safety Act 2011 and Regulation 2017.

#### **State Environmental Planning Policies:**

- State Environmental Planning Policy No. 55 – Remediation of Land (SEPP55).
- State Environmental Planning Policy (Infrastructure) 2007.

#### **Guidelines:**

- NSW EPA (1995) Sampling Design Guidelines.
- NSW EPA (2014) Waste Classification Guidelines.
- NSW EPA (2017) Guidelines for the NSW Site Auditor Scheme (3rd Edition).
- NSW EPA (2019) Draft Guidelines for the Assessment and Management of Hazardous Ground Gases.
- NSW EPA (2020) Consultants Reporting on Contaminated Land.
- WA Department of Health (2009) Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.

#### **Technical Guidance:**

- CRC Care Technical Report No. 10, Health screening levels for petroleum hydrocarbons in soil and groundwater Summary, 2011 (CRC Care, 2011).
- CRC Care Technical Report No. 39, Risk-based management and remediation guidance for benzo(a)pyrene, 2017 (CRC Care, 2017).

#### **Exemptions and Approvals:**

- NSW EPA (2014) The Excavated Natural Material Order 2014, Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014.

#### **Australian Standards:**

- Australian Standards 4482.1 Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 1: Non-Volatile and Semi-Volatile Substances 2005.

## 2.2. SEPP55 – Remediation of Land

In consideration of Category 1 or 2 remediation according to NSW *State Environmental Planning Policy Number 55 – Remediation of Land (SEPP55)*, the remediation works area is considered Category 2 (not requiring consent) as:

- The development is not Designated Development; State Significant Infrastructure; or State Significant Development under the EP&A Regulation.
- The remediation is not proposed on land identified as critical habitat under the Threatened Species Conservation Act 1995.
- Remediation work is not likely to have a significant effect on threatened species, populations, ecological communities or their habitats.
- The remediation is not proposed in an area or zone identified in a planning instrument as being an area of environmental significance such as scenic areas, wetlands.
- The remediation does not require consent under another SEPP or a regional environmental plan.
- The proposed remediation is consistent with Councils Contaminated Land Policy.

## 2.3. Compliance Requirements

- Soil disposed from the site must be classified in accordance with the NSW EPA (2014) Waste Classification Guidelines.
- Disturbance (including excavation) of any materials containing asbestos containing materials and removal of any asbestos from the site will need to be completed under an Asbestos Management Plan (AMP) prepared by a suitably qualified hygienist and Asbestos Removal Control Plan (ARCP) by an appropriately licensed Asbestos Removalist. Where greater than 10 m<sup>2</sup> of non-friable asbestos or any quantity of friable asbestos is to be removed, notification to SafeWork NSW will be required 5 days prior to removal.

## 3. Site Information

### 3.1. Site Details

A summary of site details is provided in **Table 1**.

<b>Table 1: Site Details</b>	
<b>Detail:</b>	<b>Information:</b>
Site Address:	165-169 Holden Street, Ashbury, NSW 2193
Lot Parcel:	Part Lot 1 DP115504 and part lot 1 DP911478.
Site Area	~2540 m <sup>2</sup>
Local Council:	City of Canterbury Bankstown
Current Zoning:	SP2 – Water Supply System under Canterbury Local Environmental Plan (2012).
Current site use:	Unused portion of a former depot associated with the adjoining SWC Ashbury Reservoir.
Proposed use:	Proposed to be rezoned to R2 Low Density Residential land.
Surrounding land use	<p>The site is with within a predominantly residential land use area.</p> <p><b>North:</b> Open space parkland and residential properties.</p> <p><b>South:</b> Active SWC Reservoir (WS0003) and residential properties.</p> <p><b>East:</b> Holden Street and residential properties.</p> <p><b>West:</b> Open space parkland and residential properties further west.</p>

### 3.2. Permissible Uses Under R2 Zoning

The site is proposed to be rezoned from the current SP2 infrastructure (Water Supply) zoning to R2 low density residential zoning. Under Canterbury Local Environmental Plan (2012) the permissible uses under R2 low density residential zoning include:

Permitted without consent:

- Home occupations

Permitted with consent:

- Bed and breakfast accommodation
- Boarding houses
- Building or business identification signs
- Business premises
- Car parks
- Centre-based child-care facilities
- Community facilities
- Dual occupancies
- Dwelling houses
- Exhibition homes
- Flood mitigation works
- Group homes
- Health consulting rooms
- Home businesses
- Home industries
- Office premises

- Places of public worship
- Recreation areas
- Respite day care centres
- Restaurants or cafes
- Roads
- Semi-detached dwellings
- Shops
- Oyster, pond-based and tank-based aquaculture.

### 3.3. Site History

- The site has been owned by Sydney Water since 1909 and used as a reservoir (WS0003) since at least 1930.
- The site is located adjacent the former South Ashfield Brickworks which may be the source of the identified fill material onsite.
- Historic aerial photographs indicate there were a larger number of buildings within the investigation area which appear to be a combination of permanent structures (including those remaining onsite) and demountable structures.
- NSW WorkCover licencing information for 1995 – 1996 indicates that petroleum and diesel was stored in cabinets in storage warehouses along the western boundary. Records indicate that up to 200L of fuel was stored.

### 3.4. NSW EPA Records

A search of NSW EPA records was completed by PRM on 28 January 2021 to identify potential offsite sources of contamination. The search indicated the following:

- The site has not been notified under Section 60 of the Contaminated Land Management Act 1997 (1997).
- There were no records for the site or any properties within the suburb of Ashbury in relation to contaminated land under Section 58 of the CLM Act 1997.
- There were no records of current or former licenced activities under the Protection of the Environment Operations Act 1997 held for the site.

## 4. Environmental Setting

The site environmental setting is summarised in **Table 2**.

<b>Table 2: Environmental Setting</b>	
Soils Landscape:	A review of NSW Environment & Heritage soil and land information (eSPADE) indicates soils at the site are part of the Blacktown Soil Landscape. Soils of the Blacktown landscape are typically shallow to moderately deep red and brown podzolic soils on crests, upper slopes and well-drained areas, deep yellow podzolic soils and soloths on lower slopes and areas of poor drainage.
Acid Sulphate Soils:	The CSIRO Australian Soil Resource Information System (ASRIS) indicated that soils underlying the site are mapped as having a very low probability of occurrence of acid sulfate soils (ASS).
Geology and Soil:	<p>A review of the Sydney 1:100,000 Geological Map (Department of Mineral Resources, 1983, 1:100,000 Geological Series Sheet 9130 (Edition 1)) indicates that the site is underlain by Ashfield Shale, comprising black to dark-grey shale and laminate. NSW Soils Landscape map (1:100,000) shows the site is underlain by Blacktown Soils which are described as shallow to moderately deep red and brown podzolic soils.</p> <p>Fill material was encountered across the site during previous environmental assessments which was generally described as gravely clays with varying degrees of anthropogenic inclusions consisting of building rubble, minor asbestos, coal, fly ash and slag.</p>
Hydrogeology:	<p>A review of the licensed borehole register on the NSW Government Water Information website (<a href="http://allwaterdata.water.nsw.gov.au/water.stm">http://allwaterdata.water.nsw.gov.au/water.stm</a>) was completed by PB (2015) and indicated there were no registered groundwater bores within a 500 m radius of the site.</p> <p>Previous investigations encountered groundwater at the site at depths between 5.50 meters below ground level (mbgl) and 13.95 mbgl. The significant differential in groundwater elevation over a short distance identified between monitoring wells indicates the localised groundwater flow direction to be to the west of the site towards the former brickworks pit.</p>
Topography / Drainage:	<p>The site is situated at approximately 40-50 metres Australian Height Datum (mAHD) and slopes down to the south and west.</p> <p>Surface water is expected to flow to the south/southwest with little infiltration given hardstand across the site surface.</p>

## 5. Previous Investigations

A summary of previous environmental works completed at the sites is summarised in **Table 3**. See **Section 1.3** for complete report titles.

**Table 3: Previous Environmental Works**

Report:	Works completed:
PB (2015) Stage 1 and 2 DSI	<p>PB conducted a combined Stage 1 and 2 DSI of the then proposed divestment area. The scope included a combined desktop study and intrusive soil investigation (15 test pits to depths of between 0.8 and 3.0 meters below ground level (mBGL)) and analysis of selected soil samples. Results identified the following exceedances of adopted site assessment criteria (SAC):</p> <ul style="list-style-type: none"> <li>Concentrations of benzo(a)pyrene TEQ (BaP TEQ) exceeded the adopted SAC for human health in four samples (TP3, TP9, TP12 &amp; TP14).</li> <li>Concentrations of benzo(a)pyrene exceeded the adopted ecological SAC in seven samples (TP1, TP3, TP9, TP12-TP14).</li> <li>The concentration of lead in sample TP12 (0.5-0.6) exceeded the adopted human health SAC.</li> <li>The concentration of zinc in samples TP11(0-0.1) and TP12(0.5-0.6) exceeded the adopted ecological SAC, however, PB considered these elevations limited and that they did not pose a significant risk to onsite ecological receptors.</li> <li>Asbestos containing material (ACM) in the form of fibre cement sheeting fragments were observed at two locations (TP11 and TP14). The calculated concentration of ACM for TP11 exceeded the adopted health screening level for ACM in soil for residential land use.</li> </ul> <p>PB recommended the appropriate management and removal of asbestos, lead and PAH impacts onsite in order to meet the criteria for residential land use in order for potential future divestment. Based on the preliminary findings it was estimated that approximately 1625 m<sup>3</sup> of material was impacted by asbestos, based on the assumption that asbestos impacts were confined to the upper fill material across the entire site area (measured by PB to be 2708m<sup>2</sup> noting the different proposed divestment area at the time of the PB investigation). PB noted deeper excavation would be required around TP9 where benzo(a)pyrene impacts were reported within the underlying sandy fill materials. PB undertook a preliminary waste classification from the samples collected during the investigation and considered the fill material to be classified as special waste (asbestos) and general solid waste.</p>
PRM (2018) Data Gap Assessment	<p>PRM completed a targeted soil investigation as part of a Data Gap Assessment (DGA) with the following objectives:</p> <ul style="list-style-type: none"> <li>Delineate previously identified areas of concern from PB (2015) at TP14, TP9 and TP3.</li> <li>Compare analytical data to waste classification criteria for soils which may require offsite disposal as part of the remediation works.</li> <li>Discuss any specific remediation considerations to inform the preparation of the RAP.</li> </ul> <p>The scope of work included excavation of nine test pits from depths of 0.1-1.3 mBGL and analysis of representative soil samples. Additionally, TCLP analysis of select samples was undertaken in order to assist with preparation of an insitu waste classification. Based on the findings the following conclusions were made:</p> <ul style="list-style-type: none"> <li>Review of the methodology used by PB (2015) to calculate site specific EILS concluded that additional assessment of physiochemical properties of site soils should be undertaken to improve the robustness of EILS.</li> <li>An adjustment to the SAC used by PB was undertaken for the assessment of benzo(a) pyrene risk to ecological receptors. Ecological screening levels provided in CRC Care <i>Technical Report No. 39, Risk-based management and remediation guidance for benzo(a)pyrene</i>, 2017 are based on more recent research and viewed as a more appropriate screening level for ecological risk.</li> <li>The concentrations of TRH exceeded ecological criteria at TP103 and TP107, and concentrations of PAHs exceeded for both ecological and human health criteria at TP103 and TP107. These are proposed to be removed during remediation.</li> <li>Copper and zinc exceedances identified at TP109 are also required to be removed, however, additional testing is recommended to be undertaken as part of the post-demolition testing.</li> </ul>

**Table 3: Previous Environmental Works**

	<ul style="list-style-type: none"> <li>No asbestos was identified during the DGA site works, or within any of the analysed soil samples.</li> <li>Comparison of data to waste classification criteria indicates the fill material is consistent with General Solid Waste (non-putrescible). This classification requires adoption of NSW EPA immobilisation approvals and subsequently is subject to disposal restrictions and excludes the previously identified asbestos impacted areas at TP11 and TP14.</li> </ul> <p>With respect to soil quality/fill material, the data obtained during PB (2015) and PRM (2018) investigations, PRM concluded that the site was not suitable for low-density residential land use in its current condition.</p>
ADE (2018) Geotechnical Investigation	<p>ADE Consulting Group Pty Ltd (ADE) was commissioned by Sydney Water to undertake a geotechnical investigation for a proposed low rise residential project at site.</p> <p>The objectives of the investigation were to provide information on the subsurface soil profile and groundwater conditions, geotechnical design parameters for building foundations, soil aggressivity to steel and concrete, site preparation recommendations and discuss any other geotechnical findings relevant to the proposed development.</p> <p>There were five (5) boreholes drilled to a depth of about 3.45m below ground level (bgl), one (1) borehole was drilled to 4.95 m bgl and another one (1) borehole was drilled to 10.0 m bgl. Standard Penetration Tests (SPT) were carried out within boreholes to assess soil strength and consistency. Samples were collected during drilling to assist in classifying site soils and for laboratory testing.</p> <p>Subsurface conditions at the site predominantly consisted of FILL overlaying Residual soils and extremely to highly weathered SHALE Bedrock. The Fill soils encountered at the site were generally sandy CLAY with gravel.</p> <p>The site classification Class 'P' is considered appropriate at present condition. After removal/stripping of the existing pavement and any fill, the site could be reclassified as 'H1' (Highly reactive clay sites, which may experience high ground movement from moisture changes) based on Shrink-Swell tests performed on samples collected from the boreholes.</p> <p>Aggressivity testing was conducted on selected samples. The laboratory test results were compared against tables 6.4.2 (C) and 6.5.2 (C) from AS 2159 – 2009 for exposure classification. Chemical test results indicated mildly to non-aggressive ground conditions for concrete and non-aggressive to steel structural elements.</p>
PRM (2019a) HGG & Groundwater Assessment	<p>PRM were further engaged to conduct hazardous ground gas (HGG) and Groundwater assessment at the site. The objective of the assessment was to assess potential HGG and groundwater contamination at the site and assess the suitability of the site for proposed divestment for residential land use. The scope of works included drilling nine boreholes to various depths for installation of HGG monitoring wells, including three installed as dual-purpose wells for groundwater monitoring.</p> <p>A total of six HGG spot monitoring events over a two-month period were undertaken and supplemented with continuous HGG monitoring in selected monitoring wells over a four-week period using GasClams. Groundwater samples were collected over one monitoring event. The investigation concluded the following:</p> <ul style="list-style-type: none"> <li>Laboratory analysis of groundwater samples identified concentrations of heavy metals above the adopted ecological SAC, however, the identified exceedances were considered likely to be indicative of background/natural water quality in the underlying shale aquifer.</li> <li>The Gas Screening Values (GSV) for the site were characterised as a Characteristic Gas Situation (CS) of CS1 (very low risk).</li> </ul>
PRM (2019b) Summary of Contamination Condition	<p>PRM were engaged to prepare a summary of contamination conditions for the proposed divestment portion of land. The purpose of the letter report was to review the previous environmental reports that had been undertaken at the site, provide a summary of the current contamination conditions of the site and any conclusions and recommendations.</p> <p>The summary concluded the following in regard to contamination at the site:</p> <ul style="list-style-type: none"> <li>With respect to site soils, the data obtained during the PB (2015) and PRM (2018) investigations indicate that the site is not suitable for low density residential land use in its current condition.</li> <li>With respect to HGG and groundwater quality, the site is considered suitable for the proposed divestment for residential land use with accessible garden.</li> </ul> <p>The summary concluded that the site is not suitable for residential land use in its current condition without remediation. Excavation and offsite disposal of unsuitable materials followed by site validation is considered the most suitable remediation option.</p>



**Table 3: Previous Environmental Works**

	<p>Additionally, the site is considered to present a risk of unexpected finds relating to asbestos, in particular relating to building rubble impacted fill material towards the southwest and western boundary of the site. This should be managed during the remediation works by visual observations of the environmental consultant during excavation in addition to validation sampling following removal.</p> <p>PRM recommended that a RAP be prepared to assess remediation options for the site and outline the remediation requirements including estimated disposal volumes for each waste stream. Alternatively, the identified contamination in soils could be notified to potential purchasers prior to sale and managed/remediated prior to and/or during site development works.</p>
JBS&G Site Audit Statement (2019)	<p>Andrew Lau of JBS&amp;G Australia Pty Ltd (JBS&amp;G) was engaged by Sydney Water Corporation on 23 November 2017 to conduct a site audit for the site.</p> <p>The objectives of the site audit were to:</p> <p>Independently review the environmental investigation reports as requested by the client; and</p> <p>Prepare a SAR and issue a SAS, providing an opinion on the appropriateness of the investigation to determine the nature and extent of contamination at the site.</p> <p>The audit included review of previous works completed by PB (2015) and PRM (2018) and PRM (2019).</p> <p>The findings of the site audit concluded:</p> <ul style="list-style-type: none"> <li>• The soil investigations identified concentrations of contaminants of potential concern (copper, zinc, TRH C16-34, benzo(a)pyrene, benzo(a)pyrene TEQ and total PAHs) in fill soils above the adopted site assessment criteria, which require remediation or management for residential with accessible soils/gardens land use.</li> <li>• While not identified in the recent site investigations (PRM 2019a and PRM 2019b), asbestos has previously been identified at the site as ACM fragments. There is potential for additional asbestos to be present in fill material at the site and consideration should be given to the presence of asbestos in any remediation and/or redevelopment plans for the site.</li> <li>• While assessment of groundwater at the site identified concentrations of heavy metals above the adopted site assessment criteria, the detected concentrations were attributed to background groundwater quality. There are no complete source pathway receptor linkages identified.</li> <li>• Hazardous ground gases at the site have been determined to pose very low risk and as such, no further action is required.</li> <li>• Consideration of aesthetic issues including staining, odours, anthropogenic contaminants and presence of asbestos has been adequately addressed in the assessment of soils at the site.</li> <li>• There is no evidence of migration of contaminants from the site which is likely to result in any unacceptable risks to surrounding human or ecological receptors.</li> <li>• The site investigation works (PRM 2019a and PRM 2019b) are considered to have met the requirements of the Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd Edition) (EPA 2017).</li> <li>• The nature and extent of contamination of soil, groundwater and ground gases at the site were considered to have been adequately assessed.</li> </ul>

## 6. Areas of Environmental Concern

Areas of Environmental Concern (AEC) and contaminants of potential concern (CoPC) as described in PB (2015) and PRM (2018) are summarised below. The primary source of site contamination identified is associated with fill material of variable type and extent across the entire site. The fill material was observed to:

- Vary in depth between sample locations across the site, and unknown depths beneath existing building footprints.
- Contain varied anthropogenic materials including building rubble and asbestos.
- Contain concentrations of PAH, TRH, heavy metals (lead, zinc and copper) and asbestos which exceeded residential land use investigation criteria.
- Have aesthetic considerations which are unsuitable for proposed residential land use.

A summary of exceedances from PB (2015) and PRM (2018) is detailed in **Table 4**.

Analyte	Sampling location	Results
Heavy Metals	TP12_0.5 (PB, 2015)	The concentration of lead (490 mg/kg) exceeded the adopted health SAC and the concentration of zinc (2400 mg/kg) exceeded the adopted ecological site assessment criteria (SAC).
	TP11_0-0.1 (PB, 2015)	The concentration of zinc in sample (400mg/kg) exceeded the ecological SAC adopted by PB and the revised ecological SAC of 33mg/kg adopted by PRM.
	TP109_0-0.1 (PRM, 2018)	The concentration of copper (240 mg/kg) and zinc (450 mg/kg) exceeded the adopted ecological SAC.
PAH	TP03_0.0 (PB, 2015)	The concentration of BaP TEQ (4.1 mg/kg) exceeded the adopted health SAC (3 mg/kg) and The concentration of BaP (3 mg/kg) exceeded the ecological SAC (0.7 mg/kg) adopted by PB, however, was below the revised ecological SAC of 33mg/kg adopted by PRM.
	TP12_0.5 (PB, 2015)	The concentration of BaP TEQ (4.9 mg/kg) exceeded the adopted health SAC (3mg/kg). The concentration of BaP (3.6mg/kg) exceeded the ecological SAC (0.7mg/kg) adopted by PB, however, was below the revised ecological SAC of 33mg/kg adopted by PRM.
	TP01_0.05 (PB, 2015)	The concentration of BaP (1.1 mg/kg) exceeded the ecological SAC (0.7 mg/kg) adopted by PB, however, was below the revised ecological SAC of 33mg/kg adopted by PRM.
	TP13_0.05 (PB, 2015)	The concentration of BaP (1.4 mg/kg) exceeded the ecological SAC (0.7 mg/kg) adopted by PB, however, was below the revised ecological SAC of 33mg/kg adopted by PRM.
	TP103_0.3-0.4 (PRM, 2018)	The concentration of BaP TEQ (79 mg/kg) and total PAH (790 mg/kg) exceeded the adopted health SAC (3mg/kg and 200mg/kg), and the concentration of BaP (55mg/kg) exceeded the adopted ecological SAC (33mg/kg).
	TP103_0.6-0.7 (PRM, 2018)	The concentration of BaP TEQ (3.5 mg/kg) exceeded the adopted health SAC (3mg/kg).
	TP107_0.1-0.2 (PRM, 2018)	The concentration of BaP TEQ (11mg/kg) exceeded the adopted health criteria (3mg/kg).
TRH	TP107_0.1-0.2 (PRM, 2018)	The concentration of TRH C16-C34 (320 mg/kg) exceeded the adopted ecological SAC (300mg/kg (coarse-grained)).
	TP103_0.3-0.4 (PRM, 2018)	The concentration of TRH C16-C34 (1500 mg/kg) exceeded the adopted ecological SAC (1300mg/kg(fine-grained) and 300mg/kg (coarse-grained)).
Asbestos	TP11_0.0-0.1 (PB, 2015)	The concentration of ACM (0.0107%w/w) exceeded the adopted HSL for low density residential (0.01%w/w).

**Table 4: Summary of Site Exceedances**

Analyte	Sampling location	Results
		The presence of ACM in surface soils exceeded the criterion of 'no asbestos in surface soils.

The location of previous investigation location and soil exceedances are provided in **Figure 3**.

## 6.1. Summary of Known Contamination

Above listed AECs and CoPC requiring remediation are summarised in **Table 5** and are delineated in **Figure 4**. The indicative extents of contamination have been estimated to the nearest 'clean' test pit, or site boundary.

**Table 5: Summary of Know Contamination**

Area	Description	CoPC	Comments
Area 1 Encompasses the western remediation area	Western portion surrounding existing building.	BaP TEQ, total PAH, TRH C16-C34, lead, zinc, copper, ACM.	PB intrusive works identified exceedances of SAC at TP11 and TP12 (see Table 4). PRM intrusive works identified exceedances of SAC at TP109 and TP103. No previous sampling undertaken by PB or PRM below site buildings in the west of the site (See <b>Table 6</b> for more information).
Area 2 Encompasses the eastern remediation area	North eastern portion of site.	BaP TEQ, TRH C16-C34.	PB intrusive works identified exceedances of SAC at TP03, and PRM intrusive works identified exceedances of SAC at TP107.

## 6.2. Data Gaps

Based on a review of the current site characterisation data, the following data gaps have been identified and are summarised in **Table 6**. The data gaps will be required to be addressed during site development/remediation works following demolition of existing site structures.

**Table 6: Summary of Data Gaps**

Item	Description
Potential soil contamination under existing building footprints.	Given the age of the buildings and the historical storage of fuels. COPC may be present beneath existing site buildings. Fill material has been identified at testing locations directly adjacent to building footprints (e.g TP12) indicating a high likelihood of fill material to be present beneath buildings.
The full extent of fill material is not well characterised and likely to vary across the site.	Due to the presence of concrete hardstand and buildings across the site footprint during investigation works, intrusive works (i.e test pits) have been limited to accessible non-hardstand areas (e.g garden beds/grassed areas) and those hardstand areas able to be accessed without significant disturbance of the hardstand. As such, the full extent of fill material present across the site may increase based on visual observations during remediation works, particularly below building footprints where no investigation locations have been completed to date.

**Table 6: Summary of Data Gaps**

Item	Description
Waste Classification of fill material	Preliminary insitu waste classification indicates that the fill material is consistent with General Solid Waste (GSW) (non-putrescible), excluding the previously identified asbestos impacted areas at TP11 which will require offsite disposal as GSW with Special Waste (asbestos). However, additional sampling and analysis is required to confirm this preliminary classification as it is possible that localised areas of contamination may exist in subsurface soils beneath existing site building footprints or areas of hardstand not previously assessed

## 7. Conceptual Site Model

The following Conceptual Site Model (CSM) describes the known and potential complete contamination source-pathway-receptor (SPR) linkages.

**Table 7: Conceptual Site Model**

Source	Wide-spread fill material containing elevated concentrations of heavy metals (copper, lead and zinc), TRH, PAHs and asbestos.
Contaminants of potential concern (CoPC)	<ul style="list-style-type: none"> <li>• Heavy metals</li> <li>• TRH</li> <li>• PAH</li> <li>• Asbestos</li> </ul>
Exposure Pathway	<ul style="list-style-type: none"> <li>• Direct contact with contaminated media</li> <li>• Ingestion/inhalation of soil derived dust and/or fibres.</li> </ul>
Potential Receptors	<ul style="list-style-type: none"> <li>• Future contractors during re-development works.</li> <li>• Future residents or site users/occupants.</li> <li>• Onsite flora and fauna</li> </ul>
SPR Linkages	Pathways have the potential to become complete without further management or remediation and during future development works or future intrusive works by contractors/maintenance staff.
Data Gaps	<ul style="list-style-type: none"> <li>• See Table 6.</li> </ul>

## 8. Remediation Design

### 8.1. Remediation Goals

The remediation goals include:

- Removal, to the extent practicable, unacceptable risks to human health and the environment from the identified CoPC rendering the site suitable for the most sensitive use under R2 zoning (i.e. residential with accessible soils and childcare centres). low density residential land use.
- Preventing, to the extent practicable, any potential contamination of the surrounding environment.
- Addressing unexpected finds that may be encountered during site works.
- Validation of the site in accordance with NSW EPA approved guidelines for future residential land use.

### 8.2. Extent of Remediation Required

#### 8.2.1. General

Based on the results of the previous intrusive investigations completed at the site, remediation and validation will be required in the following areas for the site to be considered suitable for future residential land use. Remediation extents have been estimated to the nearest 'clean' test pit, or site boundary. Additional validation will be required across areas not previously sampled (i.e beneath building footprints) or portions of the site not being remediated (i.e within residual fill remaining between the two remediation areas) in order to confirm suitability of the soils to remain on site.

Two remediation areas have been identified and are summarised in **Table 8** and are depicted on **Figure 4**.

Table 8: Remediation Areas	
Remediation Area	Summary
RA1	<p><b>Material description:</b> Fill: gravelly clay, grey/brown/orange, with foreign materials; brick, concrete, minor ash, charcoal and slag.</p> <p><b>Known contamination:</b> Concentrations of BaP, BaP TEQ, total PAH, TRH C16-C34, lead, zinc and copper SAC, TP12, TP109 and TP103. Asbestos was identified in shallow soils (0-0.1mBGL) at TP11.</p> <p><b>Approximate area:</b> 832 m<sup>2</sup> (note this includes soils within the area below the existing building in the west of the site which are assumed to be contaminated).</p> <p><b>Anticipated depth of remediation:</b> The extent of contaminated fill has been identified across RA1 at various depths. Generally, the fill profile within RA1 is shallow in the north (between 0.3 and 0.6mBGL) becoming deeper near TP103 (~0.8mBGL)</p> <p><b>Indicative volume of material:</b> Based on an estimate average depth of 0.6mBGL across the entire remediation area, an approximate excavation volume of 500m<sup>3</sup> has been estimated for RA1, however, it is noted that these volumes may increase during remediation based on validation results and visual observations.</p>
RA2	<p><b>Material description:</b> Fill: silty or gravelly clay, brown or red-brown, minor concrete and brick, or silty sand (topsoil) dark brown.</p> <p><b>Known contamination:</b> Concentrations of BaP TEQ and TRH C16-C34 exceeded SAC at TP03 and TP107.</p> <p><b>Approximate area:</b> 615m<sup>2</sup></p> <p><b>Anticipated depth of remediation:</b> 0.3mBGL.</p> <p><b>Indicative volume of material:</b> Based on an estimate average depth of 0.3mBGL across the entire remediation area, an approximate excavation volume of</p>

**Table 8: Remediation Areas**

Remediation Area	Summary
	185 m <sup>3</sup> has been estimated for RA2, however, it is noted that these volumes may increase during remediation based on validation results and visual observations.

### 8.2.2. Asbestos Impacted Materials

Within RA1, ACM was identified at one location in the north (TP11). The ACM was identified as fibre cement sheeting fragments in shallow soils (0-0.1mBGL). The fill in the vicinity of TP11 location noted inclusions building rubble including concrete fragments, minor ash and slag and ACM. Suspected ACM was not identified within the fill layer in other investigation locations, however, the full extent of ACM impacted fill material present across the site may increase based on visual observations during remediation works, particularly below some hardstand areas and building footprints where no investigation locations have been completed to date. The location of known ACM impacted fill at PB (2015) investigation location TP11 is depicted on **Figure 3**.

### 8.2.3. Additional Waste Classification Requirements

Fill soils located beneath the building footprints require sampling and analysis in order to provide a waste classification to support their offsite disposal. The additional sampling may be undertaken insitu (via test pitting) or exsitu following excavation and stockpiling. Soils excavated from beneath building footprints for exsitu testing are to be temporarily stockpiled on hardstands or plastic and sampled at the density as provided in Industrial Waste Resource Guidelines 702 (Soil Sampling) i.e minim of 3 samples up to 25m<sup>3</sup> then 1:25m<sup>3</sup> thereafter.

Waste Classification samples are to be analysed for a range of contaminants including metals, PAH, TRH/BTEX and Asbestos.

In consideration of the ash/coal product noted in the site fill, the waste classification results will be required to be compared to both NSW EPA (2014) and the immobilisation approvals used by the EPA under the Protection of the Environment Operations (Waste) Regulation 2014. Specifically, approval 1999/05 relating to Ash, Ash-contaminated natural excavated materials or coal-contaminated natural excavated material is considered applicable.

## 8.3. Remediation Options Assessment

The following is a list of common remediation strategies used on contaminated sites:

- Defer remediation of the soil, restrict access to the site and leave site undisturbed.
- Onsite treatment of the soil so the contaminants are either destroyed or the associated hazards are reduced to an acceptable level.
- Excavation and offsite treatment of the soil so the contaminants are either destroyed or the associated hazards are reduced to an acceptable level, after which the soil is returned to the site.
- Excavation and disposal of all contaminated soil from the site to an approved landfill.
- Consolidation and isolation of the contaminated soil by onsite containment within a suitably designed barrier and on-going management.

A summary of the remediation options assessment undertaken as part of the development of this RAP is included in **Table 9**.

**Table 9: Remediation Options Assessment**

Strategy	Discussion
<b>Defer remediation</b>	<b>Rejected</b> – does not achieve the objective of making the site suitable for the most conservative use under R2 zoning.
<b>On-site treatment</b>	<b>Rejected</b> – not a viable option for all contamination types encountered (i.e. metals, asbestos) and the cost of establishing onsite remediation is not viable.
<b>Off-site treatment</b>	<b>Rejected</b> – not a viable option as only small areas of localised material are contaminated; it is not considered financially appropriate to transport the soils for offsite treatment and not a viable option for all contamination types encountered.
<b>On site capping</b>	<b>Rejected</b> – not considered suitable or practicable for the most conservative use under R2 zoning.
<b>Partial excavation/disposal and on-site containment</b>	<b>Rejected</b> – not considered suitable or practicable for the most conservative use under R2 zoning.
<b>Excavation/offsite disposal</b>	<b>Selected:</b> Given the contamination encountered and considering the remediation objectives, excavation and offsite disposal are considered cost-effective, practical and time efficient method.

## 8.4. Rationale for the Selected Remediation Option

Excavation and offsite disposal of the identified fill materials in RA1 and RA2 at the site is considered to be the most appropriate remediation option in order to meet the remediation objective of making the site suitable for the most sensitive proposed future site use under R2 (i.e. residential with accessible soils and childcare centres).

However, if the site was proposed to be redeveloped to a less sensitive use permissible under R2, alternate remediation options may be appropriate for the site. Any such alternative remediation options/approach would be required to be detailed in a new RAP approved by Council and a NSW EPA accredited site auditor.



## 9. Remediation Approach

Various steps are required to meet the stated remediation objectives and to ensure the site is suitable for the most sensitive proposed future site use under R2 (i.e. residential with accessible soils and childcare centres).

### 9.1. Regulatory Approvals and Notifications

For works involving the removal of asbestos impacted fill, notification to start works will be required to SafeWork NSW. The notification is to be undertaken by the Principal Contractor (PC).

Where required, the site owner is responsible for notifying Council and local residents of the of the commencement (and completion) of the proposed remediation works, including scope and estimated program.

### 9.2. Planning and Site Establishment

#### 9.2.1. Project Safety and Environmental Management

Prior to the commencement of site works, the PC shall prepare a Project Safety and Environmental Management Plan (PSEMP). This plan will include specific details and work method statements describing all environmental and work health and safety (WH&S) controls to be implemented and followed during the remediation works.

The PSEMP is to specify requirements for all site personnel and procedures to minimise disturbance and impacts to surrounding areas. The following critical elements are required to be included in the PSEMP:

- Measures and procedures to minimise the potential for site workers, neighbours and/or member of the public, visitors, or neighbours to be exposed to contamination during the remedial works.
- Material tracking and imported material protocols.
- Measures and procedures to minimise impacts to any sensitive ecological communities.
- All site staff, contractors and sub-contractors are to complete site-specific safety inductions and made aware of the contamination type expected through the remediation.

See **Section 12** for more information.

#### 9.2.2. Asbestos Removal Control Plan

For works involving the removal of asbestos impacted fill in RA1, the PC is to prepare an Asbestos Removal Control Plan (ARCP) for the remedial works prior to commencement. An ARCP is prepared to ensure workers and other persons are not at risk from exposure to asbestos fibres during the asbestos removal. The ARCP must include details of how the asbestos removal will be carried out including method, tools, equipment and PPE and details of the asbestos to be removed.

#### 9.2.3. Site Establishment

Site establishment tasks shall include, but may not be limited to:

- Mobilise plant and equipment, and installation of health and safety, and environmental controls outlined in the PSEMP.

- Establishment of pedestrian and vehicle traffic routes and controls. Consideration should be given as to whether a footpath access/closure permit may be required.
- Preparation and establishment of stormwater diversions and sedimentation controls.
- Removal of vegetation (grass/ weeds/ shrubs).
- Where required, establishment of preliminary ARCP requirements including (but not limited to):
  - Appropriate asbestos and construction signage should be implemented on the exterior of the remediation area at visible locations to site users and the public to attempt to prevent inadvertent access.
  - Asbestos decontamination facilities for personnel and plant (if required in the ARCP) should be implemented within the remedial work area, which should include a mobile personal decontamination unit and the establishment of a geofabric lined pad for the washing of plant and trucks.
  - Installation of air monitoring equipment by the project hygienist.
  - Installation of dust suppression equipment as necessary

The PC shall endeavour to protect any property and infrastructure at the site and mitigate impacts to the surrounding environment to the extent practicable, throughout the works.

### 9.3. Demolition of Structures and Hardstand

Existing building and hardstand will be required to be demolished and disposed offsite to allow for the excavation of underlying fill. Demolition of structures is to be undertaken in accordance with relevant industry standards, including the management of potential hazardous building materials (HBM). The offsite disposal of site structures are required to be documented by the PC and disposal tracking information provided the Environmental Consultant for including in the Validation Report (see **Section 10.6**).

Additional validation sampling is required subsequent to demolition and disposal of site structures to address data gaps as identified in **Section 6.2**. Validation sampling requirements beneath building footprints are described in **Section 10.4**.

### 9.4. Excavation Requirements

The estimated extent of each RA and indicative disposal are detailed in **Table 10**. Volume estimates have been provided for each RA, with the extent of each RA estimated to the nearest 'clean' test pit location or site boundary. However, it is noted that these volumes may increase during remediation based on validation results and visual observations.

Table 10: Volume Estimate Summary		
Remediation Area	Estimated Volume	CoPC
RA1	Area of approximately 832m <sup>2</sup> to anticipated average depth of 0.6mBGL. Total anticipated volume 500m <sup>3</sup> .	BaP, BaP TEQ, TRH C16-C34, lead, zinc, copper and asbestos.
RA2	Area of approximately 615m <sup>2</sup> to an anticipated average depth of 0.3mBGL. Total anticipated volume 185m <sup>3</sup> .	BaP TEQ, TRH C16-C34.

## 9.5. Waste Classification and Offsite Disposal

Preliminary insitu Waste Classification undertaken by PB (2015) and PRM (2018) indicates that the fill encountered at the site generally meets the classification of General Solid Waste (non-putrescible), with the following exceptions:

- The area of ACM impact identified by PB (2015) at TP11. A classification of Special Waste (Asbestos) will apply to any asbestos impacted soils. The extent of ACM impacted fill needs to be confirmed via observations during the remedial works and will need to be excavated and disposed of separately.
- Analytical results for TP103\_0.3 returned concentrations of B(a)P and total PAH exceeding both restricted and hazardous waste criteria. In consideration of the ash/coal product noted in the fill during test pitting, the results for TP103\_0.3 were also compared to the immobilisation approvals used by the EPA under the Protection of the Environment Operations (Waste) Regulation 2014. Specifically, approval 1999/05 relating to Ash, Ash-contaminated natural excavated materials or coal-contaminated natural excavated material is considered applicable. The immobilisation approval allows for material to be classified according to the leachable concentration (TCLP) value of B(a)P alone. It is noted that disposal restrictions apply for this material which would need to be considered as outlined in 1999/05.
- Fill material located under B1 which have not been assessed.

The fill soils are to be assessed in accordance with the following:

- NSW EPA (2014) Waste Classification Guidelines.
- NSW EPA *General Approval of the Immobilisation of Contaminants in Waste* (Approval Number 1999/05) which allows ash contaminated natural materials to be assessed on their TCLP concentrations alone (not total concentrations) with respect to benzo(a)pyrene and total PAHs may be applicable.

All transport works shall be carried out in a manner that minimises disturbance and impacts to the surrounding areas. The material may need to be registered with the NSW EPA Waste Locate tracking system to comply with the legislation regarding the transporting/ movement of asbestos waste or waste containing asbestos.

Transport of classified waste to a facility that is appropriately licenced to accept the waste must be undertaken in accordance with the NSW Protection of the Environment Operations (Waste) Regulation.

## 9.6. Contingency Plan

### 9.6.1. General

Potential events that may arise during or following the remediation and actions that will be undertaken if such unexpected conditions occur are summarised in **Table 11**.

<b>Table 11: Contingency Items</b>	
<b>Event</b>	<b>Action</b>
<b>Development plans change/decided</b>	Review the applicability of this RAP to the revised development plans.
<b>Contamination is found to extend below proposed remediation depth or extent</b>	Review of the remediation strategy will be undertaken. Possible responses could include further excavation, risk assessment, further delineation sampling / monitoring.
<b>Soil classified as hazardous waste is identified</b>	Hazardous soil would need to be treated prior to being disposed to landfill. Such pre-treatment could either occur onsite or could occur at a suitably licensed offsite treatment facility. In the event hazardous waste was encountered and onsite pre-treatment was proposed then an addendum to this RAP would be prepared.
<b>Contamination is found to have migrated offsite</b>	In the event that contamination was encountered extending beyond the site boundary initially the extent and significance would be assessed along with the need for further remediation / management through monitoring and potentially fate and transport assessment / risk assessment.
<b>Validation samples fail criteria.</b>	Excavate additional soil and revalidate that area or assess other potential remediation or validation options.
<b>Underground cables or pipes containing unknown product</b>	Stop work temporarily, identify product / substance (through sampling), determine extent and origin of subject pipe, develop remediation and or material handling protocol dependant on product or substance.

### 9.6.2. Unexpected finds Protocol

If during remediation works, material is encountered which appears to be potentially contaminated and appears to be different from the contamination described in this RAP, or point sources of contamination such as underground storage tanks which were not expected to be present are encountered, the following procedures should apply:

- Any suspicious material/soil which has been excavated should be stockpiled on bunded, strong, impermeable plastic sheeting, protected from erosion and all seepage retained.
- Excavation works at that part of the site where the suspicious material (soil) was encountered should cease until inspection is carried out and documented by the environmental consultant.
- Based on visual inspection, the environmental consultant should provide interim advice on construction health and safety, soil storage and soil disposal to allow construction to proceed if possible.
- Based on sampling and analysis of the material, the environmental consultant should provide final advice, based on comparison of the laboratory test results to suitable criteria relating to human health, potential environmental impacts and waste disposal.

"Suspicious" material may include underground storage tanks, odorous material, fibrous material, brightly coloured material, tarry or ashy material, drums, or metal / plastic chemical containers etc.

Any unexpected events which may affect the outcome of the remediation should be notified to the appointed Environmental Consultant. At that time potential actions to address the unexpected event will be assessed and presented.

## 10. Validation Program

### 10.1. Data Quality Objectives

The data quality objectives (DQO) process is a systematic planning tool based on the scientific method for establishing criteria for data quality and for developing data collection designs. The DQO process is a seven-step planning approach endorsed by the NSW EPA as described in Schedule B2 of NEPC 2013.

DQOs are statements that define the confidence required in conclusions drawn for data produced for a project, and which must be set to realistically define and measure the quality of data needed.

The DQO process is intended to develop sampling designs for data collection activities that support decision making and allow the relevant parties to improve the effectiveness, efficiency and defensibility of a decision in a resource and cost-effective manner.

DQOs have been developed for this project and are discussed in the following sections.

#### Step 1: State/Define the problem

To provide an approach to manage the preferred remediation strategy of excavation and offsite disposal to ensure that the site is suitable for the proposed land use (all land uses under R2 low density residential zoning).

Validation of the remediation works is required to demonstrate that identified risks have been adequately managed or removed and that the site is suitable for the proposed residential land use.

In addition, due to the likelihood of localised unexpected finds being identified during remediation works (i.e. where existing site structures exist and have not been investigated), a detailed approach to address unexpected finds is also required.

#### Step 2: Identify the decision

The key decisions to be made are as follows:

- Has the fill material been suitably removed (to the extent practicable) and validated?
- Are there any remaining unacceptable risks to onsite or offsite receptors?
- Are there any aesthetic impacts remaining in the remediation area?
- Where materials are removed, have the materials been assessed for waste classification to all allow for offsite disposal to a suitably licensed landfill facility?
- Is any further management required?

#### Step 3: Identify inputs to the decision

The information inputs required for the project include:

- Previous environmental reports and existing environmental data.
- Conceptual site model.
- Physical observations during remediation works.
- Results of chemical analysis of validation samples collected.
- Material removal and recycling/disposal documentation.
- Adopted assessment criteria from relevant NSW EPA approved guidelines.
- Assessment of the suitability of the data for the purposes of environmental assessment through application of data quality indicators (DQIs), namely precision, accuracy, representativeness, completeness and comparability (PARCC) parameters.

## Step 4: Define the boundaries of the study

The extent of the study boundary is as follows:

- The lateral boundaries of the study are as defined by Sydney Water and outlined in **Figure 2**.
- The vertical extent of the study is varied and is defined by the depth to natural clay soils.
- The temporal extent of the study is the date of inspections and validation sampling.

## Step 5: Develop a decision rule

Laboratory analytical data will be assessed against NSW EPA endorsed criteria. The decision rules adopted to answer the decisions outlined are summarised in **Table 12**.

Table 12: Summary of Decision Rules		
No.	Decision	Rule
1	Do chemical concentrations in underlying soils pose a potential risk to human health or to the environment?	<p>All soil data will be compared against NSW EPA endorsed criteria applicable to residential land use (with access to garden/soil). If required, statistical analysis will also be undertaken to facilitate site decision.</p> <p>The following rules will be applied for assessment of human health and environmental risk:</p> <ul style="list-style-type: none"> <li>• If the results are less than the adopted site criteria, then the decision is no.</li> <li>• If the results are greater than the adopted guideline and the statistical analysis demonstrates that the upper 95% confidence limit on the average concentration falls below the adopted site criteria; with no single analyte concentration exceeding 250% of the adopted site criteria; and the standard deviation of the results being less than 50% of the site criteria then the decision is no.</li> <li>• If the statistical soil results do not meet the adopted criteria, then the decision is yes, and further assessment will be required to determine the extent of potential risk and suitable remediation actions.</li> </ul>
2	Has material been suitably classified for the purposes of offsite disposal to licensed landfill facility?	<p>If the materials have been classified in accordance with NSW EPA (2014) Waste Classification and NSW EPA <i>General Approval of the Immobilisation of Contaminants in Waste</i> (Approval Number 1999/05), then the decision is yes.</p>

## Step 6: Specify limits on decision errors

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

Specific limits for this project have been adopted in accordance with the appropriate guidance from the NSW EPA, NEPC (2013), appropriate indicators of data quality (used to assess QC) and Standard Operating Procedures (SOPs) for field sampling and handling.

To assess the usability of the data prior to making decisions, the data will be assessed against pre-determined Data Quality Indicators (DQIs) for completeness, comparability, representativeness, precision and accuracy. The acceptable limit on decision error is 95% compliance with DQIs. The pre-determined DQIs established for the project are discussed below in relation to precision, accuracy, representativeness, comparability and completeness (PARCC parameters), as follows:

- **Precision:** Measures the reproducibility of measurements under a given set of conditions. Field precision will be monitored through the use of PRMs SOPs and ensuring that these are complied with throughout the sampling event(s). Suitable criteria and/or performance indicators for assessment of laboratory precision include



performance of intra-laboratory and inter-laboratory duplicate sample sets through calculation of Relative Percentage Differences (RPD).

- **Accuracy:** Measures the bias in a measurement system. Accuracy in the field activities will be monitored through the use of SOPs and ensuring that these are complied with throughout the sampling event(s). The accuracy of the laboratory data that are generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness:** Expresses the degree which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to validate the site to the required accuracy. To ensure the data produced by the laboratory is representative of conditions encountered in the field, the following steps will be taken:
  - Blank samples will be run at the laboratory in parallel with field samples to confirm there are no unacceptable instances of laboratory artefacts.
  - Review of RPD values for field and laboratory duplicates to provide an indication that the samples are generally homogeneous, with no unacceptable instances of significant sample matrix heterogeneities.
  - The appropriateness of collection methodologies, handling, storage and preservation techniques will be assessed to ensure/confirm there was minimal opportunity for sample interference or degradation (i.e. volatile loss during transport due to incorrect preservation/transport methods/sampling technique for example).
- **Comparability:** Expresses the confidence with which one data set can be compared with another. In the event that the reported data sets are comprised of data sets from separate sampling events, issues of comparability between data sets are reduced through adherence to the same SOPs on each data gathering activity. In addition, the data will be collected by experienced samplers and NATA accredited laboratory methodologies will be employed in all laboratories.
- **Completeness:** Is defined as the percentage of measurements made which are judged to be valid measurements. In assessing the completeness of the field data the following is considered:
  - All critical locations and depths sampled.
  - Representative samples collected.
  - An appropriately experienced sampling team is engaged in the investigation program.

In validating the degree of completeness of the analytical data sets acquired during the program the following is considered:

- Whether SOPs for sampling protocols have been adhered to
- Copies of all project chain of custody (COC) documentation are reviewed and presented.

It can therefore be considered whether the proportion of "useable data" generated in the data collection activities is sufficient for the purposes of the land use assessment.

The measures/criteria employed to enable review of these parameters are detailed in **QA/QC** presented in **Section 11**.

## Step 7: Optimise the design for obtaining the data

The remediation program presented is aimed at obtaining the necessary data to allow the identified decisions in Step 2 to be made.

## 10.2. Validation Assessment Criteria

Site investigation criteria provided in NEPM 2013 are not intended to be used as clean-up or remediation criteria. However, the following criteria derived from NEPM (2013) and CRC Care (2011) guidelines are applicable based on the proposed divestment to residential land use. The validation assessment criteria (VAC) are summarised in **Table 13**.

<b>Table 13: Validation Criteria</b>	
<b>VAC</b>	<b>Applicability</b>
Health Investigation Level (HIL) A: residential land use with accessible soil.	HIL A has been selected to assess suitability for the sites zoning of R2 – low density residential.
Health Screening Level (HSL) A: low – high density residential.	In accordance with NEPC (2013) methodology, HSL for petroleum hydrocarbon compounds have been adopted for coarse grain soils as a conservative measure due to the mixed soil profiles identified onsite
Ecological Investigation Levels and Ecological Screening Levels (EIL/ESL).	EILs and ESLs for urban residential and public open space, and site specific ILs as per PRM (2018) have been selected.
Management Limits (ML)	In addition to the HIL/HSLs NEPM also includes 'Management Limits' that are designed to avoid or minimise the potential effects of petroleum hydrocarbons such as formation of observable light non-aqueous phase liquids (LNAPL), fire and explosive hazards and effects on buried infrastructure e.g. penetration of, or damage to, in-ground services by hydrocarbons. The application of the management limits requires consideration of the depth of building basements and services and depth to groundwater.
Aesthetic Impact	<p>As per NEPM 2013 the aesthetic condition of a site is required to be taken into account. An assessment of site aesthetics requires consideration of the natural state of soil on any given site, and a comparison between it and the soil encountered during investigation works.</p> <p>NEPM 2013 advises that:</p> <p><i>There are no specific numeric aesthetic guidelines, however site assessment requires balanced consideration of the quantity, type and distribution of foreign materials or odours in relation to the specific land use and it's sensitivity. For example, higher expectations for soil quality would apply to residential properties with gardens compared with industrial settings'.</i></p> <p>Given these NEPM (2013) requirements, the aesthetic criteria of relevance to the site are considered to be:</p> <ul style="list-style-type: none"> <li>• No malodorous nature (odour).</li> <li>• Significant discolouration (staining).</li> <li>• Significant volumes of various types of anthropogenic contaminants (e.g. demolition rubble) on the site surface.</li> </ul>

## 10.3. Asbestos Air Monitoring

Due to the presence of asbestos contamination at TP11 of RA1, and the proximity of the site to neighbouring residents, asbestos fibre air monitoring (AAM) is advised for all excavation work in the vicinity of TP11 in RA1. The results of the monitoring should be provided by the environmental consultant to the principal contractor each workday to confirm that control measures are adequate prior to works commencing the next day. The results of the air monitoring will be included in the Validation Report.

### 10.3.1. Exposure Trigger Levels

Trigger levels for airborne asbestos fibres have been adopted from the Code of Practice *How to Safely Remove Asbestos in the Workplace have been developed for asbestos*.

AAM results should be obtained within 24 hours of sample collection. While this precludes "real time" monitoring, inspections will be made by the LAA during excavation and loading



works and, if there are any visible dusts, amendments to the adopted dust management procedure will be made to mitigate the potential release of airborne asbestos fibres.

**Table 14: Airborne Fibre Trigger Values**

Action Level	Controls and Actions
< 0.01 fibres/ml	No new control measures are necessary and continue with control measures
>=0.01 fibres/ml but <= 0.02 fibres/ml	1. Review control measures
	2. Investigate the cause
	3. Implement controls to eliminate or minimise exposure and prevent further release
> 0.02 fibres/ml	1. Stop removal work
	2. Notify regulator (SafeWork NSW) by phone followed by email or written statement that work has ceased and the results of the air monitoring
	3. Investigate the cause and conduct a thorough visual inspection of the enclosure (if used) and associated equipment in consultation with all workers involved with the removal work
	4. Implement controls to eliminate or minimise exposure and prevent further release and extend the isolated/barricaded area around the removal area/enclosure as far as reasonably practicable (until fibre levels are at or below 0.01 fibres/ml, wet wipe and vacuum the surrounding area, seal any identified leaks (e.g. with expandable foam or tape) and smoke test the enclosure until it is satisfactorily sealed.
	5. Suspend removal works until further air monitoring is conducted and do not recommence until fibre levels are at or below 0.01 fibres/ml

## 10.4. Validation Strategy

A validation program will be undertaken during and following completion of the remediation works to demonstrate that the remediation works have met the nominated remediation goals. The adopted validation strategy consists of validation sampling and analysis and qualitative assessment (through visual observations) of the remediation works.

### 10.4.1. Validation of Remediation Areas

For RA1 and RA2 (excluding building footprints), the following will be completed by the Environmental Consultant:

- Soil samples collected from the base and walls of excavations. Samples will be collected in a systematic sampling pattern of one sample per 20 m lineal for wall >0.5m in height and one sample per 400 m<sup>2</sup> for the base (i.e 20 x 20m grid).
- All soil samples will be collected using a fresh pair of disposable nitrile gloves and placed into laboratory supplied, teflon-lined sample jars and labelled with a unique sample ID. Collected samples will be immediately transferred to laboratory supplied sample jars.
- Samples will be analysed by a NATA accredited laboratory for TRH, heavy metals and PAH.
- Each 20 x 20m grid will also require a visual assessment by the site LAA to confirm no suspected ACM is present.
- All soil samples will be assessed against criteria outlined in **Table 13**.
- If initial analytical results are above the adopted VAC further vertical and/or lateral excavation will be required, and a second round of validation samples will be collected. This will continue until all wall and base validation samples meet the VAC.
- Where asbestos is expected to be encountered (i.e. in the vicinity of TP11, RA1), daily Asbestos Air Monitoring will be undertaken to ensure controls are adequate.

- An asbestos clearance certificate (ACC) will be prepared by the hygienist following removal of any asbestos impacted fill. Once the ACC has been prepared for the area directly surrounding TP11, the requirement for ongoing AAM can be determined by the supervising hygienist/LAA and Environmental Consultant. Additional ACM finds can then be managed via the unexpected finds protocol.
- Material tracking and material importation information will be reviewed to ensure compliance with this RAP, including landfill disposal dockets for soils and miscellaneous waste items.
- Reporting (see **Section 10.6**).

### 10.4.2. Building footprints

For building 1 (B1) and building 2 (B2) the following validation is required to be completed by the environmental consultant following building demolition, offsite disposal and excavation (where required):

- Additional targeted sampling will be undertaken from the base of the excavation of the building footprint. Samples will be collected in a systematic sampling pattern of one sample per  $\sim 64\text{m}^2$  (i.e.  $8 \times 8\text{m}$  grid) across each building footprint.
- All soil samples will be collected using a fresh pair of disposable nitrile gloves and placed into laboratory supplied, teflon-lined sample jars and labelled with a unique sample ID. Collected samples will be immediately transferred to laboratory supplied sample jars.
- Samples will be analysed by a NATA accredited laboratory for TRH, heavy metals and PAH.
- The building footprint will require a visual assessment by the site LAA to confirm no suspected ACM is present.
- All soil samples will be assessed against criteria outlined in **Table 13**.
- If initial analytical results are above the adopted VAC further vertical and/or lateral excavation will be required, and a second round of validation samples will be collected. This will continue until all wall and base validation samples meet the VAC.
- Where asbestos is expected to be encountered, daily Asbestos Air Monitoring will be undertaken to ensure controls are adequate.
- An asbestos clearance certificate (ACC) will be prepared by the hygienist following removal of any asbestos impacted fill.
- Material tracking and material importation information will be reviewed to ensure compliance with this RAP, including landfill disposal dockets for soils and miscellaneous waste items.
- Reporting (see **Section 10.6**).

### 10.4.3. Areas not undergoing remediation

Following the removal of hardstand, the central portion of the site (between RA1 and RA2) will require additional validation sampling to ensure the residual fill material not being removed is suitable to remain onsite. The following validation sampling will be adapted for the central portion of the site:

- Samples will be collected in a systematic sampling pattern of one sample per  $400\text{m}^2$  (i.e.  $20 \times 20\text{m}$  grid).
- All soil samples will be collected using a fresh pair of disposable nitrile gloves and placed into laboratory supplied, teflon-lined sample jars and labelled with a unique sample ID. Collected samples will be immediately transferred to laboratory supplied sample jars.
- Samples will be analysed by a NATA accredited laboratory for TRH, heavy metals and PAH.

- Each 20 x 20m grid will also require a visual assessment by the site LAA to confirm no suspected ACM is present.
- All soil samples will be assessed against criteria outlined in **Table 13**.
- A visual inspection of the remnant fill will be completed by the project hygienist/LAA and an asbestos clearance certificate (ACC) will be prepared.
- Reporting (see **Section 10.6**).

## 10.5. Imported Materials

Where imported materials are required to be used, certified Excavated Natural Material (ENM) or certified Virgin Excavated Natural Material (VENM) must be used. All imported material is to be pre-approved by the supervising consultant prior to import.

## 10.6. Reporting

### 10.6.1. Validation Report

A validation report will be prepared by the environmental consultant at the completion of the remediation works in accordance with NSW EPA guidance and will contain as a minimum:

- Details of the remediation works conducted, including detailed photographic log.
- Information demonstrating that the objectives of the RAP have been achieved.
- Information demonstrating compliance with appropriate regulations and guidelines.
- Information detailing material tracking undertaken during the work, including imported material tracking undertaken during the works, including imported material and material disposed of offsite (if required).
- Any variations to the strategy noted during the implementation of the remediation.

### 10.6.2. Environmental Management Plan

All contaminated soils are proposed to be excavated and removed from site. Therefore, an Environmental management Plan (EMP) is not expected to be required. However, if contaminated material remains around services at the site where it is not practicable to remove, an EMP may be required. If it becomes apparent that an EMP will be required for this situation, then such a plan should be prepared by the Environmental Consultant.

## 11. QA/QC Plan

### 11.1. Field Quality Assurance and Quality Control

All field and laboratory procedures are to be assessed for DQIs in accordance with the NSW EPA (2017) *Contaminated Site: Guidelines for the NSW Site Auditor Scheme*. The QA/QC protocols to be adopted during remediation and validation are summarised in **Table 15**.

**Table 15: Field QA/QC Procedures**

Field Procedure	QA Procedure Description
Sampling Team:	Environmental Consultant must be professionally qualified environmental scientists and engineers trained in conducting site contamination projects.
Equipment Calibration:	All equipment will be calibrated as specified in relevant operator manuals. If a PID is used for the remediation works, then it should be calibrated using isobutylene gas at the start of each shift.
Chain of Custody Forms:	All samples will be logged and transferred under appropriately completed Chain of Custody forms.
Preservation:	All samples will be received at the laboratory in appropriately preserved containers, with preservation including packing samples with ice packs in eskies.
Rinsate Blanks:	Rinsate blanks will be collected at a rate of one per piece of equipment per day (if sampling equipment other than a fresh nitrile glove is used) to determine if any cross contamination may have occurred during sampling, as specified given in Section 8 of Australian Standard AS4482.1-2005. Rinsate blanks are to be analysed for Metals, TRH/BTEX PAH.
Blind Field Duplicates (for testing by Main Lab):	Blind field duplicate samples will be prepared in accordance with procedures given in Section 8 of Australian Standard AS4482.1-2005. The frequency of blind field duplicate testing will correspond to at least 5% for soil samples (1 in 20 samples). Blind duplicates are to be analysed for the same analytical suite as the primary sample.
Split Samples (for Inter-Laboratory Testing):	Split samples will be prepared will be prepared in accordance with procedures given in Section 8 of Australian Standard AS4482.1-2005. The frequency of blind field duplicate testing will correspond to at least 5% for soil samples (1 in 20 samples). Split samples are to be analysed for the same analytical suite as the primary sample.
Trip Spike and Trip Blank:	A trip spike and trip blank will be included with each sampling event. Trip spikes and trip blanks will be analysed for TRH C6-C9 and BTEX.

### 11.2. Laboratory Quality Assurance and Quality Control

The primary and secondary laboratories must be NATA registered for the specified tests. A data validation process is to be used to assess the effectiveness of the overall analytical process and to assess the use of data.

**Table 16** outlines the data validation criteria, qualifications to the data and the overall QA/QC procedures used for the laboratory testing program.

**Table 16: Laboratory QA/QC**

Procedure	QA Procedure Description
Holding Times	Holding times are the maximum permissible elapsed time in days from the collection of the sample to its extraction and/or analysis. All extraction and analyses will be completed within standard guidelines.
Reagent Blanks	The reagent blank sample is a laboratory prepared sample containing the reagents used to prepare the sample for final analysis. The purpose of this procedure is to identify contamination in the reagent materials and assess potential bias in the sample analysis due to contaminated reagents. The QC criterion is no detectable contamination in the reagents.
Laboratory Duplicates	Laboratory duplicates are field samples that are split in the laboratory and subsequently analysed a number of times in the same batch.

**Table 16: Laboratory QA/QC**

Procedure	QA Procedure Description
	These sub-samples are selected by the laboratory to assess the accuracy and precision of the analytical method. Intra-laboratory duplicates are performed on a frequency of 1 per 10 samples.
Laboratory Control Standard	A laboratory control standard is a standard reference material used in preparing primary standards. The concentration should be equivalent to a mid-range standard to confirm the primary calibration. Laboratory control samples are performed on a frequency of 1 per 20 samples or at least one per analytical run.
Matrix Spikes / Matrix Spike Duplicates (MS/MSD)	MS/MSDs are field samples to which a predetermined stock solution of known concentration has been added. The samples are then analysed for recovery of the known addition. Recoveries should be within the set range as stated by the laboratory.
Surrogate Spikes	Surrogate spikes provide a means of checking, for every analysis, that no gross errors have occurred at any stage of the procedure leading to significant analyte loss. Recoveries should be within the stated laboratory control limits.
QA/QC Conclusion	The QA/QC indicators should either all comply with the required standards or showed no variations that would have no significant effect on the quality of the data.

### 11.3. QC Sampling Frequency

If any of the above are not met, further assessment will be necessary to determine whether the non-conformance will significantly affect the usefulness of the data. Corrective actions may include requesting further information from samplers and/or analytical laboratories, downgrading of the quality of the data or alternatively, re-collection of the data.

Project DQIs utilised for sampling are shown in **Table 17**.

**Table 17: Sample DQIs**

DQO	Frequency	DQI
Precision:		
Intra-laboratory field duplicates	1 per 20 primary samples	<50% RPD
Inter-laboratory field duplicates	1 per 20 primary samples	<50% RPD
Accuracy:		
Laboratory control samples	1 per batch	70-130%
Matrix spikes	1 per batch	70-130%
Surrogate spikes	1 per batch	70-130%
Representativeness:		
Sample transport and handling appropriate	All samples	Yes
Samples extracted and analysed within correct holding times	All samples	Organics: 14 days Inorganics: 6 months
Trip spike	1 per day when sampling for volatiles	60-140% recovery
Trip blank	1 per day	<LOR
Rinsate	1 per day when reusable equipment is used	<LOR
Comparability:		

**Table 17: Sample DQIs**

DQO	Frequency	DQI
Precision:		
Standard operating procedures for sampling	All samples	Yes
Standard analytical methods used	All samples	Yes
Consistent field conditions, sampling staff and laboratory analysis	All samples	Yes
Limits of reporting appropriate and consistent	All samples	Yes
Completeness:		
Appropriate documentation for testing and COC	All samples	Yes
Appropriate logging of soil and other field observations	All samples	Yes
Satisfactory QC frequency and results	All QC samples	Yes
Data considered 95% valid	-	-

## 12. Site Management

### 12.1. Responsibilities

The implementation of the controls outlined in this RAP are the responsibility of the PC engaged to undertake the works.

Onsite works should only be conducted by contractors/individuals who have read and acknowledged understanding of this RAP.

**Table 18** provides a summary of the responsibilities for the implementation and management of this RAP. These responsibilities do not replace any other regulatory responsibilities of the parties in relation to works within the work area.

Table 18: Role Definition	
Role	Definition
Site Owner	<ul style="list-style-type: none"> <li>Appoint Principal Contractor and Environmental Consultant.</li> <li>Confirm works are Category 2 under SEPP 55.</li> </ul>
Principal Contractor	<ul style="list-style-type: none"> <li>Comply with the RAP for all remediation works including relevant legislation and guidance (including the WHS Act 2011 and Regulation 2017 or relevant legislation current at the time of the works).</li> <li>To ensure that all licences, clearances, permits and approvals are in place in the appropriate manner.</li> <li>Inform the consultant if conditions change significantly from those documented in the RAP.</li> <li>On-site implementation of the RAP.</li> <li>Day to day management of the requirements of the RAP and ensuring that the checking, monitoring and inspection of appropriate mitigation measures for contract and sub-contract personnel is undertaken.</li> <li>Notification to client and the consultant and the appropriate external bodies (such as emergency services, regulatory authorities) in the event of an environmental incident.</li> <li>Development of traffic management plan for trucks entering and leaving the site.</li> <li>Temporary suspension of remediation work if the environment or health and safety of personnel or the community is at risk.</li> <li>Suspension of individuals from the remediation area where disregard for the RAP has been identified.</li> <li>Material tracking including detailed reconciliation ('cradle to grave') of imported materials and material disposed of offsite.</li> </ul>
Site Supervisor (as appointed by the Principal Contractor)	<ul style="list-style-type: none"> <li>Evaluate conditions and complete the Site Hazard Assessment at the commencement of works.</li> <li>Ensure all workers have undertaken any appropriate remediation inductions.</li> <li>Induct all personnel onto project specific WHS before any remediation works commence.</li> <li>Inform all contractors of identified hazards/risks that have the potential to affect their health or safety.</li> <li>Maintain security for the duration of the project.</li> <li>Ensure lines of communications are established and maintained.</li> <li>Comply with the RAP for all remediation works including relevant legislation and guidance (including the WHS Act 2011 and Regulation 2017 or relevant legislation current at the time of the works).</li> <li>Conduct a Daily Toolbox Talk with all workers at the commencement of each day's work.</li> <li>Monitor the works to ensure compliance with this RAP.</li> <li>Stop works if work practices deviate from the approved RAP or conditions are considered unsafe.</li> </ul>



**Table 18: Role Definition**

Role	Definition
Environmental Consultant	<ul style="list-style-type: none"> <li>• Provide the RAP to any worker or contractor (who is under the control of the Principal Contractor).</li> <li>• Ensure all parties clearly understand the RAP requirements and ensure that compliance with the RAP is a condition of any works undertaken by any contractor/site worker contracted by the Principal Contractor.</li> <li>• Provide remediation supervision to ensure that works are being completed in accordance with all statutory requirements, best practice guidelines and the requirements of the RAP.</li> <li>• Undertake sampling, validation reporting, air monitoring and waste classification (where required).</li> <li>• Update the RAP if they become aware that the site conditions have changed and inform any other parties (contractors/site workers, etc.) of the changes.</li> </ul>

## 12.2. Hours of Operation

The Principal Contractor shall be responsible for ensuring all works are conducted during the hours prescribed in the conditions of approval for the development.

The prescribed hours are assumed to be only between the hours of:

- 7.00am and 5.00pm Monday to Friday.
- 8.00am and 5.00pm on Saturdays.
- No work to be carried out on Sundays and public holidays.

## 12.3. Site Security

No person shall enter the site or remediation area without the permission of the Principal Contractor/Site Supervisor. Contractors and visitors must be inducted onto the site prior to the start of any planned works. During excavation / remediation works, signage at the work entrance and where appropriate safety fencing, will be maintained to restrict access to the works area. Only authorised persons will be able to enter the works area.

## 12.4. Site Induction

The Principal Contractor must ensure all personnel working on the site attend an induction prior to entering the site for the first time. The site induction should include a brief outline of the remediation project, details on general site hazards (e.g. vehicle movements, heavy machinery, contamination etc.) and details on the specific hazards associated with the remediation works including but not limited to:

- Nature of the materials being handled.
- Personal protective equipment to be utilised on site.
- Necessary decontamination procedures to be undertaken whilst on site.



## 12.5. Personal Protective Equipment

**Table 19** outlines the general PPE requirements onsite, which should be readily available for ALL personnel including contractors and visitors:

Table 19: Job Specific PPE Requirements			
Type	Description	Required Yes/No	Required Activities
Head Protection	Hard Hat	Y	All site activities
Eye Protection	Safety glasses with side shields	Y	All site activities
	Goggles	-	-
	Face shield	-	-
Hand Protection	Disposable latex gloves	-	-
	Disposable nitrile gloves	Y	Soil sampling activities
	Cut resistant gloves	Y	Manual handling activities
	Rubber gloves	-	-
	Gauntlets	-	-
Respiratory Protection	Respirator (nominate type and cartridge) Respiratory Protective Equipment (RPE) compliant to AS/NZS 1716:2009.	-	Half face respirators with particulate filter required when undertaking asbestos disturbance/removal works.
Body Protection	Disposable coverall Type 5, Category 3 (prEN ISO 13982-1) or equivalent.	Y	Required when undertaking asbestos disturbance/removal works.
	Sunhat, sunscreen, repellent	Y	If working in sun
General Environmental Protection	Cold weather gear	Y	Where required
	Wet weather gear	Y	Where required

## 12.6. Site Safety Signage

The below signs are representative of some Work Health Safety signs which should be utilised on site boundaries:



## 12.7. Protection of services

The Principal Contractor shall identify and mark out all services at the site and shall obtain utility plans from relevant authorities and Dial Before You Dig (DBYD) service and any relevant information as to the presence of services at the site.

It is the Principal Contractors responsibility to gain accurate information as to the depth, size and alignment of services. These may include overhead power cables, underground power, telecommunications, drains, sewers and water mains.

The Principal Contractor shall:

- Take special care to ensure that services are protected in accordance with the conditions specified by the controlling authority.
- Arrange for a representative from the controlling authority to be present, unless the authority directs otherwise, when the remediation contractor is:
  - Proving the locations of services.
  - Excavating within 1 m of the service.
  - Arrange with the appropriate authority for the closure and subsequent restoration of any service that must be shut down while the works are in progress.
  - Adopt a method for uncovering and protecting the service from damage if the service must be uncovered and left exposed, to the satisfaction of the controlling Authority.
  - Immediately inform the owner or controlling authority of any damage or interference to any service, structure or property.
  - Carry out any temporary bypass and restoration of the services to the satisfaction of the respective authorities and owners.

## 12.8. Environment and Work Health & Safety

An Environment and Works Health & Safety Management Plan must be prepared by the Principal Contractor prior to commencement of remediation works. The objectives of the Plan will be to:

- Protect the health of workers and the general public during the remediation works and comply with applicable health and safety legislation; and
- Ensure the works do not negatively impact on potential environmental receptors and comply with applicable environmental legislation.

All site staff, contractors and sub-contractors are to complete site-specific safety inductions and be made aware of the contamination type expected through the remediation.

**Table 20** lists key environmental and WHS considerations (related to remediation works) that are required to be included in the plan and some control measures to manage hazards. It is noted that the information is a guide only. The Principal Contractor is required to undertake their own environmental and safety hazard identification risk assessment as part of preparing the plan.

Table 20: Key Environmental and Health & Safety Hazards	
Hazard	Control Measure
Air quality / vapours /odours generated from remediation/excavation	<p>Potential odours or vapours associated with the site should be controlled as follows:</p> <ul style="list-style-type: none"> <li>• Use of appropriate covering techniques such as the use of plastic sheeting to cover excavation faces or stockpiles.</li> <li>• Use of fine mist sprays and odours-suppressant agents on the impacted areas/materials.</li> </ul> <p>If odours are detected the site is to be inspected the Environmental Consultant and any recommended control measures are to be implemented throughout the remediation process.</p>
Air quality – dust	<p>Dust management measures may include:</p> <ul style="list-style-type: none"> <li>• Erection of dust screens around the perimeter of the site / remediation / excavation areas.</li> <li>• Securely covering all loads entering and exiting the site.</li> <li>• Use of water sprays carts on exposed soil.</li> <li>• Cessation of operations that may generate dust during periods of high winds.</li> <li>• Covering of stockpiles of contaminated soil when not in use and minimising periods of stockpiling.</li> <li>• Keeping excavation surfaces moist; and dust monitoring.</li> </ul>

**Table 20: Key Environmental and Health & Safety Hazards**

Hazard	Control Measure
Air quality – asbestos	<ul style="list-style-type: none"> <li>If friable asbestos is uncovered the following controls will be required: Exclusion zone is to be set up around the area with warning signs. Supervision of works by licensed asbestos contractor.</li> <li>Wearing of appropriate additional PPE such as a suitable respirator, disposable overalls, steel capped boots and gloves removed in a decontamination area prior to leaving the asbestos impacted zone.</li> <li>Minimisation of dust generation in accordance with measures implemented for dust control.</li> <li>Air monitoring for airborne asbestos fibres for the duration of excavation works.</li> </ul>
Air quality- emissions from vehicles and plant	Plant and vehicles involved in the remediation will be properly maintained to ensure their emissions comply with applicable guidelines. Vehicles and plant will be turned off when not in use.
Surface water and sediment	<p>Adequate stormwater runoff, run-on and sediment control measures for the remediation works are required to avoid sediment discharge to the stormwater system. It is considered that the following control measures may be required:</p> <ul style="list-style-type: none"> <li>Placement of silt fencing and straw bales down-gradient of the work areas to intersect sediments and reduce the risks of erosion.</li> <li>Installing measures to divert clean stormwater away from exposed contaminated soil.</li> <li>Stop works during heavy rain events.</li> <li>Surface of stockpiles should be covered with polythene sheets or tarpaulins weighted with heavy objects when not in use.</li> <li>Soil stockpiles should be appropriately bunded to prevent spreading of contamination.</li> </ul> <p>Control measures should be implemented in accordance with the guidelines stated in Managing Urban Stormwater – Soils and Construction (NSW Department of Housing, 1998). All remediation areas shall be bunded to contain surface water runoff from the remediation areas and to prevent the leaching of contaminants into the subsurface. All surface water discharges from the bunded areas to Councils stormwater system shall not exceed the threshold concentrations specified in NSW EPA guidelines.</p>
Stockpiles	Stockpiles must be tracked from the point of excavation to their final disposal at a suitably licenced landfill.
Transport of soils	<p>Contaminated soil must be classified prior to disposal in accordance with NSW EPA (2014) Waste Classification Guidelines. Disposal of contaminated soil must meet the following requirements:</p> <ul style="list-style-type: none"> <li>Contaminated soil is to be trucked in accordance with NSW EPA requirements. Trucks used to transport contaminated fill shall meet the NSW EPA licensing requirements for the waste transported.</li> <li>Trucks used to transport contaminated fill must have a suitable covering for the load.</li> <li>The wheels and exterior of the vehicles must be cleaned down prior to leaving site.</li> <li>Truck movements shall be along designated transport corridors approved by Council.</li> <li>A copy of every landfill weigh-bridge docket for each load delivered will be forwarded to the environmental consultant to reconcile volume.</li> <li>A register of truck licence plates entering and leaving the site must be maintained.</li> <li>Drivers code of conduct to be developed and signed by all truck drivers.</li> </ul>
Designation, delineation and control of access to various work zones	<p>Appropriate work zones should be set up and maintained for the remediation works for the purposes of containing and controlling the potential transfer of contaminated soil and managing health and safety of workers and the general public during the remedial works. Some examples of zones that are likely to be required include:</p> <ul style="list-style-type: none"> <li>Remediation zones – these would be set up for various remedial</li> </ul>

**Table 20: Key Environmental and Health & Safety Hazards**

Hazard	Control Measure
	<p>works across the Site. Only people who are necessary for undertaking the work should enter these zones.</p> <ul style="list-style-type: none"> <li>Decontamination Zone – should be attached to each remediation zone. At the completion of the work, personnel and equipment used in remediation are to be decontaminated within the Decontamination Zone.</li> <li>Validated Zones – area where remediation and validation has been completed. Controls required to be implemented to ensure that the areas do not become recontaminated (e.g. by tracking contaminated soil through such zones etc).</li> <li>General Construction Zones – Areas where normal construction protocols apply and no specific remediation protocols are required.</li> </ul>
Hazardous materials (including fuel and chemical management)	Any hazardous materials should be stored in accordance with appropriate environmental and health and safety regulations. Refuel plant and equipment using mobile tanker in a designated area with appropriate environmental controls / bunding. Make available “spill kits” onsite. Clean up spillage as soon as practicable using spill kits.
Noise and vibration	<p>All equipment and machinery shall be operated in an efficient manner to minimise the emission of noise.</p> <p>In the event that complaints are received or if directed by Council, noise monitoring should be carried out by a recognised acoustic consultant. Noise control measures as recommended by the acoustic consultant should be implemented throughout the remediation process.</p> <p>Vibration emissions during remediation works must not result in damage to near-by premises or results in an unreasonable loss of amenity to nearby residents. The relevant provisions of the POEO Act must be satisfied at all times.</p> <p>Specific vibration controls will be set in vicinity of any heritage structures. In the event that complaints are received or if directed by Council, vibration monitoring will be carried out by a recognised vibration consultant. Vibration control measures as recommended by the vibration consultant will be implemented throughout the remediation process. Hours of operation will be in accordance with conditions of approval.</p>
Monitoring requirements	<p>Monitoring requirements at the site are likely to include:</p> <ul style="list-style-type: none"> <li>Regular visual monitoring to check environmental and safety controls are in place and effective.</li> <li>Visual monitoring for dust generation and dust monitoring.</li> <li>Observations of odours during the works.</li> <li>Monitoring using a PID for volatile compounds in the breathing zone for workers as well as on site boundaries. The action limits should be set based on the response factor of the PID to contaminants of concern on the site.</li> <li>Monitoring for airborne asbestos fibres.</li> </ul>
Work health and safety	<p>A Site-Specific Work Health &amp; Safety Plan (SSWHS) shall be prepared prior to the commencement of the work in accordance with the relevant legislation. Potential hazards specific to the remediation works (i.e. not hazards that would be commonly encountered on construction projects) include, but are not necessarily limited to:</p> <ul style="list-style-type: none"> <li>Dermal contact or ingestion of contaminated soil or groundwater.</li> <li>Inhalation of contaminated vapours.</li> <li>Inhalation of fibres.</li> </ul> <p>No eating, drinking, chewing gum or tobacco, smoking or any practice that involves hand to mouth transfer increases the probability of ingestion of foreign matter into the body.</p> <p>Personnel should ensure that hands are thoroughly washed before eating, drinking or smoking with an appropriate sanitizer (such as Chlorohexidine).</p> <p>Any clothing that becomes dirty from onsite work should be disposed of or washed separately from other clothes.</p>

## 12.9. Traffic Control Plan

Given the location of the site in a residential street, traffic control is unlikely to be required for trucks entering or leaving the site. If deemed required, the Principal Contractor will be responsible for ensuring that a suitable traffic management plan is developed.

## 12.10. Materials Tracking

It is important that the movement of contaminated soil, clean soil and soils classified for offsite disposal are tracked across the site and tracked to the final offsite disposal destination (where required). Therefore, a Materials Tracking Plan should be designed and implemented for the remediation works and any other works involving disturbance of soil.

The movement of materials across the site should be documented on a daily basis (until such time as all contaminated soils have been removed from the site and underlying soils have been confirmed to be free of any contamination). This should be undertaken using plans of the site marked up daily. These daily materials tracking plans will show all relevant feature of the site including excavations, validated areas; stockpiles movement; as well as indicating any movement of material within or off the site. Appropriate tracking forms should be developed and completed for materials movements.

If site constraints allow, it is recommended that appropriate work zones should be set up and maintained for the remediation works; these are likely to include:

- Remediation zones – these would be set up for various remediation works across the site. Only people who are necessary for undertaking the work should enter these zones.
- Validated Zones – area where remediation and validation has been completed. Controls required to be implemented to ensure that the areas do not become re-contaminated (e.g. by tracking contaminated soil through such zones etc).
- General Construction Zones – Areas where normal construction protocols apply, and no specific remediation protocols are required.

All stockpiles must be tracked and managed from the point of excavation to their final disposal at a suitably licenced landfill (if required). Specific considerations for stockpiles will include:

- No stockpiles shall be placed on footpaths or nature strips.
- To reduce dust and stormwater issues, the period and volume of stockpiling should be minimised.
- All stockpiles shall be placed within an erosion containment boundary away from drainage lines, gutters or stormwater pits or inlets.
- Plastic sheets or similar to be placed beneath stockpiles, or stockpiles will be established on paved or hardstand areas.
- Covering of stockpiles with membranes (polythene sheets or tarpaulins weighted with heavy objects).
- Appropriate bunding of stockpiles to prevent spreading of contamination.
- Placement of silt fencing and straw bales downslope of the stockpile area to intersect sediments.

## 13. Emergency Procedures and Response

In the event of an emergency, the safety of people shall always be the FIRST priority. Provided no other risks to human life are present, attend to any injured personnel in so far as is required to prevent further injury.

ALL personnel within the works area shall be alerted to emergencies by verbal command and directed to a designated muster or assembly point.

If a spill has occurred, provided the safety of those on or off-site has been determined and emergency services have been notified, take all practical steps to prevent the spill from reaching all environmental receptors both on and off site.

Incidents, injuries and near misses must be reported into the Principal Contractor and client immediately. Environmental incidents need to be reported immediately to the client representative and the responsible authorities.

**Table 21: Summary of Potential Emergencies**

Emergency	Action
Fire or Explosion	Call the fire brigade on 000. Evacuate the area and assemble at assembly point. Warn third parties that may be impacted by the event. Ensure fire brigade is met at the site.
Medical Emergencies	<p>Prior to arrival on-site:</p> <ul style="list-style-type: none"> <li>• Ensure First Aid kits are up to date and contain First Aid supplies relevant to the nature of the work done on site.</li> <li>• Ensure appropriate first aid equipment is carried at all times.</li> <li>• Ensure at least one field person has a Senior First Aid Certificate.</li> </ul> <p>In the event of an Injury:</p> <ul style="list-style-type: none"> <li>• Apply First Aid, provided you do not place yourself or others at risk.</li> <li>• For serious injuries including hit by vehicle, vehicle accident, bitten by a snake or spider etc.</li> <li>• Call 000 for an Ambulance.</li> </ul>
Loss of Contaminant	Stop work. Use temporary bunding material to limit the extent of the spill and block storm water drains.
Utility Strike	Stop work. Assess if the area needs to be evacuated. Inform the relevant utility company.
Meteorological Event	<ul style="list-style-type: none"> <li>• Check Bureau of Meteorology website before travel to site: <a href="http://www.bom.gov.au">www.bom.gov.au</a>.</li> <li>• Listen to local radio stations for any weather alerts.</li> <li>• Regularly check the local weather forecast.</li> <li>• Drive with due care in adverse weather conditions.</li> <li>• Pull over and stop if road conditions are unsafe.</li> <li>• Cancel field work if necessary.</li> </ul>
Vehicle Collision	<p>Prior to arrival on-site:</p> <ul style="list-style-type: none"> <li>• Ensure driver is appropriately licensed and that Pre-Start Checklist has been completed.</li> </ul> <p>In the event of a Vehicle Accident:</p> <ul style="list-style-type: none"> <li>• Assess self for injuries.</li> <li>• If uninjured, and it is safe to do so, drive vehicle to side of road and turn on hazard lights.</li> <li>• If uninjured, and safe to do so, assess injuries of other occupants.</li> <li>• If necessary, apply first aid to self or others' injuries.</li> <li>• Call the emergency services on 000 if anyone is injured.</li> </ul>
Biological (snake, spider, bee etc.)	<ul style="list-style-type: none"> <li>• Ensure at least one field person has a Senior First Aid Certificate.</li> <li>• Ensure first aid kit has set press bandages.</li> <li>• Appropriate PPE.</li> <li>• Ensure all staff know how to administer EpiPen if relevant.</li> </ul>

**Table 21: Summary of Potential Emergencies**

Emergency	Action
Heat or Cold Stress	<ul style="list-style-type: none"> <li>• Check the local weather forecast.</li> <li>• Increase hot/cold fluid intake.</li> <li>• Appropriate PPE.</li> <li>• Ensure First Aid Kit has emergency space blanket/ice-packs.</li> <li>• Stop and rest as necessary in extreme conditions.</li> </ul>

### 13.1. Emergency Muster Point

In the event of an incident or emergency, all personnel shall stop all works, shut down all equipment (where practical and safe to do so) and relocate to the muster point/s.

**Table 22: Emergency Muster Point**

Emergency	Action
Location of muster or assembly point (refer to site plan).	To be confirmed by Principal Contractor
Fire, Ambulance or Police	000 (Australia)
Closest Hospital	Canterbury Hospital, 575 Canterbury Road, Campsie NSW 2194



## 14. Conclusion

This RAP documents remediation and validation strategies to address contamination on the site including waste classification of materials to be disposed offsite as part of the site remediation and contingency measures for various scenarios that could arise during the remediation.

It is considered that following full implementation of this RAP the site will be suitable for the proposed R2 low density residential land use.

All remediation works are required to be supervised, validated and reported by a suitably qualified consultant, and must be audited by a NSW EPA accredited site auditor and include a site audit statement detailing the findings of the audit.



## 15. Limitations

This report is confidential and has been prepared by Progressive Risk Management Pty Ltd (PRM) for Sydney Water Corporation (the client). This report may only be used and relied upon by the client and must not be copied to, used by or relied upon by any person other than the client.

This report is limited to the observations made by PRM during the 2018 contamination assessment and information and documentation provided by the client. PRM has assumed that the information provided is complete, accurate and reliable. PRM has not sought to independently verify those sources or the information provided by those sources and have not provided a warranty as to the completeness, accuracy, reliability or appropriateness of the information provided unless otherwise stated.

All results, conclusions and recommendations presented should be reviewed by a competent person before being used for any other purpose. PRM accepts no liability for use of, interpretation of or reliance upon this report by any person or body other than the client. Third parties must make their own independent inquiries.

This report should not be altered amended or abbreviated, issued in part or issued incomplete without prior checking and approval by PRM. PRM accepts no liability that may arise from the alteration, amendment, abbreviation or part-issue or incomplete issue of this report. To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by PRM and this report are expressly excluded (save as agreed otherwise with the client).

PRM shall bear no liability in relation to any change to site conditions after the date of this report. This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope and limitations defined herein (*Scope of Works*). Should information become available regarding conditions at the site including previously unknown sources of contamination, PRM reserves the right to review the report in the context of the additional information.

## Figures

Figure 1: Regional Site Location

Figure 2: Site Layout

Figure 3: Previous Sample Locations and Exceedances

Figure 4: Remediation Areas

326700

326600

326500

326400

6247600

6247500

6247400

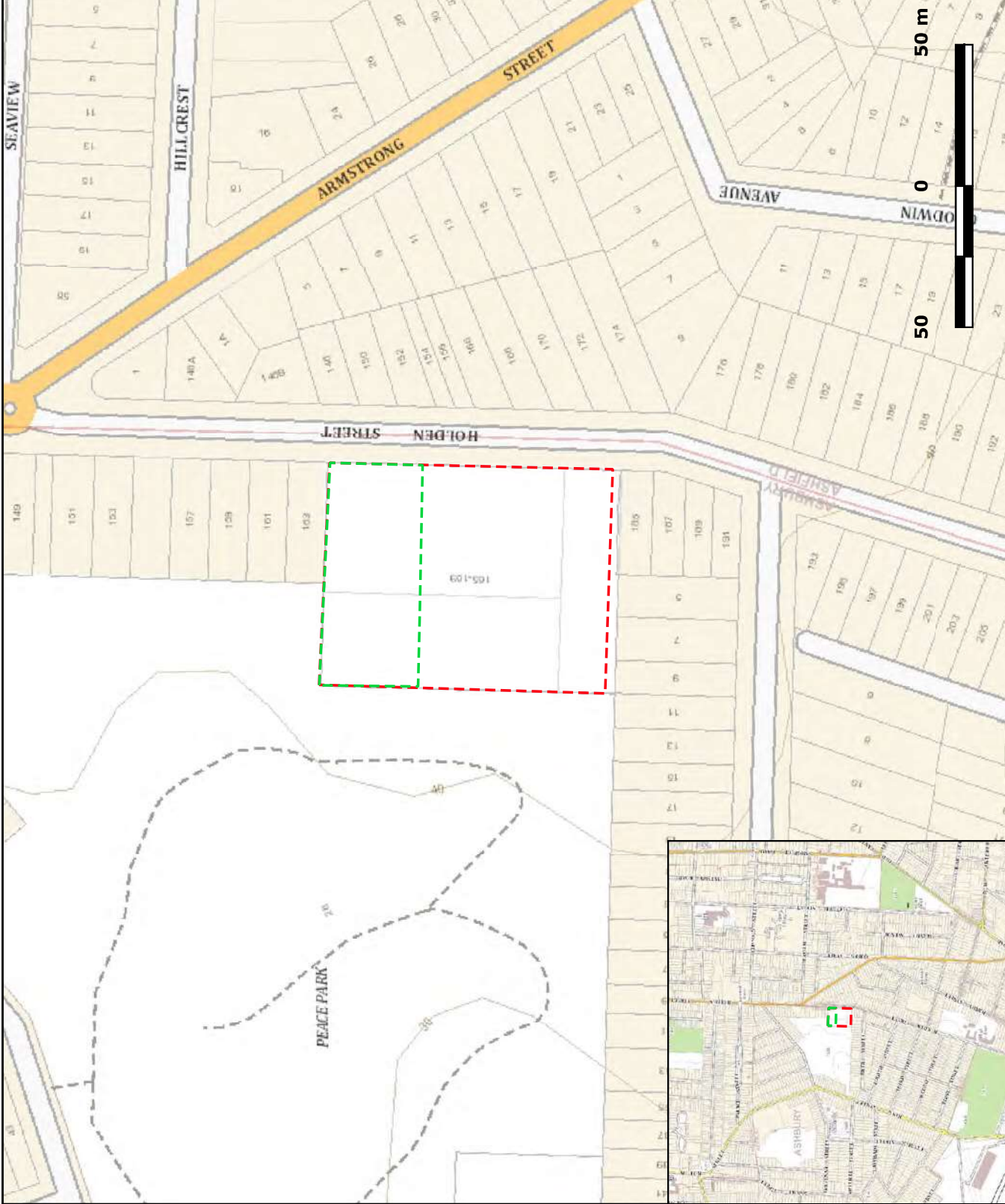
6247300

326400

326500

326600


326700



Project Reference	P034963.001
Report Name	Remediation Action Plan
Client	Sydney Water

**165-169 Holden Street,  
Ashbury NSW**

**Figure 1  
Site Locality**



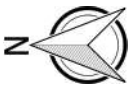
**PROGRESSIVE RISK MANAGEMENT**

Scale: 1:2000

Coord. Sys: GDA 1994 MGA Zone56

**Legend**

- Approximate Site Boundary (disposal area)
- Approximate Sydney Water Property



N















Project Reference	P034963.001		
Report Name	Remediation Action Plan		
Client	Sydney Water		
165-169 Holden Street, Ashbury NSW			
Figure 2 Site Layout			
			
PROGRESSIVE RISK MANAGEMENT			
Scale: 1:850			
Coor. Sys: GDA 1994 MGA Zone56			
<div>Legend</div> <div> Site Boundary (disposal area)</div> <div> Approximate Sydney Water Property</div> <div> Inaccessible Areas (buildings)</div>			
			Image Source: Metromap (2020)





Image Source: Metromap (2020)

Project Reference	P034963.001
Report Name	Remediation Action Plan
Client	Sydney Water
165-169 Holden Street, Ashbury NSW	
Figure 3 Sampling Locations and Site Exceedances	
	
PROGRESSIVE RISK MANAGEMENT	
Scale: 1:500	
Coord. Sys: GDA 1994 MGA Zone56	
<b>Legend</b> <div><div> Site Boundary (disposal area)</div><div> Approximate Sydney Water Property</div><div> Inaccessible Areas (buildings)</div><div> PRM Testpit Locations (2018)</div><div> PB Testpit Location (2015)</div><div> EIL/ESL Exceedance</div><div> HIL/HSL Exceedance</div><div> Asbestos Detected</div></div> <div></div>	














Project Reference	P034963.001
Report Name	Remediation Action Plan
Client	Sydney Water
165-169 Holden Street, Ashbury	
Figure 4 Remediation Areas	
 PROGRESSIVE RISK MANAGEMENT	
Scale: 1:400	
Coord. Sys: GDA 1994 MGA Zone56	
<b>Legend</b> <div><div> Site Boundary (disposal area)</div><div> Approximate Sydney Water Property</div><div> RA1</div><div> RA2</div><div> Inaccessible Areas (buildings)</div><div> PRM Testpit Locations (2018)</div><div> PB Testpit Location (2015)</div></div>	
	

Image Source: Metromap (2020)

## **Appendix A: Imported Materials Protocol**

# Imported Materials Protocol

Any material imported to the site will need to be validated/checked prior to importation to prevent potentially contaminated material from being placed at the site. This includes, but not limited to, capping material, drainage aggregates and landscaping products (topsoil/growing medium). The following sections outline the requirements for the type of material imported to the site.

## ***Imported Material Types***

### ***Virgin Excavated Natural Material (VENM)***

Any VENM to be imported to the site, including natural quarried products, will need to meet the definition as outlined in the POEO 1997. Prior to VENM being imported to the site, the VENM source will need to be approved by the environmental consultant.

In order for the source to be approved the following will need to be provided/undertaken prior to the importation:

- Appropriate VENM documentation/report (should include source site history and soil chemical analysis) for each source site to be reviewed by the environmental consultant.
- For natural quarried products the appropriate documentation for each source/supplier/material type will need to be reviewed.
- Site inspection of the source site by environmental consultant following report approval.
- If required additional QA samples may need to be obtained and analysed (minimum of 3 samples per source). Samples to be analysed for the following combinations: heavy metals, PAHs, TRH, BTEX, OCPs/OPPs, PCBs and asbestos. Additional parameters may be required and dependant on source site history.
- Visual inspection upon importation to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation.

### ***Excavated Natural Material (ENM)***

Any ENM to be imported to the site must be assessed in accordance with the Excavated Natural Material Order 2014 (or more recent version if applicable at time of import). Prior to ENM being imported to the site, the ENM source will need to be approved by environmental consultant.

In order for the source to be approved the following will need to be provided/undertaken prior to the importation:

- Appropriate ENM documentation/report for each source site to be reviewed by environmental consultant.
- Site inspection of the source site by the environmental consultant following report approval.
- If required additional QA samples may need to be obtained and analysed (minimum of 3 samples per source). Samples analysis as per the Excavated Natural Material Order 2014.
- Analysis of source material for the presence/absence of asbestos (minimum of 1 samples per 100m<sup>3</sup>) and confirmation a visual inspection for the presence of asbestos was undertaken.
- Visual inspection upon importation to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation.



### ***Recycled Material Products***

Any recycled materials to be imported to the site will need to meet the relevant NSW EPA exemption and be fit for purpose at the site. Prior to the recycled materials being imported to the site, the source/supplier will need to be approved by the environmental consultant.

In order for the source to be approved the following will need to be provided/undertaken 3 to 4 days prior to the importation:

- Appropriate documentation/report for each source/supplier/material type to be reviewed by PRM. Documentation to include confirmation that material has been classified with reference to a relevant exemption.
- Inspection of the source/material by the environmental consultant following report approval.
- If required samples obtained and analysed (minimum of 3 samples per source/material type) for the following combinations: heavy metals, PAHs, TRH, BTEX, OCPs/OPPs, PCBs and asbestos.
- Visual inspection upon importation to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation.

### ***Landscaping Materials***

Prior to the landscaping materials being imported to the site, the source/supplier/material type will need to be approved by the environmental consultant.

In order for the material type to be approved the following will need to be provided prior to the importation:

- Appropriate documentation/report for each source/supplier/material type to confirm material has been produced under an appropriate standard is fit for purpose on the site. Documentation to be reviewed by the environmental consultant.
- Inspection of the source/material by the environmental consultant following documentation approval.
- Samples to be obtained and analysed (minimum of 3 samples per source/material type) for the following combinations: heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc); PAHs; TRH; BTEX; OCP; OPPs; PCBs; and asbestos.
- Visual inspection upon importation to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation.

### ***Assessment of Imported Materials (No Documentation)***

Should suitable VENM or ENM documentation not be available for a preferred source, the following sections outline the minimum requirements for assessing the source site:

#### ***VENM Assessment***

A VENM assessment sampling and reporting should incorporate the following:

- Details of the source site address and source site history.
- Description of material (soil type, colour, odours etc).
- A minimum of 1 sample per 1,000m<sup>3</sup> to a maximum of 10 samples per source site. QA/QC samples to be collected as required.
- Soil samples to be analysed for the following combinations: heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc); PAHs; TRH; BTEX; OCP; OPPs; PCBs; and asbestos. Additional parameters may be required and dependant on source site history. Electrical Conductivity (EC) and potential Hydrogen (pH) analysis may also be undertaken for a potential ENM classification should the source fail a VENM assessment.

- With the exception of asbestos, heavy metals and EC all analytical results must be less than the laboratory limit of reporting.
- Heavy metals to be consistent with background ranges.
- Asbestos to be absent.
- Laboratory report(s) from a NATA accredited laboratory including chain of custody documentation.

The report will need to also assess whether the material contains potential acid sulfate soils (PASS) or acid sulfate soils (ASS).

### ***ENM Assessment***

ENM assessments are to be undertaken in accordance with the Excavated Natural Material Order 2014 (or more recent version if applicable at time of import). The report must also include laboratory report(s) from a NATA accredited laboratory including chain of custody documentation. Additionally, for this site the ENM assessment should include analysis for the presence/absence of asbestos.

### ***Imported Materials Assessment Criteria***

Imported materials, such as recycled and landscaping materials will be compared to the following criteria:

- Heavy metals to be consistent with background ranges as per NEPM 2013.
- Organic compounds to be less than the laboratory limit of reporting.
- Asbestos to be absent (including ENM samples).
- Landscaping materials are to also consider NEPM 2013 ecological criteria.

Importation criteria for VENM and ENM has not been provided. However, asbestos must be absent from ENM samples. The QA samples, if obtained, will be compared to the supplied documentation of the source material report.

Further assessment of risk can be considered in relation to site specific circumstances / application and available documentation for each material type.

### ***Approval Prior to Importation***

In the event materials do not meet the applicable criteria detailed in sections above, materials will not be approved. All imported materials must be approved by the environmental consultant prior to importation. It may be beneficial to develop a tracking code system for each approved source site (e.g IMP001, IMP002 etc) and use this code when recording imported loads from the relevant source site.

### ***Imported Materials Tracking/Logging***

Dockets and quantities for all imported materials will need to be provided by the principal contractor to the environmental consultant. A 'gatehouse' system will need to be developed by the principal contractor to document all loads of imported materials coming onto the site. This should include truck registration, source site name, truck type etc. Material tracking must include a detailed reconciliation ('cradle to grave') of imported materials and material disposed of offsite

### ***Unexpected Finds***

In the event that imported materials arrive on site which do not meet the applicable criteria detailed in sections above, the following procedures must be completed:

- Stop work immediately and isolate the material via physical separation from other imported material and barrier tape.
- The Client Project Manager is to be notified as soon as practicable and within 24 hrs.
- The environmental consultant is to inspect the material the nature of the non-conformance.
- The Principal Contractor is to contact the source site and arrange for the material to be returned to the source site.
- The Principal Contractor is to provide written confirmation to the environmental consultant that the material has been received by the source site, including trucking dockets.

## **Appendix B: Site Survey**

SSM 137859 - SSM 137858  
177°43'12" 182.240 (MGA GROUND)  
177°43'35" - 182.25 (SURVEY)

SSM 137858 - SSM 137857  
186°35'40" 139.954 (MGA GROUND)  
186°35'40" 139.95 (SURVEY)

SSM 137857 - SSM 137856  
179°59'43" 120.962 (MGA GROUND)  
179°59'20" 120.97 (SURVEY)

SSM 137858 - CNR (A)  
190°24'30" 113.385

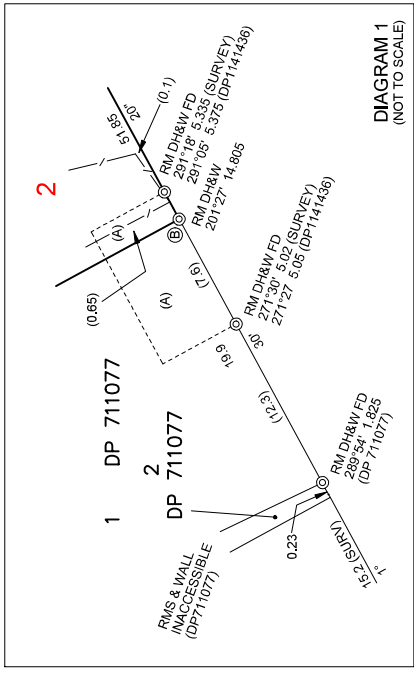
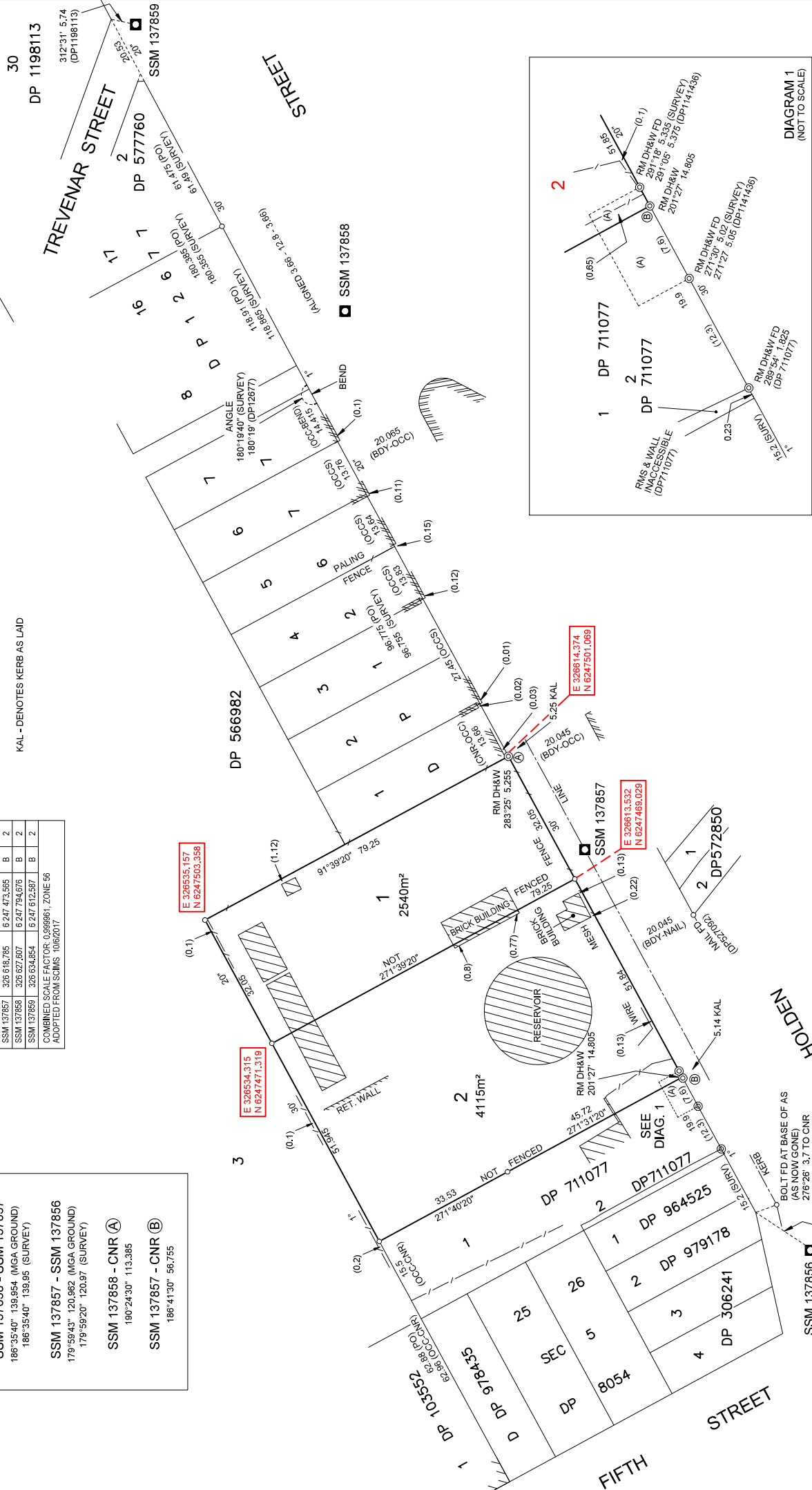
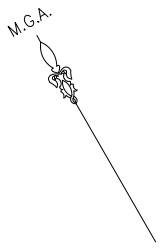
SSM 137857 - CNR (B)  
186°41'30" 56.755

SURVEYING & SPATIAL INFORMATION REGULATION 2012  
CLAUSES 35(1)(b), 51(2) AND 62

MARK	MGA COORDINATES - GDA 94		CLASS ORDER
	EASTING	NORTHING	
SSM 137859	326 618 795	6 247 352 608	B 2
SSM 137857	326 618 795	6 247 473 565	B 2
SSM 137858	326 627 807	6 247 794 576	B 2
SSM 137856	326 634 854	6 247 612 587	B 2

COMBINED SCALE FACTOR: 0.999961, ZONE 56  
ADOPTED FROM SCIMS 10/6/2017

(A) - EASEMENT FOR ELECTRICITY & OTHER PURPOSES 5.3 WIDE (DP1141436)  
KAL - DENOTES KERB AS LAID



SURVEYOR: Name: MATTHEW WILLIAM CLEARY Date: 29/5/2017 References: 118234504_02	PLAN OF SUBDIVISION OF LOT 1 IN DP911478 AND LOT 1 IN DP115504	REGISTERED	DP OR SP NUMBER
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## Abbreviations

Term	Definition
As	Arsenic
Cd	Cadmium
Cr	Chromium
Cu	Copper
bgs	Below ground surface
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CSM	Conceptual Site Model
DO	Dissolved oxygen
DP&E	NSW Department of Planning and Environment
DQO	Data Quality Objectives
EC	Electrical conductivity
EH	Redox potential
EIL	Ecological Investigation Level
EPA	New South Wales Environment Protection Authority
GSV	Ground Screening Value
HBM	Hazardous Building Materials
HGG	Hazardous Ground Gas
Hg	Mercury
HIL	Health Based Investigation Level
LOR	Limit of Reporting
MAH	Monocyclic Aromatic Hydrocarbon
NEPC	National Environment Protection Council
Ni	Nickel
OCP	Organochlorine Pesticide
OPP	Organophosphorus Pesticide
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCB	Polychlorinated Biphenyls
PRM	Progressive Risk Management
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percentage Difference
SAR	Site Audit Report
SAS	Site Audit Statement
TRH	Total Recoverable Hydrocarbons
Zn	Zinc

## 1. Introduction

### 1.1 Introduction and Background

Andrew Lau of JBS&G Australia Pty Ltd (JBS&G) was engaged by Sydney Water Corporation (Sydney Water, the client) on 17 March 2021 to conduct a site audit for the property located at 165 – 169 Holden Street, Ashbury NSW ('the site'). The site is legally identified as part Lot 1 DP115504 and part Lot 1 DP 911478 (proposed Lot 1 in plan of subdivision of Lot 1 DP115504 and Lot 1 DP911478), occupying an area of approximately 2,540 m<sup>2</sup> (**Appendix C**).

The site was historically used as a depot associated with the adjoining Sydney Water reservoir located to the south. The site has been owned by Sydney Water since 1909. The site is proposed to be divested for low density residential land use and form Lot 1 of the subdivision of the Sydney Water Reservoir property. Rezoning of the site from SP2 Infrastructure (Water Supply) to R2 Low Density Residential under the *Canterbury Local Environmental Plan 2012* (CLEP 2012) has been proposed.

A Hazardous Ground Gas and Groundwater Assessment (Progressive Risk Management 2019a), Data Gap Analysis (Progressive Risk Management 2019b) and Summary of Contamination Condition report (Progressive Risk Management 2019c) were prepared for the site in 2019. As part of the planned redevelopment process and consistent with relevant guidelines relating to the management of land contamination as part of the planning process, a non-statutory audit was conducted. The three reports were reviewed by the auditor, and a Site Audit Report (SAR) (JBS&G 2019<sup>1</sup>) and Site Audit Statement (SAS) were issued in August 2019. Conclusions drawn by the auditor, as part of the aforementioned SAS and SAR, stated that the site investigations conducted by the consultant had been conducted appropriately to determine the nature and extent of contamination at the site and that concentrations of contaminants identified in soil required remediation or management for use of the land for residential with accessible soil/gardens use.

For the purposes of ensuring that this SAR is a self-contained document, background information presented in the aforementioned previous audit for the site has been repeated in the relevant sections of the audit report.

Andrew Lau is a site auditor accredited by the NSW Environment Protection Authority (EPA) under the *Contaminated Land Management Act 1997* (CLM Act 1997) (Accreditation Number 0503). The audit was completed with the assistance of Christine Louie, a JBS&G senior consultant trained and experienced in contaminated land assessment, remediation and auditing.

### 1.2 Objectives of the Site Audit

The objectives of this site audit were to:

- Independently review the Remediation Action Plan (RAP) prepared for the site (Progressive Risk Management 2021); and
- Prepare a SAR and issue a SAS, in accordance with the requirements of the Gateway Determination for the site, providing an opinion on whether the site can be made suitable for all permissible uses within the R2 Low Density Residential zone (at the date of completion of this audit), subject to remediation in accordance with a RAP.

---

<sup>1</sup> Site Audit Report 0503-1805, 165-169 Holden Street, Ashbury NSW. JBS&G Australia Pty Ltd, reference 54448/122753 (Rev 0), dated 16 August 2019 (JBS&G 2019);

In accordance with the requirements of the CLM Act 1997, the site audit was undertaken with consideration to:

- The provisions of the CLM Act, Regulations and subsequent amendments;
- The provisions of any environmental planning instruments applying to the site; and
- Relevant guidelines made or approved by the EPA (**Appendix A**).

### 1.3 Type of Audit

The site audit is being undertaken in response to council requirements to meet Gateway Determination for the amendment of the CLEP 2012 for rezoning of the site land of the land from SP2 Infrastructure (Water Supply System) to R2 Low Density Residential. Specific conditions and requirements regarding the involvement of an Accredited Site Auditor have been stipulated and require clarification that the land can be suitably remediated for all permissible land uses within the R2 Low Density Residential zone (at the date of completion of this audit) in accordance with a RAP. As such, the site audit has therefore been conducted as a statutory audit.

Site Audit Notification (SAN) number 0503-2103 was sent to the EPA on 19 March 2021, with receipt confirmation provided by the EPA on 23 March 2021 (EPA Reference DOC21/218972).

### 1.4 Documents Reviewed

The following documentation was reviewed as part of the site audit:

- *Remediation Action Plan, Ashbury Reservoir, 165-169 Holden Street, Ashbury NSW.* Progressive Risk Management Pty Ltd, reference P034963.001, Version F, dated May 2021 (PRM 2021).

The following additional documents were also considered during the site audit:

- *Combined Stage 1 and 2 Detailed Site Investigation Sydney Water Ashfield Reservoir, 165 – 169 Holden Street, Ashbury, NSW.* Parsons Brinckerhoff, reference 2201679B-CLM-RPT-1021 Rev C, dated 24 July 2015 (Parsons Brinckerhoff 2015);
- *Hazardous Building Material Pre-Demolition Audit, Ashbury Water Reservoir WS0003 165-169 Holden Street, Ashbury NSW.* Progressive Risk Management Pty Ltd, reference P033623.001/C0151, Revision 3: Final, dated November 2017 (PRM 2017); and
- *Hazardous Building Materials Removal Plan, Ashbury Water Reservoir WS0003 165-169 Holden Street, Ashbury NSW.* Progressive Risk Management Pty Ltd, reference P033623.002/C0151, Revision 3: Final, dated February 2018 (PRM 2018a).
- *Sampling, Analysis and Quality Plan, Ashbury Water Reservoir WS0003 165-169 Holden Street, Ashbury NSW.* Progressive Risk Management Pty Ltd, reference P033725.003/C0151, Rev 0, Final, dated August 2018 (PRM 2018b);
- *Hazardous Ground Gas and Groundwater Assessment, Ashbury Reservoir 165 – 169 Holden Street, Ashbury NSW.* Progressive Risk Management Pty Ltd, reference P033725.004/C0151, Version B Final, dated February 2019 (PRM 2019a);
- *Data Gap Analysis: Ashbury Reservoir, 165 – 169 Holden Street, Ashbury NSW.* Progressive Risk Management Pty Ltd, reference P033725.001, Version 5 Final, dated 17 June 2019 (PRM 2019b); and
- *Summary of Contamination Condition Part of Ashbury Reservoir, 165 – 169 Holden Street, Ashbury NSW.* Progressive Risk Management Pty Ltd, reference P033725.005/C0151, Version B, dated 17 June 2019 (PRM 2019c).

A Geotechnical Investigation was undertaken for the site in 2018. While the report did not form part of the audit, however, for consistency, relevant background information has been included in **Section 3.3** of this report.

Correspondence relating to the site audit is provided in **Appendix B**.

## 1.5 Site Inspections

The site was inspected on the date shown in **Table 1.1** below.

**Table 1.1: Summary of Audit Inspections**

Date	Attendance	Purpose
21 January 2018	Site Auditor Assistant (Christine Louie)	Site inspection to observe site layout and condition, and field works conducted by the consultant.

## 1.6 Chronology of Site Assessment Works

The process of the assessment and audits undertaken at the site has been chronologically listed in **Table 1.2**.

**Table 1.2: Summary of Investigation and Audit Works Undertaken at the Site**

Date	Purpose
July 2015	Combined Stage 1 and 2 Detailed Site Investigation was completed by Parsons Brinckerhoff (2015) to assess the contamination status of surplus land associated with the Sydney Water depot site.
October/November 2017	A Hazardous Building Materials Audit was conducted by Progressive Risk Management (PRM) (2018a).
23 November 2017	Commencement of site audit 0503-1805.
December 2017	A Hazardous Building Materials Removal Plan was prepared by PRM (2017) to outline the requirements for removal of hazardous building materials identified at the site.
February 2018	Site intrusive works for data gap assessment and pre-demolition soil testing undertaken by PRM. The scope of works comprised the installation of seven testpits to delineate previously identified fill material and benzo(a)pyrene contamination and for in-situ waste classification.
July 2018	Preparation of Sampling, Analysis and Quality Plan (SAQP) for additional data gaps identified following intrusive site investigations and to include groundwater and hazardous ground gas assessment (HGG). Based on comments provided by the site auditor, a final document was issued on 1 August 2018 (PRM 2018c).
August 2018	Groundwater assessment and HGG intrusive investigations undertaken by PRM. Works comprised installation of three combined groundwater/HGG wells and six HGG wells. One groundwater monitoring round was undertaken during September 2018. Three rounds of spot monitoring and one round of continuous HGG monitoring (minimum of 14 days) were undertaken.
December 2018	Hazardous Ground Gas and Groundwater Assessment report and revised Data Gap Analysis were prepared by PRM. Based on comments provided by the site auditor, a final Hazardous Ground Gas and Groundwater Assessment report (PRM 2019a) and Data Gap Analysis report (PRM 2019b) were issued in 2019.
March 2019	Summary of Contamination Condition report prepared by PRM summarising soil, groundwater and ground gas conditions at the site. Based on comments provided by the site auditor, a final report (PRM 2019c) was issued in June 2019.
August 2019	Preparation of a site audit statement (0503-1805) and accompanying site audit report (JBS&G 2019) confirming that the site investigations conducted by PRM have been conducted appropriately to determine the nature and extent of contamination at the site.
February 2021	Remediation Action Plan prepared by PRM detailing remediation and validation of identified contamination at the site to make site suitable for all permissible uses under the R2 low density residential zoning (at the date of completion of this audit). Based on comments provided by the site auditor, a final report (PRM 2021) was issued in May 2021.
March 2021	Commencement of site audit (0503-2103).

Date	Purpose
May 2021	Preparation of a SAS (0503-2103) and accompanying SAR (JBS&G 2021) confirming that the remediation and validation strategy outlined in the RAP (PRM 2021) was suitable for the proposed future use of the site.

## 2. Site Description

### 2.1 Site Identification

The site details have been summarised in **Table 2.1** and described in further detail in the following sections. A survey plan identifying the subject site has been presented in **Appendix C**.

**Table 2.1: Summary Site Details**

Street Address	165 – 169 Holden Street, Ashbury NSW
Property Description	Part Lot 1 DP115504 and part Lot 1 DP911478 (proposed Lot 1 of subdivision plan of Lot 1 DP115504 and Lot 1 DP911478)
Parish	Petersham
County	Cumberland
Local Government Area	Canterbury Bankstown
Property Size	Approximately 2,540 m <sup>2</sup>
Zoning	Zone SP2 – Infrastructure: Water Supply System
Previous Use	Sydney Water depot
Current Use	Disused depot
Proposed Use	R2 low density residential zone

### 2.2 Site Condition

The consultant (PRM 2019)a reported that the site comprised of a disused portion of a former depot associated with the adjoining Sydney Water Ashbury Reservoir. The site is located within a low density residential land use setting with recreational open space (Peace Park) located to the west. The site is predominantly covered by hard stand with some grassed areas vegetated with trees and shrubs along the western, northern and eastern boundaries. Vegetation was not observed as being distressed at the time of reporting (Parsons Brinckerhoff 2015). Two vacant corrugated metal warehouse buildings/sheds are located along the western boundary of the site. A single-storey brick building is located along the southern boundary of the site and a chemical storage shed is located along the northern boundary.

The consultant stated that the site has been in use as a depot since at least 1930. Peace Park located immediately to the west and northwest was previously the site of the South Ashfield Brickworks, which manufactured brick tiles, drain pipe and other pottery wares.

### 2.3 Topography

The consultant (PRM 2021) reported that the site is located at the highest point of the local government area at approximately 40 to 50 metres Australian Height Datum (AHD). The site slopes towards the south and west.

### 2.4 Soils and Geology

Based on the 1:100,000 Geological Series Sheet 9130 (Edition 1) regional geological map (Department of Mineral Resources 1983), the consultant (PRM 2019a) identified that the site is underlain by Ashfield Shale comprising black to dark grey shale and laminite. Based on the 1:100,000 NSW Soils Landscape map, the site is identified as being underlain by Blacktown Soils comprising shallow to moderately deep red and brown podzolic soils.

The consultant reported (PRM 2019a) that fill encountered across the site during site investigations was described as gravelly clays with varying degrees of anthropogenic inclusions consisting of building rubble, coal, fly ash and slag. The depth of fill encountered varied across the site from 0.3 m to 2.3 m with fill generally located between 0.5 m and 1.0 m. Silty clays were encountered beneath fill in all borehole locations with the exception of one, with shale bedrock beneath.

## 2.5 Acid Sulphate Soils

Based on the CSIRO Australian Soil Resource Information System, the consultant (PRM 2021) reported that soils underlying the site are mapped as having a low probability of occurrence of acid sulfate soils.

## 2.6 Hydrology

The consultant (PRM 2021) reported that surface water is expected to flow to the south/southwest towards the Sydney Water Ashbury Reservoir and Peace Park, with little infiltration due to the hardstand surface across the majority of the site. The nearest surface water bodies are located 1.1 km southwest within Canterbury Racecourse and Cooks River, located approximately 1.3 kilometres to the southwest.

## 2.7 Hydrogeology

The consultant (PRM 2021) reported that a search of the NSW Government Water Information website (undertaken by Parsons Brinckerhoff in 2015) did not identify any registered groundwater bores within a 500 m radius of the site.

Groundwater was encountered at depths between 5.50 and 13.95 metres below ground level (bgl) during previous site assessments (PRM 2019a). Groundwater flow was reported to be flowing to the west.

## 2.8 Surrounding Environment

The consultant (PRM 2021) reported that the site is surrounded by the following:

- North – Peace Park recreational open space land and low density residential properties
- East – Low density residential properties.
- South – Sydney Water Reservoir (WS0003) and low-density residential properties.
- West – Peace Park recreational open space land and residential properties further to the west.

## 2.9 Audit Opinion

The information provided by the consultant (PRM 2021) in regard to the site condition and surrounding environment has been checked against and generally meets the requirements of EPA (2020<sup>2</sup>). The information provided was also consistent with the observations made during a site inspection conducted by the site auditor's assistant in January 2018 and review of site conditions via Nearmap aerial imagery from 2018 through April 2021.

Overall, the information provided by the consultant (PRM 2021), information supplemented by observations made during the site audit inspection and review of publicly available information in relation to the site condition and the surrounding environment is considered adequate for the purposes of the site audit, with the exception that details of climate (other than for the period when the HGG monitoring was undertaken) were not provided.

For completeness, the auditor conducted a review of Bureau of Meteorology (BOM) climate statistics for Canterbury Racecourse (Canterbury Racecourse AWS)<sup>3</sup> which indicates the following:

- Mean maximum temperatures ranging from 17.7° C in July to 27.9° C in January.

<sup>2</sup> *Consultants reporting on contaminated land: Contaminated Land Guidelines*. NSW Environment Protection Authority, April 2020, updated 5 May 2020 (EPA 2020).

<sup>3</sup> Bureau of Meteorology Climate Statistics for Canterbury Racecourse, accessed 5/05/2021, [http://www.bom.gov.au/climate/averages/tables/cw\\_066194.shtml](http://www.bom.gov.au/climate/averages/tables/cw_066194.shtml)

- Mean minimum temperatures ranging from 5.7° C in July to 18.5° C in January.
- Mean monthly rainfall ranging from 48.1 mm in September to 115.2 mm in February, with an average annual rainfall of 972.5 mm.

In general, the climate of the site area is described as comprising warm summers and mild winters, rainfall was described as occurring throughout the year with wetter periods from January to June. This additional data does not alter the consultants' findings or conclusions and, hence, does not affect the outcome of the audit.

The auditor notes that the area defined as the site that is the subject of this site audit comprises of a rectangular piece of land of approximately 2,540 m<sup>2</sup>. Previous site investigations encompass a larger land area that includes additional land to the southwest. As the previous site investigations have assessed the whole of the site area, the reduced site area does not affect the outcome of the audit.



### 3. Site History

The consultant (PRM 2021) reported that a review of previous site investigation reports was undertaken and a summary was presented in the RAP.

#### 3.1 Site History Information Sources

A summary of relevant historical information for the site was provided in the consultant's report (PRM 2021) and is summarised as follows:

- The site has been owned by Sydney Water since 1909 and used as a depot since at least 1930.
- The site is located adjacent to the former South Ashfield Brickworks which may have been the source of fill material identified on-site.
- Historical aerial photographs indicate that there were previously a greater number of buildings within the investigation site area comprising of permanent structures (including those still remaining on-site) and demountable structures.
- NSW WorkCover licensing records for 1995-1996 indicate that up to 200 litres of petroleum and diesel fuel was stored in cabinets in warehouses located along the western boundary.

#### 3.2 NSW EPA Records

The consultant (PRM 2021) reported that a search of the NSW EPA contaminated land database was undertaken. The search indicated that the site has not been notified to the EPA under Section 60 of the CLM Act; there are no records of current or former licensed activities listed on the public register maintained under the *Protection of the Environment Operations Act (POEO Act) 1997*; that there were no records in relation to contaminated land for the site or any properties within the suburb of Ashbury under Section 58 of the CLM Act.

#### 3.3 Previous Environmental Investigations

Previous site investigations undertaken at the site were summarised in the consultant's report (PRM 2021). An overview is presented as follows:

##### Stage 1 and 2 Detailed Site Investigation (Parsons Brinckerhoff 2015)

- A desktop study and intrusive soil investigations were undertaken for the proposed divestment area. Fifteen test pits were installed to a maximum depth of 3.0 m bgl.
- Benzo(a)pyrene TEQ was detected exceeding the adopted site assessment criteria (SAC) for human health for low density residential land use in two sample locations (TP03 and TP12) in the shallow fill layer within the site. Benzo(a)pyrene was detected above the adopted ecological SAC for urban residential and open public spaces in four samples (TP01, TP03, TP12 and TP13) in the shallow fill layer within the site.
- Lead was detected above the adopted human health SAC in fill material at 0.5 – 0.6 m bgl at TP12 in the western portion of the site.
- Zinc was detected above the adopted ecological SAC at TP11 (0.0 – 0.1 m bgl) and TP 12 (0.5 – 0.6 m bgl) in gravelly clay fill. The exceedances were considered to be limited in nature and not pose significant risk to on-site ecological receptors.
- Asbestos containing material (ACM) in the form of fibre-cement sheet fragments were observed at one location (TP11 at 0.0 – 0.1 m bgl). The fragments tested positive for asbestos. The calculated concentration of asbestos as ACM exceeded the SAC for residential land use.

- Management and removal of identified asbestos, lead and PAH impacts to meet site criteria for potential future land use was recommended if the site is proposed for divestment.

#### Hazardous Building Material Audit (PRM 2017)

- A hazardous building materials removal plan (PRM 2017) was prepared to document the legislative requirements and methodology for removal of identified HBMs and any unidentified finds.

#### Hazardous Building Materials Removal Plan (PRM 2018a)

- A hazardous building materials (HBM) audit (PRM 2018a) was conducted at the site. HBMs assessed as part of the audit included ACM, lead containing paint/dust, synthetic mineral fibre (SMF) materials, PCBs containing capacitors in fluorescent light fittings, and ozone depleting substances (ODS) containing air conditioners/refrigerators. Of these, lead containing paint, PCBs, non-friable asbestos, bonded SMF and ODSs were identified as being present at the site. Priority risk ratings were assigned to each of the identified HBMs.

#### Data Gap Analysis (PRM 2019b)

- A targeted soil investigation was undertaken in 2018 to delineate previously identified areas of concern (Parsons Brinckerhoff 2015).
- Seven testpits were installed to a maximum depth of 1.3 m bgl within the site.
- Concentrations of COPCs in soil were reported below the adopted site assessment criteria in the fill material, with the exception of copper (TP109), zinc (TP109), TRH C<sub>16-34</sub> (TP103 and TP107), benzo(a)pyrene (TP103), benzo(a)pyrene TEQ (TP103 and TP 107) and total PAHs (TP103).
- The consultant undertook assessment of PAH compounds in TPH103 0.3 – 0.4 using the PAH Source Analyst<sup>4</sup> and concluded that the PAHs detected at the site were likely to be primarily associated with a black coal ash source, consistent with ash/slag and charcoal.
- The consultant undertook statistical analysis of the dataset from the detailed site investigation (Parsons Brinckerhoff 2015) and from the data gap analysis (PRM 2019b). After removal of contamination hotspot results from the dataset, the calculated 95% upper confidence limits were below the adopted site assessment criteria.
- With respect to the fill quality, the consultant considered that the site is not suitable for low density residential land use in its current condition without remediation. The site is also considered to present a risk of unexpected finds in relation to asbestos, particularly in the fill toward the southwest and western boundary.

#### Hazardous Ground Gas and Groundwater Assessment (PRM 2019a)

- Assessment of groundwater and potential hazardous ground gas (HGG) was undertaken at the site in 2019.
- Nine boreholes were drilled for HGG monitoring well installation with three of the wells installed as dual groundwater monitoring wells.
- Six HGG spot monitoring events were undertaken over two months with continuous HGG monitoring undertaken in five wells. One round of groundwater monitoring was undertaken.
- Concentrations of heavy metals (cadmium, copper, mercury, nickel and zinc) detected above the adopted ecological site assessment criteria were considered likely to be indicative of

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<sup>4</sup> [www.pahsourceanalyst.com.au](http://www.pahsourceanalyst.com.au)

background/natural water quality in the underlying shale aquifer. Given the significant depth to groundwater, it was considered unlikely that groundwater would likely be intercepted during future development works and therefore exposure to potential ecological receptors would be negligible. Groundwater as a secondary source of contamination at the site was not required to have further consideration.

- Based on the HGG monitoring, Gas Screening Values for the site were calculated to be characteristic situation CS1 (very low risk). The presence of hazardous ground gases at the site was considered not to require further consideration.

#### Summary of Contamination Condition (PRM 2019c)

- A summary of the contamination status of the site was undertaken including review of previous site investigations and summarising the contamination condition.
- Based on exceedances of the SAC in soil, the site was considered not suitable for low density residential development without remediation.

### **3.4 Other Site Investigations**

A Geotechnical Investigation was undertaken in 2018 to provide information on the subsurface soil profile; geotechnical design parameters; and soil aggressivity for proposed low rise residential development of the site.

### **3.5 Audit Opinion**

The site history information provided by the consultant (PRM 2021) has been checked against, and generally meets, the requirements of the EPA (2020), with an exception as noted below.

A search of the NSW EPA POEO Public Register found Clean-Up Notice Number 1561819 issued to Canterbury-Bankstown Council on 24 April 2018 in relation to asbestos waste deposited at Peace Park. No other records were listed for the suburb of Ashbury. While the lack of identification of records on the public register is considered to be a discrepancy, the identified asbestos waste on the western portion of Peace Park (and assumed subsequent clean up) does not affect the outcome of the audit.

## 4. Conceptual Site Model

The *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended 2013, NEPC 2013) identifies a conceptual site model (CSM) as a representation of site related information regarding contamination sources, receptors, and exposure pathways between those sources and receptors. The development of a CSM is an essential part of all site assessments and remediation activities.

NEPC (2013) identifies the essential elements of a CSM as including:

- Known and potential sources of contamination and contaminants of concern including the mechanism(s) of contamination;
- Potentially affected media (soil, sediment, groundwater, surface water, indoor and ambient air);
- Human and ecological receptors;
- Potential and complete exposure pathways; and
- Any potential preferential pathways for vapour migration (if potential for vapours identified).

Based on the known contamination, each of the elements of the CSM are discussed as follows.

### 4.1 Sources of Contamination

Based on a review of site history and intrusive investigations conducted at the site, the consultant (PRM 2021) identified the following area of potential concern for the site:

- Uncontrolled fill material from unknown sources, particularly below building footprints.

The consultant (PRM 2019a) had identified uncontrolled filling from unknown sources at the former Ashfield Brickworks to the west resulting in potentially contaminated groundwater and HGG migrating onto the site. Assessment of groundwater at the site attributed identified concentrations of heavy metals above the adopted site assessment criteria to background groundwater quality and no complete source pathway receptor linkages were identified. Ground gas monitoring conducted at the site determined that very low risk was posed by HGG and as such HGG did not require further consideration.

Based on the identified source of contamination, the consultant (PRM 2021) identified the following contaminants of potential concern (CoPCs) for the site:

- Heavy metals (copper, lead and zinc)
- Total Recoverable Hydrocarbons (TRHs)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Asbestos.

### 4.2 Potentially Affected Media

The consultant (PRM 2021) identified the potentially contaminated media as soil.

### 4.3 Potential Human and Ecological Receptors

Potential human receptors identified included the following:

- Construction workers involved in site development works;
- Future residential land users; and

- Future site users or occupants.

Potential ecological receptors were identified on-site flora and fauna.

#### **4.4 Potential Exposure Pathways**

Based on the identified CoPCs and potential receptors, the following potential exposure pathways were identified for human receptors by the consultant (PRM 2021):

- Dermal and oral contact with impacted fill material; and
- Inhalation of soil derived fibres or dust.

Source-pathway-receptor linkages were identified by the consultant (PRM 2021) to have the potential to become complete without further management or remediation, and during future development works or intrusive works by contractors/maintenance staff.

#### **4.5 Audit Opinion**

The consultant (PRM 2021) identified potential contamination issues based on site history review and previous site investigation programs. The list of potential contaminants and associated potentially contaminated media are considered to have been suitably comprehensive noting the former use of the site as a depot.

Taking into consideration the site history review and investigations previously undertaken at the site, the auditor considers that the list of CoPCs identified by the consultant was adequate in assessing the nature and extent of contamination across the site.

The consultant (PRM 2021) also considered both human and ecological receptors, potential contaminant transport mechanisms and potential exposure pathways. The auditor considers that potential source-pathway-receptor linkages have generally been adequately addressed.

The auditor notes that the CSM prepared by the consultant (PRM 2021) was sufficiently detailed and generally meets the requirements of NEPC (2013).

Overall, the auditor considers that the identified potential contamination issues and potentially contaminated media were appropriate for the purposes of assessing the contamination status of the site and in order to draw conclusions on the suitability of the site for all permissible land uses within the R2 Low Density Residential zone (at the date of completion of this audit).

## 5. Site Investigation Results

### 5.1 Field Observations

A summary of field observations encountered during the site investigations previously undertaken by the consultant (PRM 2019a and PRM 2019b) is provided below:

- The subsurface profile across the site typically comprised brown silty clay fill with anthropogenic material (concrete, glass, brick), gravels (sandstone, shale, ironstone and shale) and rootlets underlain by silty clay. Shale bedrock underlies the natural clay.
- With the exception of one soil bore in the southwest corner of the site, fill was encountered in all bores.
- Depth of fill varied across the site. Fill material was identified to depths between 0.3 m bgs (HGG05) and 2.3 m bgs (HGG04).
- Natural silty clay was encountered to depths between 0.8 m bgs (HGG06) and 3.25 m bgs (HGG03).
- No asbestos containing material (ACM) was observed during the soil investigations.
- No odours or staining were noted during the soil investigations.
- Groundwater seepage was not encountered during the installation of the bores for ground gas and/or groundwater monitoring well installation.
- Depth to groundwater was recorded at 5.50 m (GW08), 10.14 m (GW03) and 13.95 m (GW01) with localised groundwater flow indicated to be to the west towards the former brickworks pit.
- Groundwater quality parameters were recorded during the groundwater monitoring event completed on 9<sup>th</sup> and 10<sup>th</sup> September 2018 as follows:
  - pH ranged from 5.07 to 5.53
  - electrical conductivity ranged from 13,231  $\mu\text{S}/\text{cm}$  to 14,852  $\mu\text{S}/\text{cm}$
  - dissolved oxygen ranged from 0.6 ppm to 9.28 ppm
  - oxidation reduction potential ranged from 81.3 mV to 168.8 mV.

Physicochemical parameters were measured for two monitoring wells only due to limited groundwater in GW01 at the time of sampling.

### 5.2 Soil Investigation Results

The consultant provided a summary table (**Appendix D**) including the data gap soil investigations (PRM 2019b) in addition to laboratory reports and chain of custody documentation.

A summary of the soil analytical results, in comparison to the adopted soil investigation levels is provided in **Table 5.1**, below.

**Table 5.1: Summary of Soil Analytical Results (mg/kg)**

Substance	Minimum concentration	Maximum concentration	Exceedance of SAC
<b>Metals</b>			
Arsenic	< 4	6	No exceedance
Cadmium	<0.4	< 0.4	No exceedance
Chromium (VI)	4	40	No exceedance
Copper	<1	240	Exceedance of EIL of 160 mg/kg at TP109 0 - 0.1 (240 mg/kg)
Lead	3	150	No exceedance

Substance	Minimum concentration	Maximum concentration	Exceedance of SAC
Nickel	1	120	No exceedance
Zinc	1	450	Exceedance of EIL of 390 mg/kg at TP109 0 – 0.1 (450 mg/kg)
<b>BTEXN</b>			
Benzene	<0.2	<0.2	No exceedance
Toluene	<0.5	<0.5	No exceedance
Ethylbenzene	<1	<1	No exceedance
Total Xylenes	<1	<1	No exceedance
Naphthalene	<0.1	<0.1	No exceedance
<b>TRH</b>			
TRH C <sub>6</sub> -C <sub>10</sub> (less BTEX) (F1)	<25	<25	No exceedance
TRH C <sub>10</sub> -C <sub>16</sub> (less naphthalene) (F2)	<50	<50	No exceedance
TRH C <sub>16</sub> -C <sub>34</sub> (F3)	<90	1,500	Exceedance of ESL of 300 mg/kg reported at TP107 0.1 - 0.2 (320 mg/kg) and TP103 0.3 – 0.4 (1,500 mg/kg)
TRH C <sub>34</sub> -C <sub>40</sub> (F4)	<100	170	No exceedance
<b>PAHs</b>			
Benzo(a)pyrene	<0.05	55	Exceedance of ESL of 0.7 mg/kg reported at TP103 0.3 – 0.4 (55 mg/kg)
Benzo(a)pyrene TEQ	< 0.5	79	Exceedance of HIL-A of 3 mg/kg reported at TP107 0.1 – 0.2 (11 mg/kg) and TP103 0.3 – 0.4 (79 mg/kg)
Total PAHs	< 0.05	790	Exceedance of HIL-A of 300 mg/kg reported at TP103 0.3 – 0.4 (790 mg/kg)
<b>OCPs</b>			
DDE+DDD+DDT	< 0.1	< 0.1	No exceedance
Aldrin+Dieldrin	< 0.1	< 0.2	No exceedance
Individual OCPs	< 0.1	< 0.1	No exceedance
<b>OPPs</b>			
Individual OPPs	< 0.1	< 0.1	No exceedance
<b>PCBs</b>			
Total PCBs	< 0.1	< 0.5	No exceedance
<b>Asbestos</b>			
Asbestos fragments on surface	-	-	No potential ACM was observed on surface or during test pit excavation
Asbestos (ACM >7mm)	<0.01% w/w	<0.01% w/w	No exceedance
Asbestos in soil (<2mm AF/FA)	<0.001% w/w	<0.001% w/w	No exceedance

### 5.3 Groundwater Investigation Results

The consultant (PRM 2019a) provided a summary table (**Appendix D**) in addition to laboratory reports and chain of custody documentation.

A summary of groundwater analytical results, in comparison to adopted groundwater investigation levels is provided in **Table 5.2**, below.

**Table 5.2: Summary of Groundwater Analytical Results (µg/L)**

Substance	Minimum concentration	Maximum concentration	Exceedance of GAC
<b>Metals</b>			
Arsenic	< 1	8	No exceedance
Cadmium	< 0.1	4.4	GW08
Chromium (III+VI)	< 1	< 1	No exceedance
Copper	4	250	GW01, GW03 and GW08
Lead	< 1	1	No exceedance
Mercury	< 0.05	0.1	GW08
Nickel	49	180	GW01, GW03 and GW08
Zinc	63	470	GW01, GW03 and GW08

Substance	Minimum concentration	Maximum concentration	Exceedance of GAC
<b>BTEXN</b>			
Benzene	< 1	< 1	No exceedance
Toluene	< 1	< 1	No exceedance
Ethylbenzene	< 1	< 1	No exceedance
Total Xylenes	< 2	< 2	No exceedance
Naphthalene	< 1	< 1	No exceedance
<b>TRH</b>			
TRH C <sub>6</sub> -C <sub>10</sub> (less BTEX) (F1)	< 10	< 10	No exceedance
TRH C <sub>10</sub> -C <sub>16</sub> (less naphthalene) (F2)	< 50	< 50	No exceedance
TRH C <sub>16</sub> -C <sub>34</sub> (F3)	< 100	< 100	No exceedance
TRH C <sub>34</sub> -C <sub>40</sub> (F4)	<100	< 100	No exceedance
<b>PAHs</b>			
Naphthalene	< 0.2	< 0.2	No exceedance
Total PAHs	< 0.1	< 1	No exceedance
<b>VOCs</b>			
Total VOCs	< 0.001	< 10	No exceedance
<b>Miscellaneous</b>			
Ammonia	350	380	No exceedance
Dissolved methane	< 5	< 5	No exceedance

## 5.4 Ground Gas Investigation Results

The consultant (PRM 2019a) provided a summary table (**Appendix D**) in addition to laboratory reports and chain of custody documentation.

A summary of hazardous ground gas screening values (GSVs) calculated from spot and continuous monitoring results, in comparison to adopted ground gas criteria is provided in **Table 5.3**, below.

**Table 5.3: Summary of Gas Screening Values**

Location	Minimum	Maximum	Continuous (GasClams™) <sup>2</sup>	Worse Case <sup>1</sup>
<b>Methane</b>				
HGG01	0.0001	0.0022	0.001	0.0044
HGG02	0.0001	0.0003	NA	0.0003
HGG03	0.0001	0.0002	NA	0.0002
HGG04	0.0001	0.0005	NA	0.0005
HGG05	0.0001	0.0005	NA	0.0005
HGG06	0.0001	0.0012	0.003	0.003
HGG07	0.0001	0.0003	0.0001	0.0003
HGG08	0.0001	0.0027	0.0001	0.0027
HGG09	0.0001	0.0005	0.0001	0.0005
<b>Carbon Dioxide</b>				
HGG01	0.0018	0.0036	0.0046	0.0064
HGG02	0.002	0.0087	NA	0.0261
HGG03	0.0029	0.0056	NA	0.0058
HGG04	0.0005	0.004	NA	0.0105
HGG05	0.0015	0.021	NA	0.0295
HGG06	0.0025	0.0036	0.024	0.024
HGG07	0.0008	0.0072	NA	0.0216
HGG08	0.0028	0.0216	NA	0.0576
HGG09	0.0012	0.0033	0.0009	0.0033

Notes:

<sup>1</sup> GSV based on highest flow rate and concentration observed across all six rounds

<sup>2</sup> GSV based on highest concentration from GasClams™ and location of highest flow rate

<sup>NA</sup> Not installed



## 5.5 Consultant's Interpretations and Conclusions

### 5.5.1 Soil

The consultant (PRM 2019b) provided the following discussion of soil results, conclusions and recommendations:

- Concentrations of COPCs in soil were reported below the adopted site assessment criteria in the fill material, with the exception of copper, zinc, TRH C<sub>16-34</sub>, benzo(a)pyrene, benzo(a)pyrene TEQ and total PAHs detected in soil from three testpits.
- The consultant undertook assessment of PAH compounds in TPH103 0.3 – 0.4 using the PAH Source Analyst<sup>5</sup> and concluded that the PAHs detected at the site were likely to be primarily associated with a black coal ash source, consistent with ash/slag and charcoal.
- The consultant undertook statistical analysis of the dataset from the detailed site investigation (Parsons Brinckerhoff 2015) and from the data gap analysis (PRM 2019b). Using soil bore logs and field observations, the near surface fill layer located beneath the asphalt hardstand was considered to have sufficient data for statistical analysis. After removal of contamination hotspot results (individual sample results greater than 250% of the adopted site assessment criteria) removed from the dataset, the calculated 95% upper confidence limits were below the adopted site assessment criteria.
- Exceedances of the adopted site assessment criteria identified during the detailed site investigation (Parsons Brinckerhoff 2015) that were not able to be addressed via statistical analysis include:
  - Heavy metals – TP12 0.5 – 0.6 (zinc 2,400 mg/kg); TP11 0 – 0.1 (zinc 400 mg/kg);
  - TRH (C<sub>16-C<sub>34</sub></sub>) – TP09 1.0 – 1.1 (380 mg/kg);
  - PAHs – TP03 0 – 0.1 (benzo(a)pyrene 4.1 mg/kg); TP09 1.0 – 1.1 (benzo(a)pyrene TEQ 9.5 mg/kg); TP14 0.05 – 0.1 (benzo(a)pyrene TEQ 14 mg/kg);
  - Asbestos – ACM was observed at two locations. Asbestos as ACM collected at TP11 0 – 0.1 (0.01 %w/w) exceeded the health screening level for low density residential land use.
- With respect to the fill quality, the consultant considers that the site is not suitable for low density residential land use in its current condition without remediation. The site is also considered to present a risk of unexpected finds in relation to asbestos, particularly in the fill toward the southwest and western boundary.
- A remediation action plan (RAP) is recommended to be prepared for the site to render it suitable for proposed low density residential land use.

### 5.5.2 Groundwater

The consultant (PRM 2019a) provided the following discussion of groundwater results and conclusions:

- Concentrations of heavy metals (cadmium, copper, mercury, nickel and zinc) detected above the adopted site assessment criteria were considered likely to be indicative of background/natural water quality in the underlying shale aquifer.
- Significant concentrations of heavy metals were not detected in soil at the site and the location of the site at the top of a ridge would make impact from off-site sources unlikely.

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<sup>5</sup> [www.pahsourceanalyst.com.au](http://www.pahsourceanalyst.com.au)

- Given the significant depth to groundwater, it is considered unlikely that groundwater would likely be intercepted during future development works and therefore exposure to potential ecological receptors would be negligible. The geological profile indicates that viability for groundwater abstraction is low.

The consultant (PRM 2019c) considers that groundwater as a secondary source of contamination at the site does not require further consideration.

### 5.5.3 Ground Gas

The GSVs for methane and carbon dioxide concentrations at the site have been calculated to be CS1 or very low risk. EPA (2012) states that where HGG concentrations are detected above 'typical maximum' concentrations of 1% v/v for methane and 5% v/v for carbon dioxide, an increase in the Characteristic Situation to CS2 should be considered.

While a single peak methane concentration of 2.2% v/v was identified in HGG01 during one HGG spot monitoring round, a maximum concentration of 0.5% v/v was measured during 14 day continuous monitoring using a GasClam™ during a period of comparable atmospheric pressure change. Given that methane concentrations were not detected during the other spot monitoring rounds and that site conditions do not indicate that methane surface emissions present a risk to future receptors, the consultant considered that the peak methane concentration measured at 2.2% v/v is not indicative of a 'typical maximum' concentration and that an increase in the site Characteristic Situation from CS1 to CS2 is not supported.

Peak carbon dioxide concentrations (over 5% v/v) of up to 8.7% v/v were identified in four HGG monitoring wells over two monitoring rounds with a maximum concentration of 6.7% v/v measured during continuous monitoring using GasClams™. While concentrations of carbon dioxide were detected marginally above the 'typical maximum' concentration of 5% v/v, the consultant considers that the concentrations are largely attributed to background or natural conditions, and an increase in the site Characteristic Situation from CS1 to CS2 is not supported. The geological profile and site conditions are considered unlikely to present a preferential pathway for migration of HGG from the adjacent former brickworks and present a significant risk to future receptors.

The consultant (PRM 2019c) considers that the presence of hazardous ground gases at the site do not require further consideration.

### 5.6 Audit Opinion

The consultant (PRM 2019a and PRM 2019b) provided tables which adequately summarised the laboratory results, in addition to the provision of complete laboratory reports and chain of custody documentation. The auditor notes that not all the identified COPCs were included in the summary tables. Ground gas field monitoring results were also adequately summarised in tables provided by the consultant (PRM 2019a).

The auditor notes that the exceedances of the site assessment criterion for zinc in soil in the current (PRM 2019b) and previous site investigations (Parsons Brinckerhoff 2015) in near surface samples at three locations has been inferred to be due to fill at the site. The auditor considers that given the proximity of the sample locations to existing buildings/structures and the high concentrations detected at TP12 0.5-0.6 (2,400 mg/kg), the likely source of impact is from lead/zinc-based paints on the buildings/structures at the site. The auditor does not consider this discrepancy to affect the outcome of the audit.

The auditor notes that there were inconsistencies in identification of monitoring wells as soil bores in the field records although the consultant (PRM 2019a) reports that the sequence of numbering of the locations is correct despite the use of incorrect label prefixes. Negative recordings of gas flow rate were reported by the consultant (PRM 2019a) as being instantaneous with gas flow returning to zero thereafter and therefore negative readings not being representative of actual gas flow. The

auditor considers the negative gas flow readings to be a discrepancy in the field records and accepts that gas flow rate should be considered to be zero for those incidences.

The site plans provided by the consultant (PRM 2019a and PRM 2019b) adequately identified the sampling locations relevant to the main site features such as boundaries and street frontage and have been produced to scale. Figures prepared by the consultant are included as **Appendix C**.

The laboratory procedures were generally appropriate for identified potential contaminants of concern and adopted criteria against which results were compared.

A review of the laboratory reports and associated chain of custody documentation indicates that samples were received appropriately, and no discrepancies were noted.

As part of the investigation works, the consultant (PRM 2019a and PRM 2019b) undertook appropriate assessment of aesthetic issues in accordance with EPA (2017) including contaminant odours, soil discolouration, anthropogenic material and/or presence of asbestos during soil sampling.

The consultant (PRM 2019a and PRM 2019b) addressed the potential migration of the identified contaminants of concern through an assessment of soils, groundwater and hazardous ground gases across the site. The conclusions reached by the consultant in relation to soil, groundwater and ground gas contamination issues at the site are considered appropriate and meet the requirements of the site audit. Overall, the consultant reports (PRM 2019a and PRM 2019b) are considered to have obtained and reported results in a manner which enable conclusions to be drawn regarding the need for remediation of the identified contamination for the site to be made suitable for the proposed divestment for low density residential land use.

## 6. Remediation Action Plan

### 6.1 Remediation Objectives

As detailed in the RAP (PRM 2021), the objectives of the remediation works are to:

- Remove, to the extent practicable, unacceptable risks to human health and the environment from the identified CoPCs to render the site suitable for the most sensitive uses under the proposed R2 low density residential zoning.
- Prevent, to the extent practicable, any potential contamination of the surrounding environment;
- Address unexpected finds that may be encountered during site works; and
- Validate the site in accordance with NSW EPA approved guidelines for future residential land use.

The objective of the RAP (PRM 2021) is to provide a framework for remediation and detail how the site can be made suitable for the most sensitive proposed future site uses under the R2 zoning (at the date of completion of this audit).

### 6.2 Remediation Options

The consultant (PRM 2021) reported that the following remediation options were assessed for the site:

- Defer remediation;
- On-site treatment of soil;
- Excavation and off-site treatment of soil with treated soil returned to site;
- Capping;
- Partial excavation and disposal, and on-site containment within a barrier; and
- Excavation and off-site disposal of soil to an approved landfill.

### 6.3 Extent of Remediation Required

Based on the previous investigations at the site, the consultant (PRM 2021) identified two areas of the site as requiring remediation. The remediation extents for the two areas have been estimated based on the nearest 'clean' test pit identified from the site investigations, or the site boundary.

A summary of the remediation areas is provided in **Table 6.1**.

**Table 6.1: Summary of Remediation Areas**

Remediation Area	Description
Area 1 (RA1)  Comprising of the western portion of the site surrounding the existing building	Material description: Fill: gravelly clay, grey/brown/orange with foreign materials including brick, concrete, minor ash, charcoal and slag. Known contamination: concentrations of benzo(a)pyrene, benzo(a)pyrene TEQ, total PAHs, TRH C <sub>16</sub> -C <sub>34</sub> , lead, zinc and copper exceeding the SAC at TP12, TP109 and TP103. Asbestos was identified in shallow soils at TP11. Approximate area: 832 m <sup>2</sup> (including soils beneath the existing building which are assumed to be contaminated). Anticipated depth of remediation: the fill profile is shallow in the north (between 0.3 and 0.6 m bgl) becoming deeper near TP103 (approximately 0.8 m bgl). Indicative volume of material: 500 m <sup>3</sup> based on an average depth of 0.6 m bgl across the remediation area.

Remediation Area	Description
Area 2 (RA2)  Comprising of the north eastern portion of the site	Material description: Fill: silty or gravelly clay, brown or red/brown with minor concrete and brick, or dark brown silty sand (topsoil). Known contamination: concentrations of benzo(a)pyrene, benzo(a)pyrene TEQ, and TRH C <sub>16</sub> -C <sub>34</sub> exceeding the SAC at TP03 and TP107. Approximate area: 615 m <sup>2</sup> Anticipated depth of remediation: 0.3 m bgl Indicative volume of material: 185 m <sup>3</sup> based on an average depth of 0.3 m bgl across the remediation area.

The remediation areas are shown in Figure 4 provided in **Appendix C**.

#### 6.4 Preferred Approach

The consultant (PRM 2021) conducted an evaluation of the remediation options and the remediation option considered to be most appropriate to meet the remediation objective based on cost-effectiveness, practicality and time was:

- Excavation of identified fill materials in RA1 and RA2 and off-site disposal.

#### 6.5 Remediation Approach

The following steps have been identified to be undertaken for remediation of the site and meet the remediation objectives:

1. Regulatory approvals and notifications to Council and local residents;
2. Preparation of Project Safety and Environmental Management Plan and Asbestos Removal Control Plan;
3. Site establishment;
4. Demolition and disposal of structures and hardstand;
5. Excavation of remediation areas; and
6. Waste classification and off-site disposal.

#### 6.6 Remediation Areas Excavation

The two remediation areas as shown in Figure 4 provided in **Appendix C** are to be excavated, with the lateral extent estimated to extend to the nearest 'clean' test pit location or the site boundary.

Excavation volumes have been estimated and may increase during remediation based on validation results and visual observations. Additional validation of areas beneath building footprints that have not been previously sampled and portions of the site not subject to remediation will be required to be undertaken to confirm the suitability of the soils to remain on-site. ACM was identified as fibre cement sheeting fragments in shallow soil at TP11 within RA1, and further ACM impact may be identified within fill beneath building footprints.

The estimated remediation excavation volumes are summarised in **Table 6.2**.

**Table 6.2: Remediation Excavation Volumes**

Remediation Area	Estimated Volume	CoPCs
RA1	Approximate area of 832 m <sup>2</sup> to an average depth of 0.6 m bgl Total anticipated volume 500 m <sup>3</sup>	Benzo(a)pyrene, benzo(a)pyrene TEQ, total PAHs, TRH C <sub>16</sub> -C <sub>34</sub> , lead, zinc, copper and asbestos
RA2	Approximate area of 615 m <sup>2</sup> to an average depth of 0.3 m bgl Total anticipated volume 185 m <sup>3</sup>	Benzo(a)pyrene, benzo(a)pyrene TEQ, and TRH C <sub>16</sub> -C <sub>34</sub>

## 6.7 Validation Strategy

Following completion of the remediation excavations, validation sampling and analysis and qualitative assessment (visual observations) will be undertaken to demonstrate that the remediation goals have been achieved.

### 6.7.1 Remediation Areas RA1 and RA2

The following validation sampling will be undertaken for remediation areas RA1 and RA2 (excluding building):

- Soil samples collected from the base and walls of excavations at a frequency of one sample per 20 lineal metres for walls greater than 0.5m in height and one sample per 400 m<sup>2</sup> (20 m x 20 m grid) across the excavation base.
- Samples are to be analysed by a NATA accredited laboratory for heavy metals, TRH and PAHs.
- Each 20 m x 20 m grid of the excavation base will also require a visual assessment by the site licensed asbestos assessor (LAA) to confirm no suspected ACM is present.
- All soil samples will be assessed against the validation acceptance criteria outlined in **Section 6.8**.
- If initial analytical results are above the validation criteria, further vertical and/or lateral excavation will be required, and a second round of validation samples are to be collected. This will continue until all wall and base validation samples meet the validation criteria.
- Where asbestos is expected to be encountered (in the vicinity of TP11 in RA1), daily Asbestos Air Monitoring will be undertaken to ensure controls are adequate.
- An asbestos clearance certificate (ACC) will be prepared by the hygienist following removal of any asbestos impacted fill. Once the ACC has been prepared for the area directly surrounding TP11, the requirement for ongoing air monitoring can be determined by the supervising hygienist/LAA and Environmental Consultant. Additional ACM finds will then be managed via the unexpected finds protocol.
- Material tracking and material importation information will be reviewed to ensure compliance with this RAP, including landfill disposal dockets for soils and miscellaneous waste items.

### 6.7.2 Building Footprints

In addition to the validation activities outlined in **Section 6.7.1**, the following validation sampling will be undertaken for building 1 (B1) and building 2 (B2) following building demolition, excavation and off-site disposal of material (where required):

- Additional targeted samples collected from the base excavations at a density of one sample per 64 m<sup>2</sup> (8 m x 8 m grid) across each building footprint following removal of the building.

### 6.7.3 Areas Not Undergoing Remediation

For the areas where remediation works are not proposed to be undertaken (between RA1 and RA2), the following validation sampling will be undertaken following removal of hardstand to ensure the residual fill material is suitable to remain on-site:

- Soil samples will be collected at a frequency of one sample per 400 m<sup>2</sup> (20 x 20 m grid).
- Samples are to be analysed by a NATA accredited laboratory for heavy metals, TRH and PAHs.

- Each 20 m x 20 m grid of the excavation base will also require a visual assessment by the site licensed asbestos assessor (LAA) to confirm no suspected ACM is present.
- All soil samples will be assessed against the validation acceptance criteria outlined in **Section 6.8**.
- Following visual inspection of the remnant fill by the hygienist/LAA, an asbestos clearance certificate will be prepared.

## **6.8 Validation Acceptance Criteria**

Based on the proposed divestment of the site for low density residential land use, the following criteria has been stated by the consultant (PRM 2021) as being adopted as validation criteria:

- Health Investigation Levels (HIL): HIL A – residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake, no poultry, also includes children's day care centres, preschools and primary schools;
- Health Screening Levels (HSL): HSL A for vapour intrusion in low-high density residential land use, for sand soils;
- Management Limits for TPH fractions F1 – F4 in soil: residential, parkland and public open space, for coarse soils;
- Ecological Screening Levels (ESL): urban residential/public open space land use, coarse grained soils;
- Ecological Investigation Levels (EIL) – urban residential/public open space and calculated based on site specific data (presented in PRM (2019b)); and
- Aesthetic Impact:
  - No malodorous nature (odour).
  - No significant discolouration (staining).
  - No significant volumes of anthropogenic contaminants (e.g. demolition rubble) on the site surface.

## **6.9 Quality Assurance and Quality Control**

The RAP outlined QA/QC procedures that shall be adopted as part of the validation sampling to be undertaken following remedial works.

Field QA/QC will include:

- Split samples for inter-laboratory analysis (at least 5%, 1 in 20 samples);
- Blind field samples for intra-laboratory analysis (at least 5%, 1 in 20 samples);
- Rinsate samples, where reusable sampling equipment has been used (one per piece of equipment per day);
- Trip spike samples (one per batch of samples where volatile contaminants are of concern);
- Trip blank samples (one per batch of samples where volatile contaminants are of concern).

Laboratory QA/QC shall be undertaken in accordance with its NATA accreditation, including in-house QA/QC procedures such as:

- Holding times;
- Reagent blanks;



- Spike recovery analysis;
- Laboratory duplicate analysis:
- Analysis of control standards;
- Calibration standards and blanks; and
- Statistical analysis of QC data including control standards and recovery plots.

#### **6.10 Asbestos Air Monitoring**

Due to the presence of asbestos contamination at TP11 within RA1 and proximity of the site to neighbouring residents, asbestos air monitoring (AAM) has been advised in the RAP (PRM 2021) to be undertaken for all excavation work in the vicinity of TP11. The results of the AAM should be obtained within 24 hours of sample collection and provided to the principal contractor each workday to confirm that control measures are adequate prior to commencement of work the next day.

Inspections will be made by the LAA during excavation and loading works, and amendments made to the adopted dust management procedure to mitigate potential release of airborne asbestos fibres should there be visible dusts.

Trigger levels for airborne asbestos fibres have been adopted from the NSW Government *Code of Practice How to Safely Remove Asbestos in the Workplace* and have been listed in the RAP (PRM 2021).

#### **6.11 Waste Classification**

Excavated fill soils will be assessed in accordance with the following:

- NSW EPA (2014) *Waste Classification Guidelines Part 1: Classifying Waste*; or
- NSW EPA *General Approval of the Immobilisation of Contaminants in Waste (Approval Number 1999/05)*.

A preliminary in situ waste classification undertaken by Parsons Brinckerhoff (2015) and PRM (2019b) indicated that the fill encountered at the site generally met the classification of General Solid Waste (non-putrescible), with the exception of ACM impact at TP11 (classified as Special Waste (Asbestos)); benzo(a)pyrene and total PAHs impact at TP103 (classified according to leachable concentration of benzo(a)pyrene under NSW EPA Approval Number 1999/05); and unassessed fill material under B1.

For fill soils located beneath the building footprints, sampling and analysis will be required in order to provide a waste classification to support off-site disposal of the material. Sampling may be undertaken in-situ (via test pitting) or ex-situ following excavation and temporary stockpiling on hardstand or plastic. Samples are to be collected at the density provided in *Industrial Waste Resource Guidelines 702 (Soil Sampling)*, i.e. a minimum of 3 samples up to 25m<sup>3</sup> then 1:25 m<sup>3</sup> thereafter.

Waste classification samples are to be analysed for heavy metals, PAHs, TRH/BTEX and asbestos.

All transport works will be required to be carried out in a manner that minimises disturbance and impacts to the surrounding areas. The material may need to be registered with the NSW EPA Waste Locate tracking system to comply with the legislation regarding the transporting/movement of asbestos waste or waste containing asbestos.

Transport of classified waste can only be to a facility that is appropriately licensed to accept the waste and must be undertaken in accordance with the NSW *Protection of the Environment Operations (Waste) Regulation*.

### **6.12 Imported Materials**

Where imported materials are required to be placed at the site, the material is required to be checked and approved prior to importation. Only certified Excavated Natural Material (ENM) or certified Virgin Excavated Natural Material (VENM) will be imported to the site as part of the remediation works.

An imported materials protocol is included as an appendix in the RAP (PRM 2021) and includes documentation, sampling and analysis, and material tracking requirements.

### **6.13 Contingency Plan**

The consultant (PRM 2021) provided a contingency plan in the RAP that outlines actions to be undertaken in the event of unexpected conditions occurring during remediation. Contingency situations included:

- development plans changed;
- contamination found to extend below proposed remediation depth or extent;
- soils classified as hazardous waste encountered;
- contamination found to have migrated off-site;
- validation samples fail criteria; and
- underground cables or pipes containing unknown product encountered.

An unexpected finds protocol was outlined in the RAP (PRM 2021) for the management of potentially contaminated material encountered that is different to that described in the RAP. Such contamination sources or materials include, but are not limited to the following:

- underground storage tanks;
- odorous material;
- fibrous material;
- brightly coloured material;
- tarry or ashy material; and
- drums, or metal / plastic chemical containers.

### **6.14 Validation Report**

Following the completion of all remediation and validation activities, a validation report will be prepared by the environmental consultant in accordance with NSW EPA guidance.

### **6.15 Site Management**

The consultant (PRM 2021) provided a summary of site management and occupational health and safety controls that require implementation during the remedial works. Details of the following site management requirements were outlined in the RAP (PRM 2021):

- Responsibilities;
- Hours of operation;
- Site security;
- Site induction;
- Personal protective equipment;
- Site safety signage;

- Protection of services;
- Environment and Work Health & Safety;
- Traffic Control;
- Materials Tracking.

Emergency response actions were also outlined for potential emergency situations.

#### **6.16 Consultant's Conclusions**

Overall, the consultant (PRM 2021) concluded that following full implementation of the RAP, the site will be remediated to a standard suitable for the most sensitive land uses allowable under the R2 zoning. Should the site be proposed to be redeveloped to a less sensitive permissible land use, alternate remediation options may be appropriate for the site and a new RAP approved by Council and NSW EPA accredited site auditor will be required.

#### **6.17 Audit Opinion**

The consultant's (PRM 2021) nominated remediation objectives were appropriate and consistent with the proposed uses of the site under the R2 Low Density Residential zone (at the date of completion of this audit).

The consultant considered a number of remediation and management options and adopted an approach involving excavation and off-site disposal of contaminated soils. With consideration to the nature and extent of the identified soil contamination, the auditor accepts the preferred/adopted approach to be appropriate and consistent with relevant NSW EPA guidance.

The consultant (PRM 2021) nominated a validation sampling approach following the demolition of structures and hardstand, and excavation of contaminated fill. The approach included both visual inspection of the excavations and confirmatory sampling. The auditor notes that the nominated sampling methodology and frequency nominated by the consultant is suitable and meets the requirements of the audit. The auditor notes that sampling will be required to be completed in accordance with the requirements of the NEPM 2013.

The adopted remediation approach presented in the RAP (PRM 2021) was checked by the auditor and found to be:

- Technically feasible;
- Environmentally justifiable given the nature and extent of the identified contamination; and
- Consistent with relevant laws, policies and guidelines, since the works were undertaken in a manner which did not appear to result in any relevant regulatory measures being breached.

Preliminary soil waste classification was conducted in-situ as part of previous investigations (Parsons Brinckerhoff 2015 and PRM 2019b) conducted at the site. The RAP has noted that further sampling of in-situ or ex-situ excavated soils will be required prior to removal of any material from the site for off-site disposal. Provisions for check sampling of VENM and ENM have been made in the RAP for material imported for backfilling of the site. The auditor notes that the requirements for off-site disposal of waste material and importation of materials is in accordance with the requirements of NSW EPA (2017).

The soil validation acceptance criteria nominated by the consultant have been checked against and were generally consistent with criteria approved by the EPA. The auditor notes that as part of the soil validation process, consideration will also be given to aesthetic issues (i.e., odours, staining and presence of anthropogenic materials).

Upon successful completion of the remediation and validation activities, the consultant (PRM 2021) stated that a validation report will be prepared in accordance with relevant EPA guidelines. The

auditor notes that the validation report should include, but not be limited to, additional information including site photos, tabulated results, waste disposal documentation and copies of relevant notifications and licences.

The site management provisions appear sufficient to broadly control the potential impacts associated with the proposed remediation works, and appear adequately protective of both the remediation workforce and the surrounding environment (including the neighbouring community).

Overall, the auditor considers that the proposed remediation and validation works, as detailed in the RAP (PRM 2021), meets the requirements of the site audit.

## **7. Evaluation of Land Use Suitability**

In assessing the suitability of a site for an existing or proposed land use in an urban context, the decision process for assessing urban redevelopment sites should be followed (Page 46 and 47, EPA 2017), as discussed in the following sections.

This audit was undertaken with the objective of independently reviewing the remediation action plan (PRM 2021) to determine if the land can be made suitable for all permissible uses within the proposed R2 Low Density Residential zone (at the date of completion of this audit) by the implementation of the processes outlined in the RAP.

### **7.1 Reporting in Accordance with EPA requirements**

The documents provided by the consultant have been checked against, and meet the requirements of EPA 2020. As such, the reporting of the proposed remediation and validation process is considered to be appropriate and meets the requirements of this audit.

### **7.2 Aesthetics Have Been Addressed**

The RAP (PRM 2021) makes provision for assessing aesthetics including consideration to odours, soil discolouration and the presence of anthropogenic materials (including ACM) during the proposed remediation and validation works. The requirement for asbestos clearance for the identified remediation areas RA1 and RA2, and underneath the building footprints addresses potential contamination from ACM.

As such, aesthetic issues have been and will be, appropriately addressed at the site.

### **7.3 Soils Have Been Assessed Against the Appropriate Investigation Levels**

The criteria adopted by the consultant (PRM 2021) for the RAP were checked against, and are consistent with, appropriate criteria endorsed by the EPA for the proposed land uses. As such, the soils are considered to have been assessed against appropriate investigation levels.

### **7.4 Background Soil Concentrations Have Been Adequately Addressed**

During the previous site investigation works, the consultant (PRM 2019b) had sampled in natural formations, providing a clear indication and representation of local natural soil profiles. As such, background soil concentrations are considered to have been adequately addressed.

### **7.5 All Impacts of Chemical Mixtures Have Been Assessed**

No issues relating to chemical mixtures in relation to the identified contaminants of concern were identified by the consultant. Hence, there was no requirement to give any further consideration to the impact of chemical mixtures.

### **7.6 Any Potential Ecological Risks Have Been Assessed**

Soil validation acceptance criteria include EPA endorsed ESLs and EILs (applicable to urban residential/public open space or calculated based on site specific data).

As such, ecological risks for site are considered to have been appropriately assessed as part of the site audit.

### **7.7 Site Management Strategy is Appropriate**

In accordance with the requirements of EPA 2017, the site management strategy outlined in the RAP (PRM 2021) is considered to be:

- technically feasible;
- environmentally justifiable given the nature and extent of the identified contamination; and

- consistent with relevant laws, policies and guidelines.

On this basis, the auditor accepts that the proposed remediation strategy is appropriate and, if implemented appropriately, will make the site suitable for all permissible uses within the R2 Low Density Residential zone (at the date of completion of this audit).

#### **7.8 Contaminant Migration (Actual or Potential) Has Been Addressed**

The consultant had addressed both the potential and actual migration of the identified contaminants of concern through an assessment of soils, groundwater and hazardous ground gases across the site in previous investigations (PRM 2019a and 2019b). Groundwater as a secondary source of contamination and the presence of hazardous ground gases at the site were concluded not to require further consideration.

As such, the requirements of the site audit in relation to consideration of contaminant migration have been met.

## 8. Audit Summary Opinion

On the basis of the findings of the site audit, and subject to the limitations in **Section 8**, the following summary opinions are provided:

- The proposed remediation and validation works are considered to have met the requirements of the *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd Edition)* (EPA 2017).
- There is no evidence of migration of contaminants from the site which is likely to result in any unacceptable risks to surrounding human or ecological receptors.
- The auditor notes that the remediation and validation procedures outlined in the RAP (PRM 2021) are considered appropriate to make the site suitable for the proposed land use, subject to the following requirements:
  - Appropriate supervision of the remediation works is to be undertaken by an appropriately qualified and experienced site contamination practitioner.
  - Following the completion of remediation and validation works, a validation report is prepared in accordance with relevant EPA requirements confirming the suitability of the site for all permissible uses within the R2 Low Density Residential zone (at the date of completion of this audit).
- The RAP (PRM 2021) prepared for the site addressed the identified contamination issues; with the remediation approach documented in the RAP checked by the auditor and found to be: technically feasible; environmentally justifiable given the nature and extent of the identified contamination; and consistent with relevant laws, policies and guidelines.
- A Site Audit Statement and Site Audit Report confirming the suitability of the site for the proposed land use is required upon completion of the remediation and validation works.



## 9. Limitations

This audit was conducted with a reasonable level of scrutiny, care and diligence on behalf of the client for the purposes outlined in the *Contaminated Land Management Act 1997*. The data used to support the conclusions reached in this audit were obtained by other consultants and the limitations which apply to the consultant's report(s) apply equally to this audit report.

Every reasonable effort has been made to identify and obtain all relevant data, reports and other information that provide evidence about the condition of the site, and those that were held by the client and the client's consultants, or that were readily available. No liability can be accepted for unreported omissions, alterations or errors in the data collected and presented by other consultants. Accordingly, the data and information presented by others are taken and interpreted in good faith.

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

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

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

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G and the Site Auditor reserve the right to review the report in the context of the additional information, subject to meeting relevant guideline requirements imposed by the EPA.

