

# Validation Report

51, 53 and 55 Headfort Street, Greenslopes Queensland

Department of Veteran Affairs



Reference: 784-BNEEN282781 Validation Report

12 May 2024

# DEPARTMENT OF VETERAN AFFAIRS, 51, 53 AND 55 HEADFORT STREET, GREENSLOPES QLD

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## Validation Report

**Report reference number: 784-BNEEN282781 Validation Report**

12 May 2024

## PREPARED FOR

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### Restriction on Disclosure and Use of Data

This report should be read in conjunction with the attached "Important information about your Tetra Tech Coffey Environmental Report"

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## EXECUTIVE SUMMARY<sup>1</sup>

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The Department of Veteran Affairs (DVA) is planning the redevelopment of 114 Newdegate Street, Greenslopes (Lot 123-125 RP46047) (“the Site”).

The Site is listed on the Environmental Management Register (EMR) for Hazardous Contaminants as a result of organochlorine pesticides (OCPs) being previously detected in soil. The Site is not subject to a Site Management Plan (SMP) and the EMR listing does not include a Site Suitability Statement.

DVA has a requirement to remediate and remove the Site from the EMR.

Remediation of the Site was undertaken between August 2023 and December 2023. Remediation involved the excavation and disposal of approximately 1,400 tonnes of soil material to an average excavation depth of approximately 0.45 m over the Site.

Soil materials were disposed to licenced landfills under approved Disposal Permits.

The assessment of validation data undertaken in this Validation Report has confirmed that the remedial objective has been achieved, and the Site can be considered to be suitable for for unrestricted land use, including Land Use A (residential with garden/accessible soil; childcare centres, preschools, and primary schools with access to soil) and sensitive land uses listed in Schedule 24 of the Planning Regulation 2017, and can be removed from the EMR.

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<sup>1</sup> This executive summary must be read in the context of the full report and the attached limitations.

## CONTENTS

<b>1. INTRODUCTION .....</b>	<b>1</b>
1.1 Structure of Validation Report .....	2
<b>2. TECHNICAL FRAMEWORK .....</b>	<b>3</b>
<b>3. PREVIOUS INVESTIGATIONS .....</b>	<b>4</b>
3.1 Coffey (2013) Department of Veteran Affairs Phase 1 Contaminated Land Assessment, 114 Newdegate Street, Greenslopes Queensland, 24 september 2013 .....	4
3.1.1 Overview .....	4
3.1.2 Scope of Works.....	4
3.1.3 Key Findings .....	6
3.1.4 Comments on Investigation .....	6
3.2 Coffey (2013) Department of Veteran Affairs Phase 2 Contaminated Land Assessment, 114 Newdegate Street, Greenslopes Queensland.....	8
3.2.1 Overview .....	8
3.2.2 Scope of Works.....	8
3.2.3 Key Findings .....	10
3.2.4 Comments on Investigation .....	10
3.3 Coffey (2019) Department of Veteran Affairs Delineation of Organochlorine Soil Impacts, 114 Newdegate Street, Greenslopes Queensland.....	11
3.3.1 Overview .....	11
3.3.2 Scope of Works.....	11
3.3.3 Key Findings .....	12
3.3.4 Comments on Investigation .....	13
3.4 Tetra Tech Coffey (2022) 114 Newdegate Street Greenslopes Remediation Planning, Supplementary Investigation, 11 May 2022 .....	14
3.4.1 Overview .....	14
3.4.2 SAQP Data Quality Objectives .....	14
3.4.3 Shallow Groundwater Investigation .....	16
3.4.4 Investigation Criteria included in SAQP .....	16
3.4.5 Investigation Criteria used in Supplementary Investigation.....	16
3.4.6 Scope of Works.....	19
3.4.7 Key Findings .....	21
3.4.8 Comments on Investigation .....	22
<b>4. SITE DESCRIPTION AND CHARACTERISATION .....</b>	<b>23</b>
4.1 Site Identification.....	23
4.2 Site History .....	25



4.2.1	Historical Title Information / Previous Owners and Occupiers .....	25
4.2.2	Historical Aerial Imagery .....	25
4.2.3	Historical Maps .....	26
4.2.4	Historical Land Use .....	26
4.2.5	Information held by Department of Environment and Science .....	27
4.2.6	Information held by Brisbane City Council .....	27
4.2.7	Building Structures .....	27
4.2.8	Building Services .....	28
4.2.8.1	Utilities on the Site prior to Remediation .....	28
4.2.8.2	Utilities on the Site post Remediation .....	29
4.2.8.3	Migration of Contaminants Along Building Services .....	29
4.2.9	Activities with the Potential for Contamination Not Applicable to the Site .....	29
4.2.10	Contamination from Historical Landuse .....	30
4.2.11	Data Gaps .....	31
4.3	Queensland Government Registers .....	31
4.3.1	Environmental Management Register .....	31
4.3.2	Environmentally Relevant Activities .....	31
4.3.3	Enforcement Actions .....	32
4.4	Environmental Setting and Site Characterisation .....	33
4.4.1	Topography .....	33
4.4.2	Hydrology .....	33
4.4.3	Regional Geology .....	33
4.4.4	Local Geology .....	34
4.4.5	Acid Sulfate Soils .....	36
4.4.6	Soil Landscape .....	36
4.4.7	Hydrogeology .....	36
4.4.8	Flood Risk Assessment .....	38
4.4.9	Bushfire Prone Areas .....	38
4.4.10	Fire Ants .....	38
4.4.11	Unexploded Ordinance .....	38
4.4.12	Cultural Heritage .....	38
4.4.13	Regional Ecosystems .....	38
4.4.14	Matters of State Environmental Significance (MSES) .....	38
4.4.15	Groundwater Dependent Ecosystems .....	39
4.4.16	Environmental Values and Water Quality Objectives .....	39

4.5	Summary of Contamination .....	40
4.5.1	Lithology.....	40
4.5.2	Contamination in Soil.....	40
4.5.2.1	OCPs 42	
4.5.2.2	Asbestos Containing Materials .....	42
4.5.2.3	Metals (other than Chromium and Arsenic).....	43
4.5.2.4	Chromium .....	43
4.5.2.5	Organophosphate Pesticides and Arsenic .....	44
4.5.2.6	Other Potential Contaminants of Concern .....	44
4.5.2.7	Other Anthropogenic Materials .....	44
4.5.3	Risk to Groundwater .....	45
4.5.4	Risk to Surface Water .....	45
4.5.5	Contaminants of Concern .....	45
4.5.6	Areas of Concern .....	46
4.5.7	Data Gaps and Limitation of Previous Investigations .....	47
4.5.8	Remediation of the Site .....	47
4.6	Pre-Remediation Conceptual Site Model.....	47
4.6.1	Tabulated CSM .....	49
<b>5.</b>	<b>REMEDIATION ACTION PLAN.....</b>	<b>52</b>
5.1	Remediation Strategy.....	52
5.2	Remediation Objective .....	52
5.3	Data Quality Objectives.....	52
5.4	Remediation Criteria .....	54
5.5	Materials Requiring Remediation .....	55
<b>6.</b>	<b>REMEDIATION AND VALIDATION WORKS .....</b>	<b>57</b>
6.1	Key Parties Involved in Remediation and Validation .....	57
6.2	Summary of Remedial Works .....	58
6.3	Inspections During Remediation .....	59
6.4	Air Quality Monitoring During Remediation.....	60
6.4.1	OCP Pesticides.....	60
6.4.2	Asbestos .....	60
6.5	Excavation of Materials Requiring Remediation .....	62
6.5.1	Unforeseen Contamination .....	63
6.6	Post-Remediation Ground Levels and Services .....	63
6.6.1	Ground Levels.....	63

6.6.2 Services .....	63
6.7 Disposal of Excavated Materials .....	65
6.8 Imported Materials .....	68
6.9 Validation Sampling .....	69
6.9.1 Overview .....	69
6.9.2 Ground Conditions at Validation Sampling Locations .....	73
6.9.3 Final Validation Sample Results .....	74
6.9.3.1 OCPs 74 .....	
6.9.3.2 Metals .....	74
6.9.3.3 Asbestos .....	76
6.9.3.4 Fill Materials Containing Anthropogenic Materials .....	77
6.9.3.5 Summary.....	77
6.9.4 Area Used to Stockpile Imported Materials .....	77
6.9.5 Imported Materials .....	78
6.10 Quality Assurance and Quality Control .....	78
<b>7. CONCEPTUAL SITE MODEL POST-REMEDIATION .....</b>	<b>79</b>
7.1.1 Tabulated CSM .....	79
<b>8. CONCLUSIONS .....</b>	<b>82</b>
<b>9. SITE SUITABILITY STATEMENT .....</b>	<b>82</b>
<b>10. IMPORTANT INFORMATION ABOUT YOUR TETRA TECH COFFEY REPORT .....</b>	<b>83</b>

## APPENDICES

<b>APPENDIX A: FIGURES .....</b>	<b>84</b>
<b>APPENDIX B: VALIDATION SAMPLE MATERIAL LOGS .....</b>	<b>85</b>
B.1 Northern Boundary (Headfort Street).....	86
B.2 South-West Boundary (Corner of Headfort Street and Newdegate Street).....	88
B.3 Eastern Boundary .....	89
B.4 Western Boundary (NEWDEGATE STREET) .....	90
B.5 northern boundary.....	91
B.6 Driveway Validation Sample Locations.....	91
B.7 Trench Validation Sample Locations (TR01 – TR06) .....	91
B.8 Trench Validation Sample Locations (T01 to T24) .....	92
B.9 Excavation Floor Validation Samples .....	96

B.10 Imported Materials .....	99
<b>APPENDIX C: DATA TABLES .....</b>	<b>100</b>
<b>APPENDIX D: PHOTOGRAPHS .....</b>	<b>101</b>
D.1 Boundary fence photographs .....	102
D.2 Validation Sample Photographs .....	109
D.3 Pre and post remediation photographs .....	110
<b>APPENDIX E: LABORATORY REPORTS.....</b>	<b>112</b>
<b>APPENDIX F: QAQC REPORT .....</b>	<b>113</b>
F.1 Field Quality Control (QAQC) Samples .....	113
F.2 Laboratory Quality Assurance Quality Control.....	116
F.3 Summary of Data Quality Review .....	118
F.4 QAQC RPD and Blank Sample Tables.....	119
<b>APPENDIX G: DQO/DQIS .....</b>	<b>121</b>
G.1 Data Quality Objectives.....	121
G.2 Data Quality Indicators .....	123
<b>APPENDIX H: REMEDIATION CONTRACTOR INFORMATION.....</b>	<b>127</b>
H.1 Waste Disposal Permits.....	128
H.2 Disposal Records.....	129
H.3 Imported Fill Records.....	130
<b>APPENDIX I: AIR MONITORING .....</b>	<b>131</b>
I.1 OCP Dust Monitornig Report .....	132
I.2 Abestos Air Monitoring Reports .....	133
<b>APPENDIX J: SITE SPECIFIC RISK ASSESSMENTS .....</b>	<b>134</b>
J.1 Arsenic Assessment .....	135
J.2 Asbestos Assessment .....	136
<b>APPENDIX K: SUPPORTING DOCUMENTS .....</b>	<b>137</b>
K.1 Site Identification Information .....	138
K.2 Lot Search Report.....	139
K.3 DES Response .....	140
K.4 BCC Right for information response .....	141
K.5 Previous Investigation Lithology .....	142
K.6 Regional Topography.....	143
K.7 Extract From Cross River Rail eis Groundwater Technical Report .....	144
K.8 Registered Bore Reports .....	145
K.9 Flood Risk .....	146

K.10 Fire Ants.....	147
K.11 Unexploded Ordinance .....	148
K.12 BCC City Plan .....	149
K.13 Landuse .....	150
K.14 Historical Land Titles.....	151
K.15 Building Services .....	152
K.16 Regional Ecosystems .....	153
K.17 MSES .....	154
K.18 Environmental Protection (Water) Policy 2009 South-east Queensland Map Series, PLAN WQ1431 .....	155
K.19 Brisbane River Estuary - Environmental Values and Water Quality Objectives Basin No. 143 ....	156
<b>APPENDIX L: TECHNICAL DOCUMENTS.....</b>	<b>157</b>
L.1 Supplementary Investigation SAQP .....	158
L.2 Report on Supplementary Investigation .....	159
L.3 Remediation Action Plan .....	160



## ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ACM	Asbestos-containing materials
AF	Asbestos fines
ARCP	Asbestos Removal Control Plan
ARCC	Australian Red Cross Centre
AMP	Asbestos Management Plan
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASLP	Australian Standard Leaching Procedure
C <sub>6</sub> -C <sub>36</sub>	Hydrocarbon chain length fraction
bgl	below ground level
bgs	Below ground surface
btoc	Below top of casing
BCC	Brisbane City Council
BTEXN	Benzene, toluene, ethylbenzene, xylenes and naphthalene
CLA	Contaminated Land Auditor
CLID	Contaminated Land Investigation Document
CLM	Contaminated Land Management
COC	Chain of Custody
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
DAWE	Department of Agriculture, Water and the Environment
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DES	Queensland Department of Environment and Science
DO	Dissolved Oxygen
DQI	Data Quality Indicator
DQO	Data Quality Objective
DSI	Detailed Site Investigation
DVA	Department of Veteran Affairs
EMR	Environmental Management Register
EPA	Environmental Protection Authority
FA	Fibrous asbestos
HIL	Health-based Investigation Level
HSL	Health Screening Level
IL	Investigation Levels
IP	Interface Probe

Acronyms/Abbreviations	Definition
LAA	Licensed asbestos assessor
LARC	Licensed asbestos removal contractor
LOR	Limit of Reporting
µg/L	micrograms per litre
m bgs	m below ground surface
mg/kg	milligrams per kilogram
mS/cm	milliSiemens per centimetre
mV	millivolts
MW	Monitoring Well
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure (Assessment of Site Contamination)
NHMRC	National Health and Medical Research Council
OCP	Organochlorine Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PFAS NEMP	Per-and poly-fluoroalkyl substances National Environmental Management Plan
PPE	Personal protective equipment
PSI	Preliminary Site Investigation
QA	Quality Assurance
QC	Quality Control
RAP	Remediation Action Plan
RFAI	Request for Additional Information
RPE	Respiratory protective equipment
RPD	Relative Percent Difference
SAQP	Sampling, Analysis and Quality Plan
SOP	Standard Operating Procedures
SMP	Site Management Plan
SQP	Suitably Qualified Person
SWL	Standing Water Level
TTC	Tetra Tech Coffey
TRH	Total Recoverable Hydrocarbons
WA DOH	Western Australian Department of Health
WQM	Water Quality Meter

# 1. INTRODUCTION

The Department of Veteran Affairs (DVA) is planning the redevelopment of 51, 53 and 55 Headfort Street, Greenslopes, Queensland, 4120<sup>2</sup> (Lot 123-125 RP46047) (“the Site”). The location of the Site is shown in Figure 1, Appendix A.

The Site is listed on the Environmental Management Register (EMR) for Hazardous Contaminants as a result of organochlorine pesticides (OCPs) being previously detected in soil. The Site is not listed on the Contaminated Land Register and is not subject to a Site Management Plan (SMP). The EMR listing does not include a Site Suitability Statement. The result included on the EMR listing (refer to Appendix K.1) states the following:

*“HAZARDOUS CONTAMINANT - This site has been subject to a hazardous contaminant. Refer to the summary given below. Elevated concentrations of organochlorine pesticides (DDD/DDT/DDE<sup>3</sup> and Aldrin/Dieldrin) identified on site above the nominated investigation levels.”*

Previous investigations have confirmed the presence of the OCPs Aldrin + Dieldrin which exceed the Schedule B1 *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPM) Health-based Investigation Levels for recreational areas (HIL-C). OCPs are associated with historical application of termite barriers using termiticides around buildings. Fragments of asbestos containing material (ACM) and asbestos fines have also been reported in soil which exceed NEPM guidelines for recreational areas.

The Site is owned by the DVA and is therefore located on Commonwealth land. The Commonwealth Department of Agriculture, Water and the Environment (DAWE) is advising DVA, at the Commonwealth level, on their environmental requirements and obligations. DAWE has determined the demolition and removal of the contaminated soil on the site is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and required the removal of the Site from the EMR as practicable.

DVA commissioned Tetra Tech Coffey (TTC) to prepare this Contaminated Land Investigation Document (CLID) in the form of a Validation Report to facilitate the removal of the Site from the EMR.

The Validation Report incorporates the finding of previous investigations completed in 2013, 2019, 2021 and 2022 and remediation and validation activities completed in 2023. The Validation Report is intended for use by DVA, the Site Auditor (Louise Cartwright, Epic Environmental) and the Department of Environment and Science (DES) (the Administering Authority). This Validation Report is to be read in-conjunction with limitations in Section 10.

Key information relating to the submission of this Validation Report is summarised in the following table.

**Table 1-1 Key Information**

Item	Description
Client / Site Owner	Repatriation Commission (Department of Veteran Affairs)
Site Address	51, 53 and 55 Headfort Street, Greenslopes, Queensland, 4120
Property Description	Lot 123, 124 and 125 RP46047 (the Site)
EMR Status	The Site is listed on the EMR; EMR Site IDs include: <ul style="list-style-type: none"> <li>1481512 (Lot 123 RP46047)</li> <li>1481513 (Lot 124 RP46047)</li> <li>1481514 (Lot 125 RP46047)</li> </ul>

<sup>2</sup> The Site has historically been referred to as 114 Newdegate Street, Greenslopes

<sup>3</sup> Note DDT - Dichlorodiphenyltrichloroethane; DDD – Dichlorodiphenyldichloroethane; and DDE - Dichlorodiphenyldichloroethylene

Item	Description
CLID Type	Validation Report. Voluntary submission of a CLID comprising an assessment of potential site contamination – Removing the Site from the EMR. This CLID provides final information about the Site and its intended use. No more CLIDs are forecast in the foreseeable future for the same Site and its same intended use.
Suitably Qualified Person	Jeremy Wicks, Tetra Tech Coffey
DES-Approved Contaminated Land Auditor	Louise Cartwright, Epic Environmental

## 1.1 STRUCTURE OF VALIDATION REPORT

Section 3 provides a summary of the Previous Investigations of the Site.

Section 4 provides a description of the Site, site history, the existing environment, a summary of contamination and the pre-remediation conceptual site model (CSM)

Section 5 summarises the key components of the Remediation Action Plan (RAP) for the Site and reported in Tetra Tech Coffey (2023) *114 Newdegate Street, Greenslopes QLD Remediation Action Plan, 23 August 2003*. A copy of the RAP is included in Appendix L.3.

Section 6 provides a description of the remediation works undertaken at the Site and the results of validation sampling. Section 7 provides the post-remediation conceptual site model (CSM) for the Site, along with conclusions of the remediation validation in Section 8.

Section 9 provides the Site Suitability Statement for the Site based on the completed remedial works and validation sampling.

## 2. TECHNICAL FRAMEWORK

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This Validation Report has been developed in general accordance with the following legislation, industry standards, codes of practice, and guidance documents, where relevant:

### Commonwealth

- *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Environmental Protection and Biodiversity Conservation Regulations 2000*
- *National Environment Protection Council (NEPC) Act 1994* (NEPC Act 1994).

### Queensland

- *Environmental Protection Act 1994* (EP Act)
- *Environmental Protection (Air) Policy 2019*
- *Environmental Protection (Noise) Policy 2019*
- *Environmental Protection (Water and Wetland Biodiversity) Policy 2019*
- *Environmental Protection Regulation 2019*
- *Waste Reduction and Recycling Act 2011*
- *Waste Reduction and Recycling Regulation 2011*

### Guidelines

- *National Environment Protection Council, National Environment Protection (Assessment of Site Contamination) Measure, 1999* (amended April 2013) (NEPM).
- Queensland Department of Environment and Science (DES, 2023) *Queensland Auditor Handbook for Contaminated Land Module 6: Content requirements for contaminated land investigation documents, certifications and audit reports. Version 2.03*
- Queensland Department of Environment and Science (DES, 2023) *Contaminated land investigation document—approved form, ESR/2023/6339 • Version 1.03 • 19 MAY 2023*.
- Western Australian Department of Health, *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia, 2021* (WA DOH 2021).

Redevelopment of the Site is a Controlled Action under the Commonwealth EPBC Act 1994, and requires the removal of the property from the EMR and the removal of soil with OCPs and ACM to the laboratory limits of reporting /detection (LOR) as practicable.

Removal of the Site from the EMR is subject to the requirements of the Queensland EP Act 1994 and subordinate legislation. Removal of the Site from the EMR requires this Validation Report including a Site Suitability Statement, and Site Auditor Certification.



### 3. PREVIOUS INVESTIGATIONS

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Details of the previous investigations at the Site is described in the following reports, which are summarised in the following sections:

- Coffey (2013) *Department of Veteran Affairs Phase 1 Contaminated Land Assessment, 114 Newdegate Street, Greenslopes Queensland, 24 September 2013* (PSI Report)
- Coffey (2013) *Department of Veteran Affairs Phase 2 Contaminated Land Assessment, 114 Newdegate Street, Greenslopes Queensland, 4 November 2013* (Phase 2 Report)
- Coffey (2019) *Department of Veteran Affairs Delineation of Organochlorine Soil Impacts, 114 Newdegate Street, Greenslopes Queensland, (2019 Report)*
- Tetra Tech Coffey (2022) *114 Newdegate Street Greenslopes Remediation Planning, Supplementary Investigation (Supplementary Investigation), 11 May 2022.*

Soil sampling locations from the aforementioned previous investigations are shown in Figure 2, Appendix A. A summary of the ground conditions encountered at the sample locations is provided in Appendix K.5.

Tabulated data from previous investigation locations is provided in Appendix C.7.1 and Appendix C.7.2.

Tabulated data in Appendix C.7.1 is compared to the investigation levels described in Section 3.4.5.

#### 3.1 COFFEY (2013) DEPARTMENT OF VETERAN AFFAIRS PHASE 1 CONTAMINATED LAND ASSESSMENT, 114 NEWDEGATE STREET, GREENSLOPES QUEENSLAND, 24 SEPTEMBER 2013

##### 3.1.1 Overview

This investigation included the completion of Preliminary Site Investigation (PSI) based on the requirements of Section 3 (Preliminary Investigations) of the *ASC NEPM Schedule B2 Guideline on Site Characterisation*.

##### 3.1.2 Scope of Works

The PSI was completed in 2013. The objective of the PSI was to identify current and historical activities with the potential to cause contamination. The scope of the PSI comprised:

- Desktop review of publicly available records including:
  - historical aerial photographs
  - current/historical title records
  - site layout plans and previous investigation reports
  - licences and notices (hazardous material storage, trade waste and dangerous goods)
  - service plans (“dial before you dig” search)
  - State groundwater database
  - EMR/CLR records
  - regional sensitive ecosystem database
  - right for information search with Brisbane City Council (BCC)
  - publicly available topographic, geological and hydrogeological maps.
- Site walkover to:
  - observe current site layout and uses of the property
  - general description of current/previous site operations
  - identification of current and historical (where possible) uses of adjoining properties and potentially sensitive receptors nearby

- confirmation of validity of publicly available information
- assessment for visual signs of ground contamination
- details and locations of current and former underground services
- observations of discharges to land, water and air
- observations of waste disposal locations
- local site knowledge of current and former owners or occupiers, and/or employees.
- Preliminary sampling at the Site comprising:
  - collection of four surface soil sample locations (SS01 to SS04) in a judgemental sampling pattern targeted at areas of potential contamination (refer to Table 3-1) based on the methodology summarised in Table 3-2
  - collection of soil samples at the surface by hand utilising a new nitrile glove
  - recording of soil/fill types and any evidence of potential contamination
  - analysis of four samples at a National Association of Testing Authorities (NATA) accredited laboratory for total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAHs), OCPs and organophosphate pesticides (OPPs), metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) and asbestos in soil.

Sample locations are summarised in Table 3-1, and the sampling methodology in Table 3-2.

**Table 3-1 Sample Locations**

Sample ID	Description of Sample Location
SS01	Area of salt accumulation beneath the southern building.
SS02	Within an unsealed area immediately below peeling paint and adjacent to timber potentially treated with pesticides and fibro cement sheeting.
SS03	Beneath the northern building targeting asbestos and potential pesticide use.
SS04	Wheelie bin storage area and area of compost pile and stressed vegetation.

Note: description of sample locations based on description included in Table D of the PSI Report.

**Table 3-2 Summary Soil Sampling Methodology**

Activity	Detail / Comment
Sample collection	A total of four soil samples were collected at selected locations across the site. Samples were collected by hand at the surface using a dedicated, new disposable nitrile glove.  Samples were placed in laboratory prepared sample containers and appropriately sealed.
Sample preservation	Samples were placed in laboratory supplied jars and were stored in insulated chilled containers while on site and in transit to the laboratory.
Sample submission	COC documentation was completed at the time of sample collection and accompanied the samples to the laboratory. The record of COC was attached with laboratory certificates included in the report on the PSI.
Sample analysis	Based on the field observations a total of 4 soil samples were submitted to NATA accredited laboratory Eurofins MGT for analysis.
Analytical Suite	The 4 soil samples were analysed for: <ul style="list-style-type: none"> <li>• TRH, OCPs/OPPs, PAHs</li> <li>• Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc)</li> <li>• Asbestos.</li> </ul>

### 3.1.3 Key Findings

Key findings of the PSI included the following.

#### Desk Study

- The Site had been developed prior to 1944 (earliest available aerial photography).
- The Commonwealth of Australia had interests in the property since 1901 when it held a three-year lease.
- the War Services Home Commissioner became the registered owner of the Site in 1920 and the Site was transferred to the Repatriation Commission in 1950.
- At the time of the PSI the Site was not registered on the EMR.
- No dangerous/hazardous goods licences or environmental authorities were associated with the Site.
- Representatives of the site operators (Australian Red Cross) were not aware of any spills or releases of hazardous contaminants, pest infestations, major refurbishments, building fires or storage of hazardous materials other than minor storage of cleaning chemicals and paints.

#### Site Walkover

- Fragments of asbestos containing materials (ACM) on the ground surface were observed beneath both site buildings and within the front vegetated area.
- Paint on the buildings was in poor condition and peeling and has the potential to contain lead and other metals.
- Evidence of former termite infestations was present underneath the southern building. Pesticides may have been used to remove the termite infestation.
- There is potential for pesticide use in the north eastern corner of the site where stressed vegetation was present and a neighbouring property had an orchid shade house.

#### Preliminary Sampling

- Zinc was reported in two of the four samples with concentration which exceeded the adopted ecological investigations levels (NEPM 1999 ESLs Urban residential and public open space, Fine Soil). Concentrations of zinc did not exceed adopted human health guidelines (NEPM HIL-A).
- Detectable concentrations of organochlorine pesticides were present in all four soil samples analysed. The organochlorine pesticides detected is consistent with historical treatment of pests such as termites. The concentrations of all organochlorine pesticides detected were below the nominated investigation levels (NEPM HIL-A).
- Asbestos fibres were detected in soil samples SS01 (0.007% weight/weight) and SS02 (0.02% weight/weight). These concentrations of asbestos fibres are above the recommended investigation level for fibrous asbestos or asbestos fines in soil for all site uses. Therefore, the detected concentrations have the potential to impact on current and future site users.

The conceptual site model (CSM) identified potentially complete exposure pathways to existing site users (maintenance workers) and future site users (construction workers and future land users) for asbestos and organochlorine pesticides. The CSM did not consider there to be an ecological receptor on-site or in the immediate vicinity of the Site.

The report on the PSI made recommendations for further investigation of the Site based on the findings of the investigation to further define the extent of contamination and management/remediation of the Site.

### 3.1.4 Comments on Investigation

The PSI was undertaken in general accordance with Section 3 (Preliminary Investigations) of the *ASC NEPM Schedule B2 Guideline on Site Characterisation*.

Notable data gaps from the PSI included:

- historical use of the Site prior to 1944
- whether paints used on the buildings were lead based paints
- whether fill materials were present on the Site
- the extent and significance of contamination on the Site.

Notable limitations of the PSI included:

- the investigation did not include Data Quality Objectives / Data Quality Indicators
- the limited soil sampling program did not include an assessment of field and laboratory quality assurance / quality controls (QA/QC) information.
- historical aerial imagery included in the report was small-scale and may have limited interpretation of the historical use of the Site.
- buildings on the Site limited where the investigation could be undertaken.

## 3.2 COFFEY (2013) DEPARTMENT OF VETERAN AFFAIRS PHASE 2 CONTAMINATED LAND ASSESSMENT, 114 NEWDEGATE STREET, GREENSLOPES QUEENSLAND

### 3.2.1 Overview

This investigation was undertaken to further investigate the extent of contamination on the Site.

### 3.2.2 Scope of Works

The scope of the investigation comprised:

- Field screening of ten locations for the presence of ACM.
- Emu bob of exposed surface soils for ACM.
- Collection of soil samples from twelve targeted locations and analysis of ten samples for asbestos fibres in soil.
- Collection and analysis of soil samples from eleven locations for both metals and organochlorine pesticides and two samples for cation exchange capacity (CEC) and pH.
- Collection and analysis of quality control samples.
- Interpretation of the data and preparation of the site investigation report.

Sample locations are summarised in Table 3-3, and the sampling methodology in Note: description of sample locations based on description included in Table A of the Phase 2 Report.

Table 3-4.

**Table 3-3 Sample Locations**

Location ID	Description of Sample Location
HA01	Collected adjacent to a tree stump under the Main Hall building. Potential location of pesticide use.
HA02	Collected from adjacent to the inside of the southern wall of the Main Hall building. Potential location of pesticide use.
HA03	
HA04	
HA05	Collected from the eastern side of exposed soil beneath the Main Hall building to provide coverage of the exposed soil. Potential location of pesticide use.
HA06	Collected from the eastern side beneath the Accommodation building where access could be gained. Potential location of pesticide use.
HA07	Central accessible area beneath the Accommodation building. Potential location of pesticide use.
HA08	Western accessible area beneath the Accommodation building. Potential location of pesticide use.
HA09	Located in garden bed immediately adjacent to the southern external wall of the Accommodation building. Location of potential pesticide use and paint flakes.
HA10	Located in garden bed immediately adjacent to the southern external wall of the Accommodation building. Location of potential pesticide use and paint flakes.
HA11	Collected from the location of the Phase 1 sample location SS02 to allow for analysis of CEC and pH to assess metal concentrations against Environmental Investigation Levels.
SA01/A01	Immediately surrounding Accommodation building covering areas where asbestos containing materials were present at the surface.
SA02/A02	
SA03/A03	
SA04/A04	



Location ID	Description of Sample Location
SA05/A05	Adjacent to southern wall of Main Hall building in garden bed where fill material had been placed and asbestos containing materials identified at the surface.
SA06/A06	
SA07/A07	Exposed soil from beneath the Main Hall building where asbestos containing materials were identified at the surface and to provide delineation of Phase 1 sample location SS01.
SA08/A08	
SA09/A09	Adjacent to northern wall of Main Hall building in garden bed.
SA10/A10	
SA11	Beneath Accommodation building in accessible areas where asbestos containing materials were identified at the surface.
SA12	
SA13	

Note: description of sample locations based on description included in Table A of the Phase 2 Report.

**Table 3-4 Summary of Soil Sampling Methodology**

Activity	Detail / Comment
<b>Sample collection</b>	<p>Soil samples were collected from the surface and 0.5m or auger refusal at each location from a hand trowel and/or hand auger cuttings.</p> <p>An approximate weight of 1.5kg was collected for samples selected for asbestos fines analysis.</p> <p>Sample collection was undertaken in accordance with AS4482.1-2005. Dedicated disposable nitrile gloves were used for soil sample collection. Samples were placed in laboratory prepared sample containers and appropriately sealed.</p>
<b>Asbestos field screening</b>	<p>Soil was removed from the selected locations using a shovel. A 9.5L bucket was filled with representative soil from selected depths and weighed. The contents of the bucket were then passed through a &lt;7mm sieve and hand shaken. ACM was then visually identified, collected and weighed and logged. The residual contents of the sieve were then spread across a brightly coloured board and visually inspected, and ACM fragments (if identified) collected.</p> <p>In addition to field screening an emu bob/visual inspection of unsealed areas was completed to identify and identified ACM collected and recorded.</p>
<b>Reusable sampling equipment</b>	<p>Non-disposable sampling equipment was decontaminated between each location to minimise the possibility of cross contamination between samples and to minimise the risk of impacting sample integrity. Non-disposable sampling equipment used as part of this investigation included hand auger and hand trowel.</p> <p>The decontamination process included:</p> <ul style="list-style-type: none"> <li>removal of adhered materials using brushes;</li> <li>washing of the equipment with laboratory grade detergent solution; and</li> <li>rinsing with de-ionised water.</li> </ul> <p>Appropriateness of the decontamination procedure adopted was confirmed through collection and analysis of rinsate samples.</p>
<b>Sample preservation</b>	Samples were placed in laboratory supplied jars and were stored in insulated chilled containers while on site and in transit to the laboratory.
<b>Sample submission</b>	COC documentation was completed at the time of sample collection and accompanied the samples to the laboratory. The record of COC was attached with laboratory certificates included in the investigation report.
<b>Sample analysis</b>	Samples were submitted to NATA accredited laboratories for analysis. Eurofins MGT were used as the primary laboratory and ALS Environmental (ALS) was the nominated secondary laboratory.
<b>Analytical suite</b>	<p>A total of eleven primary soil samples were analysed for:</p> <ul style="list-style-type: none"> <li>OCPs;</li> <li>Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc)</li> </ul> <p>A total of fifteen samples were analysed for asbestos</p>

Activity	Detail / Comment
QA/QC	Collection of field QA/QC samples including intra/inter laboratory duplicate samples (~10%) and a rinsate sample, which were analysed for chemical contaminants.

### 3.2.3 Key Findings

Key findings of the investigation included the following:

- the presence of ACM in soil beneath the Main Hall Building and Accommodation Building which exceeded the nominated investigation levels (HIL-A).
- AF (chrysotile) detected in one soil sample with levels below the nominated investigation levels.
- OCPs (aldrin + dieldrin) with concentrations which exceeded the nominated investigation levels (NEPM HIL-A) along the southern wall of the Main Hall, and beneath and along the southern wall of the Accommodation Building.
- the presence of anthropogenic materials including slag in soil material at sample sites located on the southern boundary of the Site (A05 and A06), sample locations to the west of the Accommodation Building (A04), and beneath and north of the Main Hall (A08 and A10).
- contamination on the Site poses a potential unacceptable risk to human health and ecological receptors and required remediation/management.
- the CSM identified potentially complete exposure pathways to existing site users (maintenance workers) and future site users (construction workers and future land users) for asbestos and organochlorine pesticides. The CSM did not consider there to be an ecological receptor on-site or in the immediate vicinity of the Site.

### 3.2.4 Comments on Investigation

The investigation was undertaken with consideration to the *ASC NEPM Schedule B2 Guideline on Site Characterisation*.

Notable data gaps from the investigation included:

- The extent and significance of contamination on the Site including OCPs and asbestos
- Borelogs included in the investigation report identified the presence of fill materials. The presence of fill materials was not discussed in the investigation report. The extent (lateral/vertical) and characteristics of fill materials on the site is a data gap.

Notable limitations of the investigation included:

- The investigation did not include Data Quality Objectives / Data Quality Indicators.
- The sampling methodology was limited to hand excavation / hand auguring which limited the depth of sampling, and the visual characterisation of fill materials. Excavation of mechanically excavated test pits is preferable where fill materials are present, and ACM is a contaminant of concern. Hand sampling methods limited the depth of samples to <0.5 m below ground surface (bgs).
- Records of the emu bob and ACM removed from the Site was not included in the investigation report.
- The assessment of ACM in soil, focussed on surface soil materials where ACM had been observed in ground surface. A limitation/data gap of the investigation was the presence of ACM in fill materials.
- Buildings on the Site limited where the investigation could be undertaken.
- The CSM did not appear to consider an assessment of groundwater/surface water, and on-site ecological receptors which may be potentially present.

### 3.3 COFFEY (2019) DEPARTMENT OF VETERAN AFFAIRS DELINEATION OF ORGANOCHLORINE SOIL IMPACTS, 114 NEWDEGATE STREET, GREENSLOPES QUEENSLAND

#### 3.3.1 Overview

The objective of this investigation was to provide additional delineation and characterisation of the previously identified organochlorine impact on the Site.

#### 3.3.2 Scope of Works

The scope of the investigation comprised:

- Setting out soil sample locations
- Collection of soil samples on the 1 October 2019 including:
  - 17 locations (sample numbers 1 through to 12 and 14 through to 18) that provide additional lateral delineation of the identified organochlorine impacted zone; one of the proposed locations (13) was inaccessible as the area was sealed with concrete;
  - 5 locations (sample numbers 6P, 7P, 9P, 13P and 14P) where the previous investigation identified OCPs impacts above the nominated investigation levels to provide confirmation of the analytical results and allow collection of samples from underlying soil profiles to assist with vertical delineation; and
  - surface soil samples from 17 locations (including sample numbers 19 through to 36) were collected for delineation purposes. Seven of these locations were selected prior to field works and the rest were selected on site based on the field observations and soil types encountered.
- Analysis of samples at NATA certified laboratories for:
  - 46 selected samples were analysed for OCPs.
  - 2 selected samples were analysed for PAHs and metals including arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc based on field observations.
  - 12 leachate samples were analysed for leachable OCPs via toxicity characteristic leaching procedure (TCLP).

The sampling methodology is summarised in Table 3-5.

**Table 3-5 Summary of Soil Sampling Methodology**

Activity	Detail / Comment
Sample collection	<p>Soil samples were collected from each location by collecting hand trowel and hand auger cuttings. Where possible, samples were collected at depths of 0.0-0.1 and 0.25-0.5 m bgs or when a change in lithology was observed. Surface soil samples were collected using a hand trowel.</p> <p>Sample collection was undertaken in accordance with ASC NEPM. Dedicated disposable nitrile gloves were used for soil sample collection. Samples were placed in laboratory prepared sample containers and appropriately sealed.</p>
Reusable sampling equipment	<p>Non-disposable sampling equipment was decontaminated between each location to minimise the possibility of cross contamination between samples and to minimise the risk of impacting sample integrity. Non-disposable sampling equipment used as part of this investigation included hand auger and hand trowel.</p> <p>The decontamination process included:</p> <ul style="list-style-type: none"> <li>• removal of adhered materials using brushes</li> <li>• washing of the equipment with laboratory grade detergent solution</li> <li>• rinsing with de-ionised water.</li> </ul>

	Appropriateness of the decontamination procedure adopted was confirmed through collection and analysis of rinsate sample.
<b>Sample preservation</b>	Samples were placed in laboratory supplied jars and were stored in insulated chilled containers while on site and in transit to the laboratory.
<b>Sample submission</b>	COC documentation was completed at the time of sample collection and accompanied the samples to the laboratory. The record of COC was included with the laboratory certificates included in the investigation report.
<b>Sample analysis</b>	Samples were submitted to NATA accredited laboratories for analysis. Eurofins MGT were used as the primary laboratory and ALS was the nominated secondary laboratory. Based on the field observations a total of 46 primary soil samples were selected for laboratory analyses.
<b>Analytical Suite</b>	<p>A total of 46 soil samples were analysed for:</p> <ul style="list-style-type: none"> <li>• OCPs.</li> </ul> <p>A total of two soil samples were analysed for:</p> <ul style="list-style-type: none"> <li>• PAHs</li> <li>• Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc).</li> </ul> <p>A total of twelve leachate samples were analysed for:</p> <ul style="list-style-type: none"> <li>• Leachable organochlorine pesticides via toxicity characteristic leaching procedure (TCLP).</li> </ul>
<b>QA/QC</b>	Collection of field QA/QC samples including intra/inter laboratory duplicate samples (~20%) field rinsate and field blank.

### 3.3.3 Key Findings

Key findings of the investigation included the following:

- OCPs analytical results identified aldrin + dieldrin at concentrations above the nominated investigation levels primarily at locations where the building external walls intersected the ground. This is consistent with the application of termite barriers around the perimeter of buildings.
- Of the 21 samples collected and analysed for OCPs from beneath the surface (0.2 to 0.5m bgs), three samples (10 – 0.45, 11 – 0.45 and 13P – 0.2) reported concentrations of aldrin + dieldrin above the nominated investigation levels (NEPM HIL-A). These three samples were located adjacent to or immediately down gradient of the southern and western walls of the accommodation building.
- Two samples collected within slag fill material used behind the retaining wall on the southern side of the main hall building were analysed for PAHs and metals. The reported concentrations of both PAHs and metals were below the nominated investigation levels adopted for this investigation.

- Total concentrations of organochlorines were above the acceptance criteria for use of the soil as coverage material at the landfill.
- Leachable dieldrin concentrations were reported in exceedance from the allowable leaching levels for clay lined landfills in six leachate samples and in exceedance of the allowable leaching levels for double lined landfills in two leachate samples.

### 3.3.4 Comments on Investigation

The investigation was undertaken with consideration to the *ASC NEPM*.

Notable data gaps from the investigation included:

- The investigation did not further investigate fill materials including the extent (lateral/vertical) and characteristics of these materials.
- Soil samples along the eastern and northern boundary of the Site were not collected.
- Risk to groundwater on-site from leaching of contaminants

Notable limitations of the investigation included:

- The investigation did not include Data Quality Objectives / Data Quality Indicators
- The sampling methodology was limited to hand excavation / hand auguring which limited the depth of excavations, and the visual characterisation of fill materials. Excavation of mechanically excavated test pits is preferable where fill materials are present, and ACM is a contaminant of concern. Hand sampling methods limited the depth of samples to <0.5 m bgs.
- Asbestos was not included in soil analysis.
- The CSM was not updated, and the report did not consider risk to groundwater/surface water, and risk to on-site ecological receptors which may be potentially present.



### 3.4 TETRA TECH COFFEY (2022) 114 NEWDEGATE STREET GREENSLOPES REMEDIATION PLANNING, SUPPLEMENTARY INVESTIGATION, 11 MAY 2022

#### 3.4.1 Overview

The investigation reported in *Tetra Tech Coffey, 2022. 114 Newdegate Street Greenslopes Remediation Planning, Supplementary Investigation, Rev 0, 11 May 2022* (Supplementary Investigation) comprised the completion of an investigation to address data gaps required for remediation planning. A copy of the report on the Supplementary Investigation is included in Appendix L.2.

The Supplementary Investigation was undertaken in accordance with Coffey (2021) *114 Newdegate Street Greenslopes Remediation Planning, Sampling, Analysis and Quality Plan, 19 July 2021* (SAQP). A copy of the SAQP has been included in Appendix L.1.

The SAQP and the report on the Supplementary Investigation were reviewed by the Site Auditor.

Specific data gaps identified in the SAQP to be addressed by the supplementary investigation included the following:

- *Previous investigations have not sampled soil materials beneath the concrete slab located along the northern half of the Accommodation Building, and beneath the concrete pavement along the eastern boundary of the Site.*
- *Elevated concentrations of zinc were found at two locations in Area 2 (SS01 and SS02). While the concentrations are below NEPM Guidelines for Parks and Open Spaces, recipient landfills may require leachability tests for waste classification purposes.*
- *The potential for contamination in the concrete slabs has not been previously investigated. OCPs have the potential to be present in concrete slabs as wells as building stumps/footings.*
- *Soil materials containing slag have been analysed however it is recommended that the slag materials be crushed and analysed.*

#### 3.4.2 SAQP Data Quality Objectives

Data Quality Objectives from the SAQP have been reproduced as follows.

The National Environment Protection Measure (NEPM, Schedule B2 Guideline on Site Characterisation - 2013) states that the nature and quality of the data collected for a particular assessment will be determined by the Data Quality Objectives (DQOs). The NEPM and the Australian Standard AS4482.1-2005 reference the US EPA *Guidance on Systematic Planning Using the Data Quality Objectives Process* (US EPA, 2006) which defines the DQO process. The US EPA defines the process as ‘a strategic planning approach based on the Scientific Methods that is used to prepare for a data collection activity. It provides a systematic procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, the tolerable level of decision errors for the study, and how many samples to collect.’

The process for establishing DQOs appropriate for a project is defined by the US EPA and comprises seven steps. The DQOs have been briefly summarised in Table 3-6.

**Table 3-6: Data Quality Objectives from SAQP**

Data Quality Objectives
<p>1. State the Problem</p> <p>DVA is planning to redevelop the Site for park/community use. DVA has advised that it has had preliminary discussions with BCC which support the end use of the Site as a Park, and has advised that remediation of the Site to a standard suitable for Park is an appropriate remediation strategy for the Site. Previous investigations have identified OCPs and asbestos which exceed guidelines for recreational use. Review of previous investigation have identified four 'Data Gaps' which include:</p> <ol style="list-style-type: none"> <li>Previous investigations have generally sampled from accessible areas on the Site and accordingly there are number of locations on the Site which have not been investigated. Materials within these areas require investigation to inform the planning for the redevelopment and remediation of the Site.</li> <li>Elevated concentrations of zinc have previously been reported in two sample locations which have potential implications for off-site disposal to landfill. These locations require leachability (TCLP) tests to confirm landfill disposal requirements.</li> <li>OCPs are potentially present in concrete slabs present on the Site as well as stumps and footings; these materials require investigation.</li> <li>Slag materials are present on the Site. Samples of slag should be collected and crushed for chemical testing.</li> </ol>
<p>2. Identify the goal of the study</p> <p>The purpose of the investigation is to investigate the Data Gaps described in Section 5 of the SAQP included in Appendix L.1.</p>
<p>3. Identify information inputs</p> <ul style="list-style-type: none"> <li>Previous investigations (where applicable)</li> <li>Field observations including the presence of visual/olfactory indicators of contamination</li> <li>Analytical data of sample media, and quality assurance / quality control (QA/QC) samples</li> <li>Outcome of QA/QC samples</li> <li>Nominated investigation levels.</li> </ul>
<p>4. Define the boundary of the study</p> <p>The study boundary is defined as Lot 123-125 RP46047 ("the Site), and the investigation of soil materials to approximately 0.5 m below ground level within the Site. The investigation will be undertaken over a period of approximately one day.</p>
<p>5. Develop a decision rule</p> <p>Primary and QA/QC samples will be collected and analysed by the laboratories for potential contaminants of concern (CoCs). Where contamination is identified and exceeds the nominated investigation levels for the protection of human health and/or the environment a recommendation will be made for:</p> <ul style="list-style-type: none"> <li>completion of further investigations to assess the nature and extent of OCP contamination requiring management (if required)</li> <li>remediation of the Site to enable the Site to be used for its intended use.</li> </ul>
<p>6. Specify performance of acceptance criteria</p> <p>Analytical data quality indicators are described in Section 10 of the SAQP included in Appendix L.1.</p>
<p>7. Develop a plan for obtaining the data</p> <p>The methodology and rationale for obtaining relevant data for the detailed site investigation is described in this plan.</p>

### 3.4.3 Shallow Groundwater Investigation

As an addendum to the SAQP a decision was made to install a groundwater monitoring well in the north-west of the Site (MW01, refer to Figure 2, Appendix A) to 6 m bgs to investigate whether a shallow groundwater bearing zone was present on the Site. The proposed methodology for the installation of the monitoring well was submitted to the Site Auditor on the 15 November 2021 (refer to Appendix L.1).

The location of the monitoring well in the north-western corner of the Site was selected for the following reasons:

- the north-western corner was the lowest corner of the Site (refer to Section 4.4.1) and inferred to be hydraulically down-gradient of OCP source areas at the western end of the Site in a shallow aquifer was present.
- the north-western corner of the Site was accessible by a drill rig.

Drilling of the borehole to 6 m bgs was considered sufficient depth to investigate whether a shallow groundwater bearing zone was present and near to the OCP contamination in the shallow soils on the Site.

### 3.4.4 Investigation Criteria included in SAQP

Investigation criteria included in the SAQP have been reproduced as follows.

The nominated investigation levels (ILs) have been selected to assess the suitability of the Site for its intended use for recreational purposes or removal of the Site from the EMR. Based on the CoC identified in previous investigations the nominated ILs include:

Assessment of the Site for Recreational Use

- NEPM health-based investigation levels in recreational land use (HIL-C)
- NEPM health screening level for asbestos for recreational land use (HSL-C)
- NEPM Ecological Investigation Levels (EIL) for in Urban Residential/Public Open Space land use settings
- Other guideline as required based on the findings of the investigation.

Assessment of the Site for removal from EMR

- NEPM health-based investigation levels in residential landuse with accessible gardens/soil (HIL-A)
- NEPM health screening level for asbestos for residential landuse with accessible gardens/soil (HSL-A)
- NEPM Ecological Investigation Levels in Urban Residential/Public Open Space land use settings
- Other guideline as required based on the findings of the investigation.

### 3.4.5 Investigation Criteria used in Supplementary Investigation

Investigation levels were further refined in the Supplementary Investigation to include the derivation of EILs and ecological criteria for OCPs which do not have an investigation in the level. The Investigation Levels adopted in the Supplementary Investigation (refer to Appendix L.2) have been reproduced as follows.

#### Introduction

Soil samples analysed were compared to established guidelines for the protection of human health and the environment. The guidelines adopted for this investigation are referred to as the nominated investigation levels (ILs).

Exceedance of an IL may trigger further consideration of risk through either qualitative risk assessment with consideration to source-pathway-receptors and/or further refinement of the IL. The ILs are summarised as follows.

## Protection of Human Health

The nominated ILs have been selected to assess the suitability of the Site for its intended use for recreational purposes or removal of the Site from the EMR. Based on the PCOC identified in previous investigations the nominated ILs include:

Assessment of the Site for Recreational Use:

- NEPM health-based investigation levels in recreational land use (HIL-C)
- Other guideline as required based on the findings of the investigation.

Assessment of the Site for removal from EMR

- NEPM health-based investigation levels in residential landuse with accessible gardens/soil (HIL-A)
- Other guideline as required based on the findings of the investigation.

Table 3-7 and Table 3-8 summarise the adopted human health guidelines for soils.

**Table 3-7: Human Health ILs for Soil and Sediment**

Analyte	Adopted IL
<ul style="list-style-type: none"> <li>• Metals</li> <li>• Organo-chlorine pesticides (OCs)</li> <li>• Carcinogenic PAH (Benzo(a)pyrene TEQ)</li> <li>• Total PAH</li> </ul>	<p>Assessment of the Site for Recreational Use:</p> <ul style="list-style-type: none"> <li>• NEPM health-based investigation levels in recreational land use (HIL-C)</li> <li>• Other guideline as required based on the findings of the investigation.</li> </ul> <p>Assessment of the Site for removal from EMR</p> <ul style="list-style-type: none"> <li>• NEPM health-based investigation levels in residential landuse with accessible gardens/soil (HIL-A)</li> <li>• Other guideline as required based on the findings of the investigation.</li> </ul>
<ul style="list-style-type: none"> <li>• Total Recoverable Hydrocarbons (TRH)</li> <li>• Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) Compounds</li> <li>• Naphthalene (N)</li> </ul>	<p>The most conservative of the following guidelines has been selected (refer to Table 3-7):</p> <ul style="list-style-type: none"> <li>• NEPM HSL Vapour intrusion (Residential) &lt;1 m SAND or Recreational/Open Space &lt;1m SAND</li> <li>• NEPM Management Limits (Residential, Parkland and Open Space).</li> <li>• CRC Care Soil Health Screening Levels for Direct Contact Residential HSL-A Low Density.</li> </ul>

**Table 3-8: Summary of Adopted Human Health ILs for TRH**

TRH Fraction	HSL-A	Management Limits <sup>4</sup>	Direct Contact	Adopted IL
TRH C6-C10 minus BTEX	45	700	4400 <sup>5</sup>	45
TRH >C10-C16	110	1000	3300	110
TRH >C16-C34	N/A	2500	4500	2500
TRH >C34-C40	N/A	10000	6300	6300

<sup>4</sup> The NEPM defines the management limits as *Petroleum hydrocarbon 'management limits' are limited to petroleum hydrocarbon compounds. They are maximum values that should remain in a site following evaluation of human health and ecological risks and risks to groundwater resources and apply to all soil depths based on site-specific considerations. These limits are to consider the formation of light non aqueous phase liquids, fire and explosion risks and damage to buried infrastructure.*

<sup>5</sup> Note the direct contract guideline is for TRH C6-C10 (inclusive of BTEX)

## Asbestos

For asbestos in soil, a screening level of 0.1 g/kg (0.01 % w/w equivalent) was adopted based on the laboratory detection limit for analysis of asbestos in non-homogenous samples using the methodology outlined in Australian Standard AS 4964 – 2004: Method for the Qualitative Identification of Asbestos in Bulk Samples (AS4964-2004). Furthermore, an assessment criterion of 'no respirable fibres' was adopted; a detection of respirable fibres would indicate an exceedance of the assessment criteria.

## Protection of Ecological Receptors

For the purpose of this assessment the following Ecological ILs (EILs) have been adopted based on the NEPM Ecological Investigation Levels (EIL) for in Urban Residential/Public Open Space land use settings.

The EILs were derived with consideration to the following physico-chemical soil properties from two soil samples reported in Coffey (2013) including HA11 (replication of sample SS02) and HA07, and soil samples from MW01 which was completed in this investigation. Soil material reported from these locations were comprised of Clayey Sandy SILT (HA07), sandy silty CLAY (HA11), and generally consistent with the description of fill and natural materials observed on the Site.

The physico-chemical properties of the samples previously investigated included:

- CEC: 17 meq/100g (MW01-0.25), 25 meq/100g (HA07), 30 meq/100g (HA11), 33 meq/100g (MW01-0.75)
- pH: 5.5 (MW01-0.25), 5.8 (HA07), 6.3 (HA11) and 6.6 (MW01-0.75).

EILs derived based on the ASC NEPM are summarised in the following Table 3-9.

**Table 3-9: Adopted EILs**

Potential Contaminant	Adopted EIL	Assumption
Zinc	420	Based on the sum of the Aged Contamination Limits (ACL) and Ambient Background Concentration (ABC) where: <ul style="list-style-type: none"> <li>• ACL = 400 mg/kg (urban residential/public open space land use and an assumed CEC of 20 meq/100g and pH of 6</li> <li>• ABC = 20 mg/kg (Note 1)</li> </ul>
Copper	196	Based on the sum of the Aged Contamination Limits (ACL) and Ambient Background Concentration (ABC) where: <ul style="list-style-type: none"> <li>• ACL = 190 mg/kg (urban residential/public open space land use and an assumed pH of 6</li> <li>• ABC = 6 mg/kg (Note 1)</li> </ul>
Chromium III	245	Based on the sum of the ACL and ABC where: <ul style="list-style-type: none"> <li>• ACL = 190 mg/kg (urban residential/public open space land use and 1% clay content was assumed</li> <li>• ABC = 55 mg/kg (Note 1)</li> </ul>
Nickel	287	Based on the sum of the ACL and ABC where: <ul style="list-style-type: none"> <li>• ACL = 270 mg/kg (urban residential/public open space land use and an assumed CEC of 20 meq/100g</li> <li>• ABC = 17 mg/kg (Note 1)</li> </ul>
Lead	1112	Based on the sum of the ACL and ABC where: <ul style="list-style-type: none"> <li>• ACL = 1100 mg/kg (urban residential/public open space land use)</li> <li>• ABC = 12 mg/kg (Note 1)</li> </ul>
Arsenic	100	Based on the generic EIL for urban residential/public open space land use
DDT	180	

Potential Contaminant	Adopted EIL	Assumption
TRH C6-C10	180	Based on the generic ESL for urban residential/public open space land use, and coarse soils
TRH >C10-C16	120	
TRH >C16-C34	300	
TRH >C34-C40	2800	

Note 1: BH01 to BH05 are located beneath the Main Building and were found to comprised natural materials (an no fill materials). The Ambient Background Concentration (ABC) was derived as the arithmetic mean of sample results from these sample locations.

There are no EILs for a range of OCPs reported on the site including Aldrin, Dieldrin, Endosulfan, Endrin and Heptachlor.

Ecological guidelines from the United States Environmental Protection Agency (USEPA) were adopted where there is no Australian guideline.

The US EPA<sup>6</sup> has set the following ecological screening levels for dieldrin (0.0029 mg/kg), aldrin (0.03 mg/kg), chlordane (0.0029 mg/kg), heptachlor epoxide (0.00015 mg/kg) and endrin (0.00019 mg/kg).

### 3.4.6 Scope of Works

The investigation comprised the excavation of 21 hand augered boreholes over the Site on the 3 September 2021, and soil boring the installation of one groundwater monitoring well to 6 m bgs on 17 November 2021. Soil and groundwater sampling was completed in accordance with the methodology summarised below in Table 3-11.

Sample locations are summarised in Table 3-10, and the sampling methodology in Table 3-11. Soil sampling locations are shown in Figure 2, Appendix A.

**Table 3-10 Sample Locations**

Sample Location	Purpose of Sample Location
BH01 to BH08	Concrete coring and soil sampling beneath the sealed area beneath Main Hall Building, and the concrete drive way along the eastern end of the Site.
BH09 to BH11	Concrete coring between the accommodation building and main hall.
BH12 to BH13	Two surface soil samples (0-0.1 m bgs) where elevated levels of zinc were reported in previous investigations
BH14 to BH15	Two boreholes at previous sampling sites where elevated concentrations of OCPs were reported and there is currently no leachability data including HA10 and HA09.
BH16 to BH17	Two boreholes at previous sampling sites where elevated concentrations of OCPs were reported and there is currently no leachability data including HA10 and HA09.
BH16 to BH20	Four boreholes around the perimeter of the Site in grassy areas outside the building envelope.
BH21	Concrete coring and soil sampling beneath the sealed area of the Accommodation Building

<sup>6</sup> USEPA Region 4 (2018), Region 4 Ecological Risk Assessment Supplementary Guidance, March 2018 update.

Slag 1 to 2	Collection of two pieces of slag from garden bed (surface) on the southern side of the Main Hall.
MW011	To investigate the presence of a shallow groundwater

**Table 3-11 Summary of Soil and Groundwater Sampling Methodology**

Activity	Detail / Comment
<b>Sample collection</b>	<p>Soil samples were collected from each location by collecting hand trowel and hand auger cuttings. Where possible, samples were collected at depths of 0-0.1 m, 0.3 m and 0.5 m below ground level (if practicable). Surface soil samples were collected using a hand trowel. Selected concrete cores were also collected for analysis.</p> <p>Sample collection was undertaken in accordance with AS4482.1-2005. Dedicated disposable nitrile gloves were used for soil sample collection. Samples were placed in laboratory prepared sample containers and appropriately sealed.</p>
<b>Groundwater well installation and sampling</b>	<p>One groundwater monitoring well (MW01) was installed in the north western corner of the Site. Groundwater was not intersected during drilling and a dry well was installed.</p> <p>The monitoring well was constructed from 50mm Class 18 uPVC with machine slotted screening and casing. Threaded joints and end caps were used. The bore annulus was backfilled with washed, graded sand to approximately 0.5 m above the top of the 3 m screened well section and then sealed by an approximate 1 m thickness of bentonite. The remaining bore annulus was backfilled with cement grout to seal the bore annulus from surface water infiltration. A cap was installed on top of the well string to minimise the potential for infiltration of water and other foreign matter falling into the well. The monitoring well was finished with a flush gatic cover.</p> <p>The monitoring well was checked again on the 24 November 2021 with an interface probe. No groundwater was present in the monitoring well.</p>
<b>Reusable sampling equipment</b>	<p>Non-disposable sampling equipment was decontaminated between each location to minimise the possibility of cross contamination between samples and to minimise the risk of impacting sample integrity. Non-disposable sampling equipment used as part of this investigation included hand auger and hand trowel.</p> <p>The decontamination process included:</p> <ul style="list-style-type: none"> <li>• removal of adhered materials using brushes;</li> <li>• washing of the equipment with laboratory grade detergent solution; and</li> <li>• rinsing with de-ionised water.</li> </ul> <p>Appropriateness of the decontamination procedure adopted was confirmed through collection and analysis of rinsate sample.</p>
<b>Sample preservation</b>	Samples were placed in laboratory supplied jars and were stored in insulated chilled containers while on site and in transit to the laboratory. It is noted that concrete cores which were placed inside laboratory supplied bulk bags and sealed.
<b>Sample submission</b>	COC documentation was completed at the time of sample collection and accompanied the samples to the laboratory.
<b>Sample analysis</b>	Samples were submitted to NATA accredited laboratories for analysis. Eurofins MGT were used as the primary laboratory and ALS was the nominated secondary laboratory.
<b>Analytical Suite</b>	<p>The following samples were analysed for:</p> <ul style="list-style-type: none"> <li>• 47 soil samples: OCPs, metals (arsenic, cadmium, chromium, copper, lead, nickel and zinc), and asbestos.</li> <li>• 10 concrete samples: OCPs</li> <li>• 2 slag samples: metals and PAH</li> </ul> <p>A total of 14 leachate samples were analysed for:</p> <ul style="list-style-type: none"> <li>• Leachable organochlorine pesticides or metals (chromium, lead or zinc) via the TCLP.</li> </ul> <p>No groundwater was intersected in the monitoring well and therefore a groundwater sample was not collected.</p>



### 3.4.7 Key Findings

Key findings of the investigation included the following:

- Soil material with OCPs which exceed human health-based guidelines for park/community use (NEPM HIL-C) are predominately located in the upper soil deposits between the Accommodation Building and Main Hall Building, and in a small area south of the Main Hall Building and along the western perimeter of the Accommodation Building.
- Soil material with OCPs which exceed human-health based guidelines for residential use with accessible gardens (NEPM HIL-A)<sup>7</sup> are more widely distributed and generally include upper soil materials north of the Main Hall Building and an area south of the Main Hall Building.
- Elevated concentrations of OCPs (predominately Dieldrin) are mainly limited to soil materials from surface to 0.2 m depth with the exception of sampling site 11 and 10. Elevated concentrations were reported at 0.45 m depth which exceed HIL-C at site 11, and exceeded the HIL-A in sampling site 10 in the investigation completed in 2019 (Coffey, 2019). While these sampling sites potentially represent localised hotspots where contamination is found at a deeper depth from the application of termiticides, the elevated results at this depth may also be the result of cross-contamination where materials from the upper ground deposits contaminated materials from lower ground deposits during sampling. Further investigation to confirm whether cross-contamination occurred at these locations was not considered to be necessary.

Elevated concentrations of OCPs at depths greater than >0.2 m have not been observed in any of the other sample locations. This includes the following sample locations from the 2021 investigation:

- BH14 which is located next to the sampling point where the highest concentration of OCPs had previously been reported (HA10, Dieldrin+Aldrin 505 mg/kg). BH14 reported a concentrations of Dieldrin+Aldrin of 9.15 mg/kg at 0.1 m and 0.91 mg/kg at 0.3 m.
- BH21 which was completed in 2021 and reported the highest Dieldrin+Aldrin concentration in this mobilisation of 103.2 mg/kg at 0.1 m, and 1.41 mg/kg at 0.3 m.

The occurrence of elevated concentrations of OCPs in shallow soil materials is consistent the application of termiticides into the shallow soil materials (~100 mm bgs) adjacent to the two structures on the Site and the chemical properties of aldrin and dieldrin which absorb to soils (particularly soils with high organic matter) and have low solubility (and therefore leachability). These properties also apply to the other OCPs reported including DDT and its breakdown products DDD and DDE, and endosulfan compounds and heptachlor compounds.

- OCPs were not reported above the LOR in soil samples from the following areas:
  - the concrete slab along the driveway along the eastern boundary of the Site (BH06 to BH08)
  - the south eastern corner (BH16)
  - the western boundary of the Site (BH17 to BH19).
- Fragments of ACM and asbestos fines which exceed the nominated ILs have been reported in previous investigations of the Site. Fragments of ACM were not observed in the Supplementary Investigation and asbestos was not reported in soil samples analysed in 2021. As a precautionary measure the upper soil deposits should be considered to contain ACM and there would also be the potential for fragments of ACM to be displaced into the upper soil deposits during demolition of the existing buildings.
- Fill materials have been found across the Site. The thickness of fill is deepest along the western boundary of the Site (approximately 0.6 m) and shallowest along the eastern boundary (approximately 0.1 m). Fill materials were not found beneath the concrete slab beneath Main Hall Building.
- Fill materials containing ash and/or slag type material has been reported across the Site, and particularly along the western side of the Site. Contamination posing unacceptable health or ecological risks has not been found in association with this material.
- Risk to Human Health and Ecological Receptors
  - Soil materials which in the upper ground deposits (~ <0.25 m bgs) are considered to pose an unacceptable risk to human health where OCPs are present which exceed the NEPM HIL-C and due

<sup>7</sup> Compliance with NEPM HIL-A guidelines will be required if the Site is to be removed from the EMR.



to the potential for ACM. OCPs also pose a potential unacceptable risk to ecological receptors based on the adopted guidelines.

- Risk to Groundwater Receptors
  - A groundwater monitoring well was installed in the north western corner of the Site to 6 m bgs. Groundwater was not intersected and is likely to be at a depth greater than 20 m bgs (refer to Section 4.4.7). Risk to groundwater receptors was considered to be low based on no shallow water bearing zone being found on the Site and the low leachability of the OCPs present.
  - Further consideration to groundwater receptors post-completion of the Supplementary Investigation was not considered to be required.
- Risk to Surface Receptors
  - Risk to surface water receptors is also considered to be low based on the low leachability of OCPs present and the Site being in a stable condition. There is a potential risk to surface water receptors during remediation from the erosion of soil materials during rainfall events. Risk to surface water receptors can be managed during site clearance and remediation activity through the implementation of routine construction site management controls.
- The primary objective for the remediation of the Site is to make it suitable for park and community use.
- The proposed remediation strategy will involve the excavation and removal of up to 0.6 m depth of soil material over the Site based on the presence of OCPs, ACM and/or the presence of fill materials which contain anthropogenic materials and physical hazards (e.g. sharp and angular) which are considered unsuitable for use in a park.

### 3.4.8 Comments on Investigation

The investigation was undertaken in accordance with the SAQP and based on the requirements of the *ASC NEPM*.

Notable data gaps from the investigation included:

- Soil materials located along the northern site boundary which required disposal to monocell required further investigation to define extent of materials requiring disposal to monocell.

Notable limitations of the investigation included:

- Site access constraints limited the sampling methodology to hand excavation / hand auguring / and a single mechanically drilled borehole which limited the depth of excavations, and the visual characterisation of fill materials. Excavation of mechanically excavated test pits is preferable where fill materials are present, and ACM is a contaminant of concern. Hand sampling methods limited the depth of samples to <0.5 m bgs.

## 4. SITE DESCRIPTION AND CHARACTERISATION

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### 4.1 SITE IDENTIFICATION

A current title search and registered survey plan of the Site is provided in Appendix K.1.

The Site is located on the corner of Newdegate Street and Headfort Street, Greenslopes, Brisbane. The Site location is shown in Figure 1, Appendix A.

Two buildings were located on the Site and comprise a former Main Hall Building and Accommodation Building (refer to Figure 2, Appendix A).

The Site is currently comprised of cleared land following the completion of the remediation works undertaken in 2023. An aerial photograph of the Site from the 31 October 2023 is shown in Figure 11, Appendix A and in Figure A below.



**Figure A Aerial Photograph of the Site During Remediation (source Nearmap, 13/11/23)**

Site identification details are summarised in Table 4-1.

Table 4-1 Site Identification Details

Item	Detail		
Site Address	114 Newdegate Street, Greenslopes QLD		
Lot/Plan Number	Lot 123 on RP46047	Lot 124 on RP46047	Lot 125 on RP46047
Address	51 Headfort Street, Greenslopes, QLD, 4120	53 Headfort Street, Greenslopes, QLD, 4120	55 Headfort Street, Greenslopes, QLD, 4120
Geographic coordinates	Lat: -27.51339 Long: 153.04843	Lat: -27.51336 Long: 153.04825	Lat: -27.51334 Long: 153.04810
Area (m <sup>2</sup> )	647	647	639
Historical use	Veterans accommodation	Veterans accommodation	Veterans accommodation
Current use	Vacant land	Vacant land	Vacant land
Current Occupiers	None	None	None
Future use	Open space and commercial	Open space and commercial	Open space and commercial
EMR Listing	Yes	Yes	Yes
EMR Site ID	148512	148513	148514
CLR listing	No	No	No
EMR Result Description	HAZARDOUS CONTAMINANT - This site has been subject to a hazardous contaminant. Refer to the summary given below. Elevated concentrations of organochlorine pesticides (DDD/DDT/DDE and Aldrin/Dieldrin) identified on site above the nominated investigation levels.		
Date property was listed on the EMR	The Department of Environment and Science (DES) advised (refer to Appendix K.3) that the Site was listed on the EMR on the 29/1/2016 following notification of the Site by the Department of Veteran Affairs on the 23/12/2015. The Site was listed on the EMR with the description <i>"Hazardous contaminant - Elevated concentrations of organochlorine pesticides (DDD/DDT/DDE and Aldrin/Dieldrin) identified on site above the nominated investigation levels"</i> which is consistent with the current EMR Result Descriptions.		
Current Zoning	NC Neighbourhood Centre <sup>8</sup> (refer to plan in Appendix K.12)		
Future zoning	Unknown		
Local Council	Brisbane City Council		
Total Site Area	1,933 m <sup>2</sup>		
Site Owner	Repatriation Commission <sup>9</sup> (refer to Appendix K.1)		
Land Use on the Site	The Site is currently comprised of cleared vacant land following the completion of the remediation works undertaken in 2023 (refer to Section 6).		
Land Use surrounding the Site	Surrounding landuse is shown in Appendix K.13, and includes: North – Residential houses East – Residential houses South – Headfort Street then Residential houses West – Newdegate Street then Health care (Greenslopes Private Hospital)		
Services	During remedial works services were disconnected and removed from the Site with the exception sewer pit with manhole cover in the north eastern corner. The location of these services is shown in Figure 12, Appendix A. Refer to Section 4.2.8 for further information on building services pre-remediation and Section 6.6.2 for information on services post-remediation.		

<sup>8</sup> Brisbane City Plan 2014. Neighbourhood centre is a small mix of land uses to service residential neighbourhoods. It includes small-scale convenience shopping, professional offices, community services and other uses that directly support the immediate community.

<sup>9</sup> The Repatriation Commission is part of the Department of Veterans Affairs

## 4.2 SITE HISTORY

### 4.2.1 Historical Title Information / Previous Owners and Occupiers

Historical title information was obtained for the PSI (refer to Section 3.1) and has been reproduced in Appendix K.14. Historical title information is summarised in Table 4-2.

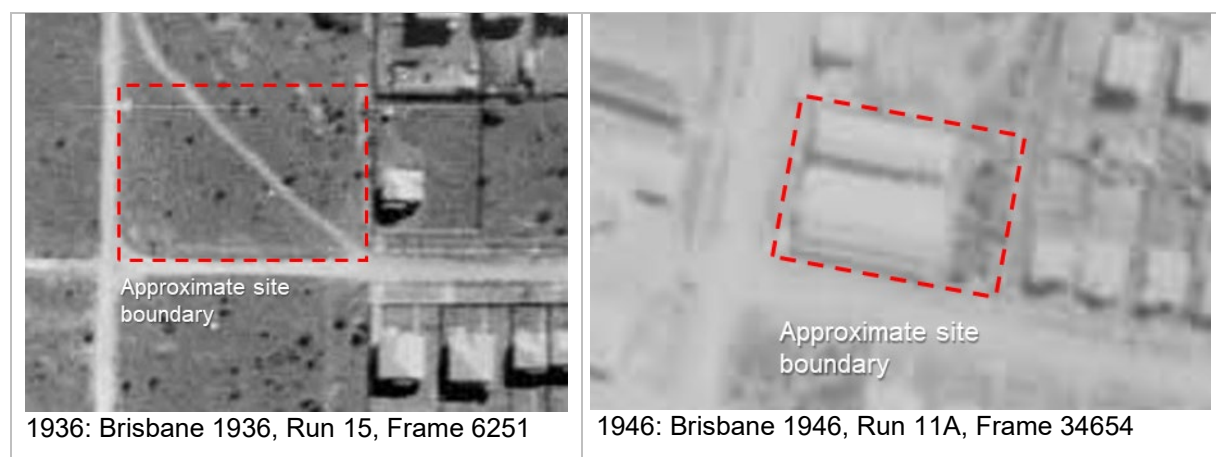
**Table 4-2 Summary of Historical Title Information**

Year	Registered Owner	Comment
1858	Thomas Blackel Stephens/Anne Stephens	Portion 102, 52 acres. Three year Lease to Commonwealth of Australia in 1901. Transfer to Stephens Estates Limited 1904.
1873	Thomas Blackel Stephens/Anne Stephens	Portion 102A, 4 acres 32 perches.
1920	War Services Home Commissioner	Sub 1 of Portion 102, 46 acres 26 perches.
1950	Repatriation Commission	Resub 2 and 134 to 173, 10 acres 15 39/100 perches.

The review of the historical certificates of title indicated the Commonwealth of Australia had interests in the site from as early as 1901 with a lease which covered the site and surrounding properties. The property was transferred to the current registered owner of the Site (the Repatriation Commission<sup>10</sup>) in 1950 (refer to Appendix K.1).

### 4.2.2 Historical Aerial Imagery

Historical aerial photography shows the Site is provided in the LotSearch Report included in Appendix K.2. Historical aerial imagery shows the land was cleared land in 1936, and potentially in use for rural purposes (see image below). The site was acquired by the Commonwealth of Australia in 1920 and the Site was developed as the Australian Red Cross Centre (ARCC) between 1936 and 1941 (refer to Appendix K.2). Historical images of the Site from 1943 and 1946 are shown in Figure B below.



**Figure B: Historical Aerial Images (source: QImagery)**

The historical aerial photograph of the Site in 1946 shows the accommodation building in the north and the main hall building in the south. The location of these buildings is shown in Figure 2, Appendix A, and in Figure

<sup>10</sup> The Repatriation Commission is part of the Department of Veterans Affairs



C on the following page. The configuration of buildings on the Site therefore remained the same over this time period until the buildings were demolished in 2023.



**Figure C Historical Aerial Image of the Site 2021 (Image source: Queensland Globe, 2021)**

### 4.2.3 Historical Maps

Historical maps of the Site are provided in the LotSearch Report included in Appendix K.2.

Historical maps included in Appendix K.2 show buildings on the Site in 1947 which is consistent with historical aerial imagery, and the Site as the 'Red Cross Centre' in 1948.

### 4.2.4 Historical Land Use

Based on historical aerial imagery (refer to Section 4.2.2) the Site was cleared land in 1936, and developed as the Australian Red Cross Centre (ARCC) between 1936 and 1941

The ARCC was built to provide recreational services to military personnel who were patients at the 112th Australian Military Hospital. Post World War II, the ARCC was used for a similar purpose for service personnel and veterans. The buildings on the Site were later used for community purposes and to provide temporary accommodation for the families of patients at the Greenslopes Repatriation Hospital<sup>11</sup>. The former ARCC buildings remain on the Site to early 2023 and were subsequently removed from Site during the remedial works outlined in this report in 2023.

<sup>11</sup> <https://heritage.brisbane.qld.gov.au/heritage-places/806>, accessed 16 July 2021.

Interviews with representatives from the Australian Red Cross for the PSI (refer to Section 3.1.3) did not identify historical incidents involving releases of hazardous materials, building fires, or the storage of hazardous materials other than the storage of cleaning chemicals and paints.

No building fires occurred on the Site after 2013 to when the buildings were demolished in 2023.

No storage/use of hazardous materials or dangerous goods were observed in subsequent inspections of the Site undertaken in previous investigations between 2013 to when the Site was demolished in 2023.

#### 4.2.5 Information held by Department of Environment and Science

DES has confirmed in writing on the 20 March 2024 (refer to Appendix K.3) that the information it holds on the Site is the report *Department of Veterans Affairs, Phase 2 Contaminated Land Assessment. 114 Newdegate Street, Greenslopes QLD. Prepared by Coffey Environments Australia Pty Ltd. 4 November 2013. Project Ref: ENAUBRIS09222AA*. This report has been summarised in Section 3.2. DES also provided advice in regard to when the Site was listed on the EMR; this information is summarised in Table 4-1. Accordingly DES does not hold any additional information on the Site which has not been considered in the preparation of this document.

#### 4.2.6 Information held by Brisbane City Council

The PSI undertaken in 2013 (refer to Section 3.1) included a Right For Information (RFI) search with BCC. Information provided by BCC in response to the RFI search on the 30 July 2013 is provided in Appendix K.4.

The search results identified that BCC did not hold any information in regards to dangerous goods, hazardous materials and environmental licenses for the Site.

The response from BCC is consistent with information provided by the Australian Red Cross and site observations in inspection during the PSI which did not identify dangerous goods/hazardous materials being stored/used on the Site (refer to Section 3.1).

No information on activities with the potential for contamination would be expected to be held by BCC since this search was completed for the following reasons:

- DES rather than BCC is the administering authority in regard to contaminated land, and therefore any new information on contaminated land will be submitted to DES rather than BCC. Information held by DES is summarised in Section 4.2.5.
- There has been no change in the configuration of the Site since the RFI was submitted in 2013.
- There has been no change in the use of the Site (other than the Site being used by the Australian Red Cross) since 2013.
- No hazardous materials/dangerous goods being stored/used on the Site were observed in subsequent inspections of the Site by Coffey/Tetra Tech Coffey from 2013 to the present day.

#### 4.2.7 Building Structures

The buildings which were historically located on the Site are shown in Figure 2, Appendix A, and in Figure C. Other structures such as sheds, tanks, storage vehicles, and workshops were not historically located on the Site.

The buildings on the Site did not have basements and had shallow concrete foundations (<0.4 m deep) which were removed during the demolition/remediation of the Site in 2023.

Building structures were confirmed to contain ACM and lead based paints in a survey of the Site undertaken in 2021 and documented in Coffey (2021) *Asbestos and Hazardous Materials Pre-Demolition Assessment, 114 Newdegate Street, Greenslopes QLD 4120, 9 April 2021*.

Asbestos was also found in some of the paints used on the Site and is documented in the report Tetra Tech Coffey (2022) *Asbestos Paint Assessment, 114 Newdegate Street, Greenslopes QLD, 27 April 2022*.

In 2022 and prior to the demolition and remediation of the Site undertaken in 2023 (refer to Section 6), DVA engaged Enviropacific Services (EPS) to remove paint materials which were flaking off the exterior of buildings and paint materials which had flaked off the buildings to ground surface. These building remedial works were undertaken under an Asbestos Removal Management Plan (ARMP) under the supervision of a Licenced Asbestos Assessor (LAA). EPS has advised that materials removed were disposed as regulated wastes to appropriately licenced disposal facilities.

In an inspection of the Site on the 3 July 2023 and prior to the undertaking of demolition and remediation of the Site, paint flakes were not readily observable on the ground surface at the Site and paint materials flaking off the exterior of buildings were not observed.

The building structures were demolished and removed from the Site in 2023 under an ARMP, and under the supervision of a LAA.

## 4.2.8 Building Services

**NOTE TO SITE AUDITOR:** The sub-section on utilities on the site prior to remediation is to be updated following receipt of the required information from EPS. The sub-sections on utilities on the site post-remediation and migration of contaminants along building services are complete.

### 4.2.8.1 Utilities on the Site prior to Remediation

Underground utilities which historically connected to the Site included:

- Reticulated potable water (fire main) which connected to a fire hydrant on the Site off Newdegate Street (refer to Appendix K.15). Records from BCC<sup>12</sup> indicate the fire main was a cast iron pipe installed in 1976.
- Sewer manhole and connection to the sewer network located in the north western corner of the Site (refer to Appendix K.15). Records from BCC<sup>13</sup> indicate the sewer pipe in the north west of the Site was installed in 1954 and has an invert level of 23.07 m AHD (approximately 0.7 m below pre-remediation site levels). The pipe was located beneath the soil material requiring remediation and was therefore not intersected during remediation (refer to Section 6).

Other utilities (gas, electricity, telecommunications) were not located on the Site as an underground utility.

Stormwater from the roof of Site buildings historically discharged into the BCC kerb drainage in Newdegate Street. The contractor responsible for demolition/remediation of the Site confirmed that sub-surface stormwater drainage pipes were not encountered during demolition/remediation. Underground stormwater drainage pipes are located on the adjoining properties east of the Site (refer to Appendix K.15).

The contractor responsible for the demolition of the Site (Enviropacific Services (EPS)) advised that the only underground utilities connecting to the Site included the fire main and the sewer in the north west corner of the Site (refer to Appendix K.15).

During demolition of the Site EPS undertook the following:

- the fire main into the Site was decommissioned.
- local clay sewer pipes located beneath the accommodation building and main hall were removed which connected to the sewer main were removed. These pipes had a depth of approximately <0.4 m. The approximate area<sup>14</sup> from which the pipes were removed is shown in Appendix K.15.

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<sup>12</sup> [eBIMAP2 mapping service | Brisbane City Council](#)

<sup>13</sup> [eBIMAP2 mapping service | Brisbane City Council](#)

<sup>14</sup> the location of sewer pipes beneath the main hall building and accommodation building were not surveyed by EPS and was not a requirement for the demolition of the Site.

#### 4.2.8.2 Utilities on the Site post Remediation

Utilities which remain on the Site post-remediation are shown in Figure 12, Appendix A and include:

- a water main installed by the Remediation Contractor (EPS) connection located on the eastern boundary
- a sewer main in the northern eastern corner of the Site
- a sub-surface gravel drain installed by the Remediation Contractor which connects to a PVC stormwater pipe at the Site boundary and discharges into the gutter of Newdegate Street.

#### 4.2.8.3 Migration of Contaminants Along Building Services

The contaminants of concern for the Site (refer to Section 4.5 and Section 4.2.10) are non-leachable (asbestos) or have low solubility/leachability (OCPs) and therefore the migration of contamination along preferential pathways which may be associated with building services (e.g. bedding sands) is not considered to be an applicable transport pathway for the migration of contamination on the Site.

#### 4.2.9 Activities with the Potential for Contamination Not Applicable to the Site

Section 3.3 of Schedule B2 of the NEPM includes a range of activities with the potential to cause contamination which have not been undertaken on the Site based on previous investigations and historical information included in this document (refer 4.2). These include:

- Industrial/commercial processes and manufacturing of products
- Chemical storage/use other than those typically found in residential landuse setting including cleaning products and paints (refer to Section 3.1.3)
- Raw materials used in industrial process and manufacturing
- Intermediate products which may be formed in industrial processes and manufacturing
- Fuel storage
- Industrial/commercial activities which would result in the generation of waste products with the potential for contamination.
- Waste storage (other than domestic wastes) and disposal of waste to land
- Incidents associated with spills from industrial processes such as raw product, intermediate product or waste spills
- Discharges to land and water from waste products associated with industrial/commercial activities
- Power generation
- Earthmoving activities.

#### Notifiable Activities

The historical use of the Site has not included any of the Notifiable Activities described in Schedule 3 of the *Environmental Protection Act 1994*.

#### Per-and Poly-fluoroalkyl Substances (PFAS)

The historical use of the Site has not included in of the activities described in Appendix B of HEPA (2020) *Per- and poly-fluoroalkyl substances National Environmental Management Plan, Version 2.0* (PFAS NEMP).



In addition there are no records of fires on the Site, and fill materials placed on the Site (1936 to 1941) pre-date the use of PFAS in Queensland which occurred after the 1950s<sup>15</sup>.

The Site is not located in the vicinity of PFAS investigation sites by Defence, Airservices Australia or Queensland Fire and Emergency Services (refer to Appendix K.2). The nearest PFAS investigation site is a fire station located at Annerley located approximately 1.6 km north west of the Site. This fire station is not hydraulically connected to the Site.

Accordingly PFAS is not considered to be a contaminant of concern for the Site.

#### 4.2.10 Contamination from Historical Landuse

The PSI undertaken in 2013 (refer to Section 3.1) identified the presence of ACM on the Site as well as organochlorine pesticides in soil associated with the application of termiticides used in termite barriers.

##### Termite Barriers and Organochlorine Contamination

The buildings on the Site were constructed from timber and termite barriers would have been installed around the perimeter of these buildings. Further investigations of the Site undertaken between 2013 and 2022 provided further information on the extent of organochlorine pesticides on the Site. OCPs which have been reported in soils within the Site from previous investigations include:

- DDT, DDE and DDD
- Aldrin and Dieldrin
- Chlordane
- Endrin aldehyde
- Endrin ketone
- Endosulfan I
- Endrin
- Heptachlor
- Heptachlor epoxide.

##### Termite Barriers and Other Potential Contaminants of Concern

OPPs and arsenic which can also be associated with the application of termiticides were not identified in previous investigations as contaminants of concern at the Site (refer to Section 3 and Section 4.5.2.5).

##### Lead

Elevated concentrations of lead which could be associated with lead based paints were not reported in previous investigations of the Site (refer to Section 3). Paint materials which had flaked off the building were removed from the Site prior to the undertaking of remediation of the Site in 2023 (refer to Section 4.2.7). Accordingly lead is not considered to be a contaminant of concern for the Site.

##### ACM

Fragments of ACM on the ground surface at the Site and asbestos fines in shallow soil materials have been reported in previous investigations of the Site (refer to Section 4.5).

ACM were also observed in fill materials during remediation; refer to the following sub-section.

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<sup>15</sup> <https://www.qld.gov.au/environment/management/environmental/incidents/pfas/about>

## Fill Materials

Fill materials were identified on the Site in previous investigations (refer to Section 3) and included the presence of anthropogenic materials including ash and slag materials. Fill materials underly the buildings which were located on the Site and therefore were placed on the Site prior to the construction of the buildings between 1936 and 1941. There are no records of the placement of fill materials on the Site including those held by DES (refer to Section 4.2.5), BCC (refer to Section 4.2.6) and the Australian Red Cross (refer to 3.1) and therefore the fill materials can be considered as ‘uncontrolled fill materials’.

During remediation of the Site, ACM was found in the fill materials (refer to Section 6).

Remediation of the Site in 2023 resulted in the removal of fill materials on the Site, and soil materials with OCP contamination which required remediation to achieve the remediation objectives.

## Contaminants of Concern

In summary the Contaminants of Concern for the Site include:

- OCPs
- Asbestos

### 4.2.11 Data Gaps

Based on the previous investigations of the Site (refer to Section 4.2) and the information included in Section 4.2, the history of the Site is considered to be sufficiently understood in regard to historical activities which occurred which resulted in contamination on the Site and the contaminants of concern associated with these activities. Contaminants of concern have been confirmed through previous investigations of the Site (refer to Section 3) and were summarised in Section 4.2.10.

## 4.3 QUEENSLAND GOVERNMENT REGISTERS

### 4.3.1 Environmental Management Register

The Site is listed on the EMR for Hazardous Contaminants including elevated concentrations of organochlorine pesticides (DDD/DDT/DDE and Aldrin/Dieldrin). EMR search results are included in Appendix K.1. The Maximum concentrations reported on the Site from previous investigations are summarised in Section 4.5.

The Site is not subject to a SMP and the EMR listing does not include a Site Suitability Statement.

The Site is not listed on the Contaminated Land Register (CLR). Further information on the EMR listing pertaining to the Site is provided in Table 4-1.

### 4.3.2 Environmentally Relevant Activities

A search of Environmental Relevant Activities (ERA) held by DES was included in the Lot Search Report included in Appendix K.2. The Lot Search Report did not identify any ERA on the Site, or within the vicinity of the Site (1 km search radius). In addition the known historical uses of the Site would not constitute an ERA under Schedule 2 of the *Environmental Protection Regulation 2019* and require an Environmental Authority.

### 4.3.3 Enforcement Actions

A search of Enforcement Actions (EAs) held by DES was included in the Lot Search Report included in Appendix K.1. The Lot Search Report did not identify any EAs on the Site, or within the vicinity of the Site (1 km search radius).

## 4.4 ENVIRONMENTAL SETTING AND SITE CHARACTERISATION

The Site is located in a predominantly residential area approximately 5.5 km south east of the Brisbane Central Business District. The Greenslopes Private Hospital and associated medical facilities are located west of the Site and on the western side of Newdegate Street.

### 4.4.1 Topography

A Topographical map of the Site and the surrounding area is provided in the Lot Search Report in Appendix K.2 and the topographical map included in Appendix K.6.

The topography of the surrounding area is dominated by Stephen Mountain<sup>16</sup> which has a height of 55 m AHD and is located west of the Greenslopes Hospital and approximately 400 m west of the Site.

Topography in the vicinity of the Site falls in an approximate northwest direction towards Norman Creek (drain<sup>17</sup>) in Ekibin Park East located 840 m northwest of the Site (refer to Appendix K.6). The location of Ekin Park East is shown in Appendix K.6.

Prior to remediation of the Site in 2023 (refer to Section 6), the Site had a ground elevation of approximately 25 m AHD, and topography on the Site sloped gently from the southeast towards the northwest (refer to Figure 13, Appendix A).

Remediation of the Site in 2023 involved the excavation and off-site disposal of materials requiring remediation, and average excavation depth of approximately 0.45 m over the Site (refer to Section 6). Post-remediation ground levels of the Site are shown in Figure 14, Appendix A.

### 4.4.2 Hydrology

Surface water receptors are shown in the topographical map included in Appendix K.6

Surface water runoff from the Site is discharged into the BCC kerb drainage system in Newdegate Street. Stormwater in the vicinity of the Site will discharge to the Norman Creek (drain<sup>17</sup>) via the kerb drainage system in streets as well as pipe drainage in the area which is shown in the plan included in Appendix K.15.

South of the Site is Glindemann Creek which is a tributary of Norman Creek. Glindemann Creek is not hydraulically connected to the Site.

### 4.4.3 Regional Geology

Regional geology of the Site and the surrounding area is shown in the geology map included in the Lot Search Report included in Appendix K.2.

Regional geology of the Site and surrounding land is the Neranleigh-Fernvale beds (DCf) (NFB). This geological formation is described as feldspathic and lithic meta-arenite, metasilstone and conglomerate proximal turbidites, with structurally intercalated or stratigraphically underlying chert, jasper and basic meta-volcanics<sup>18</sup>.

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<sup>16</sup> Stephens Mountain has an elevation of 55 m AHD and is located west of Greenslopes Private Hospital and is approximately 400 m from the Site (<https://qtopo.information.qld.gov.au/>, accessed 1 September 2021)

<sup>17</sup> Note Norman Creek is a concrete lined drain in Ekibin Park East

<sup>18</sup> <https://asud.ga.gov.au/search-stratigraphic-units/results/14021>, accessed 1 September 2021

#### 4.4.4 Local Geology

Lithologies recorded in previous investigations of the Site (refer to Section 3) are summarised in Appendix K.4. Investigation locations are shown in Figure 2, Appendix A.

Previous investigation of the Site (refer to Section 3) have identified the subsurface geology of the Site is comprised of fill materials, which are underlain by natural silty clay soils, which are underlain by mudstone. These lithologies are described further as follows:

##### Fill Materials

Fill materials comprised:

- reworked firm, dry, red brown, low plasticity silty clay fill interspersed with bedding sands and gravels in the north of the Site.
- ash and slag-type materials from the east, south and west of the Site. Photographs of these materials taken during remediation are provided in Section 6.5.



Plate 1: Example ash fill material with ACM

During remediation ACM comprising broken sheets of cement sheeting were frequently encountered in fill materials on the Site. All fill materials were removed from the Site during remediation (refer to Section 6).

Other anthropogenic encountered in fill materials included brick, concrete, wood, slag, ash, and glass.

In some vegetated areas over the Site a thin (<0.1 m) layer of topsoil (fill) containing organic matter was observed.

Fill materials were variable in depth and composition over the Site. Fill was identified to a maximum depth of 0.6 m, and were deepest along the southern and south-western boundary of the Site.





Plate 2: Excavation of ash fill materials during remediation along the southern boundary of the Site during remediation

## Natural Materials

Underlying the fill material was the natural residual soil materials comprising firm, dry, red/brown, low plasticity silty clays transitioning to slightly moist medium plasticity orange/brown silty clays with occasional bands of sub rounded gravels. As shown in Plate 3 natural undisturbed soils were relatively consistent in appearance across the Site. Accordingly undisturbed natural soils were readily distinguishable from the overlying fill materials.



Plate 3: Natural soil materials comprising red/brown silty clays



Weathered mudstone was encountered from approximately 2.9 m bgs in the north-western portion of the Site in MW1 (refer to Figure 2, Appendix A). Weathered mudstone was not encountered during remediation and this is attributed to the depth of soils requiring remediation which was <1 m bgs.

The NFB which underly the Site (refer to Section 4.4.3) was not encountered during the drilling of MW1. It should be noted the contaminants of concern were located in fill and surface materials and accordingly it was not a requirement of the investigation to confirm the depth of the NFB on the Site.

#### 4.4.5 Acid Sulfate Soils

Acid sulfate soil mapping for the Site and the surrounding area is provided in the Lot Search Report included in Appendix K.2. The Site is located in an area with extremely low probability of occurrence of acid sulfate soils.

Acid sulfate soils are typically found in coastal areas lower than 5 m AHD<sup>19</sup>. The Site is located at approximately 25 m AHD (refer to Section 4.4.1) and not is a low-lying coastal area.

#### 4.4.6 Soil Landscape

Soil mapping for the Site and the surrounding area is provided in the Lot Search Report included in Appendix K.2. Soils at the Site and the surrounding area are described as Tenosol (Tb64). The description of Tensol soil type from the Atlas of Australian Soils is as follows (refer to Appendix K.2):

*Rolling to hilly terrain with gentle to moderate slopes: chief soils are hard acidic yellow (Dy3.41) and red (Dr3.41) mottled soils. Associated are hard alkaline yellow (Dy3.43) and red (Dr3.43) mottled soils; sandy acidic yellow mottled soils (Dy5.41), (Dy5.31), and (Dy5.81) and leached sands (Uc2.2), all containing large amounts of nodular ironstone material, also with mottled clays, at depth, below the (Uc2) soils. As mapped, small areas of adjoining units are included.*

#### 4.4.7 Hydrogeology

The SKM/Aurecon (2011) *Cross River Rail Environmental Impact Statement Technical Report No.4 Groundwater Assessment, July 2011*<sup>20</sup> describes groundwater in the Cross River Rail (CRR) Study Area which includes Greenslopes (CRR Technical Report 4). CRR Technical Report 4 describes that there are two broad aquifer types in the CRR Study Area including: fractured rock aquifer systems which includes the Neranleigh-Fernvale beds where the Site is located; and alluvial aquifers associated with water courses.

The Site is located in an elevated area on a hill and is therefore not in an alluvial area.

Shallow alluvial aquifers however are expected to be present in the vicinity of Norman Creek which has a ground elevation of 10 m AHD. Norman Creek is considered to be the nearest alluvial aquifer which is hydraulically down-gradient from the Site.

The CRR Technical Report 4 reports that groundwater yield in the NFB is low and can range from 0 to 1.0 L/s. Modelled groundwater levels in the CRR Technical Report 4 indicate that the depth to the water table at the Site would be approximately 20 to 50 m bgs. The modelled output from this technical report has been reproduced in Appendix K.7.

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<sup>19</sup> <https://www.qld.gov.au/environment/land/management/soil/acid-sulfate/explained#:~:text=Coastal%20areas%20lower%20than%205m,at%20elevations%20below%2020m%20AHD.>

<sup>20</sup>

<https://eisdocs.dsdp.qld.gov.au/Completed%20Projects/Cross%20River%20Rail/EIS/EIS%2030%20Aug%202011/03%20Volume%203/Technical%20Report%204%20Groundwater.pdf>

Registered groundwater bores within 2 km of the Site are shown in the Lot Search Report included in Appendix K.2. Appendix K.2 also includes information on groundwater bores in the search areas including their purpose, lithology and the aquifer.

The nearest registered bore to the Site is RN133887 is located approximately 920 m to the east of the Site. This borehole is located in the NFB (refer to the geological map in Appendix K.2). The bore report for RN133887 included in Appendix K.8 indicates groundwater was encountered at 51.2 m bgs, and groundwater was salty and had a yield of 0.03 L/s.

This bore is located at approximately 45 m AHD (refer to Appendix K.8) and therefore the groundwater table in the NFB would be at approximately -5 m AHD.

Ground elevation on the Site pre-remediation was approximately 25 m AHD (refer to Section 4.4.1). If a groundwater elevation of -5 m AHD was assumed on the Site, the depth to groundwater on the Site in the NFB would be approximately 30 m bgs which is consistent with model prediction in the CRR Technical Report which predicted a depth to groundwater of 20 to 50 m bgs in this area.

Of the other registered bores within a 2 km of the Site, those which are still in use were installed for monitoring purposes and are not considered to provide relevant information to the interpretation of groundwater on the Site. One bore (133416) was installed for water supply. Bore 133416 was installed approximately 1130 m south of the Site in the Brisbane Tuff geological unit and is not hydraulically connected to the Site.

Extraction for use of groundwater in the vicinity of the Site is considered unlikely based on the supply of reticulated potable water in Brisbane and low yield of the NFB.

## Potential for a Shallow Groundwater Aquifer on the Site

In the Supplementary Investigation groundwater monitoring well (MW01) was installed to investigate the potential for a shallow groundwater aquifer (refer to Section 3.4.3). Groundwater was not intersected during the drilling of MW01<sup>21</sup> which was extended to 6 m bgs or the gauging of this monitoring well (refer to Section 3.4.7).

The absence of shallow groundwater on the Site is consistent with the conditions which are unlikely to support the formation of a shallow groundwater aquifer for the reasons outlined in the following paragraph.

The Site is located in an elevated area on a hill. In combination with the topography of the Site and surrounding area which slopes to the north, urbanisation of the local area with hard surfaces (i.e. roof, hard surfaces and roads) which discharge runoff into the stormwater drainage system, and natural soil types<sup>22</sup> which would retard infiltration of rainfall and promote surface water runoff, conditions of the Site and the surrounding area are more likely to support the shedding of rainfall as surface water runoff into the stormwater drainage system (refer to Section 4.4.2) and not promote conditions which support the ponding and infiltration of rainwater which would be required for the formation of a shallow groundwater aquifer.

## Risk from contamination at the Site

A key finding of the Supplementary Investigation (refer to Section 3.4.7) was that prior to the undertaking of remediation the risk to groundwater receptors (which includes hydraulically down-gradient) was considered to be low for the following reasons:

- groundwater was not intersected and is likely to be at a depth greater than 20 m bgs. No shallow water bearing zone being found on the Site and conditions are unlikely to support the formation of groundwater

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<sup>21</sup> MW01 was installed in September 2021

<sup>22</sup> Natural soils on the Site and the surrounding area are silty clays and the underlying materials being mudstones. These materials are likely to have a lower permeability and therefore retard surface water infiltration into the underlying materials (refer to Section 4.4.5).



- OCP contaminants on the site strongly absorb to soils and have low solubility/leachability. The risk of these contaminants leaching to underlying groundwater is therefore considered to be low. The low leachability of these contaminants is demonstrated by elevated concentrations of OCPs being generally limited to soil materials less than 0.2 m bgs. The occurrence of elevated concentrations of OCPs in shallow soil materials is consistent the application of termiticides into the shallow soil materials.

Post-remediation (refer to Section 6) risk to groundwater is considered to be negligible on the basis that the source of contamination requiring remediation has been removed from the Site.

#### 4.4.8 Flood Risk Assessment

BCC Flood Awareness Online Mapping<sup>23</sup> included in Appendix K.9 shows the Site is not located in an area which has been mapped at risk from with riverine/creek or overland flow flooding.

In addition, the Site is not within the Queensland Floodplain Assessment Overlay (refer to Appendix K.2).

#### 4.4.9 Bushfire Prone Areas

Bushfire mapping for the Site and the surrounding area is provided in the Lot Search Report included in Appendix K.2. The Site is not located in an area which is prone to bushfires.

#### 4.4.10 Fire Ants

Fire ant mapping for the Site and the surrounding area is provided in Appendix K.10. The Site is located in 'Fire ant biosecurity zone 2'. Zone 2 covers suburbs which are yet to receive eradication treatment<sup>24</sup>.

#### 4.4.11 Unexploded Ordinance

Unexploded Ordinance (UXO) mapping for the Site is provided in Appendix K.11 based on mapping from the Department of Defence<sup>25</sup>. The Site is not located in an area with mapped risk of UXO.

#### 4.4.12 Cultural Heritage

The Lot Search Report included in Appendix K.2 included a search of Commonwealth and State heritage registers. The Site is not recorded on either Commonwealth or State Heritage registers.

#### 4.4.13 Regional Ecosystems

Regional Ecosystem mapping for the Site is provided in Appendix K.16. The Site is not located in an area with mapped Regional Ecosystems. Regional Ecosystems are located west of the Site at Stephens Mountain, and south west of the Site near Glindemann Creek.

#### 4.4.14 Matters of State Environmental Significance (MSES)

MSES mapping for the Site is provided in Appendix K.17. The Site is not located in an area with MSES. MSES areas are located west of the Site at Stephens Mountain, and south west of the Site near Glindemann Creek.

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<sup>23</sup> <https://www.brisbane.qld.gov.au/community-and-safety/community-safety/disasters-and-emergencies/be-prepared/flooding-in-brisbane/flood-awareness-map>

<sup>24</sup> <https://www.fireants.org.au/stop-the-spread/fire-ant-biosecurity-zones>

<sup>25</sup> <https://uxo.defence.gov.au/>

#### 4.4.15 Groundwater Dependent Ecosystems

The Lot Search Report included in Appendix K.2 includes a map showing Groundwater Dependent Ecosystems (GDEs) within a 1 km radius of the Site. There are no GDEs at the Site, and two GDEs within a 1 km radius of the Site. These are summarised in the following table.

**Table 4-3 Summary of Groundwater Dependent Ecosystems**

Type	GDE Potential	Ecosystem Type	Aquifer Geology	Distance
Aquatic	Moderate potential GDE - from regional studies	Riverine wetland	Unconsolidated sedimentary	234m
Terrestrial	Moderate potential GDE - from regional studies	Vegetation	Unconsolidated sedimentary	423m

The terrestrial GDE is located south west of the Site near Glindemann Creek and the aquatic GDE is located west of the Site on Glindemann Creek. Glindemann Creek is not hydraulically connected to the Site. Therefore the Site is not hydraulically connected to these GDEs (refer to Section 4.4.2).

#### 4.4.16 Environmental Values and Water Quality Objectives

The Site is located within freshwater reaches of Norman Creek Catchment as shown in the *Environmental Protection (Water) Policy 2009 South-east Queensland Map Series, PLAN WQ1431* (Queensland Government, 2022) included in Appendix K.18

Under the Environmental Protection (Water) Policy (2009), the Site falls within the area covered by the *'Brisbane River Estuary - Environmental Values and Water Quality Objectives Basin No. 143* (Department of Environment and Science, 2022).

The environmental values identified for Norman Creek (freshwater) in this document are summarised in Table 4-4.

**Table 4-4 Water Quality Environmental Values**

Water Resource	Environmental Values											
	Aquatic ecosystems	Irrigation	Farm supply/use	Stock water	Aquaculture	Human consumer	Primary Recreation	Secondary recreation	Visual recreation	Drinking water	Industrial use	Cultural and spiritual values
Norman Ck Fresh Water	✓					✓		✓	✓			✓

The management intent for Norman Creek (fresh water) is moderately disturbed ecosystem (refer to Appendix K.19). For a moderately disturbed ecosystem, the following water quality objectives:

- Australian drinking water guidelines (2011 updated December 2013) prepared by National Health and Medical Research Council (NHMRC)
- Australian and New Zealand guidelines for fresh and marine water quality 2000 (2018 edition) prepared by Australian and New Zealand Environment and Conservation Council (ANZECC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) ("ANZECC Guidelines).

For toxicants a 95% level of protection is assumed for lowland freshwater based on the management intent described in *Environmental Protection (Water) Policy 2009, South-east Queensland Map Series PLAN WQ1423* (Queensland Government, 2010)

- Guidelines for Managing Risks in Recreational Water (NHMRC, 2008).

## Risk from contamination at the Site

A key finding of the Supplementary Investigation (refer to Section 3.4.7) was that prior to the undertaking of remediation the risk to surface water receptors was considered to be low based on the low leachability of OCPs present and the Site being in a stable condition. Post-remediation (refer to Section 6) risk to surface water is considered to be negligible on the basis that the source of contamination requiring remediation has been removed from the Site.

## 4.5 SUMMARY OF CONTAMINATION

This section provides a summary of contamination at the Site prior to the undertaking of remediation. This section summarises information from previous investigations of the Site completed between 2013 and 2021 which are described in Section 3.

Previous investigation sampling locations are shown in Figure 2, Appendix A. A summary of the ground conditions encountered at the sample locations is provided in Appendix K.4. Tabulated data from previous investigation locations is provided in Appendix C.7.1 and Appendix C.7.2. Tabulated data is compared to the investigation levels described in Section 3.4.5.

### 4.5.1 Lithology

Lithology on the Site is discussed in summarised in Section 4.4.4.

### 4.5.2 Contamination in Soil

The maximum concentration of OCPs and metals which have been reported in previous investigations of the Site (refer to Section 3) are summarised in the following table.

**Table 4-5 Maximum Reported Concentrations**

Analyte (mg/kg)	EIL – Res/Open Space (mg/kg)	HIL-A Residential Criteria (mg/kg)	HIL-C Recreational Criteria (mg/kg)	Soil Materials Surface to 0.2 mbgs (mg/kg)	Soil Materials Deeper than 0.2 mbgs (mg/kg)	No. Samples Exceeding HIL-A Surface to 0.2 m bgs / deeper than 0.2 m bgs	No. Samples Exceeding HIL-C Surface to 0.2 m bgs / deeper than 0.2 m bgs
<b>OCPs</b>						-	-
4,4-DDE				2.2	0.22	-	-
a-BHC				<0.1	<0.05	-	-
Aldrin				98	0.98	-	-
Aldrin + Dieldrin		6	10	506	14	18 / 2	15 / 1
b-BHC				<0.1	<0.05	-	-
chlordane		50	70	140	0.5	2 / 0	1 / 0
d-BHC				<0.1	<0.05	-	-
DDD				2.1	0.15	-	-
DDT	180			23	<0.2	-	-
DDT+DDE+DDD		240	400	26.5	0.37	-	-
Dieldrin				420	14	-	-
Endrin aldehyde				0.24	<0.05	-	-
Endrin ketone				8.5	0.05	-	-
Endosulfan I		270	340	0.26	<0.05	-	-
Endosulfan II				<0.05	<0.05	-	-
Endosulfan sulphate				<0.1	<0.05	-	-
Endrin		10	20	6.5	0.1	-	-

Analyte (mg/kg)	EIL – Res/Open Space (mg/kg)	HIL-A Residential Criteria (mg/kg)	HIL-C Recreational Criteria (mg/kg)	Soil Materials Surface to 0.2 mbgs (mg/kg)	Soil Materials Deeper than 0.2 mbgs (mg/kg)	No. Samples Exceeding HIL-A Surface to 0.2 m bgs / deeper than 0.2 m bgs	No. Samples Exceeding HIL-C Surface to 0.2 m bgs / deeper than 0.2 m bgs
g-BHC (Lindane)				<0.1	<0.05	-	-
Heptachlor		6	10	1	<0.05	-	-
Heptachlor epoxide				3.4	0.26	-	-
Hexachlorobenzene		10	10	<0.1	<0.05	-	-
Methoxychlor		300	400	<0.2	<0.2	-	-
Toxaphene		20	30	<1	<1	-	-
Total OCP				527.38	14.52	-	-
<b>Metals</b>						-	-
Arsenic	100	100	300	32	23	-	-
Cadmium		20	90	1.4	<1	-	-
Chromium (III+VI)	245	100	300	100	180	Note 2	-
Copper	196	6000	17000	33	74	-	-
Lead	1112	300	600	160	120	-	-
Mercury		10	13	0.1	<0.1	-	-
Nickel	287	400	1200	66	84	-	-
Zinc (Note 1)	420	7400	30000	2000	160	-	-

Note 1: Zinc exceeded the EIL in three samples SS01, SS02 and HA11. There were no zinc exceedences of HIL-A and HIL-C.

Note 2: Refer to 'Note on Chromium' included in this section. The supplementary investigation concluded that Chromium is present as a Chromium III rather than Chromium IV and therefore the HILs in the NEPM (which are for Chromium IV) do not apply.

Sample locations which exceeded HIL-A and HIL-C criteria are summarised in the following table.

**Table 4-6 Samples Locations Exceeding HIL-A and HIL-C Criteria**

Sample Depth	Analyte	Exceeded HIL-A	Exceeded HIL-C
Upper soil (0.0-0.2m)	Aldrin + dieldrin	HA07/SA12	HA07/SA12
		HA09	HA09
		HA10	HA10
		8-0.0	8-0.0
		9-0.0	9-0.0
		9P-0.0 (HA09)	9P-0.0 (HA09)
		10-0.0	10-0.0
		11-0.0	11-0.0
		13P-0.0 (HA07)	13P-0.2 (HA07)
		13P-0.2 (HA07)	14P-0.0 (HA10)
		14P-0.0 (HA10)	QC07 (DUP 14P-0.0)
		QC07 (DUP 14P-0.0)	QC08 (TRIP 14P-0.0)
		QC08 (TRIP 14P-0.0)	34-0.0
		15-0.0	36-0.0
		34-0.0	BH21_0.1
		36-0.0	
		BH14_0.1	
		BH21_0.1	
Deeper soil (>0.2m)	Chlordane	HA02, HA03	HA03
	Chromium (III + VI)	Note 2	Note 2
	Aldrin + dieldrin	10-0.45, 11-0.45	11-0.45,
	Chlordane	Nil	Nil
	Chromium (III + VI)	Note 2	Note 2

Notes:

1) Sample location with a concentration at the health guideline level.

2) Refer to Section 4.5.2.4 in regard to chromium.

It is noted that samples exceeding HIL-C also exceed HIL-A.

#### 4.5.2.1 OCPs

OCP contaminants in soils were associated with historical application of termite barriers using termiticides around buildings.

Soil material with OCPs which exceed human health-based guidelines for park/community use (NEPM HIL-C) were predominately located in the upper soil deposits between the Accommodation Building and Main Hall Building, and in a small area south of the Main Hall Building and along the western perimeter of the Accommodation Building.

Soil material with OCPs which exceed human-health based guidelines for residential use with accessible gardens (NEPM HIL-A<sup>26</sup>) were more widely distributed and generally include upper soil materials north of the Main Hall Building and an area south of the Main Hall Building.

Elevated concentrations of OCPs were generally limited to soil materials less than 0.2 m below ground surface (bgs). The occurrence of elevated concentrations of OCPs in shallow soil materials is consistent the application of termiticides into the shallow soil materials and the chemical properties of OCPs detected which readily absorb to soils (particularly soils with high organic matter) and have low solubility (and therefore low leachability).

OCPs were not reported above the LOR in soil samples from the following areas:

- the concrete slab along the driveway along the eastern boundary of the Site (BH06 to BH08)
- the south eastern corner (BH16).
- the western boundary of the Site (BH17 to BH19).

Soil materials in the upper ground deposits (~ <0.25 m bgs) were considered to pose an unacceptable risk to human health where OCPs were present which exceed the NEPM HIL-C and due to the potential for ACM. OCPs also posed a potential unacceptable risk to ecological receptors based on the adopted guidelines.

**Accordingly OCPs was a contaminant of concern for the Site.**

HIL-D criteria for dieldrin was exceeded in four sampling locations (HA10, 9, BH21, HA09) (refer to Figure 3, Appendix A).

All soil materials with OCP contamination which required remediation were removed from the Site in the remediation works described in Section 6.

#### 4.5.2.2 Asbestos Containing Materials

Fragments of ACM and asbestos fines which exceed the nominated investigation levels (ILs) of 0.01% w/w and 0.001% w/w, respectively, were reported in previous investigations of the Site at the following locations (refer to Figure 3, Appendix A):

- SS01
- SS02
- SA01/A01
- Main Hall (under building)
- Accommodation Building (under building)
- Unsealed External Areas
- SA04/A04, SA06/A06, SA10/A10 (15)

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<sup>26</sup> Compliance with NEPM HIL-A guidelines will be required if the Site is to be removed from the EMR.

Fragments of ACM were not observed in the 2021 investigation and asbestos was not reported in soil samples analysed in 2021.

**Accordingly asbestos was contaminant of concern for the Site.**

Based on the investigation data and as a precautionary measure the upper soil deposits (<0.25 m bgs) the following Areas of Concern (AoCs) were determined and are described further in Section 4.5.6 (refer to Table 4-7 and Figure 4A, Appendix A). These areas were considered to potentially contain ACM/asbestos fines<sup>27</sup>:

- Area 1A
- Area 1B
- Area 1C
- Area 3C
- Area 1
- Area 2
- Area 3A
- Area 3B.

During remediation ACM was found throughout the fill material on the Site. All fill materials were removed from the Site in the remediation works described in Section 6.

#### 4.5.2.3 Metals (other than Chromium and Arsenic)

With the exception of chromium, soil samples from previous investigations reported concentrations of metals which were below the NEPM HIL-A and HIL-C health guidelines. Zinc exceeded the EILs in fill materials in three samples, and were below the EILs in all other samples and samples deeper than 0.25 m bgs.

With the exception of chromium, all samples from soil material deeper than 0.2 m bgs reported metals with concentrations which were below the NEPM HIL-A and HIL-C guidelines, and the EILs.

**Accordingly metals were not contaminants of concern for the Site.**

#### 4.5.2.4 Chromium

In the Supplementary Investigation (refer to Section 3.4) Chromium was below the NEPM-HIL C and EILs, and exceeded the NEPM HIL-A in the following samples: BH06\_0.5, BH07\_0.3, BH08\_0.3, BH16\_0.5, BH21\_0.3, and BH21\_0.5. All of these samples were from natural materials, and at these locations the concentration of chromium was found to increase with depth.

The NEPM HIL-A guideline is based on Chromium VI which is commonly used as a solvent within industrial processes. As no source of chromium has been identified in fill materials and there is no previous industrial use of the Site, the source of chromium in these samples was considered to be natural and Chromium III. Analysis of Chromium (Total) and Chromium VI was undertaken from soil samples collected from MW01 at 0.25, 0.5, 0.75 and 1 m bgl. Concentrations of Chromium (Total) increased with depth however no positive detection of Chromium VI was reported. This finding supports the assumption that chromium reported in soil samples is Chromium III.

During remediation of the Site, fifteen representative samples of natural materials distributed over the Site were analysed for Chromium VI. All samples analysed reported a non-detectable concentration for Chromium

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<sup>27</sup> Note this was the inferred potential distribution of asbestos in soils pre-remediation based on the investigation data. During remediation ACM was found throughout the fill material on the Site.

VI, and provided an additional line of evidence to conclude that chromium in natural soils on the Site is Chromium III.

**Accordingly Chromium VI was not a contaminant of concern for the Site.**

Chromium III is an essential nutrient and does not have a guideline value in the NEPM. The US EPA regional screening level (THQ 0.1)<sup>28</sup> for Chromium III is 12,000 mg/kg. All soil samples had concentrations of chromium below this guideline.

#### 4.5.2.5 Organophosphate Pesticides and Arsenic

Organophosphate pesticides (OPPs) and arsenic can also be associated with the application of termiticides.

Previous investigations of the Site reported non-detectable concentration of OPPs. **Therefore OPPs were not contaminants of concern for the Site.**

The maximum concentration of arsenic reported in previous investigations of the Site was 32 mg/kg which was below the adopted health guidelines and ecological guidelines (100 mg/kg). Previous investigations of the Site have not identified elevated concentrations of arsenic on the Site which would likely be present if arsenic was historically used as a termiticide.

**Therefore arsenic was not a contaminant of concern for the Site.**

#### 4.5.2.6 Other Potential Contaminants of Concern

Previous investigations of the Site did not report the detection of other potential contaminants of concern (PCOC) including:

- PAH including soil materials containing a slag type material
- benzene, toluene, ethyl benzene and xylenes (BTEX)

Sample location SS04 in Coffey (2013) reported TRH in the C<sub>16</sub>-C<sub>34</sub> fraction with concentration which was below the adopted HIL-A, HIL-C and EILs. No visual or olfactory signs of contamination were observed at this sampling location (and elsewhere on the site) however organic matter was present.

The TRH previously reported was considered a false positive, relating to organic matter within the shallow soil profile for the following reasons:

- no visual or olfactory signs of hydrocarbon contamination were observed at this sampling location
- the site history did not identified storage/use of hydrocarbons
- other potential organic contaminants (BTEX and PAH) were not reported in the sample analysed (or other samples analysed)
- the sample was collected from a depth and location where organic matter would be present.

Notwithstanding the above the soil material represented by sample location SS04 was removed as part of the remediation works undertaken in 2023 (refer to Section 6).

**Accordingly PAH, TRH and BTEX were not contaminants of concern for the Site.**

#### 4.5.2.7 Other Anthropogenic Materials

Fill containing anthropogenic materials which pose physical hazards (sharp and angular) were observed on the Site and were considered to be unsuitable for use in a park/open space and should be removed from the Site where there is a likelihood that future users of the Site may come into contact with these materials.

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<sup>28</sup> <https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables>, accessed 2 December 2021



During remediation all fill materials were removed from the Site in the remediation works described in Section 6.

### 4.5.3 Risk to Groundwater

A groundwater monitoring well was installed in the north western corner of the Site to 6 m bgs (refer to MW01 in Figure 2, Appendix A) in the Supplementary Investigation (refer to Section 3.4). Groundwater was not intersected and is likely to be at a depth greater than 20 m bgs (refer to Section 4.4.7). Risk to groundwater receptors was considered to be low based on the following lines of evidence:

- OCP contaminants on the site strongly absorb to soils and have low solubility/leachability. This is demonstrated by elevated concentrations of OCPs being reported in the upper soil materials (<0.2 m bgs) where the termiticides were historically applied, and substantially lower concentrations in deeper soil materials (>0.2 m bgs) which provides an additional line of evidence to support the conclusion the OCPs have low leachability/solubility on the Site. The risk of these contaminants leaching to underlying groundwater is therefore considered to be low.
- No shallow water bearing zone has been identified within 6 m of the ground surface, and conditions on the Site and surrounding area are unlikely to result in the formation of shallow water bearing zone (refer to Section 4.4.7).

The DES *Contaminated land investigation document – approved form, Version 1.03, 19 May 2023* states the following on Page 6 of 24:

*For the CLID to be in the approved form, the sampling program must have collected sufficient data to establish the nature and vertical and lateral extent of contamination in all relevant media. Where mobility of a contaminant is an issue, properties such as contaminant leachability and groundwater and soil vapour flow direction must be assessed.*

As noted above the investigation data for the Site has established that elevated concentrations of OCPs are in the upper soil materials (<0.2 m bgs) where the termiticides were historically applied, and OCPs have low solubility/leachability and therefore low mobility and are held in solid (soil/fill) media. Accordingly, it can be concluded that mobility of the contaminants is not of concern and therefore further consideration into contaminant leachability and sampling of groundwater media (i.e. in the NFB) is not warranted.

Post-remediation (refer to Section 6) risk to groundwater is considered to be negligible on the basis that the source of contamination requiring remediation has been removed from the Site.

### 4.5.4 Risk to Surface Water

A key finding of the Supplementary Investigation (refer to Section 3.4.7) was that prior to the undertaking of remediation the risk to surface water receptors was considered to be low based on the low leachability/mobility of OCPs present and the Site being in a stable condition with no visible signs of erosion on the Site.

Post-remediation (refer to Section 6) risk to surface water is considered to be negligible on the basis that the source of contamination requiring remediation has been removed from the Site.

### 4.5.5 Contaminants of Concern

In summary the Contaminants of Concern for the Site (in solid media) included:

- OCPs
- Asbestos.



### 4.5.6 Areas of Concern

Based on the completed investigations the Site was segregated into four main AoCs (Area 1 to Area 4). The AoCs were then further sub-divided based on contaminant concentration, lithology and the depth contamination, and implication of these attributes in regard to off-site disposal and the remediation of the Site. The AoCs are summarised in the following tables which have been reproduced from Appendix G in the RAP included in Appendix L.3:

- Table 4-7 which summarises the AoCs for ground surface to 0.25 m bgs; and the areas are shown in Figure 4A, Appendix A
- Table 4-8 which summarises the AoCs for ground surface to 0.25 m bgs; and the areas are shown in Figure 4B, Appendix A

It should be noted that during remediation ACM comprising broken sheets of cement sheeting were frequently encountered in fill materials on the Site, and accordingly decision was made to remove fill materials from the Site.

All fill materials and the materials described in these AoCs were removed from the Site during remediation (refer to Section 6).

**Table 4-7 AoCs Ground Surface to 0.25 m bgs**

AoC	Description of Area and Requirement for Remediation
Area 1A Area 1B Area 1C Area 3C	OCPs exceeded NEPM HIL-C and NEPM HIL-A guidelines for parks and open space and residential areas respectively. While the majority of OCP contamination was expected to be within the first 0.2 m bgs of soil, OCP contamination potentially extended further into deeper soil deposits (~0.4 m bgs).  ACM was potentially present in shallow soil materials. Fill materials containing anthropogenic materials which pose physical hazards (sharp and angular) were considered unsuitable for use in a park/open space were also potentially present and were referred as “Unsuitable Fill Materials” (refer to note at end of table).
Area 1	OCPs in Area 1 exceeded NEPM HIL-C and NEPM HIL-A guidelines for parks and open space and residential areas respectively. While the majority of OCP contamination was expected to be within the first 0.2 m bgs of soil, OCP contamination potentially extended further into deeper soil deposits (~0.4 to 0.5 m bgs).  ACM was potentially present in shallow soil materials. Fill materials containing anthropogenic materials which pose physical hazards (sharp and angular) were considered unsuitable for use in a park/open space were also potentially present.
Area 2	Area 2 had detectable concentration of OCP with concentrations below NEPM HIL-A guidelines for residential areas with accessible gardens. Based on data from previous investigations OCP contamination was expected to be within the upper 0.2 m of soil, however there was potential for detectable concentrations to be present which are deeper than 0.2 m.  ACM was potentially present in shallow soil materials. Unsuitable Fill Materials were also potentially present.
Area 3A Area 3B	Area 3A/3B had detectable concentration of OCP with concentrations below NEPM HIL-A guidelines for residential areas with accessible gardens <sup>29</sup> . Based on data from previous investigations OCP contamination was expected to be within the upper 0.2 m of soil, detectable concentrations have also been identified in materials deeper than 0.2 m bgs.  ACM was potentially present in shallow soil materials. Unsuitable Fill Materials were also potentially present.
Area 4A	OCPs in Area 4A were below the NEPM HIL-A guidelines for residential areas with accessible gardens. Detectable OCPs concentrations were observed at the perimeter of Area 4A (at sampling locations BH01, BH03, BH12). These detectable OCP concentrations were below the NEPM HIL-A guidelines for residential areas with accessible gardens.  ACM was not expected to be present in shallow soil materials in this area based on the site geology being natural material (and no apparent fill) and the soil material being covered in hardstand.

<sup>29</sup> Sample locations 6,7 and 4,5 are considered to be representative of Area 3A/Area 3B

AoC	Description of Area and Requirement for Remediation
Area 4B	OCPs in Area 4B were not detected in the samples analysed from this area. ACM was not expected to be present in shallow soil materials in this area based on available data and the soil material being covered in hardstand.

Note: **Unsuitable Fill Materials** are those containing anthropogenic materials which pose physical hazards (sharp and angular) are unsuitable for use in a park/open space.

**Table 4-8 AoCs 0.25 m bgs to 0.4 m bgs**

AoC	Description of Area and Requirement for Remediation
Area 1	OCPs in Area 1 exceeded NEPM HIL-C and NEPM HIL-A guidelines for parks and open space and residential areas respectively. While the majority of OCP contamination was expected to be within the first 0.2 m bgs of soil, based on the existing data OCP contamination extends further into deeper soil deposits (~0.4 to 0.5 m bgs).
Area 2	Area 2 had detectable concentration of OCP with concentrations below NEPM HIL-A guidelines for residential areas with accessible gardens. Based on the existing data OCP contamination was expected to be within the upper 0.2 m of soil, however there was potential for detectable concentrations to be present which are deeper than 0.2 m.
Area 4A Area 4B	Materials in this area were to be excavated where Unsuitable Fill Materials were present.

#### 4.5.7 Data Gaps and Limitation of Previous Investigations

As noted in Section 4.2.11 at the completion of the Supplementary Investigation the Site was considered sufficiently characterised to enable the preparation of the RAP (refer to Section 5) and undertake the remediation works (refer to Section 6). Additional sampling prior to remediation was required to further define the dimensions of Area 1C; this sampling was completed as part of the remediation works described in Section 6). In addition the RAP included processes for the management of unforeseen contamination (unexpected finds) if encountered during the remediation of the Site.

Site access constraints limited the sampling methodology to hand excavation / hand auguring / and a single mechanically drilled borehole in the north west corner of the Site. This limited the depth of excavations, and the visual characterisation of fill materials. Excavation of mechanically excavated test pits is preferable where fill materials are present, and ACM is a contaminant of concern. Hand sampling methods limited the depth of samples to <0.5 m bgs.

#### 4.5.8 Remediation of the Site

Remediation of the Site was undertaken in 2023 and included the excavation and off-site disposal of soil materials requiring remediation and the removal of all fill materials from the Site. The remediation works undertaken including validation data are described in (refer to Section 6), and a post-remediation CSM is provided in Section 7.

Remediation of the Site involved the removal of materials which are represented by the sample data included Appendix C.7.1 and Appendix C.7.2. In addition to the materials represented by the sample data, during remediation ACM comprising broken sheets of cement sheeting were frequently encountered in fill materials on the Site, and accordingly decision was made to remove fill materials from the Site. These materials were managed as an unexpected find/unforeseen contamination. All fill materials were removed from the Site during remediation (refer to Section 6).

### 4.6 PRE-REMEDIATION CONCEPTUAL SITE MODEL

The following is a summary of the conceptual site model from the Supplementary Investigation included in Appendix L.2. A tabulated pre-remediation conceptual site model is provided in Section 4.6.1, and illustrative CSM is provided in Figure 15, Appendix A.

Historical termiticides applied to the soil on the Site as termite barriers, and ACM (most likely from buildings on the Site) are considered to be the **primary sources** of contamination on the Site.

Contamination present in soil and other environmental media as a result of the primary source is considered as a **secondary source of contamination**. Contaminant of concern associated with the application of termiticides on the Site include OCPs (mainly aldrin and dieldrin), and asbestos. Other OCPs present in soil included DDT+DDE+DDD, endosulfan I, endrin, heptachlor, endrin aldehyde and endrin ketone.

Once in soil, contamination has the potential to be distributed through **transportation pathways** such as erosion and deposition (wind and water) and the leaching of contaminants to groundwater and surface water, and anthropogenic activities which involve the movement of soil materials such as site redevelopment. Transportation pathways can also be considered as secondary sources of contamination (e.g. contamination in groundwater).

Based on the Supplementary Investigation, the transportation pathways considered to be relevant to the Site include erosion and deposition (wind and water), and anthropogenic activities which involve the movement of soil materials such as site redevelopment.

The leaching of contaminants to groundwater and surface water is considered to be low risk based on the OCP contaminants present which strongly absorb to soil and have low solubility/leachability. This is demonstrated by elevated concentrations of OCPs being reported in the upper soil materials (<0.2 m bgs) where the termiticides were historically applied, and substantially lower concentrations in deeper soil materials (>0.2 m bgs) which provides an additional line of evidence to support the conclusion the OCPs have low leachability/solubility on the Site. The risk of these contaminants leaching to underlying groundwater is therefore considered to be low.

No shallow groundwater water bearing zone has been identified within 6 m of the ground surface. The absence of shallow groundwater on the Site is consistent with the conditions which are unlikely to support the formation of a shallow groundwater aquifer for the following reasons.

The Site is located in an elevated area on a hill. In combination with the topography of the Site and surrounding area which slopes to the north, urbanisation of the local area with hard surfaces (i.e. roof, hard surfaces and roads) which discharge runoff into the stormwater drainage system, and natural soil types<sup>30</sup> which would retard infiltration of rainfall and promote surface water runoff, conditions of the Site and the surrounding area are more likely to support the shedding of rainfall as surface water runoff into the stormwater drainage system (refer to Section 4.4.2) and not promote conditions which support the ponding and infiltration of rainwater which would be required for the formation of a shallow groundwater aquifer.

Groundwater on the Site is expected to be hosted in the Neranleigh-Fernvale beds between 20 and 50 m bgs.

Pre-remediation the risk to surface water receptors was considered to be low based on the low leachability of OCPs present and the Site being in a stable condition with no visible signs of erosion.

Fill containing anthropogenic materials which pose physical hazards (sharp and angular) were observed on the Site and were considered to be unsuitable for use in a park/open space and should be removed from the Site where there is a likelihood that future users of the Site may come into contact with these materials.

**Receptors** could potentially be exposed to contaminants derived from the disturbance of contaminants present in within soil.

Potential receptors considered applicable redevelopment of the Site include:

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- <sup>30</sup> Natural soils on the Site and the surrounding area are silty clays and the underlying materials being mudstones. These materials are likely to have a lower permeability and therefore retard surface water infiltration into the underlying materials (refer to Section 4.4.5).

- workers involved with the site redevelopment work
- persons involved with the cleaning clothing, vehicles and equipment used in redevelopment
- general public including persons who could be subject to contaminated media generated during redevelopment (e.g. dust)
- ecological receptors including native and domestic terrestrial flora and fauna
- surface water receptors.

Post redevelopment potential receptors which may be exposed to contaminants in soil include:

- general public accessing the park and community facilities
- persons involved with maintenance of the park and community facilities
- persons who work at the community facilities
- persons who could be subject to contaminated media generated from the Site (e.g. dust)
- ecological receptors including terrestrial and aquatic flora and fauna (including native and domestic terrestrial fauna).
- surface water receptors.

**Exposure pathways** for human receptors include dermal contact, ingestion, inhalation (dust and fibres) and plant uptake mechanisms. For a community park setting the consumption of home grown produce may potentially occur, and therefore the consumption of produce, and ingestion of soil adhered to produce should also be considered.

Exposure pathways for ecological receptors include direct contact and ingestion for invertebrates. Exposure pathways for vertebrates (mammals/birds) include bioaccumulate OCPs through the consumption of organisms and/or direct contact with the soil.

#### 4.6.1 Tabulated CSM

The following table provide a CSM for source-pathway-receptor linkages for the Site based on the pre-remediation condition of the Site and landuse involving open space and community use. The table includes a summary of whether complete source-pathway-receptor linkages (exposure pathways) could occur. In regard to this summary, note:

- 'Likely' refers to an exposure pathway which could occur and if they occur there is potential for an unacceptable risk to the receptor (i.e. a complete exposure pathway)
- 'Potential' refers to an exposure pathway which could occur however further assessment would be required to establish whether an unacceptable risk to receptor could occur.
- 'Unlikely' refers to an exposure pathway which are considered unlikely to occur and therefore it is unlikely that there would be an unacceptable risk to receptor (i.e. an incomplete exposure pathway).
- 'Not applicable' refers to an exposure pathway which is not considered to be plausible and therefore incomplete.

**Table 4-9 Pre Remediation Conceptual Site Model (Source-Pathway-Receptors)**

Contamination Source	Contaminants of Concern	Media	Plausible Exposure Pathways	Receptors	Complete exposure pathway (without remediation)
Asbestos containing materials (ACM) in Fill Materials	Asbestos	Fill/topsoil materials	Inhalation of fibres	Construction workers	Likely
				General public including persons who could be subject to contaminated media generated during redevelopment and post-construction	Likely
				General public accessing the Site in the future	Likely
				Surrounding land users/neighbouring properties	Potential
				Terrestrial ecological receptors at the Site	Likely
Anthropogenic Materials in fill material	Anthropogenic Materials which pose a physical hazard	Fill	Dermal contact	General public including persons who could be subject to contaminated media generated during redevelopment and post-construction	Potential
Historical termiticides applied to Site buildings as termite barriers	OCPs	OCPs in soil media	Inhalation of contaminated dust	Construction workers	Likely
			Dermal contact with contaminated soil	General public including persons who could be subject to contaminated media generated during redevelopment and post-construction	Likely
			Ingestion of contaminated soil	General public accessing the Site in the future	Likely
			Biological uptake mechanisms	Surrounding land users/neighbouring properties	Potential
				Terrestrial ecological receptors at the Site	Potential
		Surface water with OCPs	Ingestion	Construction workers	Unlikely
			Dermal contact	General public including persons who could be subject to contaminated media generated during redevelopment and post-construction	Unlikely
				General public accessing the Site in the future	Potential
				Surrounding land users/neighbouring properties	Unlikely
				Terrestrial flora and fauna	Potential
			Biological uptake mechanisms	Aquatic flora and fauna in Norman Creek (drain)	Unlikely (Note 2)

Contamination Source	Contaminants of Concern	Media	Plausible Exposure Pathways	Receptors	Complete exposure pathway (without remediation)
		Groundwater with OCPS	Ingestion	Construction workers	Not applicable (Note 1)
			Dermal contact	General public including persons who could be subject to contaminated media generated during redevelopment and post-construction	Not applicable (Note 1)
				General public accessing the Site in the future	Not applicable (Note 1)
				Surrounding land users/neighbouring properties	Not applicable (Note 1)
				Terrestrial flora and fauna within the Property	Not applicable (Note 1)
				Aquatic flora and fauna in Norman Creek (drain)	Not applicable (Note 1)
		Terrestrial biota within the Site	Consumption, bioaccumulation, biomagnification	Construction workers	Not applicable
				General public accessing the Site if the future	Unlikely
				Terrestrial flora and fauna within the Property	Potential
		Aquatic biota in Norman Creek (drain)	Consumption, bioaccumulation, biomagnification	Construction workers	Unlikely
				General public accessing Norman Creek (drain)	Unlikely
				Aquatic flora and fauna in Norman Creek (drain)	Unlikely

Note 1: Groundwater has not been observed on the Site to a depth of 6 m bgs, and risk to groundwater from OCP contamination in soil is considered to be very low to negligible.

Note 2: Pre-remediation the risk to surface water receptors was considered to be low based on the low leachability of OCPs present and the Site being in a stable condition with no visible signs of erosion.

## 5. REMEDIATION ACTION PLAN

This section summarises information from the RAP included in Appendix L.3.

### 5.1 REMEDIATION STRATEGY

The remediation strategy for the Site was to remove contaminated soil from the Site to enable the Site to be removed from the EMR and to make the Site suitable for park and community use. This includes the removal of soils which are unsuitable for park use based on the presence of physical hazards.

Soils removed from the Site were to be disposed to a licenced landfill or beneficially reused at a resource recovery facility. Other potential remediation options such as containment (e.g. capping) were not considered based on the requirement from DAWE to remove the contaminated soil from the Site and the property from the EMR. Alternatives to disposal to a licenced landfill such as thermal destruction are considered cost prohibitive and were not considered.

### 5.2 REMEDIATION OBJECTIVE

The primary objectives for the remediation of the Site are to make it suitable for park and community use, and to remove contaminated soil from the Site as far as practicable such that the Site can be removed from the EMR.

### 5.3 DATA QUALITY OBJECTIVES

This section reproduces the Data Quality Objectives in the RAP included in Appendix L.3.

As stated in Section 18 Appendix B of Schedule B2 of the ASC NEPM, the DQO process is a seven-step iterative planning approach used to define the type, quantity and quality of data needed to support decisions relating to the environmental condition of a site.

The seven-step DQO process adopted for the validation of remediation is summarised in the following table.

**Table 5-1: Data Quality Objectives from RAP**

<b>1. State the problem</b>	<p>The primary objectives for the remediation of the Site are to make it suitable for park and community use, and to remove the OCP contaminated soil from the Site as practicable such that the property can be removed from the EMR.</p> <p>Remediation is required to remove the Site from the EMR and will include:</p> <ul style="list-style-type: none"> <li>the removal of OCP impacted soil materials which exceed the Remediation Criteria in Section 7.3 of the RAP included in Appendix L.3</li> <li>the removal of Unsuitable Fill Materials (fill materials containing anthropogenic materials which pose physical hazards (sharp and angular) are unsuitable for use in a park/open space)</li> </ul> <p>Validation of the Site is required to confirm that the remediation objectives have been achieved. The main problems are:</p> <ul style="list-style-type: none"> <li>What areas require remediation?</li> <li>How should site soils be validated?</li> <li>What validation sampling density should be used?</li> </ul>
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	<ul style="list-style-type: none"> <li>What contaminants should be analysed for?</li> </ul>
<b>2. Identify the decision</b>	<p>Is the data suitable for assessing whether the areas requiring remediation have been remediated?</p> <p>Is the Site suitable for the proposed land uses?</p>
<b>3. Identify inputs to the decision</b>	<p>The primary inputs to assessing the above include:</p> <ul style="list-style-type: none"> <li>Previous investigations (where applicable)</li> <li>Field observations including the presence of Unsuitable Fill Materials</li> <li>Analytical data of validation sample media, and quality assurance / quality control (QA/QC) samples</li> <li>Data quality protocols</li> <li>Remediation criteria (refer to Section 7.3 of the RAP included in Appendix L.3).</li> </ul>
<b>4. Define the boundaries of the study</b>	<p>The boundaries for the validation sampling program are identified as follows:</p> <ul style="list-style-type: none"> <li>Spatial Boundaries: Lot 123 on RP46047, Lot 124 on RP46047, and Lot 125 on RP46047.</li> <li>Temporal boundaries: The status of the sampling points at the time of the investigation.</li> <li>The vertical study boundary will be the depth of the validation samples described in Section 8.6 of the RAP included in Appendix L.3.</li> </ul>
<b>5. Develop a decision rule</b>	<p>The decision rules to be applied to the DSI include:</p> <p>For OCPs in soil, the following approach is to be adopted:</p> <ul style="list-style-type: none"> <li>Where OCPs concentrations for each sample are below the adopted remediation criteria, no further remediation is required.</li> <li>Where soil contaminant concentrations are reported to exceed the adopted remediation criteria, and it is not practicable to remediate the Site so it can be removed from the EMR, the soil contaminant concentrations will be compared to NEPM HIL-C criteria. If there is an exceedance of HIL-C remediation criteria the following additional steps will be undertaken: <ul style="list-style-type: none"> <li>Where sufficient data is available, calculate the 95% Upper Confidence Level of the mean (95%UCL), data range and standard deviation.</li> <li>Where the 95% UCLs are less than the assessment criteria and no individual results in the data set are to be greater than 250% of the assessment criteria; and the standard deviation of the data set is to be within 50% of the assessment criteria, no further remediation is required.</li> <li>Where the 95% UCL is more than the assessment criteria, consider these results in the context of the current CSM to evaluate whether there are plausible pollutant linkages remaining.</li> <li>If plausible pollutant linkages are identified, then further remediation should be undertaken to remove impacted soil.</li> </ul> </li> </ul> <p>For Unsuitable Fill Materials, the following approach is to be adopted:</p> <ul style="list-style-type: none"> <li>A SQP who is competent in the identification of Unsuitable Fill Materials will inspect the site to confirm that these materials have been removed.</li> </ul>
<b>6. Acceptable limits on decision error</b>	<p>Decision errors are incorrect decisions caused by using data that is not representative of site conditions due to sampling or analytical error. As a result, a decision may be</p>



	<p>made that remediation/management is not needed when it is, or vice versa. There are two types of decision error:</p> <ul style="list-style-type: none"> <li>• Sampling errors, which occur when the samples collected are not representative of the conditions within the investigation area; and</li> <li>• Measurement errors, which occur during sample collection, handling, preparation, analysis and data reduction.</li> </ul> <p>To consider whether decision errors have been made, an assessment of data quality indicators will be undertaken as described in Section 8.6.4 (including a QA/QC assessment of the data collected). The closeness of the data to the assessment criteria will also be considered.</p>
<b>7. Optimise the design for obtaining data</b>	<p>The methodology and rationale for obtaining relevant data for validation is described in Section 8.6 of the RAP included in Appendix L.3.</p>

## 5.4 REMEDIATION CRITERIA

This section reproduces the remediation criteria from Section 7.3 of the RAP included in Appendix L.3.

The remediation criteria for the soil remediation is the NEPM residential land use (HIL-A) such that the Site can be removed from the EMR.

### Note on ecological receptors

Following implementation of the proposed remediation strategy it is considered that there would be no plausible exposure pathway for ecological receptors on the basis that the majority of the contaminant source would have been removed from the Site.

### Note on groundwater and surface water receptors

OCPs have low solubility/leachability and therefore low risk of leaching into surface water and groundwater is low and of negligible concern.

Post remediation the risk to surface water and groundwater receptors is considered to be low based on the removal of the contaminant source from the Site, the reinstatement of the Site with clean fill, and stabilisation of soil materials with ground cover and/or sealed areas. Accordingly no remediation criteria are considered to be required for the protection of groundwater and surface water receptors.

### Modified Criteria for Arsenic

A modified remediation criteria for arsenic for the validation of the Site was developed based on information provided in the NEPM 2013 Toolbox, and is documented in Appendix J.1.

### Modified Criteria for Asbestos

A modified remediation criteria for asbestos for the validation of the Site was developed and is included in Appendix J.2. During remediation it was identified that fill materials on the Site contain ACM. Visual confirmation of natural ground following the removal of fill materials was therefore required for the remediation of the Site.

## Note on Chromium

Chromium (Total) was reported at concentrations which exceed the NEPM HIL-A Tier 1 guideline (100 mg/kg) in samples of natural soils in the Supplementary Investigation (refer to Section 4.5.2.4) and from natural materials in validation samples undertaken in validation sampling (refer to Section 6.9.3).

The NEPM HIL-A Tier 1 guideline is based on hexavalent chromium (Chromium VI) which is commonly used as a solvent within industrial processes. Chromium VI was not detected in the Supplementary Investigation and from representative samples undertaken in validation sampling (refer to Section 6.9.3).

As no source of chromium has been identified in fill materials in the Supplementary Investigation and there was no previous industrial use of the Site, the source of chromium in these samples is considered to be natural and Chromium III.

Chromium III is an essential nutrient and does not have a guideline value in the NEPM. The US EPA regional screening level (THQ 0.1)<sup>31</sup> for Chromium III is 12,000 mg/kg and has accordingly been adopted as the Remediation Criteria for Chromium (Total) for the final validation samples.

## 5.5 MATERIALS REQUIRING REMEDIATION

Based on the data from previous investigations materials requiring remediation to achieve the remediation objective were identified and documented in Section 8 and Appendix G of the RAP (refer to Appendix L.3). The areas which were identified in the RAP as requiring remediation are shown in Figure 4A and Figure 4B, Appendix A and summarised in the following tables.

**Table 5-2 Materials Requiring Remediation Ground Surface to 0.25 m bgs as per Figure 4A**

Area	Excavation Depth (m bgs)	Approximate Bank Excavation Volume (m <sup>3</sup> )
Area 1A	0.25	20
Area 1B	0.25	30
Area 1C	0.25	10
Area 3C	0.25	10
Area 1	0.25	195
Area 2	0.2	100
Area 3A	0.2	25
Area 3B	0.2	35
Area 4A	0.2	70
Area 4B	Note 1	-

Note 1: Materials from Area 4B require removal where **Unsuitable Fill Materials** are present. Unsuitable Fill Materials are those which contain anthropogenic materials which pose physical hazards (sharp and angular) are unsuitable for use in a park/open space are also potentially present and are herein referred to in this RAP as "Unsuitable Fill Materials".

<sup>31</sup> <https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables>, accessed 2 December 2021

**Table 5-3 Materials Requiring Remediation 0.25 to 0.4 m bgs as per Figure 4B**

Area	Excavation Depth (m bgs)	Approximate Bank Excavation Volume (m <sup>3</sup> )
Area 1	0.25-0.4	155
Area 2	0.25-0.4	120
Area 4A	Note 1	-
Area 4B	Note 1	-

Note 1: Materials from Area 4A/4B require removal where Unsuitable Fill Materials are present.

During remediation ACM were observed in fill materials over the Site which required a change to the planned excavation extents. This is described below in Section 6.

## 6. REMEDIATION AND VALIDATION WORKS

### 6.1 KEY PARTIES INVOLVED IN REMEDIATION AND VALIDATION

The following companies were involved in the remediation and validation works at the Site.

**Table 6-1 Key Parties involved in Remediation and Validation**

Role	Organisation	Responsible Persons	Responsibilities
<b>Client</b>	Department of Veteran Affairs	Dave Binney	<ul style="list-style-type: none"> <li>Engagement of Principal Contractor, SQP and Site Auditor.</li> <li>Compliance with statutory requirements.</li> </ul>
<b>Principal Contractor / Remediation Contractor</b>	Enviropacific Services (EPS)	Mick Merriman	<ul style="list-style-type: none"> <li>Implementation of RAP and EMP</li> <li>Employment a Competent Person who will be responsible for undertaking full-time supervision of the remediation work. The Competent Person must be experienced in the undertaking remediation works and have the necessary experience to:               <ul style="list-style-type: none"> <li>visually identify soil materials containing suspect/potential ACM</li> <li>visually identify soil materials which contain anthropogenic materials which pose physical hazards (i.e. sharp and angular) that are unsuitable for use in a park/open space</li> <li>visually identify unforeseen contamination</li> <li>implement the RAP and EMP including but not limited to the required controls to manage potential risks to human health and the environment.</li> </ul> </li> </ul>
<b>Suitably Qualified Person</b>	Tetra Tech Coffey	Jeremy Wicks	<ul style="list-style-type: none"> <li>Provide technical support to the Principal Contractor/Remediation Contractor in regard to contaminated land investigation and management</li> <li>Preparation of Disposal Permits for submission to DES by EPS</li> <li>Complete site inspections during remediation to check compliance against the RAP and EMP</li> <li>OCP air monitoring during remediation</li> <li>Collection of validation samples</li> <li>Preparation of this Validation Report.</li> </ul>
<b>Licensed Asbestos Assessor (LAA)</b>	Tetra Tech Coffey	Laura Smith / Patricy Cortes	<ul style="list-style-type: none"> <li>Review of contractor Safe Work Method Statement (SWMS) relating to asbestos aspects of the project and their Asbestos Removal Control Plan (ARCP)</li> <li>Asbestos and lead control air monitoring</li> <li>Clearance inspections (and clearance air monitoring where required) following the completion of demolition and remediation works</li> <li>Issue of an asbestos Clearance Report following the completion of demolition and remediation works</li> </ul>
<b>DES-Approved Contaminated Land Auditor</b>	Epic Environmental	Louise Cartwright	<ul style="list-style-type: none"> <li>Undertake role of DES approved contaminated land auditor (CLA) and conduct auditing services in accordance with provisions of Chapter 12, Part 3A of the Environmental Protection (EP) Act 1994</li> </ul>
<b>OCP Dust Monitoring</b>	Ektimo	Henry Diona	<ul style="list-style-type: none"> <li>OCP air monitoring during remediation including set up of samplers, sampling in accordance with the methodology included in the RAP, analysis of samples at the NATA</li> </ul>

Role	Organisation	Responsible Persons	Responsibilities
			accredited laboratory and preparation of the factual report on air monitoring.
Waste Facility	Remondis – Ti Tree Bioenergy	Edward Hartigan	<ul style="list-style-type: none"> <li>Acceptance of contaminated soil to monocell disposal cell, as per DES soil disposal permit</li> </ul>
	BMI	Peta Rutherford	<ul style="list-style-type: none"> <li>Stapylton: Acceptance of contaminated soil to lined disposal cell, as per soil disposal permit</li> <li>Acacia Ridge: Acceptance of concrete for recycling</li> <li>Redbank: Acceptance of soil for reuse</li> </ul>

## 6.2 SUMMARY OF REMEDIAL WORKS

Following the completion of demolition of the buildings by EPS, the remedial works were undertaken between August and December 2023. In summary the remedial works included:

- Site establishment by EPS including the following:
  - Work area fencing, warning signage and temporary site facilities.
  - Disconnection of building services to the Site
  - Occupational health and safety controls and monitoring.
  - Environmental monitoring and controls.
  - Vehicular transit routes onto and off the site.
  - Location, isolation, relocation, protection and/or termination of services potentially affected by the remediation/redevelopment works, if any.
  - Contingency planning and controls to address unexpected finds.
- Establishment of OCP dust monitoring stations by Ektimo prior to the undertaking of site work. Undertaking of air quality monitoring during remediation (refer to Section 6.4).
- Setting out of remediation areas by EPS based on the requirements of the RAP.
- Setting out of the Site boundaries by EPS based on survey plan information provided by DVA to EPS.
- Excavation of soil materials required for the remediation between 28 August 2023 and 23 October 2023. Based on the results of validation sampling, the removal of additional soil material along the northern boundary of the Site was undertaken between 13 December 2023 and 14 December 2023 to remove soil materials with asbestos (refer to Section 6.5).
- Removal of building services from the Site with the exception of a pre-existing sewer connection shown in Figure 12, Appendix A (refer to Section 6.6.2), and the reconnection of a water main to the Site.
- Off-site disposal of excavated materials under DES approved Disposal Permits by EPS (refer to Section 6.7).
- Inspection of excavated areas by the SQP prior to validation sampling. Collection of validation samples by experienced TTC Environmental Scientists under the supervision of the SQP (refer to Section 6.9).
- Submission of validation samples to NATA accredited laboratories including Eurofins (primary samples) and ALS (inter-laboratory duplicate samples).
- Preparation of this Validation Report.

The remediation of the Site was undertaken in general accordance with the requirements of the RAP. A deviation from the RAP was the requirement to remove all fill materials from the Site based on the presence of ACM in fill materials. This requirement is discussed in Section 6.5.

Photographs of the general condition of the Site pre and post remediation are shown in Appendix D.3.

## 6.3 INSPECTIONS DURING REMEDIATION

Inspections undertaken by the SQP during remediation are summarised in Table 6-2.

In summary inspections undertaken by the SQP confirmed that the remedial works being undertaken by EPS were in general accordance with the RAP and EMP.

At the completion of excavations for remediation excavated areas were inspected by the SQP to confirm that materials had been excavated to required excavation depth and to natural ground (refer to Section 6.5).

**Table 6-2 Summary of Site Inspections by the SQP**

Date	Comment
3/7/2023	Pre-remediation inspection of the Site during demolition works to discuss the timing of the remedial works. Inspection of areas which were previously covered in buildings and not accessible in previous investigations.
4/8/2023	Pre-remediation meeting with EPS to discuss the RAP, EMP, health and safety requirements, and ambient air quality monitoring.
28/8/2023	Inspection at commencement of remediation. EPS inducted SQP, and briefed SQP on site controls being implemented. Asbestos in fill materials was discussed in the meeting and the requirement to excavate all fill materials. Inspection of the OCP dust samplers installed at the Site. SQP discussed the Disposal Permit(s) and Waste Levy Exemption and the requirement for waste tracking with EPS, and the requirement to adhere to the conditions of these approvals.
31/8/2023	Inspection at commencement of remediation. Setting out of sample locations for further characterisation of Area 1C (refer to Section 6.9)
5/9/2023	Inspection of remediation excavation works along the southern boundary of the Site. Discussion of excavations around the heritage fence with EPS.
7/9/2023	Inspection of remediation excavation works along the southern boundary of the Site. Inspection of portion of exposed heritage footings of heritage fence. Discussion with EPS on the requirements for the importation of materials and the requirement to create a designated area for the stockpiling of these materials.
12/9/2023	Inspection of remediation excavation works along the southern boundary of the Site. Setting out of sample intervals along the wall and the requirement to sample each strata encountered along boundary walls with the TTC Environmental Scientist. Inspection of portion of exposed heritage footings of heritage fence and imported materials.
18/9/2023	Inspection of eastern boundary with EPS and discussion of excavations along this boundary. Discussion of sampling requirements with the TTC Environmental Scientist.
21/9/2023	Inspection of western boundary and discussion of excavations along this boundary. Inspection of trench excavation. Discussion of sampling requirements with the TTC Environmental Scientist.
6/10/2023	Inspection of site during excavations along the southern boundary of the Site.
10/10/2023	Inspection of site during excavations along the western boundary. Inspection of southern boundary excavations including the excavated trench along this boundary. Discussion of sampling requirements with the TTC Environmental Scientist along the western, southern boundary and trench.
16/10/2023	Inspection of site during excavations. Discussion of sampling requirements with the TTC Environmental Scientist along the western boundary. EPS was observed to be undertaking dust suppression.
18/10/2023	Inspection of site during excavations. Inspection trenches excavated in the eastern portion of the Site. Discussion of sampling requirements with the TTC Environmental Scientist along the western boundary.
26/10/2023	Inspection of site at completion of planned excavations. Setting out of sampling grid with surveyor, and the extent of boundary excavations. Discussion of sampling requirements with the TTC Environmental Scientists.



Date	Comment
4/12/2023	Inspection of site to discuss validation results with the Site Auditor and EPS. During the inspection it was agreed that further excavation was to take place along the full extent of the northern boundary (approximately 0.3 m in width and 0.1 m deep). In the meeting the exceedance of Arsenic in the limited number of sample locations along the eastern boundary was discussed. It was agreed that it was not practicable to undertake further excavations along this boundary and a combination of a modified remediation criteria and statistical assessment of data was to be used to assessed risk from these exceedances. Service trenches where asbestos had been reported were also discussed.
13/12/2023 14/12/2023	Inspection of site during additional excavations along the northern boundary of the site. Discussion of sampling requirements with the TTC Environmental Scientist.

## 6.4 AIR QUALITY MONITORING DURING REMEDIATION

### 6.4.1 OCP Pesticides

OCP dust monitoring was undertaken in accordance with the requirements of the RAP between 28 August 2023 and 23 October 2023. OCP dust monitoring was not undertaken between 13 December 2023 and 14 December 2023 on the basis that materials requiring remediation for OCPs had been removed from the Site.

OCP dust samples were analysed by the Australian Government National Measurement Institute (NMI). A report on the OCP dust monitoring is provided in Appendix I.1. In summary detectable concentrations of OCPs were reported for the following analytes: Heptachlor, Aldrin, trans-Chlordane, cis-Chlordane, Dieldrin.

All samples reported concentrations of OCPs below the residential air quality guidelines included in Section 10.7 of the RAP (refer to Appendix L.3) which have also been reproduced in the report included in Appendix I.1.

### 6.4.2 Asbestos

Asbestos air quality monitoring was undertaken throughout the duration of the remediation works. Asbestos air monitoring results are included in Appendix I.2. In summary all asbestos air monitoring sample results were <0.01 fibres/ml<sup>32</sup>.

During site excavation active dust suppression was undertaken by EPS to mitigate dust emissions. A photograph of active suppression is presented in Plate 4 as follows.

<sup>32</sup> The air monitoring results are below the lowest detectable limit of 0.01 fibres/mL for static air monitoring as required in accordance with the Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres, 2nd Edition [NOHSC:3003 (2005)].



Plate 4: Active dust suppression during site excavation works along the eastern boundary

## 6.5 EXCAVATION OF MATERIALS REQUIRING REMEDIATION

Excavation and removal of materials requiring remediation commenced on the 28 August 2023 in accordance with the RAP. The general sequence of excavation involved the excavation of materials from south to north over the Site.

As excavation commenced, frequent occurrence of ACM were reported in fill materials on the Site. ACM were also observed in the bedding material surrounding services and/or in the service material (e.g. pipe). Examples of ACM fragments found in ash fill materials during excavation are provided in the photographs presented in Plate 5 below.



Plate 5: Examples of ACM in fill material

The finding of ACM in fill materials was considered to be **unforeseen contamination** and managed under Section 8.5 of the RAP included in Appendix L.3.

Based on these findings a decision was made in-conjunction between EPS, DVA, the Site Auditor and the SQP to modify the planned extent of remediation so that all fill materials on the Site, and bedding materials associated with buried services were to be removed and disposed off-site to an appropriately licenced landfill under DES approved Disposal Permit(s) (refer to Section 6.7).

The disposal of the fill materials with ACM were already permitted under the DES approved disposal permits. In addition remediation was being undertaken under an ARCP and therefore the required controls were in place to remove these materials.

Excavated materials were not stockpiled on the Site and were placed directly into skip bins and covered. Photographs of covered skip bins are provided in Section 6.7.

At the completion of the remediation works in December 2023 a total of approximately 1,400 tonnes of material were disposed from the Site (refer to Section 6.7). Assuming an in-situ bulk-density of 1.6 tonnes/m<sup>3</sup>, approximately 875 m<sup>3</sup> of fill/soil materials were removed from the Site. Based on the area of the Site of 1,933m<sup>2</sup> this equates to an average excavation depth of approximately 0.45 m over the Site.

A plan showing the lateral extent of excavations and surveyed ground levels at the completion of remediation is provided in Figure 14, Appendix A.

Table 6-3 provides a description of the lateral extents of excavations. Representative photographs of boundary excavations are shown in Appendix D.1.



**Table 6-3 Summary of Lateral Extent of Remediation Excavations at Boundary**

Boundary	Comment
Eastern	Excavation undertaken to boundary fence line along the eastern side of the Site which is the property boundary with the adjoining lot.
Northern	Excavation undertaken along the northern boundary extended approximately 0.1 m north of the northern property boundary which was defined as fence line along this boundary.
Southern	Excavation undertaken to the retaining wall located along the southern boundary of the Site along Headfort Street which is the practicable limit of excavation and is the southern boundary of the Site.
Western	Excavation undertaken to approximately 0.5 m west of western boundary of the Site along Newdegate Street.
Southern Western Corner	Excavation extended approximately 0.5 m south west of south-western boundary of the Site with the exception of the heritage brick fence. Excavations were undertaken to the footings of the heritage fence which were observed to extend into the natural ground on the Site.

During excavation, bedding material associated with service trenches on the Site were stripped to natural ground. The approximate location of the service trenches is shown in Figure 7, Appendix A.

### 6.5.1 Unforeseen Contamination

Unforeseen contamination encountered during remediation comprised ACM in fill materials.

## 6.6 POST-REMEDATION GROUND LEVELS AND SERVICES

### 6.6.1 Ground Levels

Post-remediation ground surface levels are shown in Figure 14, Appendix A. Ground-levels on the Site are lower post-remediation however the direction of the slope of land on the Site to the north is similar to pre-remediation site conditions.

### 6.6.2 Services

Services which remain on the Site at the completion of remediation are shown in Figure 12, Appendix A and include:

- a water main installed by EPS connection located on the eastern boundary
- a sewer main in the northern eastern corner of the Site
- a sub-surface gravel drain installed by EPS which connects to a PVC stormwater pipe at the Site boundary and discharges into the gutter of Newdegate Street. Drainage on the Site to Newdegate Street is similar to pre-remediation site conditions.



Photograph showing water main connection and materials being removed around this service.



Photograph showing excavated service trench along the northern boundary and the exposed sewer main at the end of the trench. A gravel drain was installed by EPS in the service trench shown (refer to Figure 12, Appendix A).

**Plate 6: Images of services and service trenches**

## 6.7 DISPOSAL OF EXCAVATED MATERIALS

**NOTE TO THE SITE AUDITOR: THIS SECTION IS TO BE UPDATE FOLLOWING RECEIPT OF THE REQUIRED INFORMATION FROM EPS AND THE RECIPIENT WASTE FACILITIES. THIS COMMENT ALSO APPLIES TO WASTE TRACKING INFORMATION IN APPENDIX H.2**

Prior to the undertaking of remedial works two Disposal Permits (SDP010002201 and SDP010002171) and a Waste Levy Exemption (230021CSE) were obtained and held by EPS. During remedial works and following the decision to remove all fill materials from the Site (refer to Section 6) an additional Disposal Permit was obtained (SDP010002171) and held by EPS. A summary of the disposal authorisations is provided in Table 6-4.

During remediation waste tracking was undertaken by EPS. Records provided by EPS in regard to the disposal of materials under the disposal authorisations is provided in Appendix H.1 and summarised in Table 6-5, and is based on waste tracking records provided by EPS and included in Appendix H.2.

Excavated materials were not stockpiled and were placed directly into skip bins and covered. An example of covered skip bins observed during an inspection of the site is provided in the following photographs presented in Plate 7.



Example of covered skip bin 5/9/23



Example of covered skip bin 16/10/23

**Plate 7: Covered waste skip bins**

### Delineation of Area 1C

Prior to the excavation and disposal of materials from Area 1C six additional samples (0-0.1 m) were collected and analysed for OCP pesticides. The sample locations are shown in Figure 5, Appendix A and the results are included in Appendix C.5.1 and Appendix C.5.2. All results reported concentrations within lined landfill acceptance limits and confirmed the boundary of Area 1C as defined in the RAP was appropriate.



**Table 6-4 Summary of Disposal Authorisations held by EPS**

DES Reference Number	Authorisation Type	Receival Site	Approved Quantity (m3)	Approved Quantity (tonnes)	Comment
SDP010002201	Disposal Permit (Lined Landfill)	BMI Group Stapylton Resource Recovery Facility	500	-	-
SDP010002299	Disposal Permit (Lined Landfill)	144 Rossmanns Road, Stapylton, QLD (Lots 2 and 3 SP279441)	1000	-	-
SDP010002171	Disposal Permit (Monocell)	Ti Tree Bioenergy facility, 55 Champions Way, Willowbank, QLD (Lot 3 on SP167885 & Lot 8 on RP24574)	150	-	-
230021CSE	Waste Levy Exemption <sup>33</sup>	Stapylton Resource Recovery Facility and Ti Tree Bioenergy facility	-	910	Authorisation applied to Disposal Permits SDP010002171 and SDP010002201.

**Table 6-5 Quantities of Material Disposed by EPS under Disposal Permits (TABLE TO BE COMPLETED FOLLOWING RECEIPT OF INFORMATION FROM EPS)**

Disposal Permit Number	Quantity Disposed (tonnes)	Quantity Disposed (m <sup>3</sup> ) (Note 1)	Materials Disposed Under Authorisation
SDP010002201			
SDP010002299			
SDP010002171			
<b>Total</b>			

Note 1: Estimated 'bulked' volume of material disposed provided by EPS. EPS assumed an ex-situ bulk density of 1.5 t/m<sup>3</sup> as an estimate to determining material volumes based on the typical material type and filling the 12 m<sup>3</sup> skips to ~10 m<sup>3</sup> full.

<sup>33</sup> Separate to the DES approved waste levy exemption, it was determined by the BMI Group based on information provided by Tetra Tech Coffey that the disposal of materials was exempt from the Queensland waste levy based on the potential for friable asbestos in the materials excavated.

**Table 6-6 Quantities of Material Disposed by EPS under Waste Levy Exemptions (TABLE TO BE COMPLETED FOLLOWING RECEIPT OF INFORMATION FROM EPS)**

Waste Levy Exemption	Quantity Disposed (tonnes)	Quantity Disposed (m <sup>3</sup> ) (Note 1)	Materials Disposed Under Authorisation
230021CSE			
<b>Total</b>			

Note 1: Estimated 'bulked' volume of material disposed provided by EPS. EPS assumed an ex-situ bulk density of 1.5 t/m<sup>3</sup> as an estimate to determining material volumes based on the typical material type and filling the 12 m<sup>3</sup> skips to ~10 m<sup>3</sup> full.

## 6.8 IMPORTED MATERIALS

Imported materials comprised a 26.5 mm crushed rock and 75 mm rock aggregate material source from the Boral quarry at Petrie. Based on the records provided by EPS (refer to Appendix H.2) approximately 225 tonnes crushed rock material was imported or approximately 125 m<sup>3</sup> (assuming a bulk density of 1.8 tonnes/m<sup>3</sup>) and 30 tonnes of 75 mm aggregate was imported. Imported materials were used in the shoring of boundary walls and in the driveway access point<sup>34</sup>.



**Plate 5: Imported materials used in the shoring of boundary walls**

The quarry is comprised of three properties which are shown in Appendix H.2 and summarised Table 6-7. A search of the EMR/CLR was completed for these properties as summarised in the following table, and search results provided in Appendix H.2.

**Table 6-7 Boral Quarry Petrie EMR/CLR Search**

Lot/Plan	EMR Search Result
2 RP208504	Property on the EMR for PETROLEUM PRODUCT OR OIL STORAGE. Property is not the CLR.
1 CP846007	Property is not on the EMR/CLR
29 S311167	Property is not on the EMR/CLR

Tetra Tech Coffey contacted the Boral Quarry Manager<sup>35</sup> at Petrie who advised that the listing was associated with former fuel tanks in a workshop area which have since been removed from the Site, and not associated with the quarried material which is from natural materials. Samples of imported materials (crushed rock) were collected and analysed, and the results discussed in Section 6.9.

<sup>34</sup> Note there was not a requirement to re-instate (backfill) the Site to pre-remediation ground levels

<sup>35</sup> David Hartzler, Quarry Manager (personal communication, 19/2/24)

## 6.9 VALIDATION SAMPLING

### 6.9.1 Overview

Validation sampling was undertaken in accordance with the RAP. Validation samples were collected at an approximate 5 m grid spacing over the Site including:

- Site boundary excavation walls
- excavation floors
- service trenches
- imported material.

Prior to the collection of validation samples from excavation floors and service trenches, the excavated surface levels were inspected by the LAA to confirm that no visible ACM were present. The excavated surface levels were then inspected by the SQP and/or an experienced Tetra Tech Coffey Environmental Scientist to confirm that natural materials were present. This was undertaken prior to sampling by an experienced Tetra Tech Coffey environmental scientist under the supervision of the SQP.

Natural soil materials observed on the Site were comprised of relatively consistent in appearance, medium to high plasticity, brown to brown/orange CLAY.

For Site boundary excavation walls, representative samples were collected from each strata encountered within the wall which included various combinations of: topsoil, ash fill and other fill materials, and then the underlying natural ground. For the Site boundary excavation walls along the eastern, western and southern boundaries of the Site a sample of the natural ground from the floor of the excavation adjacent to the wall (within 0.5 m of the wall) was collected prior to the shoring of the wall with imported material.

For trenches, a set of samples were collected every 5 linear m along the trench. Samples were collected from the natural ground in the trench and included a sample from the base of the trench, and each side wall of the trench at the approximate mid-point of the excavation.

Material logs for the validation samples are provided in Appendix B.

Representative photographs of validation samples collected are provided in Appendix D.2.

Validation samples (excluding imported materials) were analysed for the contaminants of concern in the RAP which included:

- 8-metals arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury
- hexavalent chromium (CrVI)<sup>36</sup>
- OCPs
- asbestos.

Representative samples of ash fill and fill materials in boundary walls were also analysed for PAHs.

Imported materials were analysed for the potential contaminants of concern in the RAP including:

- 8-metals arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury
- hexavalent chromium (CrVI)<sup>39</sup>
- TRH/BTEX
- PAH
- OCPs

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<sup>36</sup> Representative samples of natural materials were analysed for hexavalent chromium where concentrations of total chromium exceeded the default Tier 1 HIL-A guidelines in the NEPM.

- OPPs
- asbestos.

Samples collected were submitted to NATA accredited laboratories including Eurofins (primary samples) and ALS (inter-laboratory duplicate samples) with the exception of samples collected on the 14 December 2023 for asbestos analysis. These samples were submitted to the NATA accredited laboratory HazSure Laboratories for analysis.

Laboratory reports for validation samples and imported materials are provided in Appendix E.

Table 6-9 on the following page provides a summary of the validation samples collected. Table 6-8 provides a summary of the sampling suffixes used in the naming 39of samples.

Validation sample results are discussed in Section 6.9.2, and an assessment of the quality assurance / quality control data in Section 6.10. In summary, TTC consider the data collated to support the validation assessment is reasonably accurate, comparable, precise, complete and representative in which to draw conclusions.

**Table 6-8 Validation Sampling ID Suffix**

Validation Samples Type	Suffix used in Sample ID
Topsoil (walls)	_TS
Ash Fill (walls)	_Ash
Fill (walls)	_Fill
Natural Ground (Excavation Floor)	_F _B
Natural Ground (walls)	_NW _W

### Note on Sample Depths

Validation samples collected from the finished surface of excavated areas (excavation floors and the bottom of trenches) were collected from materials at approximately 0-0.1 m depth.

Validation samples from boundary walls were collected from targeted lithologies rather than pre-determined depth intervals. Depth of the final validation sample locations are included in Appendix B and Appendix C.

**Table 6-9 Summary of Validation Samples**

Validation Sample Series	Location	Sample Date	Appendix A Figure Reference	Appendix C Data Table Reference	Status for use in site validation	Comment
HS01 to HS12	Southern Boundary (Headfort Street)	12/9/23 18/9/23	Figure 8	C.1.1 C.1.2	Final	-
HS10A and HS10B	South-Western Boundary	18/9/23	Figure 8	C.1.1 C.1.2	Final	-
HSA01 to HSA04	Eastern Boundary	20/9/23	Figure 8	C.1.1 C.1.2	Final	-
HSB01 to HSB08	Western Boundary (Newdegate Street)	16/10/23 18/10/23 26/10/23	Figure 8	C.1.1 C.1.2	Final	-
HSB01_230923 to HSB03_230923	Western Boundary (Newdegate Street)	26/9/3	Figure 9	C.4.1 C.4.2	Redundant	HSB01_230923 to HSB01_230923 are redundant western boundary locations and are superseded by HSB01 to HSB08 sample series collected on 16/10/23, 18/10/23 and 26/10/23. EPS made a decision to excavate beyond the western boundary of the Site once it had been determined that these samples had been collected from materials located within the Site boundary. Re-sampling along the western boundary was undertaken once boundary excavations had been completed. Results from these samples are not discussed further in this report.
HSB18 to HSB27	Northern Boundary	14/12/23	Figure 8	C.1.1 C.1.2	Final	-
HSB09 to HSB17	Northern Boundary	18/10/23	Figure 9	C.4.1 C.4.2	Redundant	HSB09 to HSB10 are redundant northern boundary locations and are superseded by HSB18 to HSB27. Based on the detection of asbestos in the majority of these samples a decision was made to undertake further excavation along the northern boundary (refer to Section 6.5). Results from these samples are not discussed further in this report.
A1 to A10 B1 to B10 ... H1 to H10	Excavation Floor	26/10/23	Figure 8	C.1.1 C.1.2	Final	-



Validation Sample Series	Location	Sample Date	Appendix A Figure Reference	Appendix C Data Table Reference	Status for use in site validation	Comment
DW-B1 to DW-B4	Site access point (drive way) Excavation Floor	18/10/23	Figure 7	C.1.1 C.1.2	Final	-
TR01 to TR06 T01 to T26	Service Trenches	21/9/23 16/10/23 18/10/23 26/10/23	Figure 7	C.1.1 C.1.2	Final	-
V01 to V14	Area used to place imported materials on Site	7/9/23	Figure 6	C.2.1 C.2.2	Redundant	Natural ground from the excavation floor were sampled prior to the importation of materials. These results are discussed in Section 6.9.3, and the results are superseded by the excavation floor samples completed on the 26/10/23
CF01 to CF06 IF01 to IF06	Imported Materials	12/9/23 26/10/26	Figure 10	C.3.1 C.3.2	Final	Imported materials were sampled from a stockpile on the 12/9/23 from the area where imported materials were placed (see Figure 6, Appendix A). Imported materials were also sampled from the shoring materials and the sample locations are shown in Figure 10, Appendix A.

## 6.9.2 Ground Conditions at Validation Sampling Locations

The following table provides a summary of the ground conditions observed at the validation sampling locations. Material logs for the validation samples are provided in Appendix B.

**Table 6-10 Summary of Ground Conditions at Validation Sample Locations**

Location	Comment
<b>Southern Boundary (Headfort Street)</b>	The profile for material along the southern side (Headfort Street boundary) wall of the excavation comprised concrete hardstand, underlain by a concrete aggregate layer, underlain by a layer of ash fill material, and underlain by natural soils. Samples were collected at the midpoint of each layer. The profile of the face of the southern wall had a typical layer thicknesses 0.7 to 0.8 m of concrete wall with base, 0.1 to 0.3 m of ash, and 0.2 to 0.5 m of natural ground becoming the site floor.
<b>Eastern Boundary</b>	The profile for material along the eastern boundary wall, bordering the adjacent property and driveway. The excavation wall consists of a silty topsoil mixed with grave fill, underlain coarse gravel fill layer, and underlain by natural soils. Samples were collected from the midpoint of each layer. The profile of the face of the eastern wall had a typical layer thicknesses 0.1 to 0.2 of topsoil (fill), 0.3 to 0.4 m of fill, and 0.2 to 0.3 m of natural ground.
<b>Western Boundary (Newdegate Street)</b>	The profile for material along the western side (Newdegate Street boundary) wall of the excavation consists of topsoil (fill), underlain by a layer of ash fill material, and underlain by natural soils. Samples were collected from the midpoint of each layer. The profile of the face of the western wall had a typical layer thicknesses 0.2 to 0.4 m of topsoil mixed in with fill, 0.1 to 0.3 m of ash, and 0.2 to 0.4 m of natural ground.
<b>Northern Boundary</b>	Materials along the northern boundary were observed to be natural soils comprising silty clay.
<b>Excavation Floor</b>	The site floor validation sample profile consisted of the site floor excavated down into natural clays to levels depth between 0.15 m bgs to 0.3 m bgs.
<b>Service Trenches</b>	The samples collected from the excavated trenches consisted of wall and floor samples intersecting every 5 m along the trenches, at midpoints of the walls and floor. The profile was natural clay with trace weathered rock.

### 6.9.3 Final Validation Sample Results

Final sample validation results for the contaminants of concern are presented in Appendix C.1.1 (chemical analytes) and Appendix C.1.2 (asbestos). Sample locations are shown in Figure 8, Appendix A (boundary and excavation floor samples) and Figure 7, Appendix A (site access driveway and trenches). The final validation sample results are summarised in the following table.

**Table 6-11 Chemical Final Validation Sample Results**

Analyte (mg/kg unless shown)	No. Samples / No. Detects	Minimum Value	Maximum Value	Remediation Criteria	No. of Samples Exceeding Remediation Criteria
Aldrin + Dieldrin	308 / 28	<0.05	4.6	6	Nil
Chlordane	308 / 38	<0.05	12	50	Nil
Endosulfan I	308 / 2	<0.05	0.26	270	Nil
Endrin	308 / 4	<0.05	0.09	10	Nil
Heptachlor	308 / 3	<0.05	0.07	6	Nil
DDT+DDE+DDD	308 / 4	<0.05	0.07	240	Nil
Arsenic	312 / 298	<2	350	160 (Note 1)	4
Cadmium	308 / 0	<0.4	<1	20	Nil
Chromium (hexavalent)	15 / 0	<1	<1	100	Nil
Chromium (Total)	308 / 302	<5	230	12000 (Note 2)	Nil
Copper	308 / 306	<5	180	6000	Nil
Lead	308 / 218	<5	370	300	1
Mercury	311 / 13	<0.1	5.7	40	Nil
Nickel	308 / 307	<5	95	400	Nil
Zinc	308 / 308	10	610	7400	Nil
PAHs (Sum of total)	24 / 0	<0.5	<0.5	300	Nil

Note 1: modified criteria for arsenic, refer to Appendix J.1.

Note 2: modified criteria for Chromium (Total), refer to Section 5.4

#### 6.9.3.1 OCPs

All sample results reported concentrations of OCPs which were non-detect or below the remediation criteria.

#### 6.9.3.2 Metals

With the exception of arsenic and lead, all samples reported results for metals which were non-detect or below the remediation criteria. Further discussion regarding arsenic, lead and chromium detections are provided below.

#### Arsenic

Arsenic (As) exceeded the remediation criteria (see Note 1, Table 6-11) at two locations (HSA02\_TS\_230920: 350 mg/kg and HSA03\_TS\_230920: 170 mg/kg). These two sample locations were collected from 'topsoil materials' directly beneath a copper chromium arsenic (CCA) treated timber fence located on the eastern boundary of the Site (refer to Section 6.5), which is considered to be the source of arsenic. Leachability testing using Australian Standard Leaching Procedure (ASLP) using pH neutral water was undertaken on these topsoil samples to assess the mobility of arsenic. The leachability results (refer to Appendix C.5) confirms that the arsenic is leachable under the ASLP test. In the fill materials underlying the topsoil, substantially lower concentrations of arsenic were reported (HSA02\_FILL\_230920: 18 mg/kg and HSA03\_FILL\_230920: 43 mg/kg) which provide lines of evidence to support that the arsenic in the topsoil has low leachability, and has not contaminated underlying materials.

An assessment of this exceedance is included in Appendix J.1. The assessment of the modified remediation criteria and statistical analysis concluded that the exceedance of arsenic in the samples does not preclude the Site as being assessed as suitable for any use noting:

- the maximum value reported is 175% of the modified criteria and is therefore less than 250% of the criteria as required in Schedule B1 of the NEPM.
- the standard deviation (88 mg/kg) is less than 50% of the modified criteria as required in Schedule B1 of the NEPM.
- the mean and UCL 95% are below the modified criteria for arsenic.

## Lead

Lead exceeded the remediation criteria in one sample (HSB04\_F\_231016) with a concentration of 370 mg/kg. This sample was collected from fill material west of the western boundary of the Site within the BCC road reserve (and therefore not within the boundary of the Site). The result from this sample is not considered to be a risk to future users of the Site noting the material sampled is 0.5 m west of the Site Boundary.

## Chromium

Representative samples of natural materials with total chromium concentrations greater than 100 mg/kg were sampled for Chromium VI. The results are summarised in the following table and confirm that the form of Chromium in soil is Chromium III. This finding is consistent with the Supplementary Investigation. Therefore the modified remediation criteria for Chromium III was applied as discussed in Section 5.4.

**Table 6-12 Chromium Results (mg/kg)**

Sample ID	Chromium (Total)	Chromium VI
B1	190	<1
C7	130	<1
D4	150	<1
D8	190	<1
E2	130	<1
E4	130	<1
F10	150	<1
G3	130	<1
G10	140	<1
QC114 (Dup of H9)	160	<1
H10	180	<1
T18-B	220	<1
T21-B	220	<1
T22-B	160	<1
T24-B	170	<1

### 6.9.3.3 Asbestos

As noted in Section 6.5 frequent occurrence of ACM was reported in fill materials, and a decision was made to excavate and remove all fill materials from the Site.

A site-specific risk assessment for asbestos and the validation of the Site was undertaken and is included in Appendix J.2. A summary of this assessment is provided as follows.

The assessment framework for asbestos in the NEPM is based on the Western Australian Department of Health (DoH) (2009) *Guidelines for the assessment, remediation and management of asbestos-contaminated sites in Western Australia* which were revised in 2021<sup>37</sup> (WA Guidelines).

Section 6.8 of the WA Guidelines states:

*Validation will be necessary for remediation works. For all validation activities, no matter how simple or complex, the evaluation and reporting of a remediation methodology must be adequately recorded throughout the course of a project.*

*Any validation sampling should be based on the recommended sampling methods in Chapter 5. Validation to verify completion of remedial activities should be determined as part of the RAP. For example, the validation of excavated asbestos-contamination where boundaries of the waste or fill can be readily distinguished can be based on removing material until natural soils are revealed, or another change in a condition indicative of non-impacted soil is evident. The decision parameters and confirmation of remediation must be recorded.*

As outlined in the WA Guidelines, the validation of ACM contamination where boundaries of the fill can be readily distinguished, can be based on removing material until natural soils are revealed.

The remediation of the Site involved the removal of the impacted domain (fill material) to natural materials. Visual confirmation of the undisturbed natural materials on the Site is therefore considered to be the primary line of evidence to support the validation of the Site, and the conclusion that the fill materials were removed from the Site.

In accordance with the RAP, 270 (500 ml) validation samples were collected from natural soil materials at the Site<sup>38</sup> over a 5 m x 5 m systematic sampling grid. Asbestos was not reported in 266 of the 270 validation samples collected, and was detected in three samples within the Site boundary<sup>39</sup>.

The non-detection of asbestos in 266 of the 270 validation samples is considered to provide a secondary line of evidence to support the validation of the Site and that the impacted domain (fill material) was removed.

Asbestos was detected in three samples from a service trench which was observed to be excavated into natural materials (refer to Figure 8, Appendix A). These samples are summarised as follows:

- T02\_B which reported an estimated concentration of asbestos fines (AF) (as chrysotile loose fibre bundles) of 0.0029% w/w asbestos which exceeded the NEPM Health Screening Level (HSL) Residential A criteria of 0.001%. This sample was collected from the base of the trench. Samples collected from the walls of the trench at this sampling location reported non-detects for asbestos (T02\_W1 and T02\_W2).
- T04\_W1 which reported a concentration of AF (as chrysotile loose fibre bundles) of 0.0011% which is approximately equal to the NEPM HSL-A criteria of 0.001%. This sample was collected from the wall

<sup>37</sup> Western Australia Department of Health (2021), *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia*.

<sup>38</sup> Samples were collected from a 5 x 5 m sampling grid which is double the density recommended in Section 4.1, Schedule B1 of the NEPM which recommends a 10 x 10 m sampling grid.

<sup>39</sup> Note asbestos was also detected in sample HS10\_TS\_230918. This sample was collected from topsoil material south west of the Site in the BCC road reserve, and not within the Site boundary. The form of asbestos detected as loose chrysotile fibres with a concentration below the NEPM HIL-A criteria.

of the trench. Samples collected from the opposite wall/base of the trench at this sampling location reported non-detects for asbestos at this sampling location (T04\_W2 and T04\_B).

- T05\_B which reported a concentration of AF (as chrysotile loose fibre bundles) of 0.00026% which was below NEPM HSL-A criteria of 0.001%. Samples collected from the walls of the trench at this sampling location reported non-detects for asbestos (T05\_W1 and T05\_W2).

No free fibre (trace / respirable) asbestos was reported in any of the 270 samples analysed.

Appendix two of the WA Guidelines state:

*In the case of AF, a few low-level concentration detects may sometimes be construed as trivial, incidental or background, especially if contamination is not suggested by site history or the main contamination contributing to the source of fibre has been removed. The context and use of a conceptual site model that reflects the relevant exposure scenarios and the frequency and occurrence of other positive and negative results should be considered.*

The reported laboratory validation results should be considered in this context, that is the impacted domain (fill material) has been removed across the Site to natural soil.

Both the NEPM and WA Guidelines reference the adoption of a Tier 2 (site specific) assessment of risks should be undertaken where exceedances of Tier 1 screening levels (NEPM HSLs) are reported (or a conservative management approach adopted).

Based on the reported results exceeding the NEPM HSLs being limited to single exceedance (the result for T04\_W1 should be considered as equal to 0.001%) and considering the remediation approach adopted (removal of impacted domain), in accordance with the NEPM and WA guidelines, a detailed site specific risk assessment is not considered to be required to support that the risks posed to future site users are acceptably low. Notwithstanding this, site specific criteria were developed for the Site (refer to Appendix J.2) which resulted in a modification of the NEPM HSL-A by a factor of 10 to 0.01% w/w asbestos. The AF concentrations reported in soil at T02\_B, T04\_W1 and T05\_B were less than the modified HSL-A criteria.

#### 6.9.3.4 Fill Materials Containing Anthropogenic Materials

Fill containing anthropogenic materials which pose physical hazards (sharp and angular) were observed in previous investigations of the Site and were considered to be unsuitable for use in a park/open space and should be removed from the Site where there is a likelihood that future users of the Site may come into contact with these materials. All fill materials were removed from the Site as part of the remediation works, and accordingly these anthropogenic materials have been removed from the Site.

#### 6.9.3.5 Summary

In summary based on the final validation results, the remedial objectives and remediation criteria are considered to have been achieved, and the Site is considered to be suitable for any use.

### 6.9.4 Area Used to Stockpile Imported Materials

Prior to the importation of Imported Materials, the area used to stockpile imported materials was stripped to natural ground and sampled over a 5 m grid in accordance with the RAP. Sample results are presented in Appendix C.2.1 (chemical analytes) and Appendix C.2.2 (asbestos).

Sample locations are shown in Figure 6, Appendix A.

In summary all samples had concentrations of metals and OCPs below the remediation criteria, and non-detects for asbestos. Therefore there is negligible risk in regard to the potential for cross-contamination associated with the mixing of imported materials and with underlying soil materials.



## 6.9.5 Imported Materials

Imported Materials were sampled in general accordance with the requirement of the RAP. The estimated volume of imported material is 125 m<sup>3</sup> (refer to Section 6.8) and 12 samples were collected which is an approximate sampling density of 1 per 10 m<sup>3</sup>.

Sample results are presented in Appendix C.3.1 (chemical analytes) and Appendix C.3.2 (asbestos).

Sample locations are shown in Figure 10, Appendix A.

All samples had:

- non-detects for OCPs/OPPs, TRH/BTEX, PAH and PFAS
- low concentrations of metals (arsenic, chromium, copper, nickel and zinc) which were below the remediation criteria, and non-detects for cadmium, lead and mercury.
- non-detectable concentrations of hexavalent chromium
- concentrations within the remediation criteria.

In summary the material imported meets the requirements of the RAP and can be considered to be suitable for its intended use.

## 6.10 QUALITY ASSURANCE AND QUALITY CONTROL

An assessment of quality assurance and quality control is included in Appendix F and the DQOs/DQIs in Appendix G. In summary validation data collected by TTC was undertaken by an experienced environmental scientist in accordance with TTC standard operating procedures, the RAP and under the supervision of the SQP. Samples were collected in laboratory provided containers, stored in chilled insulated containers, and submitted to a NATA accredited laboratory (ALS) under chain of custody documentation. Each sample was collected with a new set of nitrile gloves. Samples were received by the laboratory in good condition and analysis was completed within the required holding times for the contaminants of concern. Data collected by TTC is considered to be directly useable for the validation of the Site.

In summary, TTC consider the data collated to support the validation assessment is reasonably accurate, comparable, precise, complete and representative in which to draw conclusions.

## 7. CONCEPTUAL SITE MODEL POST-REMEDIATION

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The assessment of the validation data in this report has confirmed that the remedial objective has been achieved, and accordingly the source of contamination requiring remediation has been removed from the Site and remediation objectives have been met.

Consequently, further consideration to transportation pathways, exposure pathways and receptors is not considered to be required.

### 7.1.1 Tabulated CSM

The following table provide a CSM for source-pathway-receptor linkages for the Site post-remediation and considers the potential for the Site to be used for residential purposes under the NEPM (HIL-A). The table includes a summary of whether complete source-pathway-receptor linkages (exposure pathways) could occur. In regard to this summary, note:

- ‘Likely’ refers to an exposure pathway which could occur and if they occur there is potential for an unacceptable risk to the receptor (i.e. a complete exposure pathway)
- ‘Potential’ refers to an exposure pathway which could occur however further assessment would be required to establish whether an unacceptable risk to receptor could occur.
- ‘Unlikely’ refers to an exposure pathway which are considered unlikely to occur and therefore it is unlikely that there would be an unacceptable risk to receptor (i.e. an incomplete exposure pathway).
- ‘Not applicable’ refers to an exposure pathway which is not considered to be plausible and therefore incomplete.

**Table 6.1:** Post Remediation Conceptual Site Model (Source-Pathway-Receptors)

Contamination Source	Contaminants of Concern	Media	Plausible Exposure Pathways	Receptors	Complete exposure pathway (without remediation)
Asbestos containing materials (ACM) in Fill Materials	Asbestos	Fill/topsoil materials	Inhalation of fibres	Construction workers	Not applicable (Note 1)
				General public including persons who could be subject to contaminated media generated during redevelopment and post-construction	Not applicable (Note 1)
				General public accessing the Site in the future	Not applicable (Note 1)
				Surrounding land users/neighbouring properties	Not applicable (Note 1)
				Terrestrial ecological receptors at the Site	Not applicable (Note 1)
Anthropogenic Materials in fill material	Anthropogenic Materials which pose a physical hazard	Fill	Dermal contact	General public including persons who could be subject to contaminated media generated during redevelopment and post-construction	Not applicable (Note 1)
Historical termiticides applied to Site buildings as termite barriers	OCPs	OCPs in soil media	Inhalation of contaminated dust	Construction workers	Not applicable (Note 2)
			Dermal contact with contaminated soil	General public including persons who could be subject to contaminated media generated during redevelopment and post-construction	Not applicable (Note 2)
				General public accessing the Site in the future	Not applicable (Note 2)
			Ingestion of contaminated soil	Surrounding land users/neighbouring properties	Not applicable (Note 2)
			Biological uptake mechanisms	Terrestrial ecological receptors at the Site	Not applicable (Note 2)
		Surface water with OCPs	Ingestion	Construction workers	Not applicable (Note 2)
			Dermal contact	General public including persons who could be subject to contaminated media generated during redevelopment and post-construction	Not applicable (Note 2)
				General public accessing the Site in the future	Not applicable (Note 2)
				Surrounding land users/neighbouring properties	Not applicable (Note 2)
			Biological uptake mechanisms	Terrestrial flora and fauna	Not applicable (Note 2)
				Aquatic flora and fauna in Norman Creek (drain)	Not applicable (Note 2)

Contamination Source	Contaminants of Concern	Media	Plausible Exposure Pathways	Receptors	Complete exposure pathway (without remediation)
		Groundwater with OCPS	Ingestion	Construction workers	Not applicable (Note 2)
			Dermal contact	General public including persons who could be subject to contaminated media generated during redevelopment and post-construction	Not applicable (Note 2)
				General public accessing the Site in the future	Not applicable (Note 2)
				Surrounding land users/neighbouring properties	Not applicable (Note 2)
				Terrestrial flora and fauna within the Property	Not applicable (Note 2)
				Aquatic flora and fauna in Norman Creek (drain)	Not applicable (Note 2)
		Terrestrial biota within the Site	Consumption, bioaccumulation, biomagnification	Construction workers	Not applicable (Note 2)
				General public accessing the Site if the future	Not applicable (Note 2)
				Terrestrial flora and fauna within the Property	Not applicable (Note 2)
		Aquatic biota in Norman Creek (drain)	Consumption, bioaccumulation, biomagnification	Construction workers	Not applicable (Note 2)
				General public accessing Norman Creek (drain)	Not applicable (Note 2)
				Aquatic flora and fauna in Norman Creek (drain)	Not applicable (Note 2)

Note 1: The remediation of the Site (refer to Section 6) involved the excavation and off-site disposal of all fill materials from the Site which contained ACM and other anthropogenic materials.

Note 2: The remediation of the Site (refer to Section 6) involved the excavation and off-site disposal of all fill/soil materials with OCPs which required remediation.

## 8. CONCLUSIONS

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The Department of Veteran Affairs (DVA) is planning the redevelopment of 114 Newdegate Street, Greenslopes (Lot 123-125 RP46047) (“the Site”).

The Site is listed on the EMR for Hazardous Contaminants as a result of organochlorine pesticides (OCPs) being previously detected in soil. The Site is not subject to a Site Management Plan (SMP) and the EMR listing does not include a Site Suitability Statement.

DVA has a requirement to remediate and remove the Site from the EMR.

Remediation of the Site was undertaken between August 2023 and December 2023. Remediation involved the excavation and disposal of approximately 1,400 tonnes of soil material to an average excavation depth of approximately 0.45 m over the Site.

Soil materials were disposed to licenced landfills under approved Disposal Permits.

The assessment of validation data undertaken in this Validation Report has confirmed that the remedial objective has been achieved, and the Site can be considered to be suitable for its unrestricted use and removed from the EMR.

This Validation Report is to be read in-conjunction with limitations in Section 9.

## 9. SITE SUITABILITY STATEMENT

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The following site suitability statement has been adapted from Section 3.3.2 of the Queensland Government (2023) *Queensland Auditor Handbook for Contaminated Land – Module 6: Content requirements for contaminated land investigation documents, certifications and audit reports*.

### **Outcome 1—The land is not contaminated land and is suitable for any use**

‘The land described as Lot 123 RP46047, 124 RP46047, and 125 RP46047 is not contaminated land and is suitable for unrestricted land use, including Land Use A (residential with garden/accessible soil; childcare centres, preschools, and primary schools with access to soil) and sensitive land uses listed in Schedule 24 of the Planning Regulation 2017. It has been demonstrated that:

1. the land is not being used for a notifiable activity, and
2. the land is not affected by a hazardous contaminant, and
3. the land is not prescribed contaminated land, and
4. an appropriate assessment of site contamination has been conducted using current best practice and in accordance with the current state and Commonwealth legislation, policies and guidelines, Australian Standards, and the National Environment Protection (Assessment of Site Contamination) Measure 1999.

## 10. IMPORTANT INFORMATION ABOUT YOUR TETRA TECH COFFEY REPORT

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## IMPORTANT INFORMATION ABOUT YOUR TETRA TECH COFFEY ENVIRONMENTAL REPORT

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### Introduction

This report has been prepared by Tetra Tech Coffey for the Department of Veteran Affairs (DVA-), the Queensland Department of Environment and Science (DES) and the Site Auditor.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice.

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Tetra Tech Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Tetra Tech Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

### Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

### Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Tetra Tech Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Tetra Tech Coffey should be kept apprised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statutes and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

## Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Tetra Tech Coffey would be pleased to assist with any investigation or advice in such circumstances.

## Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

## Report for benefit of DVA, DES and the Site Auditor

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Tetra Tech Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Tetra Tech Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

## Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Tetra Tech Coffey prepared the report and has familiarity with the site, Tetra Tech Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Tetra Tech Coffey disowns any responsibility for such misinterpretation.

## Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

## Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

## APPENDIX A: FIGURES

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## APPENDIX B: VALIDATION SAMPLE MATERIAL LOGS

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## B.1 NORTHERN BOUNDARY (Headfort Street)

Sample ID	Depth m bgs	Depth m AHD	Lithology
HS01_ASH_230912	0.70	27.00	FILL (ASH): black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS01_NW_230912	0.75	26.95	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange.
HS01_F_230912	0.90	26.80	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
HS02_ASH_230912	0.70	27.00	ASH: black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS02_F_230912	1.10	26.60	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
HS02_NW_230912	0.85	26.85	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange.
HS03_ASH_230912	0.80	26.90	FILL (ASH): black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS03_F_230912	1.10	26.60	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
HS03_NW_230912	0.90	26.80	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange.
HS04_ASH_230912	0.85	26.85	FILL (ASH): black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS04_F_230912	1.10	26.60	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
HS04_NW_230912	0.90	26.80	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange.
HS05_ASH_230912	0.90	26.80	FILL (ASH): black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS05_F_230912	1.10	26.60	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
HS05_NW_230912	0.95	26.75	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange.
HS06_ASH_230912	1.00	26.70	FILL (ASH): black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS06_F_230912	1.20	26.50	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
HS06_NW_230912	1.10	26.60	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange.
HS07_ASH_230912	0.95	26.75	ASH: black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS07_F_230912	1.20	26.50	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
HS07_NW_230912	1.10	26.60	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange.
HS08_ASH_230912	0.90	26.80	ASH: black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS08_F_230912	1.10	26.60	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
HS08_NW_230912	1.00	26.70	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange.
HS11_ASH_230918	0.90	26.90	ASH: black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.



Sample ID	Depth m bgs	Depth m AHD	Lithology
HS11_NW_230918	0.95	26.85	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange.
HS11_FLOOR_230918	1.10	26.70	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
HS12_ASH_230918	0.95	26.55	ASH: black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS12_NW_230918	1.00	26.50	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange.
HS12_FLOOR_230918	1.10	26.40	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.

## B.2 South-West Boundary (Corner of Headfort Street and Newdegate Street)

Sample ID	Depth m bgs	Depth m AHD	Lithology
HS10_TS_230918	0.10	27.10	FILL (TOPSOIL): Silty CLAY: dark brown, dry, loose, low plasticity, with rootlets.
HS10_ASH_230918	0.40	26.80	FILL (ASH): black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS10_NW_230918	0.70	26.50	NATURAL CLAY: uniform, dry, stiff to very stiff, medium to high plasticity, brown to brown/orange.
HS10_FLOOR_230918	1.00	26.20	NATURAL CLAY: brown to brown/orange, uniform, dry, medium to high plasticity, with trace fine extremely weathered mudstone.
HS10_TS_230918	0.10	27.10	FILL (TOPSOIL): Silty CLAY: dark brown, dry, loose, low plasticity, with rootlets.
HS10A_ASH_230918	0.40	26.90	FILL (ASH): black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS10A_NW_230918	0.70	26.60	NATURAL CLAY: brown to brown/orange, uniform, medium to high plasticity, with trace fine extremely weathered mudstone.
HS10A_FLOOR_230918	1.00	26.30	NATURAL CLAY: brown to brown/orange, uniform, dry, medium to high plasticity, with trace fine extremely weathered mudstone.
HS10A_TS_230918	0.10	27.20	FILL (TOPSOIL): Silty CLAY: dark brown, dry, loose, low plasticity, with rootlets.
HS10A_ASH_230918	0.40	26.90	FILL (ASH): black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS10A_NW_230918	0.70	26.60	NATURAL CLAY: brown to brown/orange, uniform, dry, very stiff, medium to high plasticity.
HS10A_FLOOR_230918	1.00	26.30	NATURAL CLAY: brown to brown/orange, uniform, dry, medium to high plasticity, with trace fine extremely weathered mudstone.
HS10B_TS_230918	0.10	27.10	FILL (TOPSOIL): Silty CLAY: dark brown, dry, loose, low plasticity, with rootlets.
HS10B_ASH_230918	0.30	26.90	FILL (ASH): black and dark grey, dry fly ash, with trace burnt timber, trace roots and trace rootlets.
HS10B_NW_230918	0.70	26.50	NATURAL CLAY: brown to brown/orange, uniform, dry, very stiff, medium to high plasticity.
HS10B_FLOOR_230918	1.00	26.20	NATURAL CLAY: brown to brown/orange, uniform, dry, medium to high plasticity, with trace fine extremely weathered mudstone.

## B.3 EASTERN BOUNDARY

Sample ID	Depth m bgs	Depth m AHD	Lithology
HSA01_TS_230920	0.05	27.05	FILL (TOPSOIL): Gravelly SILT: brown low plasticity silt with sub-rounded coarse gravel, trace rootlets.
HSA01_FILL_230920	0.20	26.90	FILL: Silty GRAVEL: brown medium to coarse sub rounded gravel, with low plasticity silt.
HSA01_NW_230920	0.25	26.85	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
HSA02_TS_230920	0.05	26.75	FILL (TOPSOIL): Gravelly SILT: brown low plasticity silt with sub-rounded coarse gravel, trace rootlets.
HSA02_FILL_230920	0.20	26.60	FILL: Silty GRAVEL: brown medium to coarse sub rounded gravel, with low plasticity silt.
HSA02_NW_230920	0.25	26.55	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
HSA03_TS_230920	0.05	26.15	FILL (TOPSOIL): Gravelly SILT: brown low plasticity silt with sub-rounded coarse gravel, trace rootlets.
HSA03_FILL_230920	0.20	26.00	FILL: Silty GRAVEL: brown medium to coarse sub rounded gravel, with low plasticity silt.
HSA03_NW_230920	0.25	25.95	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
HSA04_TS_230920	0.05	25.95	FILL (TOPSOIL): Gravelly SILT: brown low plasticity silt with sub-rounded coarse gravel, trace rootlets.
HSA04_FILL_230920	0.20	25.80	FILL: Silty GRAVEL: brown medium to coarse sub rounded gravel, with low plasticity silt.
HSA04_NW_230920	0.25	25.75	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.

Note 1: sample depths at each location along the eastern boundary wall were measured from the top of the topsoil layer.

## B.4 WESTERN BOUNDARY (NEWDEGATE STREET)

Sample ID	Depth m bgs	Depth m AHD	Lithology
HSB01_TS_231016	0.10	26.60	FILL (TOPSOIL): Silty CLAY: dark brown, dry, loose, low plasticity, with rootlets.
HSB01_ASH_231016	0.35	26.35	FILL (ASH): black and dark grey, dry fly FILL (ASH), with trace burnt timber, trace roots and trace rootlets.
HSB01_NW_231016	0.50	26.20	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
HSB01_F_231016	0.70	26.00	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
HSB02_TS_231016	0.10	26.50	FILL (TOPSOIL): Silty CLAY: dark brown, dry, loose, low plasticity, with rootlets.
HSB02_ASH_231016	0.30	26.30	FILL (ASH): black and dark grey, dry fly FILL (ASH), with trace burnt timber, trace roots and trace rootlets.
HSB02_NW_231016	0.40	26.20	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
HSB02_F_231016	0.60	26.00	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
HSB03_TS_231016	0.10	25.90	FILL (TOPSOIL): Silty CLAY: dark brown, dry, loose, low plasticity, with rootlets.
HSB03_ASH_231016	0.50	25.50	FILL (ASH): black and dark grey, dry fly FILL (ASH), with trace burnt timber, trace roots and trace rootlets.
HSB03_NW_231016	0.60	25.40	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
HSB03_F_231016	0.65	25.35	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
HSB04_TS_231016	0.10	25.50	FILL (TOPSOIL): Silty CLAY: dark brown, dry, loose, low plasticity, with rootlets.
HSB04_ASH_231016	0.50	25.10	FILL (ASH): black and dark grey, dry fly FILL (ASH), with trace burnt timber, trace roots and trace rootlets.
HSB04_NW_231016	0.60	25.00	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
HSB04_F_231016	0.70	24.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
HSB05_TS_231016	0.10	25.00	FILL (TOPSOIL): Silty CLAY: dark brown, dry, loose, low plasticity, with rootlets.
HSB05_ASH_231016	0.30	24.80	FILL (ASH): black and dark grey, dry fly FILL (ASH), with trace burnt timber, trace roots and trace rootlets.
HSB05_F_231016	0.45	24.65	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
HSB06_TS_231016	0.10	24.40	FILL (TOPSOIL): Silty Clay: dark brown, dry, loose, low plasticity, with rootlets.
HSB06_ASH_231016	0.55	23.95	FILL (ASH): black and dark grey, dry fly FILL (ASH), with trace burnt timber, trace roots and trace rootlets.
HSB06_NW_231016	0.70	23.80	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
HSB06_F_231016	0.90	23.60	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
HSB07	0.10	24.10	NATURAL: silty CLAY: pale brown, uniform, low to medium plasticity, with trace rootlets
HSB08	0.20	23.30	NATURAL: silty CLAY: pale brown, uniform, low to medium plasticity, with trace rootlets

## B.5 NORTHERN BOUNDARY

Sample ID	Depth m bgs	Depth m AHD	Lithology
HSB18	0-0.10	23.25	NATURAL: silty CLAY: pale brown, uniform, dry, low to medium plasticity, with trace rootlets.
HSB19	0-0.10	23.35	NATURAL: silty CLAY: pale brown, uniform, dry, low to medium plasticity, with trace rootlets.
HSB20	0-0.10	23.45	NATURAL: silty CLAY: pale brown, uniform, dry, low to medium plasticity, with trace rootlets.
HSB21	0-0.10	23.65	NATURAL: silty CLAY: pale brown, uniform, dry, low to medium plasticity.
HSB22	0-0.10	23.65	NATURAL: silty CLAY: pale brown, uniform, dry, low to medium plasticity.
HSB23	0-0.10	23.75	NATURAL: silty CLAY: pale brown, uniform, dry, low to medium plasticity.
HSB24	0-0.10	23.75	NATURAL: silty CLAY: pale brown, uniform, dry, low to medium plasticity, with trace rootlets.
HSB25	0-0.10	23.75	NATURAL: silty CLAY: pale brown, uniform, dry, low to medium plasticity, with trace rootlets.
HSB26	0-0.10	23.75	NATURAL: silty CLAY: pale brown, uniform, dry, low to medium plasticity.
HSB27	0-0.10	23.95	NATURAL: silty CLAY: pale brown, uniform, dry, low to medium plasticity, with trace rootlets.

## B.6 DRIVEWAY VALIDATION SAMPLE LOCATIONS

Sample ID	Depth m bgs	Depth m AHD	Lithology
DW-B1	0.30	24.40	NATURAL CLAY: brown to brown/orange, dry, very stiff, uniform, medium to high plasticity, with trace fine extremely weathered mudstone.
DW-B2	0.30	24.40	NATURAL CLAY: brown to brown/orange, dry, very stiff, uniform, medium to high plasticity, with trace fine extremely weathered mudstone.
DW-B3	0.30	24.20	NATURAL CLAY: brown to brown/orange, dry, very stiff, uniform, medium to high plasticity, with trace fine extremely weathered mudstone.
DW-B4	0.30	24.20	NATURAL CLAY: brown to brown/orange, dry, very stiff, uniform, medium to high plasticity, with trace fine to course extremely weathered mudstone.

## B.7 TRENCH VALIDATION SAMPLE LOCATIONS (TR01 – TR06)

Sample ID	Depth m bgs	Depth m AHD	Lithology
TR01_TRENCH WALL_230921	0.55	24.65	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
TR02_TRENCH WALL_230921	0.35	24.85	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
TR03_TRENCH FLOOR_230921	0.60	24.60	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to course extremely weathered rock.
TR04_TRENCH WALL_230921	0.25	24.95	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
TR05_TRENCH WALL_230921	0.25	24.95	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
TR06_TRENCH FLOOR_230921	0.50	24.70	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to course extremely weathered rock.

## B.8 TRENCH VALIDATION SAMPLE LOCATIONS (T01 TO T24)

Sample ID	Depth m bgs	Depth m AHD	Lithology
T01_B	0.55	23.75	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T01_W1	0.23	24.08	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T01_W2	0.22	24.08	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T02_B	0.50	23.50	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T02_W1	0.25	23.75	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T02_W2	0.30	23.70	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T03_B	0.50	23.40	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T03_W1	0.35	23.55	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T03_W2	0.35	23.55	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T04_B	0.55	23.05	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T04_W1	0.32	23.28	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T04_W2	0.35	23.25	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T05_B	0.55	22.85	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T05_W1	0.40	23.00	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T05_W2	0.30	23.10	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T06_B	0.50	22.90	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T06_W1	0.25	23.15	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T06_W2	0.25	23.15	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T07_B	0.50	22.90	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T07_W1	0.25	23.15	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T07_W2	0.25	23.15	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T08_B	0.55	22.85	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T08_W1	0.30	23.10	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T08_W2	0.21	23.19	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T09_B	0.60	22.80	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.



Sample ID	Depth m bgs	Depth m AHD	Lithology
T09_W1	0.30	23.10	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T09_W2	0.32	23.08	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T10_B	0.60	22.90	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T10_W1	0.30	23.20	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T10_W2	0.30	23.20	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T11_B	0.60	23.10	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T11_W1	0.30	23.40	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T11_W2	0.30	23.40	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T12_B	0.60	23.30	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T12_W1	0.30	23.60	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T12_W2	0.30	23.60	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T13_B	0.60	23.70	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T13_W1	0.30	24.00	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T13_W2	0.30	24.00	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T14_B	0.60	24.30	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T14_W1	0.30	24.60	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T14_W2	0.30	24.60	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T15_B	0.60	24.40	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T15_W1	0.30	24.70	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T15_W2	0.30	24.70	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T16_B	0.60	25.10	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T16_W1	0.30	25.40	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T16_W2	0.30	25.40	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T17-B	0.55	23.25	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T17-W1	0.15	23.65	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T17-W2	0.15	23.65	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.

Sample ID	Depth m bgs	Depth m AHD	Lithology
T18-B	0.55	23.45	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T18-W1	0.35	23.65	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T18-W2	0.35	23.65	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T19-B	0.40	23.90	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T19-W1	0.20	24.10	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T19-W2	0.25	24.05	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T20-B	0.55	23.55	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T20-W1	0.20	23.90	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T20-W2	0.15	23.95	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T21-B	0.60	23.60	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T21-W1	0.25	23.95	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T21-W2	0.30	23.90	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T22_F_231016	0.50	23.90	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T22_WA_231016	0.15	24.25	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T22_WB_231016	0.20	24.20	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T22-B	0.38	24.02	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T22-W1	0.20	24.20	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T22-W2	0.20	24.20	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T23_F_231016	0.50	23.40	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T23_WA_231016	0.20	23.70	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T23_WB_231016	0.25	23.65	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T23-B	0.50	23.40	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T23-W1	0.25	23.65	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T23-W2	0.25	23.65	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T24-B	0.45	23.55	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T24-W1	0.15	23.85	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.

Sample ID	Depth m bgs	Depth m AHD	Lithology
T24-W2	0.15	23.85	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T25_B	0.60	24.00	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T25_W1	0.30	24.30	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T25_W2	0.30	24.30	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T26_B	0.45	23.65	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T26_W1	0.20	23.90	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T26_W2	0.20	23.90	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T27_B	0.50	23.60	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
T27_W1	0.19	23.91	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.
T27_W2	0.20	23.90	NATURAL CLAY: brown to brown/orange, uniform, dry, stiff to very stiff, medium to high plasticity.

## B.9 EXCAVATION FOOR VALIDATION SAMPLES

Sample ID	Depth m bgs	Depth m AHD	Lithology
A1	0-0.1	23.20	NATURAL CLAY: uniform, medium to high plasticity, brown to brown/orange, with medium to coarse extremely weathered rock.
A2	0-0.1	23.30	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
A3	0-0.1	23.20	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
A4	0-0.1	23.40	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
A5	0-0.1	23.20	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
A6	0-0.1	23.50	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
A7	0-0.1	23.70	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
A8	0-0.1	23.80	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
A9	0-0.1	23.70	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
A10	0-0.1	24.50	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
B1	0-0.1	23.60	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
B2	0-0.1	23.60	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
B3	0-0.1	23.60	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
B4	0-0.1	23.60	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
B5	0-0.1	23.80	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
B6	0-0.1	23.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
B7	0-0.1	23.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
B8	0-0.1	24.10	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
B9	0-0.1	23.60	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
B10	0-0.1	24.70	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
C1	0-0.1	24.00	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
C2	0-0.1	24.10	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
C3	0-0.1	24.00	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
C4	0-0.1	23.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
C5	0-0.1	24.10	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.

Sample ID	Depth m bgs	Depth m AHD	Lithology
C6	0-0.1	24.10	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
C7	0-0.1	23.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
C8	0-0.1	23.80	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
C9	0-0.1	23.80	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
C10	0-0.1	24.80	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
D1	0-0.1	24.60	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
D2	0-0.1	24.20	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
D3	0-0.1	24.10	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
D4	0-0.1	24.30	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
D5	0-0.1	24.40	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
D6	0-0.1	23.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
D7	0-0.1	24.60	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
D8	0-0.1	24.20	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
D9	0-0.1	24.20	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
D10	0-0.1	25.10	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
E1	0-0.1	25.00	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
E2	0-0.1	24.70	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
E3	0-0.1	24.50	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
E4	0-0.1	24.70	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
E5	0-0.1	24.80	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
E6	0-0.1	24.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
E7	0-0.1	24.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
E8	0-0.1	24.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
E9	0-0.1	24.50	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
E10	0-0.1	25.70	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
F1	0-0.1	25.40	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.

Sample ID	Depth m bgs	Depth m AHD	Lithology
F2	0-0.1	25.10	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
F3	0-0.1	25.10	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
F4	0-0.1	25.20	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
F5	0-0.1	25.20	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
F6	0-0.1	25.30	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
F7	0-0.1	25.20	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
F8	0-0.1	25.20	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
F9	0-0.1	25.30	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
F10	0-0.1	25.60	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
G1	0-0.1	25.80	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
G2	0-0.1	25.50	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
G3	0-0.1	25.70	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
G4	0-0.1	25.80	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
G5	0-0.1	25.60	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
G6	0-0.1	25.70	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
G7	0-0.1	25.70	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
G8	0-0.1	25.80	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
G9	0-0.1	25.60	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
G10	0-0.1	25.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
H1	0-0.1	26.20	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
H2	0-0.1	25.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
H3	0-0.1	26.00	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
H4	0-0.1	25.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
H5	0-0.1	25.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
H6	0-0.1	25.80	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.
H7	0-0.1	25.90	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to coarse extremely weathered rock.



Sample ID	Depth m bgs	Depth m AHD	Lithology
H8	0-0.1	26.10	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to course extremely weathered rock.
H9	0-0.1	26.10	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to course extremely weathered rock.
H10	0-0.1	26.70	NATURAL CLAY: uniform, dry, medium to high plasticity, brown to brown/orange, with trace medium to course extremely weathered rock.

## B.10 IMPORTED MATERIALS

Sample ID	Depth m bgs	Depth m AHD	Lithology
IF1_231026	0-0.1	-	FILL: Silty Gravel, blue/grey, fine to course, sub angular to sub rounded.
IF2_231026	0-0.1	-	FILL: Silty Gravel, blue/grey, fine to course, sub angular to sub rounded.
IF3_231026	0-0.1	-	FILL: Silty Gravel, blue/grey, fine to course, sub angular to sub rounded.
IF4_231026	0-0.1	-	FILL: Silty Gravel, blue/grey, fine to course, sub angular to sub rounded.
IF5_231026	0-0.1	-	FILL: Silty Gravel, blue/grey, fine to course, sub angular to sub rounded.
IF6_231026	0-0.1	-	FILL: Silty Gravel, blue/grey, fine to course, sub angular to sub rounded.

## APPENDIX C: DATA TABLES

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## APPENDIX D: PHOTOGRAPHS

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## D.1 BOUNDARY FENCE PHOTOGRAPHS



Example of excavation to Eastern Boundary Fence



Eastern Boundary Fence with boundary fence. Imported material was place along the boundary fence following excavation and validation.



Excavation along the southern boundary was undertaken to the retaining wall which was the practicable limit of excavation.









Excavation along the western boundary of the Site. The survey peg shown is offset 0.5 m west off the Site boundary.



Excavation along the western boundary of the Site. The survey peg shown is offset 0.5 m west off the Site boundary.





Excavation along the western boundary of the Site. The survey peg shown is offset 0.5 m west off the Site boundary.





Excavation along the northern boundary required the removal of the boundary fence. Surface materials to natural ground were scrapped to approximately 0.1 m north of the Site boundary marked by the red tape.



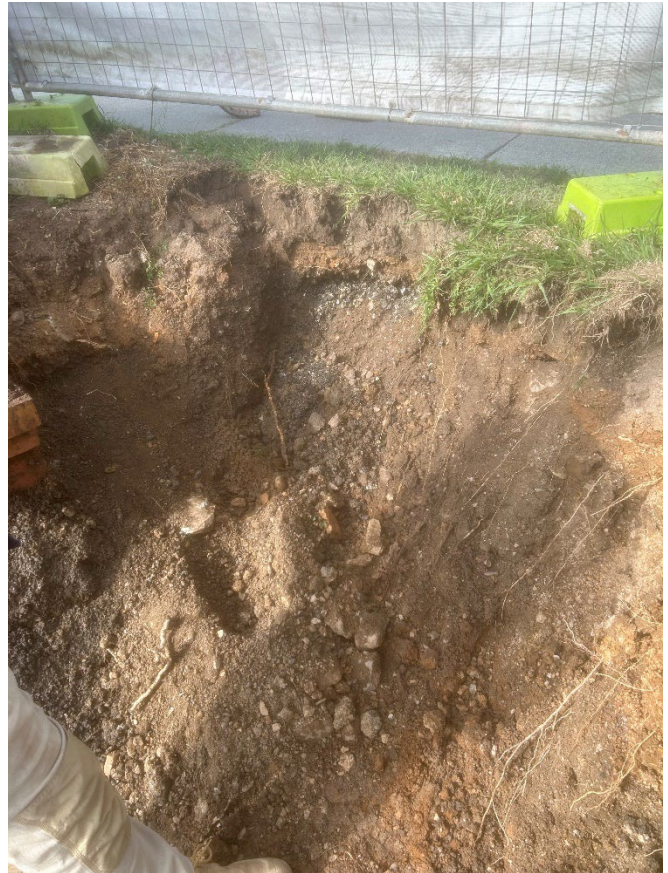
Excavation along the northern boundary required the removal of the boundary fence. Surface materials to natural ground were scrapped to approximately 0.1 m north of the Site boundary marked by the red tape.





Excavation along the south western boundary of the Site with the footings of the heritage wall exposed. The footings of the heritage wall extended to natural ground

Heritage  
wall



Excavation in the south western corner of the Site extended beyond the boundary of the Site into the Road Reserve. The photograph shows the excavation taking place past the footings of the heritage wall.

## D.2 VALIDATION SAMPLE PHOTOGRAPHS



## D.3 PRE AND POST REMEDIATION PHOTOGRAPHS



Pre-Remediation: Photograph of the Site in 2019 (source: Google Street View)



Post-Remediation: Photograph of the Site on the 26 October 2023





Post-Remediation: Photograph of the Site on the 26 October 2023

## APPENDIX E: LABORATORY REPORTS

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## APPENDIX F: QAQC REPORT

The sampling and analysis process (collection, transport and analysis) was guided by the sampling and analysis quality plan and conducted according to standard operating procedures (SOPs) in the field and in the laboratory as part of the quality assurance process, in order to minimise the effect of natural and inherent variability and extraneous factors on data quality.

To measure the effectiveness of the quality assurance process, quality control (QC) samples are part of the field and laboratory procedures to assess both the accuracy and the precision of the results produced.

- Measures of ACCURACY are indicative of how close the reported results are to the true result. For practical reasons, measures of accuracy are usually confined to the laboratory procedures.
- Measures of PRECISION provide information on the variability in the results. Precision can be assessed as:
  - “repeatability” or intra-laboratory variation – the degree of variation in a result when the same laboratory analyses a sample (or blind replicate) several times, and;
  - “reproducibility” or inter-laboratory variation – the degree of variation in a result when a different laboratory separately analyses a sample.

The quality control was based on guidelines presented in:

- NEPM [the National Environment Protection (Assessment of Site Contamination) Measure 1999]
- AS4482.1 Guide to the sampling and investigation of potentially contaminated soil, Part 1: Non-Volatile and Semi-volatile Substances.

The outcome of the Field and Laboratory quality control are presented in this Quality Assurance / Quality Control report.

### F.1 FIELD QUALITY CONTROL (QAQC) SAMPLES

	Soil
Days of sampling	10
Primary samples	317
Inter-laboratory Field Duplicates (at least 1 in 20 samples)	18
Intra-laboratory Field Duplicates (at least 1 in 20 samples)	26
Field Blank (as required)	8
Trip Blanks (at least 1 per sampling event)	7
Trip Spike (where loss of organics in transport is considered a risk)	Not required for investigation.
Equipment Rinsate (at least 1/day/matrix/equipment)	7

#### Samples Analysed

Primary samples and intra-laboratory duplicates were sent to Eurofins for laboratory analysis.

Inter-laboratory duplicate samples were submitted to ALS as QAQC check of the primary laboratory.

## Inter-Laboratory and Intra-Laboratory Duplicates

ITEM	QUESTION	YES	NO (Comment below)
1	Were an <u>Adequate Number</u> of inter-laboratory and intra-laboratory duplicates analysed for each chemical?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Were RPDs within Control Limits?	<input type="checkbox"/>	<input checked="" type="checkbox"/>

### Comments

RPDs between primary, inter-laboratory duplicate sample and intra-laboratory duplicate samples are provided in Appendix F.4. Where RPD exceedances have been reported they are considered to be minor and predominately attributed to:

- sample heterogeneity in regard to organo-chlorine pesticides distribution in the soil matrix
- sample heterogeneity in regard to metals distribution in fill materials
- natural variability in regard to metals in natural soil materials.

RPD exceedances are not considered to impact the outcome of the investigation.

## Field Blanks

ITEM	QUESTION	YES	NO (Comment below)
1	Were Field Blanks collected?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Were the Field Blanks free of contaminants? (If no, comment whether the contaminants present are also detected in the samples and whether they are common laboratory chemicals.)	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### Comments

Concentrations of zinc marginally above LOR (5 µg/L) were detected in two field blank samples (QC03-230918 and QC06\_FB at 6 µg/L and 8 µg/L respectively). The zinc concentrations detected are potentially associated with zinc in rinsate water and/or sample bottles supplied by the analytical laboratory. Contamination during sampling and/or transport to the laboratory is considered unlikely based on non-detects for other analytes (metals and OCPs). Zinc in validation samples was below the remediation criteria for the site.

## Trip Blanks

ITEM	QUESTION	YES	NO (Comment below)
1	Was a trip blank undertaken on each day of sample?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Were the Trip Blanks free of contaminants? (If no, comment whether the contaminants present are also detected in the samples and whether they are common laboratory chemicals.)	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### Comments

Trip Blanks submitted to the laboratory were requested for analysis of metals/OCPs however the samples were analysed for TRH/BTEXN. The Field Blanks submitted can also a surrogate for the Trip Blanks and did not report evidence of cross-contamination either during sampling or during transport to the laboratory.

## Trip Spike

ITEM	QUESTION	YES	NO (Comment below)
1	Was a trip spike undertaken?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Was analyte recovery suitable (>50%)? (If no, comment whether the low recovery and apparent concentrations may present a risk of a false negative.)	<input type="checkbox"/>	<input type="checkbox"/>

### Comments

Trip spike samples were not required for the investigation because contaminants of concern were not volatile.

## Rinsate Blanks

ITEM	QUESTION	YES	NO (Comment below)
1	Were Equipment Rinsates collected and analysed every day?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Were the Equipment Rinsates free of contaminants? (If no, comment whether the contaminants present are also detected in the samples and whether they are common laboratory chemicals.)	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### Comments

Rinsate samples were collected on the days where re-usable sampling equipment was used.

Concentrations of the contaminants of concern were reported in the following samples.

Sample ID	OCPs	Chromium (III+VI)	Copper	Lead	Nickel	Zinc
QC08_230921		✓	✓	✓		✓
QC05_RB						✓
QC13_230921	✓	✓	✓		✓	✓

The result for QC\_05 is similar to the detection of zinc in some of the field blanks analysed and potentially attributed to laboratory provided rinsate water and/or sample bottles.

Metals and/or OCPs in QC08\_230921 (20/9/23) and QC13\_230921 (21/9/23) were detected in rinsate samples collected on the 20/9/23 and 21/9/23 respectively. The rinsate samples were collected off a geotechnical pick used to break the ground surface where required. The rinsate sample was collected following cleaning of the geological pick with detergent (Liquinox) and then rinsing of the pick with potable water and drying the pick with clean paper towel (this decontamination procedure was undertaken between each use of the pick).

The detection of metals and OCPs in these samples is potentially attributed to materials which were not removed from the pick and/or dust materials which settled on the pick after decontamination and prior to the collection of the rinsate sample.

Notwithstanding these non-conformances the low detections of some metals and OCP in the rinsate blanks are not considered to have affected the validity of the results noting:

- OCPs were not detected in any soil sample analysed on the 21/9/23 and in the majority of samples on the 20/9/23. Where detected OCPs were found, the concentrations below the remediation criteria.



- Metals were below the remediation criteria with the exception of arsenic in two samples<sup>40</sup> treated fence. It should be noted that arsenic was not detected in the rinsate samples.
- Each sample was collected with a new set of nitrile gloves.
- Non-detects were reported in all other rinsate samples indicating that the decontamination procedures were generally effective.

It is noted that Rinsate blanks were not collected during all sampling events on the basis that reusable sampling equipment was not used on those sampling days.

## Summary of Field Quality Control

In summary, the field QC results are considered acceptable for the purposes of this investigation.

Field QAQC was:	<input checked="" type="checkbox"/>	Satisfactory
	<input type="checkbox"/>	Partially Satisfactory
	<input type="checkbox"/>	Unsatisfactory

## F.2 LABORATORY QUALITY ASSURANCE QUALITY CONTROL

### Laboratories

ITEM	QUESTION	YES	NO (Comment below)
1	Was a NATA registered laboratory used?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Did the laboratory perform the requested tests?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Were the laboratory methods adopted NATA endorsed?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Were the appropriate test procedures followed?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Were the reporting limits satisfactory?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	Was the NATA Seal on the reports?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Were the reports signed by an authorised person?	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### Comments

Eurofins – Eurofins has been adopted as the primary laboratory for analysis of soil samples. Eurofins is a NATA accredited laboratory (NATA accreditation number 1261) for all the analytes requiring analysis.

ALS Environmental – ALS has been adopted as the secondary laboratory for analysis of soil samples. ALS is a NATA accredited laboratory (NATA accreditation number 825) for all the analytes requiring analysis.

Precision / Accuracy of the Laboratory Report	<input checked="" type="checkbox"/>	Satisfactory
	<input type="checkbox"/>	Partially Satisfactory
	<input type="checkbox"/>	Unsatisfactory

<sup>40</sup> Arsenic contamination associated with these samples is attributed to a copper chromium arsenic (CCA) treated fence.

## Sample Handling

ITEM	QUESTION	YES	NO (Comment below)
1	Were the sample <b>holding times</b> met?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Were the samples in <b>proper custody</b> between the field and reaching the laboratory?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Were the samples <b>properly and adequately</b> preserved? <i>This includes keeping the samples chilled, where applicable.</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Were the samples received by the laboratory in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### Comments

Batch 1055969 reported a holding time breach of 1-day for OCPs and PAHs. Samples were delivered to the laboratory in chilled insulated containers and stored by the laboratory in refrigerated areas. The contaminant of concern (OCPs) have low volatility and the non-conformance is considered to be minor and not have affected the validity of the results.

Sample Handling was:	<input checked="" type="checkbox"/>	Satisfactory
	<input type="checkbox"/>	Partially Satisfactory
	<input type="checkbox"/>	Unsatisfactory

## Laboratory Blanks.

Eurofins and ALS laboratory method blank results reported concentrations of contaminants below the laboratory reporting limits.

## Laboratory Duplicates

Internal laboratory duplicates analysed by Eurofins and ALS were within acceptable limits (<30% RPD) with the exception of the following batches which reported non-conformances outside the acceptance limits:

- Eurofins: 1025750, 1028239, 1029417, 1036638 and 1039102
- ALS: EB2334519

Non-conformances are likely to be attributed to sample heterogeneity and were considered by the laboratories prior to the issuing of the laboratory reports.

## Laboratory Control Samples

Matrix spike analyses were performed by Eurofins and ALS were within the adopted 70% – 130% acceptability criteria with the exception of the following batches which reported non-conformances outside the acceptance limits:

- ALS: EB2328260, EB2328861, EB2340686

Non-conformances are likely to be attributed to sample heterogeneity and were considered by the laboratories prior to the issuing of the laboratory reports.

## Matrix Spikes

Matrix spike analyses were performed by Eurofins and ALS were within the adopted 70% – 130% acceptability criteria. Minor non-conformances were reported in the following batches:

- Eurofin: 1027451, 1036638
- ALS: EB2332532 and EB2328260. EB2330054 EB2332532

Non-conformances in matrix spike recoveries are likely to be attributed to sample heterogeneity and were considered by the laboratories prior to the issuing of the laboratory reports.

## Surrogate Recoveries

Surrogate recoveries were all within the target recovery of 70-130% with the exception of the following batches which reported minor non-conformances which were considered by the laboratories prior to the issuing of the laboratory reports.

- ALS: EB2328260
- Eurofins: 1024818, 1027451, 1028239, 1029417, 1035652, **1036638**, 1039102, 1055969.

## Summary of Internal Laboratory Quality Control

ITEM	QUESTION	YES	NO (Comment below)
1	Were the laboratory blanks/reagents blanks free of contamination?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Were the spike recoveries within control limits?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3	Were the RPDs of the laboratory duplicates within control limits?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4	Were the surrogate recoveries within control limits?	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Comment: refer to comments on the previous pages in regard to spike recoveries, laboratory RPDs and surrogates.

Laboratory internal QAQC was:	<input checked="" type="checkbox"/>	Satisfactory
	<input type="checkbox"/>	Partially Satisfactory
	<input type="checkbox"/>	Unsatisfactory

## F.3 SUMMARY OF DATA QUALITY REVIEW

In summary, a number of minor non-conformances were identified in the laboratory QA/QC data. These non-conformances however are not considered to preclude the use of the analytical data for this investigation.

## F.4 QAQC RPD AND BLANK SAMPLE TABLES





## APPENDIX G: DQO/DQIS

As stated in Section 18 Appendix B of Schedule B2 of the ASC NEPM, the DQO process is a seven-step iterative planning approach used to define the type, quantity and quality of data needed to support decisions relating to the environmental condition of a site.

The seven-step DQO process adopted for the validation of remediation based on the RAP included in Appendix K is summarised in the following table.

### G.1 DATA QUALITY OBJECTIVES

<b>1. State the problem</b>	<p>The primary objectives for the remediation of the Site is to remove contamination such that the Site can be removed from the EMR.</p> <p>Remediation is required to remove the Site from the EMR and will include:</p> <ul style="list-style-type: none"> <li>the removal of OCP impacted soil materials which exceed the Remediation Criteria</li> <li>the removal of fill materials from the Site.</li> </ul> <p>Validation of the Site is required to confirm that the remediation objectives have been achieved. The main problems are:</p> <ul style="list-style-type: none"> <li>What areas require remediation?</li> <li>How should site soils be validated?</li> <li>What validation sampling density should be used?</li> <li>What contaminants should be analysed for?</li> </ul>
<b>2. Identify the decision</b>	<p>Is the data suitable for assessing whether the areas requiring remediation have been remediated?</p> <p>Is the Site suitable for the proposed land uses?</p>
<b>3. Identify inputs to the decision</b>	<p>The primary inputs to assessing the above include:</p> <ul style="list-style-type: none"> <li>Previous investigations (where applicable)</li> <li>Field observations including the presence of Unsuitable Fill Materials</li> <li>Analytical data of validation sample media, and quality assurance / quality control (QA/QC) samples</li> <li>Data quality protocols</li> <li>Remediation criteria (refer to Section 7.3).</li> </ul>
<b>4. Define the boundaries of the study</b>	<p>The boundaries for the validation sampling program are identified as follows:</p> <ul style="list-style-type: none"> <li>Spatial Boundaries: Lot 123 on RP46047, Lot 124 on RP46047, and Lot 125 on RP46047.</li> <li>Temporal boundaries: The status of the sampling points at the time of the investigation.</li> <li>The vertical study boundary will be the finished floor level of excavation from which validation samples were collected.</li> </ul>
<b>5. Develop a decision rule</b>	<p>The decision rules to be applied to validation include:</p> <p>For OCPs in soil, the following approach is to be adopted:</p>

	<ul style="list-style-type: none"> <li>Where OCPs concentrations for each sample are below the adopted remediation criteria, no further remediation is required.</li> <li>Where soil contaminant concentrations are reported to exceed the adopted remediation criteria the following additional steps will be undertaken: <ul style="list-style-type: none"> <li>Review and modification of the Tier 1 HIL-A NEPM assessment criteria as appropriate.</li> <li>Where sufficient data is available, calculate the 95% Upper Confidence Level of the mean (95%UCL), data range and standard deviation.</li> <li>Where the 95% UCLs are less than the assessment criteria and no individual results in the data set are to be greater than 250% of the assessment criteria; and the standard deviation of the data set is to be within 50% of the assessment criteria, no further remediation is required.</li> <li>Where the 95% UCL is more than the assessment criteria, consider these results in the context of the current CSM to evaluate whether there are plausible pollutant linkages remaining.</li> <li>If plausible pollutant linkages are identified, then further remediation should be undertaken to remove impacted soil.</li> </ul> </li> </ul> <p>For fill materials, the following approach is to be adopted:</p> <ul style="list-style-type: none"> <li>A SQP who is competent in the identification of fill materials will inspect the site to confirm that these materials have been removed.</li> </ul>
<b>6. Acceptable limits on decision error</b>	<p>Decision errors are incorrect decisions caused by using data that is not representative of site conditions due to sampling or analytical error. As a result, a decision may be made that remediation/management is not needed when it is, or vice versa. There are two types of decision error:</p> <ul style="list-style-type: none"> <li>Sampling errors, which occur when the samples collected are not representative of the conditions within the investigation area; and</li> <li>Measurement errors, which occur during sample collection, handling, preparation, analysis and data reduction.</li> </ul> <p>To consider whether decision errors have been made, an assessment of data quality indicators will be undertaken as described in Appendix G.2. A QA/QC assessment of the data collected is included in Appendix F. The closeness of the data to the assessment criteria will also be considered.</p>
<b>7. Optimise the design for obtaining data</b>	<p>The methodology and rationale for obtaining relevant data for validation is described in Section 8.6 of the RAP, and Section 8.9 of this Validation Report.</p>

## G.2 DATA QUALITY INDICATORS

Data Quality Indicators (DQIs) are used to show that the DQOs have been met. DQIs for the project are based on the field and laboratory considerations in Section 19.6 of ASC NEPM 2013 Schedule B2 Appendix B, which include:

- Completeness – a measure of the amount of useable data (expressed as %) from a data collection activity.
- Comparability – the confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event.
- Representativeness – the confidence (expressed qualitatively) that data are representative of each media present on the Site.
- Precision – A quantitative measure of the variability (or reproducibility) of data.
- Accuracy – a quantitative measure of the closeness of reported data to the true value; and
- The QA review will include a check of performance against the DQIs.

The DQIs adopted for soil sampling is discussed in the following tables.

**Table A: DQI Completeness**

DQI	Field Considerations	DQI Performance	Laboratory Considerations	DQI Performance
Completeness	Critical locations sampled	Samples were collected from nominated locations with no deviation from the sampling plan, without reasonable justification.	Critical samples analysed according to sampling plan.	Samples were analysed for COPC.
	Samples collected	Samples were collected in accordance with Tetra Tech Coffey's Standard Operating Procedures (SOPs) during the assessment.	Identified COPCs included.	As above.
	Standard Operating Procedures (SOPs) appropriate and complied with	No departure from Tetra Tech Coffey SOPs without reasonable justification.	Appropriate methods and LORs	Samples were analysed by NATA accredited laboratories, for the analyses to be performed and appropriate methods were used. LORs were less than assessment criteria.
	Experienced sampler	Experienced Tetra Tech Coffey Environmental Scientists undertook the sampling.	Sample documentation complete	Chain of custody's (COCs) were returned, signed and dated by laboratory. NATA endorsed laboratory certificates were completed in accordance with Schedule B3 of the ASC NEPM. Field logs were completed in accordance with Coffey SOPs.

DQI	Field Considerations	DQI Performance	Laboratory Considerations	DQI Performance
	Documentation correct	Samples were handled and transported under appropriate chain of custody (COC) documentation. Coffey retained original COC documentation. Sample Receipt Notifications (SRN) from the laboratory were reviewed to assess that samples were received cool and in good condition.	Sample holding times were be complied with	Samples were analysed within holding times specified in Schedule B3 of the ASC NEPM.

**Table B: DQI Comparability**

DQI	Field Considerations	DQI Performance	Laboratory Considerations	DQI Performance
Comparability	Same SOPs used on each occasion	Tetra Tech Coffey SOPs were implemented.	Same sample analytical methods will be used.	The same NATA accredited laboratories were used to undertake analyses of primary, duplicate and triplicate samples collected for this study. The laboratory used the same analytical methods for each sample for each analytical parameter.
	Experienced sampler	Experienced Tetra Tech Coffey Environmental Scientist(s) conducted sampling.	Same sample LORs	As above
	Climatic conditions (temperature, rainfall, wind etc.)	Environmental scientist attempted to sample in similar climatic conditions if practicable.	Same laboratories	As above
	Same types of samples collected	Samples were collected in the appropriate laboratory supplied containers specific to the analyses performed.	Same units	As above

**Table C: DQI Representativeness**

DQI	Field Considerations	DQI Performance	Laboratory Considerations	DQI Performance
Representativeness	Appropriate media sampled according to sample plan	Soil samples were collected and analysed in accordance with Tetra Tech Coffey's SOPs.	Appropriate media sampled according to this plan	Collected samples were analysed by NATA accredited laboratories.
	All media identified in sample plan	Soil samples collected and analysed in accordance with Tetra Tech Coffey's SOPs.	-	-
	SOPs appropriate and complied	Tetra Tech Coffey's SOPs were be implemented.	Analysis of field duplicates	Laboratory duplicates were analysed in general accordance with ASC NEPM. Duplicate and triplicate samples collected for soil.

**Table D: DQI Precision**

DQI	Field Considerations	DQI Performance	Laboratory Considerations	DQI Performance
Precision	SOPs appropriate will be complied with	Tetra Tech Coffey's SOPs were implemented.	Analysis of laboratory duplicates	Relative Percent Differential (RPD) values for laboratory duplicates and recovery of matrix spikes were within acceptable ranges.
	Analysis of field duplicates	As for laboratory considerations	Analysis of field duplicates	Duplicates were analysed at a frequency set out in Appendix F. RPDs were be calculated and compared to relevant acceptance criteria.  Tetra Tech Coffey adopted 30% for concentrations more than 10 times the LOR and 50% for concentrations less than 10 times the LOR (Standards Australia 1997).



**Table E: DQI Accuracy**

DQI	Field Considerations	DQI Performance	Laboratory Considerations	DQI Performance
Accuracy	SOP appropriate and complied with	Tetra Tech Coffey SOPs were implemented	Same sample analytical methods will be used.	The same NATA accredited laboratories were used to undertake analyses of primary, duplicate and triplicate samples collected for this study. The laboratory used the same analytical methods for each sample for each analytical parameter.
	Trip blanks	Trip blank sample was collected using laboratory supplied distilled water.	Trip blanks	A laboratory prepared trip blank was included for each sample set.
	Rinsate sample	Where reusable sampling equipment was utilised (if any) a rinsate sample was be collected using laboratory supplied distilled water.  If rinsate sampling is not completed as part of the assessment, justification will be required.	Rinsate sample	Non-detection of COPCs in rinsate sample.
	-	-	Laboratory duplicate and Matrix spike	RPD values for laboratory control duplicates and recovery of matrix spikes were within acceptance limits.

## APPENDIX H: REMEDIATION CONTRACTOR INFORMATION

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## H.1 WASTE DISPOSAL PERMITS

## H.2 Disposal Records

## H.3 Imported Fill Records



## APPENDIX I: AIR MONITORING

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## I.1 OCP DUST MONITORING REPORT

## I.2 ABESTOS AIR MONITORING REPORTS

## APPENDIX J: SITE SPECIFIC RISK ASSESSMENTS

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## J.1 ARSENIC ASSESSMENT



## J.2 ASBESTOS ASSESSMENT

## APPENDIX K: SUPPORTING DOCUMENTS

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## K.1 SITE IDENTIFICATION INFORMATION

## K.2 LOT SEARCH REPORT

## K.3 DES RESPONSE

## K.4 BCC RIGHT FOR INFORMATION RESPONSE



## K.5 PREVIOUS INVESTIGATION LITHOLOGY

## K.6 REGIONAL TOPOGRAPHY

## K.7 EXTRACT FROM CROSS RIVER RAIL EIS GROUNDWATER TECHNICAL REPORT

## K.8 REGISTERED BORE REPORTS

## K.9 FLOOD RISK

## K.10 FIRE ANTS



## K.11 UNEXPLODED ORDINANCE

## K.12 BCC CITY PLAN

## K.13 LANDUSE

## K.14 HISTORICAL LAND TITLES

## K.15 BUILDING SERVICES

## K.16 REGIONAL ECOSYSTEMS



## K.17 MSES

## K.18 ENVIRONMENTAL PROTECTION (WATER) POLICY 2009 SOUTH-EAST QUEENSLAND MAP SERIES, PLAN WQ1431

## K.19 BRISBANE RIVER ESTUARY - ENVIRONMENTAL VALUES AND WATER QUALITY OBJECTIVES BASIN NO. 143

## APPENDIX L: TECHNICAL DOCUMENTS

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## L.1 SUPPLEMENTARY INVESTIGATION SAQP

## L.2 REPORT ON SUPPLEMENTARY INVESTIGATION



## L.3 REMEDIATION ACTION PLAN