DLA Environmental Services
an ERM Group company

Remediation Action Plan

Ivanhoe Estate
Corner Herring Road and Epping Road
Macquarie Park NSW 2113

Frasers Property Australia

0448889

March 2018

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DLA Environmental Services Pty Ltd: ABN 80 601 661 634

BRISBANE
Level 4, 201 Leichhardt Street, Spring Hill QLD 4000
PO Box 1400, Spring Hill QLDD 4000
Ph: +61 7 3839 8393

ADELAIDE
35 Edward Street, Norwood SA 5067
PO Box 3187, Norwood, SA 5067
Ph: +61 8 8332 0960
Fax: +61 7 3844 5858

PERTH
Level 1, Suite 3
34 Queen Street, Perth, WA 6000
Ph: +61 8 9481 4961
Fax: +61 2 9870 0999

SYDNEY
Unit 11 Macquarie Link, 277 Lane Cove Road
Macquarie Park NSW 2113
Ph: +61 2 9870 0900
Fax: +61 2 9870 0999

NEWCASTLE
Level 4, 45 Watt Street
Newcastle NSW 2300
Ph: +61 2 4933 0001

MELBOURNE
Level 10, 224 Queen Street
Melbourne, Vic 3000
Ph: +61 3 9036 2637
Fax: +61 2 9870 0999

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This report is limited to the scope defined herein. Sampling and chemical analysis of environmental media are based on representative samples, the intensity of those samples being in accordance with the usual levels of testing carried out for this type of investigation and appropriate for the objectives of this report. Due to the inherent variability in environmental media, DLA cannot warrant that the whole overall condition of the Site is identical or substantially similar to the representative samples.

ABBREVIATIONS

A list of abbreviations used throughout the report is provided below:

ABC	Ambient Background Concentration
ACL	Added Contaminant Limit
ACM	Asbestos Containing Material
AEC	Area of Environmental Concern
AHD	Australian Height Datum
BGL	Below Ground Level
BTEX	Benzene, Toluene, Ethyl Benzene, Xylene
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
DEC	Department of Environment and Conservation
DLA	DLA Environmental Services
DSI	Detailed Site Investigation
EC	Electrical Conductivity
EIL	Ecological Investigation Level
ENM	Excavated Natural Material
EPA	Environment Protection Authority (NSW)
ESL	Ecological Screening Level
HIL	Health-Based Investigation Level
HSL	Health Screening Level
NA	Not Applicable
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NL	Not Limiting
NSW	New South Wales
OC/OP	Organochlorine and Organophosphorus Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
ppm	parts per million
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance and Quality Control
RAP	Remedial Action Plan
SCC	Specific Contaminant Concentration
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxicity Equivalence Quotient
TRH	Total Recoverable Hydrocarbons
VAC	Validation Acceptance Criteria
VENM	Virgin Excavated Natural Material

EXECUTIVE SUMMARY

DLA Environmental Services was engaged Frasers Property Australia to prepare a Remediation Action Plan for the property identified as Ivanhoe Estate located at the corner of Herring Road and Epping Road, Macquarie Park, NSW, 2113 (the Site).

The RAP sets goals and documents the management procedures and environmental safeguards to be implemented during remediation works to ensure that the Site will be rendered suitable for future land use consistent with 'Residential A' as described in the *National Environment Protection (Assessment of Site Contamination) Measure 2013 (No.1)* (NEPC, 2013).

Remediation and validation works required under this Plan are in response to the identification of TRH contamination in soils in an area of the Site.

Excavation and off-site disposal of contaminated material is considered the most suitable remediation strategy as it is time efficient and offers no constraints on future land use. The strategy ensures removal of all contaminated materials and ongoing exposure risks, and can be carried out as part of the proposed redevelopment works.

The Remediation Action Plan also provides requirements for validation, waste disposal, Site management, and health and safety.

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1.0 INTRODUCTION

1.1 General

DLA Environmental Services (DLA) was engaged by Frasers Property Australia to prepare a Remediation Action Plan (RAP) for the following area:

IVANHOE ESTATE
Corner of Herring Road and Epping Road,
Macquarie Park, NSW, 2113
(the Site).

This RAP provides information on the works which are proposed to manage and remediate contamination previously identified at the Site. The RAP has been prepared utilising information obtained from previous assessment of the Site and from experience, knowledge, and current industry practice in the remediation of similar sites.

1.2 Objectives

The objective of this RAP is to detail all necessary actions to be undertaken at the Site in order to render the Site suitable for the proposed redevelopment, thereby posing no unacceptable risk to human health or the environment.

In particular, this RAP sets remediation goals and documents management procedures and environmental safeguards for the proposed future land use consistent with 'Residential A' as described in the *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013* (No.1) ('NEPM', NEPC, 2013).

1.3 Scope of Works

The scope of the RAP has been defined on the basis of the findings of the following reports:

- *Detailed Site Investigation – Ivanhoe Estate, Herring Road, Macquarie Park, NSW* (JBS&G, dated 30 September 2016, reference: 52047/10496 (Rev A));
- *Summary of In-Ground Contamination – Ivanhoe Estate, Corner Herring and Epping Roads, Macquarie Park,, NSW 2113* (DLA, dated 11 October 2016, reference: DL3953_S005491); and

- *Supplementary Site Investigation – Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Park, NSW, 2113* (DLA Environmental, dated June 2017, reference: DL3593_S006887).

In this regard, the RAP includes:

- A summary of the history and environmental setting of the Site, including previous environmental investigations;
- A summary of the contamination identified on-site that requires remediation;
- An evaluation of available remediation options and a summary of the preferred remedial strategy that will render the Site suitable for the proposed development from a contamination perspective;
- A summary of the validation criteria to be adopted and design of a validation plan to confirm that the remediation strategy was successful; and
- Appropriate safeguards to perform the remediation works in an environmentally acceptable manner, having regard to best-practice work, health and safety procedures.

2.0 SITE DESCRIPTION

2.1 Site Identification

The Site identification details are summarised in Table 1.

Table 1: Site Identification Summary

ITEMS	DETAILS
Site Name	Ivanhoe Estate
Address	Corner Herring Road and Macquarie Park, NSW, 2113
Local Government Authority	City Of Ryde
Lot and Deposited Plan	Lots 6 to 17 and 18 to 20 in Deposited Plan 861433 Lot 1 in DP 859537 Lot 100 in Deposited Plan 1223787 Part Lot 5 in Deposited Plan 740753
Site Zoning	B4 – Mixed Use under the Ryde Local Environmental Plan 2014
Current Use	Residential (Department of Housing)
Proposed Use	Mixed Use
Site Area (approx.)	8.2 hectares
Locality Map	Refer to **Figure 1** – Site Location
Site Plan	Refer to **Figure 2** – Site Layout and Remediation Area

2.2 Proposed Development

DLA understands that the Site is to be subdivided and redeveloped into a combination of low and high density land use. The most conservative land use scenario has been adopted, which is consistent with the definition of 'Residential with gardens and accessible soil' provided in Schedule B7 of the NEPM (NEPC, 2013).

2.3 Boundaries and Surrounding Land Use

The boundary and surrounding landscape features of the site are summarised in Table 2.

Table 2: Boundaries and Surrounding Land Use

DIRECTION	DETAILS
North-west	Herring Road with high-density residential premises and Macquarie University beyond
North-east	Medium to high-density residential premises
South-west	Epping Road with low-density residential premises beyond
South-east	Commercial (offices) premises

2.4 Environmental Setting

The landscape and environmental setting of the Site is summarised in Table 3.

Table 3: Environmental Setting

DIRECTION	DETAILS
Topography	The Site lies at elevations between approximately 47m Australian Height Datum (AHD) in the southern-most corner and 75m AHD along the north-western boundary. The Site exhibits an overall gradient from the north-western boundary down towards the south / south-east.
Geology and Soils	The 1:100,000 Sydney Geological Series Sheet (9130) indicates that the Site lies on the boundary of Triassic-aged Ashfield Shale of the Wianamatta Group and Hawkesbury Sandstone. Ashfield Shale comprises black and dark grey shale and laminite derived from lacustrine environments. Hawkesbury Sandstone comprises medium to coarse grained quartz sandstone with very minor shale and laminite lenses derived from braided alluvial channel fill. Subsurface conditions encountered on-site during previous investigation identified the presence of fill material across most of the Site area. Geotechnical investigations carried out on-site (Douglas Partners, 2017), indicate that the subsurface of the Site comprises the following: - Filling – including pavement materials, past filling from on-site and possibly imported materials, to variable depth but typically less than 1 m below ground level (bgl), though possibly deeper, particularly towards Shrimptons Creek; underlain by, - Residual Soil – likely to be generally stiff and very stiff silty clay, sandy clay and clayey sand, possibly with some ironstone or sandstone gravel fragments, to typical depths of 0.2 m to 1.5 m bgl, though likely to be generally deeper (and possibly weaker, with overlying alluvial soils) towards Shrimptons Creek; underlain by, - Sandstone bedrock.

DIRECTION	DETAILS
Acid Sulfate Soils	The 1:25,000 Prospect / Parramatta River Acid Sulfate Soil Risk Map indicates that there are no known occurrences of acid sulfate soil in the vicinity of the Site.
Hydrology	Shrimpton Creek runs along the south-eastern boundary of the Site. Shrimpton Creek flows in a broadly northerly direction, ultimately discharging to the Lane Cove River which is located approximately 1.35 km to the north-east of the Site. The surface of the Site comprises both sealed and unsealed surfaces. In areas of the Site where unsealed surfaces are present (i.e. lawns and garden beds), it is expected that surface water (rainfall) would infiltrate into the subsurface. In areas of the Site where impervious pavements are present (i.e. roadways), or where the subsurface becomes waterlogged following periods of prolonged or heavy rainfall, runoff water would form overland flow and follow the gradient of the land.
Hydrogeology	Review of the NSW Office of Water groundwater data indicates that there are no registered bores within a 500m radius of the Site. The closest registered bore to the Site is located approximately 650m to the north / north-east and is registered for use for monitoring purposes. No details regarding the depth to groundwater are available for the nearby registered bores, however it is expected that regional groundwater would be present at depth within the underlying bedrock. Based on the hydrology of the local area, it is expected that groundwater underlying the Site would flow in a north-easterly direction towards the Lane Cove River.

3.0 SUMMARY OF PREVIOUS INVESTIGATIONS

3.1 Detailed Site Investigation

Detailed Site Investigation – Ivanhoe Estate, Herring Road, Macquarie Park NSW (JBS&G, dated 30 September 2016, reference: 52047/104956 (Rev A)).

The Detailed Site Investigation (DSI) comprised a review of previous investigations, historical information and intrusive sampling which included 26 grid-based and targeted borehole locations.

The results of the soil sampling and laboratory analysis reported contaminants of potential concern at concentrations less than the investigation criteria, with the exception of benzo(a)pyrene which exceeded the adopted ecological criteria at one sample location. This ecological exceedance was not considered to present an unacceptable ecological risk due to its expected limited effects on plant uptake.

The report concluded that the soils underlying the Site do not present an unacceptable risk to human health or the environment from a contamination perspective, and do not preclude redevelopment of the Site for its intended land use.

3.2 Summary of In-Ground Contamination

Summary of In-Ground Contamination – Ivanhoe Estate, Cnr Herring and Epping Roads, Macquarie Park NSW 2113 (DLA, dated 11 October 2016, reference: DL3953_S005491).

The document was prepared in response to a review of the DSI report (JBS&G, 2016) which indicated that historical cut and fill activities were undertaken on-site to facilitate the construction of larger developments in the estate.

Based on a review of the available historical and investigation data, DLA concluded that there was a low likelihood of unacceptable contamination to be present on the Site as a result of past and present land use activities, however data gaps existed for the cut and fill areas.

DLA recommended that additional visual inspections and limited sampling be performed across the cut and fill areas with the aim of addressing the identified data gaps with regards to the presence of subsurface contamination associated with fill material.

3.3 Supplementary Site Investigation

Supplementary Site Investigation – Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Park, NSW, 2113 (DLA Environmental, dated June 2017, reference: DL3593_S006887).

The Supplementary Investigation report provided environmental characterisation of soil across data gap areas identified on-site in order to assess the suitability of these areas for proposed future residential land use.

The investigation included the collection of soil samples collected from nine targeted boreholes. Soil samples collected from borehole BH8 reported petroleum hydrocarbons at concentrations exceeding the health and ecological screening levels, while all other samples reported contaminant concentrations below the investigation and screening levels.

Based on the results of the current investigation data, DLA concluded that the area of the Site in the vicinity of borehole BH8 was not suitable for the proposed redevelopment from a contamination perspective, however could be made suitable via the implementation of an appropriate remediation strategy.

4.0 EXTENT OF CONTAMINATION

Based on the available data, DLA has identified one Area of Environmental Concern (AEC) on-site as detailed in Table 4. The AEC defines the extent of remediation which is understood to be required to make the Site suitable for its proposed future land use.

Table 4: Extent of Contamination: AECs

AEC ID	LOCATION	CONTAMINANT OF CONCERN	MAXIMUM DEPTH (bgl)	REFERENCE
AEC 1	BH8	TRH	> 0.4m	DLA, 2017

Refer to **Figure 2** – Site Layout and Remediation Area.

A section of the Site to the east has not undergone any contamination investigations, therefore the presence of contamination within this area cannot be precluded. Assessment of this data gap area of the Site will be carried out as part of the initial phases of remediation works – refer to **Section 7.5.1** of this RAP.

Based on the nature of the current and former occupation of the Site, and the known limited extent of soil contamination identified to date, the potential for the significant contamination of groundwater underlying the Site is expected to be low. Although elevated concentrations of some contaminants may be present within the groundwater (i.e. heavy metals), these are expected to be representative of background conditions associated with highly disturbed urban environments. As such, the groundwater underlying the Site is not considered to present a risk to human health or the environment from a contamination perspective and, therefore, remediation or management is not considered necessary.

5.0 CONCEPTUAL SITE MODEL

5.1 Overview

A Conceptual Site Model (CSM) is a representation of an environmental system and the processes that determine the transport of contaminants from sources through environmental media to environmental receptors. The development of a CSM comprises an iterative process of characterising site contamination on the basis of historical, anecdotal, previous and current environmental data.

An exposure pathway is a means by which an ecosystem, human population or individual (receptor) may be exposed to site-derived contaminants. If a source, transport mechanism (pathway), an exposure point and a sensitive receptor are all present then a complete exposure pathway exists.

5.2 Potential Contaminants

Site-specific AECs and associated contaminants of potential concern (COPCs) are summarised in **Section 4.0** of this RAP.

5.3 Release and Transport Mechanisms

Contaminants generally migrate from a site via a combination of windblown dusts, infiltration, groundwater migration and surface water runoff. The potential for contaminants to migrate is a combination of:

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

Windblown Dust Migration

As the hydrocarbon impacted area is unsealed, windblown dust migration is a potential minor risk.

Surface Water Migration

The migration of chemical contaminants via surface water runoff is considered to be low considering the absence of widespread chemical contamination within the Site.

Soil and Groundwater Migration

The potential for migration of chemical contamination through the soil profile is considered to be low given the isolated nature of chemical contamination identified on-site and the generally impermeable nature of the clay soils comprising the subsurface of the Site.

Vapour Generation

The vapour generation potential associated with volatile COPCs (i.e. petroleum hydrocarbons) is identified as a potential migration pathway. However, vapour generation would require significant subsurface contamination to be present which, based on previous investigations, is not expected.

5.4 Potential Exposure Pathways

Based on the identified COPCs and future potential Site development activities, the exposure pathways for the Site's use include:

- Dermal contact with chemically impacted soils;
- Ingestion of chemically impacted soils; and
- Inhalation of hydrocarbon vapours.

5.5 Sensitive Receptors

The potential sensitive receptors at the Site include:

- Present and future Site users;
- Construction and maintenance workers; and
- Visitors to the Site.

6.0 SELECTION OF PREFERRED REMEDIAL STRATEGY

6.1 Remediation Options

The preferred hierarchy of options for site remediation and/or management is set out in Section 6(16) of the NEPM (NEPC, 2013). According to this document, the order of preference for soil remediation and management is:

1. On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2. Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the Site;
3. Removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill; and,
4. Consolidation and isolation of the soil on-site by containment within a properly designed barrier.

A review of the available remediation methods and technologies indicates that the following strategies may be applicable to the remediation of the Site.

6.1.1 On-site Treatment of Contaminated Media

On-site treatment of contaminated media may include *in-situ* methods such as stabilisation and oxidation, and *ex-situ* methods such as thermal desorption and bioremediation. For the higher ranges of hydrocarbons, enhanced bio-remediation (addition of microbial agents) may be required for the timely breakdown of hydrocarbon compounds in soil. *Ex-situ* on-site treatment requires sufficient land area to facilitate the process for the life of the remediation program.

Both *in-situ* and *ex-situ* remediation methods often take an extended period of time to complete and have costs associated with mobilisation and monitoring. In addition, treatment technologies often target only one type of contaminant (i.e. volatile organics) and therefore are not typically suitable for sites with multiple types of contamination, especially heavy metals.

The benefits of on-site treatment of contamination are that off-site disposal of contaminated media is not typically necessary and the importation of Virgin Excavated Natural Material (VENM) to reinstate excavations is not required.

The option for on-site treatment of contaminated media is considered suitable for implementation at the Site due to the relatively small volume of soil that requires remediation and the identified COPC.

However, given that in-situ treatment strategies typically require a longer time frame to achieve the required result, this approach is not considered a feasible option for implementation at the Site.

6.1.2 Off-site Treatment of Contaminated Media

Off-site treatment of contaminated media includes the same methods as on-site treatment however remediation is untaken in an alternate location. This method is typically adopted when the remediation site has an insufficient land area to accommodate the remediation technology.

Unlike on-site treatment, off-site treatment requires excavation of contaminated soils, or extraction of contaminated groundwater, and transportation of the media to the treatment site. Reinstatement of on-site excavations is also required following treatment.

The option for off-site treatment of contaminated media is considered suitable for implementation at the Site due to the relatively small volume of soil that requires remediation and the identified COPC. However, given that ex-situ treatment strategies typically require a longer time frame to achieve the required result, this approach is not considered a feasible option for implementation at the Site.

6.1.3 Excavate and Off-Site Disposal

Landfill disposal is the simplest of all remediation methods, and involves the excavation of the contaminated materials, and disposal off-site to a NSW EPA approved landfill disposal site with appropriate environmental safeguards. The formed excavation is then backfilled using clean, validated fill materials.

The selection of an appropriate landfill will normally depend largely upon the results of classification of the wastes. It is sometimes necessary for heavily contaminated soils to be pre-treated prior to disposal, to reduce the concentrations or minimise the mobility of the contaminants. Special criteria are sometimes applicable to certain categories of waste. Contaminants covered by Chemical Control Orders have restrictions placed on their handling and disposal.

This option is considered suitable for implementation at the Site given the type of contamination identified on-site, and the proposed future land use.

6.1.4 On-Site Capping and Containment

On-site capping and containment involves the installation of a physical barrier around the contaminated areas to prevent potential migration pathways of contaminants.

This option is not considered suitable for implementation at the Site given the proposed future land use and the need for the implementation of a long-term Environmental Management Plan.

6.2 Preferred Strategy

The preferred remediation strategy is:

EXCAVATE, CLASSIFY AND DISPOSE OFF-SITE

The Site strategy selected must be the most cost-effective solution, which does not bring about unacceptable long-term liabilities, and which does not impose unreasonable constraints on future Site developments or present operations. The strategy must also be capable of achieving the technical, environmental and economic objectives of the overall project.

Excavation and off-site disposal of contaminated material is considered the most suitable remediation strategy as it is time efficient and offers no constraints on future land use. This is the preferred strategy based on a minimal amount of material being disposed off-site. The strategy ensures removal of all contaminated materials and ongoing exposure risks, and can be carried out as part of the proposed redevelopment works.

7.0 IMPLEMENTATION OF REMEDIATION STRATEGY

7.1 General

The proposed remediation strategy incorporates the following elements:

1. Stakeholder consultation;
2. Implementation of an accepted Site Environmental Management Plan (SEMP) during remediation works;
3. Site establishment and pre-remedial works;
4. Additional investigations;
5. Remediation works; and
6. Validation.

7.2 Stakeholder Consultation

On approval of the strategy, the Stakeholders including on-site residents and relevant regulatory bodies will be informed of the intention to conduct remediation work, and the progress at all stages of the remediation works.

7.3 Implementation of Site Environmental Management Plan

A Site Environmental Management Plan (SEMP) covering the remedial works has been prepared for the Site. Before work commences it is imperative that all issues relating to potential impacts have been reviewed. The SEMP including Remediation Works Management and Health and Safety Plans is presented in **Section 10.0** of this RAP.

7.4 Site Establishment and Pre-Remedial Works

Initial activities at the Site shall involve the establishment of all plant and equipment necessary for the remediation works. Prior to the commencement of any earthmoving activities, it will be necessary to install environmental protection safeguards, as well as Site security measures. These measures are included as part of the SEMP presented in **Section 10.0** of this RAP.

7.5 Remediation Works

7.5.1 Data Gap Assessment

The south-eastern portion of the Site, shaded green in **Figure 2**, comprises a supplementary area of the Site that has not yet been subject to intrusive investigation to assess the presence, or otherwise, of contamination. As such, data gap investigations are required in order to assess the suitability of the land for future land use consistent with 'Residential A' (NEPC, 2013) from a contamination perspective.

The data gap assessment will be undertaken by a suitably qualified and experienced environmental consultant concurrently with the initial phases of remediation works.

The data gap area covers approximately 3,700 m^2. Therefore, in accordance with the *Contaminated Sites: Sampling Design Guidelines* (NSW EPA, 1995), a total of 11 test locations will be targeted for assessment.

At each test location, test pits will be excavated to depths sufficient to intercept natural ground, thereby confirming the vertical extent of fill material. In the case that access restrictions preclude the excavation of test pits, boreholes will be drilled using a mechanically operated drill rig that is able to extend to depths sufficient to intercept natural ground.

Soil samples will be collected from the fill material at regular intervals and submitted for laboratory analysis for the following typical suite of COPC: heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn), Total Recoverable Hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene, Xylene (BTEX), Polycyclic Aromatic Hydrocarbons (PAH), Organochlorine / Organophosphorus Pesticides (OC/OP), Polychlorinated Biphenyls (PCBs) and asbestos (only where visible evidence noted).

Additional soil samples will be collected for quality assurance / quality control (QA/QC) purposes in accordance with the strategy presented in **Section 9.2** of this RAP.

Each soil sample will be screened in the field using a photoionisation detector (PID) to assess the presence of volatile organic compounds (VOCs).

The analytical results obtained during the data gap assessment will be assessed against the validation criteria presented in **Section 9.3** of this RAP.

Where required, delineation sampling will be carried out to assess the lateral and vertical extent of contamination to assist in informing the remediation strategy for these areas of the Site.

The results of the data gap assessment will be used to assess whether additional areas of contamination are present on-site that require remediation. In the case that additional areas of contamination are identified, remediation will be carried out as described in **Section 7.5.3** of this RAP.

7.5.2 Remediation of AEC 1

AEC ID	LOCATION	CONTAMINANT OF CONCERN	MAXIMUM DEPTH (bgl)	REFERENCE
AEC 1	BH8	TRH	> 0.4m	DLA, 2017

For AEC 1, the following remediation activities will be undertaken:

1. AEC 1 will be delineated by marking an approximately 5 m x 5 m grid centred quadrant around the original borehole location (i.e. BH8);
2. Soil within the gridded AEC will be excavated to a minimum depth of 0.5 m bgl. Given that the vertical extent of the hydrocarbon impact has not yet been delineated, a PID will be used to screen the faces of the excavation to assist in assessing the likely presence of residual contamination. In the event that PID readings and/or visual or olfactory evidence suggests that contamination extends beyond the proposed depth of the remedial excavation, then excavation will continue until the evidence of contamination has been removed. Similarly, in the event that evidence of contamination is identified on the walls of the remedial excavation, then the excavation will be extended laterally until the evidence of contamination has been removed.
3. Excavated soil will be stockpiled within a designated area of the Site for waste classification in accordance with **Section 8.1** of this RAP; and
4. The walls and base of the excavation will be validated by a suitably qualified and experienced environment consultant in accordance with the validation strategy presented in **Section 9.0** of this RAP.

Following successful validation, where required, the excavation will be reinstated with material validated in general accordance with **Section 8.2** of this RAP.

7.5.3 Remediation of Additional AECs

For additional AECs identified as part of the data gap assessment (refer to **Section 7.5.1** of this RAP), the following remediation activities should be undertaken:

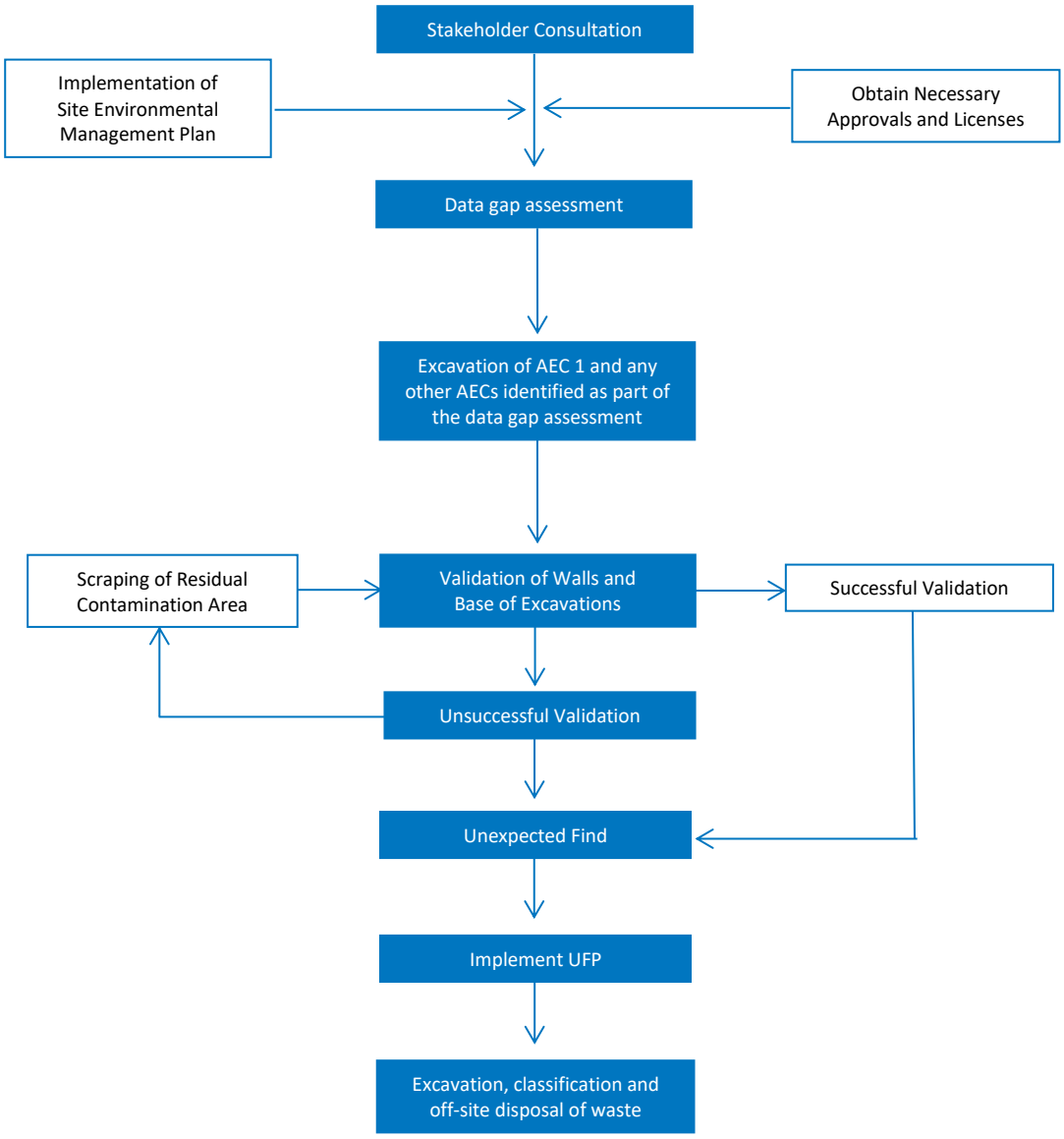
1. The AEC will be delineated by marking a grid centred on the original test location. The lateral extent of the grid will be based on the lateral extent of the identified contamination. Typically,

the gridded area will extend at least 2m beyond the known lateral extent of identified contamination. In the case that evidence of contamination is identified on the walls of the excavation (i.e. >2m beyond the known lateral extent of contamination), then the excavation will be extended laterally until the evidence of contamination has been removed or the excavation has been sufficiently extended that it can be delineated by surrounding 'clean' test locations.

2. Soil within the gridded AEC will be excavated to depths of at least 0.2m below the known vertical extent of identified contamination. In the case that visual or olfactory evidence of contamination is noted to extend beyond the proposed depth of the excavation (i.e. > 0.2m below the known vertical extent of contamination), then excavation will continue until the evidence of contamination has been removed.
3. Excavated soil will be stockpiled within a designated area of the Site for waste classification in accordance with **Section 8.1** of this RAP; and
4. The walls and base of the excavation will be validated by a suitably qualified and experienced environment consultant in accordance with the validation strategy presented in **Section 9.0** of this RAP.

Following successful validation, where required, the excavation will be reinstated with material validated in general accordance with **Section 8.2** of this RAP.

A schematic of the **Remediation Process** is shown overleaf:


Stakeholder Consultation
Implementation of Site Environmental Management Plan
Obtain Necessary Approvals and Licenses
Data gap assessment
Excavation of AEC 1 and any other AECs identified as part of the data gap assessment
Scraping of Residual Contamination Area
Validation of Walls and Base of Excavations
Successful Validation
Unsuccessful Validation
Unexpected Find
Implement UFP
Excavation, classification and off-site disposal of waste

8.0 WASTE MANAGEMENT

All waste disposal activities will be undertaken in accordance with *the Waste Classification Guidelines* (NSW EPA, 2014), the *Waste Avoidance and Resource Recovery Act 2001* (NSW), the *Protection of the Environment Operations Act 1997* (NSW) and other relevant legislation.

8.1 Waste Soil Classification

For waste classification purposes, representative soil samples will be collected at a rate of at least one sample per 25 m^3 of excavated material, with a minimum of two samples collected. In the event that soil samples are collected *in-situ* (i.e. fill material has not been excavated prior to sampling for waste classification purposes), a similar sampling density should be adopted, allowing for bulking factors.

The sampling frequency and analytical schedule may need to be adjusted on a "case by case" basis, depending on factors such as:

- The volume of the material;
- The homogeneity of the material; and
- The visual assessment of the material.

Where possible, to assist in efficient classification and off-site disposal (if required), less impacted soils will be segregated from those which have visual or olfactory indicators of contamination, or are suspected to contain asbestos.

Soil samples collated for waste classification purposes will be analysed for COPC including asbestos (presence / absence), heavy metals, TRH, BTEX, PAH, OC/OP and PCBs.

Where existing data is available and representative of the excavated soil, the analytical plan may be amended.

The results of the laboratory analysis will be compared against the *Waste Classification Guidelines* (NSW EPA, 2014).

Based on the results of the primary analysis, it may be required that toxicity characteristics leaching procedure (TCLP) testing be carried out for heavy metals and PAH to further define the appropriate classification for off-site disposal.

All soils that require off-site disposal as part of the remediation works will be disposed to an appropriately NSW EPA licensed landfill facility.

8.2 Importation of Soil

In the case that fill is to be imported to the Site, the material must be either:

- Virgin Excavated Natural Material (VENM); or
- Excavated Natural Material (ENM).

In accordance with the *Protection of the Environment Operations Act 1997*, VENM must be 'natural material (such as clay, gravel, sand, soil or rock fines) that:

- has been excavated or quarried from areas that are not contaminated with manufactured chemicals or process residues, as a result of industrial, commercial, mining or agricultural activities; and
- does not contain any sulfidic ores or soils or any other waste.'

The VENM must be accompanied by a validation certificate from the supplier which adequately certifies that the material is VENM, or otherwise be subject to validation sampling prior to importation to the Site.

Where validation of VENM is required, representative soil samples will be collected at a rate of approximately one sample per 50m^3 of VENM, with a minimum of two samples collected for analysis.

Soils will be analysed for the following COPC as a minimum: heavy metals, TRH, BTEX, PAH, OC/OP, PCB and asbestos.

In accordance with the *Protection of the Environment Operations (Waste) Regulation 2014*, ENM is naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:

a) been excavated from the ground;
b) contains at least 98% (by weight) natural material; and,
c) does not meet the definition of VENM in the Act.

ENM does not include:

a) material located in a contamination hotspot;
b) material that has been processed; or
c) material that contains asbestos, acid sulfate soil, potential acid sulfate soils, or sulfidic ores.

Assuming the material meets the above criteria, confirmation of the ENM classification is carried out by the comparison of contaminant concentrations against the thresholds presented in Table 4 of NSW EPA *The excavated natural material order 2014.*

Imported soil will be observed by a suitably qualified and experienced environmental consultant as it is delivered to Site to confirm:

- that it appears consistent with the source; and
- that there is no visual or olfactory evidence of contamination such as staining, anthropogenic materials or odours.

In the case that discrepancies exist, the imported material will be refused entry to the Site and not considered suitable for use until appropriately validated.

The appointed contractor will provide the environmental consultant with copies of dockets pertaining to imported fill soils to confirm the source, type and quantities of materials. These will be included in the validation report.

8.3 Stockpile Footprints

Validation sampling of near-surface soils within the footprint of stockpiles generated as part of the remediation program will be carried out to assess whether contamination of the ground surface has occurred.

Stockpile footprints will be validated through the collection and analysis of approximately one sample per 50 m^2, or part thereof.

Validation samples will be analysed for the relevant COPC.

8.4 Materials Handling

Transport of waste and disposal of materials must be conducted in accordance with the requirements of the *Protection of the Environment Operations Act 1997*. Licences and approvals required for disposal of the material will be obtained prior to removal of materials from the Site. Removal of waste materials from the Site will only be carried out by contractors holding appropriate licences, consent and/ or approvals to manage, handle or dispose of the waste materials.

The contractor will track the movement of all materials excavated and handled as part of the remediation program. This will include tracking of (but is not limited to):

- Stockpile locations, with corresponding source of materials;
- Off-site disposal records for soils (trucking record, landfill dockets); and
- Estimated volume(s) of soils exported from the Site.

9.0 VALIDATION SAMPLING AND ANALYSIS QUALITY PLAN

9.1 Validation Procedure

9.1.1 Validation Procedure for AECs

Validation of AEC1 and any other AEC identified as part of the data gap assessment will be performed by way of visual inspection and soil sampling. Visual inspections will directly observe for indications of contamination (e.g. odours, staining, asbestos), the presence of which may warrant a more intensive sampling approach. Validation sampling will be required for excavations created following the removal of the TRH impacted soils. As a minimum, sampling numbers and analysis will conform to the validation plan presented in Table 5.

Table 5: Validation Plan for AECs

LOCATIONS	SAMPLING DENSITY	ANALYTICAL STRATEGY
Base	At least one sample per 5 m by 5 m grid	COPC
Walls (North, South, East, West)	At least one sample from each wall. Where the excavation extend to depths greater than 1 m bgl, there is a change of strata or staining is evident, additional sampling will be collected from each excavation wall to ensure appropriate validation.	

9.1.2 Unexpected Finds

Validation of any unexpected find will be dependent on contaminant type and the individual circumstances of each contamination event. Sample numbers and analysis will be dependent on the area of impact and a review of initial assessment data.

In the case that previously unidentified contamination hotspots are identified following demolition of existing buildings and structures, the impacted material will be excavated as follows:

1. Delineation of excavation area/s by marking a grid around the identified impact;
2. Excavation of identified gridded areas to the required depths (based on the depth of the identified impact);
3. Stockpiling, waste classification and removal of associated soils in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014);
4. Validation of the resultant excavation in general accordance with the sampling density provided in Section 9.1.1 of this RAP with analysis targeting the relevant COPC; and
5. Backfilling of excavation with material assessed as suitable for the future land use if required.

Refer to **Appendix A** - Unexpected Finds Protocol.

9.2 Quality Assurance / Quality Control

The quality assurance / quality control (QA/QC) program for the Site will ensure the representativeness and integrity of samples and accuracy and reliability of the analysis results. This includes cleaning of tools before and between sampling, and delivery of samples to the laboratory within holding times and in good condition.

The QC program for the Site will monitor and measure the effectiveness of the QA procedures. This will involve the use:

- intra-laboratory field duplicate samples which will be collected at a rate of 10% of the total number of primary samples collected;
- inter-laboratory field duplicate samples which will be collected at a rate of 5% of the total number of primary samples collected;
- trip spike and trip blank samples which will be collected at a rate of one per day of fieldwork where samples are to be submitted for analysis for volatiles; and
- rinsate samples which will be collected at a rate of one per day of fieldwork where non-dedicated sampling equipment is used.

9.3 Validation Acceptance Criteria

The VAC and methods for assessing acceptable concentrations of contaminants at the Site were derived from the following publications:

- *NEPM* (NEPC, 2013); and
- *Health screening levels for petroleum hydrocarbons in soil and groundwater, Part 2: Application document,* CRC CARE Technical Report no. 10 (CRC Care, 2011).

9.3.1 Health Screening Levels

Health Screening Levels (HSLs) are used to assess selected petroleum compounds and fractions to assess the risk to human health via inhalation and direct contact with affected soils and groundwater. The HSLs were developed by the Co-operative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) and were derived through the consideration of health effects only, with particular emphasis on the vapour exposure pathway. Other considerations such as ecological risk, aesthetics, the presence of free phase product and explosive / fire risk are not addressed by the HSLs.

In order to determine whether the HSLs tabulated in Schedule B1 of NEPC (2013) are applicable or whether a site-specific determination is required, CRC CARE provide an application checklist which should be completed prior to using the HSLs. The following parameters were considered in completing the checklist:

- **Potential Contaminants –** Petroleum Hydrocarbons;
- **Land use –** HSL A;
- **Potential Pathways –** soil vapour intrusion, direct contact;
- **Media –** soil;
- **Soil Types –** previous investigations identified clay within the subsurface of the Site which has been adopted as the dominant soil profile; and
- **Depth to Contamination –** various, all data will initially be compared with the HSLs for the shallowest depth range, with any failures then further considered.

On the basis of these considerations, the following HSL has been adopted:

- HSL A – Residential A for 'clay' (or 'fine').

The adopted soil HSLs for vapour intrusion, from Table 1A(3), Schedule B1 of NEPM (NEPC, 2013), are summarised in Table 6.

Table 6: TRH Soil Criteria for Vapour Intrusion (mg/kg)

ANALYTES	HSL-A (Clay) 0 to 1.0m	HSL-A (Clay) 1.0 to <2.0m	HSL-A (Clay) 2.0 to <4.0m	Direct Contact HSL-A
Benzene	0.7	1	2	100
Toluene	480	NL	NL	14,000
Ethylbenzene	NL	NL	NL	4,500
Xylenes	110	310	NL	12,000
Naphthalene	5	NL	NL	1,400
F1: C_6-C_{10}	50	90	150	4,400
F2: C_{10}-C_{16}	280	NL	NL	3,300
F3: C_{16}-C_{34}	NA	NA	NA	4,500
F4: C_{34}-C_{40}	NA	NA	NA	6,300

NL = Not Limiting (i.e. the soil vapour concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario).

NA = Not Applicable (i.e. NEPM (NEPC, 2013) does not provide HSLs for the F3 and F4 hydrocarbon fractions).

Vapour Intrusion Criteria sourced from NEPM (NEPC, 2013) *Table 1A(3) – Soil HSLs for vapour intrusion.*

Direct Contact Criteria sourced from Friebel and Nadebaum 2011, Health Screening Levels for petroleum Hydrocarbons in Soil and Groundwater, Part 1: Technical Development Document, *Table A4 – Soil Health Screening Levels for Direct Contact.*

9.3.2 Management Limits

The NEPM (NEPC, 2013) states that Management Limits are relevant for operating sites where significant sub-surface leakage of petroleum compounds has occurred, and when decommissioning industrial sites. Considering that significant sub-surface leakage of petroleum compounds was not encountered in previous investigations at the Site, Management Limits are not deemed applicable for the validation of the Site.

9.3.3 Health Investigation Levels

The Health Investigation Levels (HILs) are scientifically based, generic assessment criteria designed to be used in the first stage (Tier 1) of an assessment of potential risks to human health from chronic exposure to contaminants. They are intentionally conservative and are based on a reasonable worst case scenario for four generic land use scenarios. Considering the proposed land use, the following HIL has been adopted:

– Residential A – Residential with garden/accessible soil.

The adopted HILs, from Table 1A(1) and Table 7, Schedule B1 of NEPM (NEPC, 2013), are shown in Table 7.

Table 7: Site Assessment Criteria for Soils (mg/kg)

ANALYTES	HIL-A
Heavy Metals	
Arsenic	100
Cadmium	20
Chromium	100
Copper	6,000
Lead	300
Mercury	40
Nickel	400
Zinc	7,400
PAH	
Benzo(a)pyrene TEQ	3
Total PAHs	300

ANALYTES	HIL-A
PCB	
PCB	1
Pesticides	
DDT+DDE+DDD	240
Aldrin and Dieldrin	6
Chlordane	50
Endosulfan	270
Endrin	10
Heptachlor	6
HCB	10
Methoxychlor	300
Mirex	10
Toxaphene	20
Asbestos	
Bonded ACM	0.01% w/w
Friable Asbestos/Asbestos Fines	0.001% w/w
Surface Asbestos (0.1m)	No Visible

TEQ: Toxic Equivalence Quotient, expresses an aggregate measure of toxicity based on a number of contributing PAH compounds.

9.3.4 Ecological Investigation Levels

According to NEPM (NEPC, 2013), Schedule B (5a) – *Guideline on Ecological Risk Assessment*, factors that may influence a Risk Management Decision (and therefore determine Ecological Risk Assessment outcomes) are generally based on economic, ecological or societal considerations.
Examples include:

- The size of the site, land value, cost of remediation (economic);
- The type of contaminants present, current and potential site land use, surrounding land use (societal); and,
- The ecological significance (e.g. a rare and endangered species or a species that supports a valued ecological process or a sensitive introduced species of low ecological significance) of the values identified in the Receptor Identification component of Ecological Risk Assessment to be protected.

Ecological Investigation Levels (EILs) have been implemented to environmentally manage the effect of contaminants on terrestrial ecosystems and species sensitivity. The EILs referenced in this report have been developed for the generic land use setting of urban residential areas and public open space. It is important to note that the contamination is assumed to be aged (>2 years), as fresh contamination associated with current industrial / agricultural activity and chemical spills are not likely present on-site. EILs have been derived for: Arsenic (As), Copper (Cu), Chromium (CrIII), DDT, naphthalene, Nickel (Ni), Lead (Pb) and Zinc (Zn).

Ambient Background Concentration (ABC)

For Ni, CrIII, Zn and Pb (aged contamination), the EILs are the sum of Added Contaminant Limits (ACLs) and ABCs. To establish the ABC of a contaminant, the recommended method is to measure the ABC at an appropriate unpolluted reference site.

For As, DDT and Naphthalene (aged contamination), the EILs are generically obtained (i.e. not dependent on soil type).

Added Contaminant Limit (ACL)

The ACL is the added contamination (in excess of the ABC). ACLs are applicable to Cr III, Cu, Ni and Zn and are based on soils properties of pH, Cation Exchange Capacity and the clay content.

The EILs to be adopted for comparison purposes would be calculated at the time of investigation using Site-specific data.

9.3.5 Ecological Screening Levels

Ecological screening levels (ESLs) have been developed for selected petroleum hydrocarbon compounds and are applicable for assessing risk to terrestrial ecosystems. ESLs broadly apply to coarse and fine-grained soils and various land uses. They are generally applicable to the top 2 m of soil.

The adopted ESLs, from Table 1B(6), Schedule B1 of NEPM (NEPC, 2013), are summarised in

Table8.

Table 8: Ecological Screening Levels

ANALYTES	ESL (Fine) Urban Residential and Public Open Space
Benzene	65
Toluene	105
Ethylbenzene	125
Xylenes	45
Benzo(a)Pyrene	0.7
F1: C_6-C_{10}	180
F2: C_{10}-C_{16}	120
F3: C_{16}-C_{34}	1,300
F4: C_{34}-C_{40}	5,600

9.3.6 Waste Classification Criteria

The characterisation of materials for off-site disposal during the remediation program of the Site will be performed in accordance with:

- *Waste Classification Guidelines* (NSW EPA, 2014);
- *Excavated Natural Material (ENM) Order* (NSW EPA, 2014) and *Excavated Natural Material Exemption* (NSW EPA, 2014);
- *Protection of the Environment Operations Act 1997* and associated regulations; and
- All other relevant resource recovery orders, resource recovery exemptions and approvals issued by the NSW EPA.

A selection of criteria from the aforementioned sources are summarised in Table 9.

Table 9: Waste Classification Criteria

ANALYTE	GENERAL SOLID WASTE			RESTRICTED SOLID WASTE			ENM	
	CT1[a]	TCLP1[b]	SCC1[c]	CT2[d]	TCLP2[e]	SCC2[f]	Ave. Conc.[g]	Max. Conc.[h]
	mg/kg	mg/L	mg/kg	mg/kg	mg/L	mg/kg	mg/kg	mg/kg
BTEX								
Benzene	10	0.5	18	40	2	72	--	0.5
Toluene	288	14.4	518	1,152	57.6	2073	--	65
Ethylbenzene	600	30	1080	2,400	120	4320	--	25
Xylenes (total)	1000	50	1800	4,000	200	7200	--	15
TRH								
$C_6 – C_{10}$	NA	NA	650	NA	NA	2600	--	--
$>C_{10} – C_{36}$	NA	NA	10000	NA	NA	40000	250	500
PAH								
PAH (total)	NA	NA	200	NA	NA	800	20	40
Benzo(a)pyrene	0.8	0.04	10	3.2	0.16	23	0.5	1
Heavy Metals								
Arsenic	100	5.0	500	400	20	2000	20	40
Cadmium	20	1.0	100	80	4	400	0.5	1
Chromium	100	5	1900	400	20	7600	75	150
Copper	--	--	--	--	--	--	100	200
Lead	100	5	1500	400	20	6000	50	100
Mercury	4	0.2	50	16	0.8	200	0.5	1
Nickel	40	2	1050	160	8	4200	30	60
Zinc	--	--	--	--	--	--	150	300
Other								
pH (pH units)	--	--	--	--	--	--	5 to 9	4.5 to 10
Foreign Materials	--	--	--	--	--	--	0.05%	0.10%
E.C. (dS/m)	--	--	--	--	--	--	1.5	3.0

CT – Contaminant Threshold.
TCLP – Toxicity Characteristics Leaching Procedure.
SCC – Specific Contaminant Concentration
E.C. – Electrical Conductivity
NA – No applicable as these contaminants are only assessed using Specific Contaminant Concentrations.
a – *Waste Classification Guidelines* (NSW EPA, 2014), Table 1: CT1 & CT2 values for classifying waste by chemical assessment without the TCLP test, Column 1: General Solid Waste.
b – *Waste Classification Guidelines* (NSW EPA, 2014), Table 2: TCLP and SCC values for classifying waste by chemical assessment, General Solid Waste Column 1: Leachable concentration.
c – *Waste Classification Guidelines* (NSW EPA, 2014), Table 2: TCLP and SCC values for classifying waste by chemical assessment, General Solid Waste Column 2: Specific Contaminant Concentration.
d – *Waste Classification Guidelines* (NSW EPA, 2014), Table 1: CT1 & CT2 values for classifying waste by chemical assessment without the TCLP test, Column 2: Restricted Solid Waste.
e – *Waste Classification Guidelines* (NSW EPA, 2014), Table 2: TCLP and SCC values for classifying waste by chemical assessment, Restricted Solid Waste Column 1: Leachable concentration.
f – *Waste Classification Guidelines* (NSW EPA, 2014), Table 2: TCLP and SCC values for classifying waste by chemical assessment, Restricted Solid Waste Column 2: Specific Contaminant Concentration.

g – *Excavated Natural Material Order* (NSW EPA, 2014), Table 4, Column 2 – Maximum Average Concentration for Characterisation.

h – *Excavated Natural Material Order* (NSW EPA, 2014), Table 4, Column 3 – Maximum Average Concentration for Characterisation.

9.3.7 Application of Criteria

Validation for chemically tested soils will be determined when concentrations are reported below the criteria, thereby not posing an unacceptable risk to human health or the environment. For chemical analysis, the individual contaminant concentration must not exceed the validation guidelines by more than 250%.

9.4 Validation Report

At the completion of the remediation activities, a Validation Report will be prepared by the environmental consultant engaged to validate the remedial works with reference to the *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW OEH, 2011).

The validation report will include:

- Executive summary;
- Scope of work;
- Site identification details;
- Summary of the site history;
- Summary of the site condition and surrounding environment;
- Summary of the site geology and hydrogeology;
- Remediation activities undertaken (including extent and observations of excavation/s, waste documentation materials tracking and imported fill documentation);
- Validation sampling and analysis plan (including methodology);
- QA/QC protocols for field works and laboratory analysis;
- Basis for validation criteria and validation sampling records; and
- Conclusions and recommendations.

10.0 SITE ENVIRONMENTAL MANAGEMENT PLAN

10.1 General

The Principal Contractor will be responsible for control of the Site during remedial works.

The Principal Contractor will be responsible for preparing Remediation Work Method Statements (RWMS) that address environmental, health and safety hazards, and risks during the remediation. The RWMS shall address, but may not be limited to, the issues and controls presented in the following subsections.

10.2 Health and Safety

The Principal Contractor will prepare a project-specific occupational health and safety plan for the remediation works. This plan shall identify the potential risks associated with the works and detail the health and safety measures and procedures that are to be adopted to protect both on-site workers and the general public.

10.2.1 Hours of Operation

Working hours for any on-site remedial works would be set in consultation with Ryde City Council, but it is envisaged the likely hours would be as follows:

Mondays to Fridays	7:00 am to 5:00 pm
Saturdays	7:00 am to 3:00 pm
Sundays and Public Holidays	No Work Permitted

10.2.2 Emergency and Out of Hours Contact Numbers

DLA	+61 2 9476 1765	**NSW EPA**	131 555
Simon Spyrdz DLA General Manager	0413 628 438	**SafeWork NSW**	13 10 50
Contractor	To be confirmed	**Client representative**	To be confirmed

The RWMS will outline plans to respond to incidents associated with the works (e.g. fires, spills or other uncontrolled releases).

As part of site induction procedures, all employees, sub-contractors and visitors to the Site will be made aware of the emergency protocols in place.

10.2.3 Site Access

Access to the Site will be restricted to authorised staff and contractors who have been inducted and appropriately trained for the works being undertaken. Fencing has been installed and will be maintained around the perimeter of the Site and the remediation area will also be secured from entry outside of remediation works occurring.

Signage, including Site contact details, will be erected near the Site entry gate. The signage will remain displayed at the entrance throughout the duration of the remediation works.

10.2.4 Personnel Protective Equipment

All workers will be provided with and use the appropriate personal protective equipment (PPE).

When working in, or visiting, designated 'dirty' areas of the Site, the minimum level of PPE required will include disposable overalls, boots (steel toe cap and sole), gloves and eye protection.

In the event that workers will be exposed to asbestos-impacted soils or asbestos containing materials, a P2 respirator will be used.

All PPE shall conform to approved standards.

First aid and safety equipment including fire extinguishers will be provided within restricted zones for use in an emergency. In addition, hard hats and reflective high visibility clothing shall be provided and worn on-site at all times.

10.2.5 Training

All Site personnel shall be informed and fully trained through an induction procedure in relation to the potential Site hazards.

10.2.6 Safety Officer / First Aid Personnel

Designated Safety and First Aid Officer(s) shall be on-site at all times, and shall be trained for working on sites of a similar nature and be fully conversant with relevant procedures.

10.2.7 Vapours

Potential hazards associated with volatile organic vapours shall be monitored using alarmed vapour detection devices in operational areas to monitor health and explosive/fire risks. The health and

safety plan will establish trigger levels and an associated action plan relating to gas risks during the works.

10.3 Erosion and Sediment Control

Erosion and sediment control measures to be implemented during the remediation program will be in accordance with *Managing Urban Stormwater, Soils and Construction, 4th edition* (Landcom (2004)).

A Site-specific erosion and sediment control plan will be developed by the Principal Contractor, or their authorised representative. The plan will show the location of sediment control devices as required based on remediation works to be undertaken.

10.3.1 Excavation Management

To minimise erosion and sedimentation during the remediation works, where practicable, the area of exposed surfaces at any one time will be minimised through controlled sequencing of works and progressive excavation and restoration. Prior to the commencement of excavation works, sand bags or similar water diversion measures will be used to divert surface runoff away from work zones and proposed excavation areas towards any existing drains.

Activities that involve soil disturbance will be avoided during heavy rain periods.

Excavation areas will be isolated through the use of temporary barricades and fencing.

10.3.2 Surface Water Management

In order to minimise the need for treatment/disposal of potentially contaminated surface water from excavations, controls shall be implemented to divert surface water away from the remediation area.

10.3.3 Stockpile Management

Stockpiles will be designated and handled to ensure that excavated material is properly tracked and classified to avoid mixing of different classes of waste from occurring.

Where possible, to assist in efficient classification and off-site disposal, less impacted soils will be segregated from those which have visual or olfactory indicators of contamination, or suspected to contain asbestos. Stockpiles will be bunded with sediment control barriers to mitigate runoff from the stockpile areas to surrounding areas.

Stockpiles will not be placed within or immediately adjacent to drainage lines, easements, footpaths, roadways or existing stormwater drains.

Stockpiles will be positioned and formed to minimise potential for stockpile erosion where possible.

10.3.4 Haulage of Soils

Soil must not be tracked off the Site as a result of vehicle, plant and equipment movements. To limit the potential for tracking of soil or sediment off-site via vehicle, plant or equipment movement, the following controls should be implemented:

- Vehicles, plant and equipment on the Site will be kept to a practical minimum;
- Vehicle, plant and equipment entry to and exit from the Site will be kept to a practical minimum; and
- Plant and equipment will be washed down before it leaves the Site.

Any vehicles carrying soil materials for off-site treatment or disposal will be covered in accordance with good industry practice, prior to leaving the Site.

10.3.5 Inspection and Maintenance

Erosion and sediment control measures will be inspected at the start of each day during remediation works and also during and immediately after periods of heavy rainfall to ensure they are in good condition.

Erosion and sediment control will be maintained, as applicable, by ensuring silt fences are upright and securely fixed, and that any sediment or residue behind the fence or barrier is removed and disposed appropriately to maintain retention capacity of the structure.

Where control measures are found to be damaged, they will be either repaired or replaced promptly.

10.4 Noise Controls

Noise producing machinery and equipment will only be operated during working hours as approved by local Council and/or NSW EPA. Australian Standard *AS2436-1981 Guide to noise control on construction, maintenance and demolition sites,* outlines guidelines for the minimisation of noise on construction and demolition sites which are to be followed at all times.

No ‘offensive noise’ as defined under the *Protection of the Environment Operations Act 1997* should be created during remediation works/activities.

Mechanical plant, equipment and the like used during remediation works/activities will use practical and reasonable noise attenuating devices and measures to minimise noise being transmitted from the Site. All equipment and machinery must be properly maintained and operated in an efficient manner to minimise the emission of noise. Plant and equipment shall be switched off or throttled to a minimum when not in use.

10.5 Odour and Dust Control

Controls to minimise dust and odour emissions from the Site may include:

- Staging excavation works to minimise the disturbance of any contaminated soil surfaces as well as minimising the size of the excavation face open at any one time;
- Use of odour neutralising or suppressant sprays. If strong odour is noticed on or off the Site, work will cease and odour sources will be covered (and treated, if necessary) until the odour dissipates; and
- Covering contaminated excavation faces and/or stockpiles with synthetic barriers or wetting down during periods of high wind.

10.6 Communication and Complaints

Where complaints are made directly to the Principal Contractor, on Site workers or sub-contractors, this will be documented on an Environmental Complaint Form and will be recorded on a complaint register. After initial recording, the Principal Contractor will forward all complaints to Ryde City Council. Where complaints are received directly by Council, this would be communicated back to the Principal Contractor via the usual communication channels (e.g. email, phone, regular site meetings etc.)

Separate incident reporting will also be completed for complaints relating to environmental issues, which may include pollution arising from the works. Monitoring and/or corrective actions will be taken as soon possible depending on the nature of the complaint and followed up on the incident report. The Principal Contractor will report to Council as soon as practical following an incident.

11.0 ROLES AND RESPONSIBILITIES

11.1 Principal Contractor

The Principal Contractor will retain overall responsibility for ensuring that the RAP is appropriately implemented. The actual implementation of the RAP will be carried out by the Remediation Contractor on behalf of the Principal Contractor. The Principal Contractor will also be responsible for acquiring or organising the acquisition of all necessary approvals and licenses for the proposed remediation works proposed.

The Principal Contractor will provide relevant information regarding Site environmental management to contractors and subcontractors working at the Site, and will ensure that they are fulfilling the responsibilities for the work.

11.2 Remediation Contractor

The Remediation Contractor is responsible for day-to-day environmental performance of the remediation works, including the implementation and maintenance of acceptable environmental controls and plans during all remediation works. The Remediation Contractor will nominate a Site Manager who will be responsible for initial response to any unexpected finds encountered during remediation works.

The Remediation Contractor will maintain records and documents produced as a result of this RAP, and will implement an inspection and maintenance program.

The Remediation Contractor may also take on the role of Principal Contractor.

11.3 Sub-Contractors

Subcontractors will be advised of required work procedures through induction, training, and meetings provided by the Principal Contractor. Maintenance of subcontractor equipment will be the responsibility of the subcontractors. The subcontractor is responsible for ensuring that all works executed by the subcontractor complies with relevant SafeWork NSW requirements, as necessary.

11.4 Environmental Consultant

The Environmental Consultant will be primarily responsible for providing guidance on the implementation of this RAP to achieve Site validation. In achieving this end, the Consultant will be responsible for:

- Supervising, overseeing and directing remediation works;
- Undertake all validation assessment work in accordance with the RAP;
- Provide advice and recommendations based on inspections and validation results;
- Undertaking assessments for the characterisation, classification and disposal of wastes;
- Providing advice on issues under the *Protection of the Environment Operations Act 1997* (NSW); and
- Undertaking all necessary monitoring activities and preparation of management plans, if required.

12.0 APPROVALS AND LICENSES

Remediation Works Consent

State Environmental Planning Policy (SEPP) No.55 – *Remediation of Land,* relates to the decision-making process in undertaking remediation activities and making planning decisions in regard to contaminated and potentially contaminated land. It is understood that the proposed remediation works are considered to be classified as 'Category 2' Remediation Works (i.e., not requiring consent) by reference to the following:

- The work is not designated development under Schedule 3 of the *Environmental Planning and Assessment Act 1979* or under a planning instrument;
- The work proposed is not on land identified as critical habitat under the *Threatened Species Conservation Act 1995*;
- Consideration of Section 5 of the *Environmental Planning and Assessment Act 1979* indicates that the remediation work is not likely to have a significant effect on threatened species, populations or ecological communities;
- The work is not proposed in a zone identified in a planning instrument as being of environmental significance; and
- The work does not require consent under another SEPP.

The notification requirements of SEPP 55 require Council to be notified 30 days before Category 2 remediation works commence.

Development Approval Conditions

The *Environmental Planning and Assessment Act 1979* provides a framework for the development of land within NSW and indicates the level of assessment required and the consent authority responsible for assessing the development. The Act also specifies planning controls according to the nature and scale of development. All remediation and validation works are required to comply with SEPP 55 and relevant conditions of the Development Application.

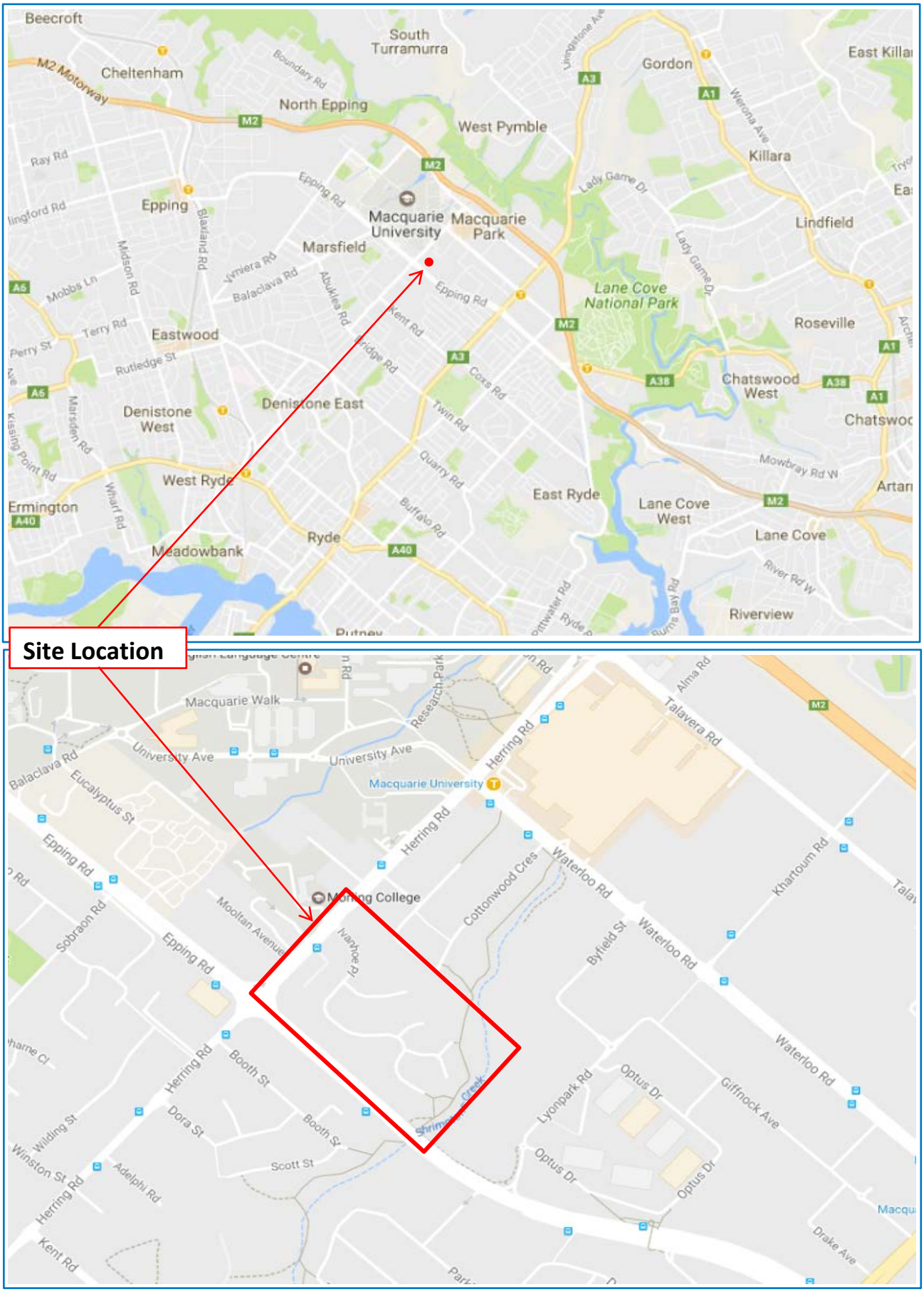
13.0 CONCLUSION

The Site can be made suitable for the intended land-use subject to appropriate remediation in accordance with this RAP and SEPP 55.

In conclusion, this RAP:

- Has been developed in a manner consistent with current industry practice;
- Has selected a preferred remediation strategy based on the site-specific issues and currently available technologies;
- Has outlined the means of validation for the completed works; and
- Has outlined options available when access to all of the Site is available.

FIGURE 1 – SITE LOCATION



DLA Environmental Services Unit 3, 38 Leighton Place Hornsby NSW 2077	**DESIGNED:** DLA **COMPILED:** SK **PROJ. No.** DL3953	**FIGURE TITLE:**	SITE LOCATION	
		PROJECT TITLE:	Ivanhoe Estate, Macquarie Park NSW	**DATE:** 02/06/2017
		CLIENT:	Frasers Property Australia	**FIGURE:** 1

FIGURE 2 – SITE LAYOUT AND REMEDIATION AREA

DLA Environmental Services
A Pacific Environment company

Compiled
AR

Legend

- Site Boundary
- TRH Exceedance Location
- Remediation Area
- No investigations have been conducted in this area

N

Approximate Scale

0m 75m 130m

Figure Title
Site Layout and Remediation Area

Project Title
Ivanhoe Estate, Macquarie Park

Client
Frasers Property Australia

Project No.	Date	Scale	Figure No.	Revision
DL 3953	7/02/2018	As Shown	1	Version 1.1

APPENDIX A – UNEXPECTED FINDS PROTOCOL

UNEXPECTED FINDS PROTOCOL (UFP) – CORNER HERRING ROAD AND EPPING ROAD, MACQUARIE PARK, NSW, 2113.

DLA Environmental Services (DLA) have produced this Unexpected Finds Protocol (UFP) for the Site identified as:

Ivanhoe Estate

Lots 6 - 17 and 18 – 20 DP 861433, Lot 1 DP 85957, Lot 100 DP 1223787 Part Lot 5 DP 740753 (the Site).

This UFP has been developed following the detection of a hydrocarbon hotspot during investigation works on Site.

Due to the history of the Site (both past and present), there is potential for residual asbestos materials and chemicals to be present in soils. These soils may require additional assessment or management. It is imperative that the potential for such material to impact Site workers and the remainder of the Site is minimised during remedial and construction works.

The Site has been historically been utilised for market gardens/agricultural activities, storage and application of herbicides/pesticides and heavy metals, uncontrolled filling, electrical transformers, with the potential of hazardous building materials from existing and former site structures. Although no evidence of contamination can be inferred following the completion of hydrocarbon hotspot removal works, it is thought prudent to implement a UFP to cover all possible potential contamination scenarios. Potential contamination on the Site which may exist outside the scope of the past environmental investigations will be managed through the following UFP.

DLA Environmental Services
Unit 3/38 Leighton Place
Hornsby NSW 2077

Level 4, 45 Watt Street
Newcastle NSW 2300

(ASX: PEH) ABN: 80 601 661 634
sydney@dlaenvironmental.com.au
Ph: +61 2 9476 1765

1.0 TYPICAL FEATURES OF 'UNEXPECTED FINDS'

The main features to look for are:

- Material containing anthropogenic artefacts such as rubble, plastics, metal etc.;
- Material with an obvious unnatural odour, i.e. fuel, solvent, burnt odour;
- Material that is noticeably stained in colour;
- Asbestos or suspected asbestos containing material;
- Material with fibres visible;
- Any material that has evidently been dumped at the Site.

2.0 IMPLEMENTATION OF THE PROTOCOL

2.1 General

Prior to the commencement of any excavation or construction works onsite, an occupational health and safety induction should be attended by all Site staff. The aim and importance of the UFP and how it is to be implemented should be discussed at this time. Responsibility for its implementation will be assigned to the Principal Contractor.

Monitoring of environmental issues will be undertaken on a daily basis. If an unexpected find is revealed during Site works, the following protocol is to be followed.

2.2 Implementation Process

1. Cease disturbance of the affected portion of the site and evacuate the immediate area.

2. Contact the Principal Contractor and the Contractors Environmental Representative (CER) and advise the Developer (Frasers Property) immediately.

3. Principal Contractor to conduct an assessment of the location and extent of the unexpected find.

4. High risk areas should be isolated and secured against unintended access.

5. Temporary encapsulation (sealing) of the high risk area to ensure no airborne spread of contamination occurs may be appropriate. This may involve clean soil, plastic sheeting, etc.

6. Dust should be prevented by wetting the soil and drainage controls should be arranged where there is a potential for runoff to occur (runoff should be minimised).

7. Warning signs should be placed in the vicinity.

8. If the Principal Contractor considers that the material warrants further investigation, the area is to be barricaded to provide an exclusion zone.

9. If necessary, environmental controls should be established to minimise the potential for migration of contaminants from the impacted area.

10. Principal Contractor to complete UFP form (refer to **Section 3.0**) and issue to all relevant stakeholders.

11. The CER will undertake further visual assessment and sample collection and analysis. If necessary, samples will be sent to a NATA registered laboratory.

12. Evaluation of analytical data with respect to specific health screening levels will be undertaken. Determination will be made if soils are suitable for the proposed land use, need to be remediated or disposed of offsite to a suitably licensed facility. If soils are suitable to remain on-site and/or the area is found to be clean, a work instruction will be provided to this effect. **A waste classification letter must be provided prior to any offsite disposal.**

13. If the material is subsequently found to contain asbestos, an appropriately licensed contractor will be employed to remove it.

14. Affected areas will be reopened for earthworks following a clearance of the location and issuance of a report by the CER

2.3 Notes

1. Any suspected asbestos containing should be left in place and not disturbed. The CER will organise appropriate environmental professionals for further investigation purposes.

2. It is essential that material of differing compositions not be mixed.

3. All sampling for validation, waste classification or characterisation purposes will be carried out in accordance with the following documents:

- *Contaminated Sites: Sampling Design Guidelines* (NSW EPA, 1995);
- *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No.1)* (NEPC, 2013);
- *Contaminated Sites: Guidelines for Assessing Service Station Sites* (NSW EPA, 1994);
- *Waste Classification Guidelines* (NSW EPA, 2014).

4. Any unexpected finds encountered should be listed on a UFP register, which should include the action taken and the status of the unexpected find. A suitable register is included in **Section 4.0**.

5. Once an unexpected find has been identified and a UFP form filled in the Principal Contractor and CER should liaise with the client as to the appropriate means of managing the situation. This should include discussions around the handling, treatment and disposal of material, OH&S considerations and how the affected area will be validated and reopened for works.

6. Prior to closing out an unexpected find it will be important to ensure the appropriate documentation is obtained, such as: photographs, the UFP form, waste classification letter(s) and a validation report or letter.

7. A UFP form should be completed on each day of the remedial works as part of the daily site records. This will ensure that the process is being undertaken even if no unexpected finds are encountered. The form should include the name, company and the position of the person undertaking the field observations.

3.0 UNEXPECTED FINDS PROTOCOL FORM

To be completed by the Site Controller/Environmental Representative

SITE: _____

PERSONNEL ON-SITE: _____

DATE: _____

DAILY SUMMARY:

1.	Suspect material encountered during daily activities: (if YES, compete 2 to 5)	YES	☐	NO	☐
2.	CER contacted:	YES	☐	NO	☐
3.	UFP Reference Number (label occurrences sequentially 1, 2, 3, etc.).	_____			

DESCRIPTION OF MATERIAL ENCOUNTERED:

4.	Asbestos or suspected ACM present:	YES	☐	NO	☐
5.	Brief written description of material:				
	☐				
6.	Material isolated:	YES	☐	NO	☐
7.	Location of contaminated material (incl. field sketch/map if required):				
8.	Photographs taken:	YES	☐	NO	☐

NAME: _____ **SIGNATURE:** _____

4.0 UNEXPECTED FINDS REGISTER

UNEXPECTED FINDS REGISTER						
UFP No.	**Date Found**	**Suspect Material**	**Description**	**Recorded on UFP Form**	**Action Taken**	**Status**
				YES ☐ NO ☐		
				YES ☐ NO ☐		
				YES ☐ NO ☐		
				YES ☐ NO ☐		
				YES ☐ NO ☐		
				YES ☐ NO ☐		