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Remediation Action Plan

Burra Park Development
Elizabeth Drive, Badgerys Creek

Prepared for
Robert Jones Development Pty Ltd

Project 86548.14
July 2023



Document History

Document details

Project No.	86548.14	Document No.	R.002.Rev0
Document title	Remediation Action Plan Burra Park Development		
Site address	Elizabeth Drive, Badgerys Creek		
Report prepared for	Robert Jones Development Pty Ltd		
File name	86548.14.R.002.Rev0		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Grant Russell	Christopher C Kline	06 July 2023

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 0	1	0	Robert Jones Development Pty Ltd; Roy Wang

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature	Date
Author 	06 July 2023
Reviewer  For CCK	06 July 2023



Douglas Partners Pty Ltd
 ABN 75 053 980 117
www.douglaspartners.com.au
 18 Waler Crescent
 Smeaton Grange NSW 2567
 Phone (02) 4647 0075

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Remediation Action Plan

Burra Park Development

Elizabeth Drive, Badgerys Creek

1. Introduction

Douglas Partners Pty Ltd (DP) has prepared this remediation action plan (RAP) for the proposed Burra Park at Elizabeth Drive, Badgerys Creek ("the site"). The RAP was commissioned by BHL Group Pty Ltd (BHL) on behalf of Robert Jones Development Pty Ltd (RJD). The site is approximately 280.5 hectares (ha) in size, as shown in Drawing 1, Appendix A. The RAP is required to support the development application made by BHL to Penrith City Council.

The following key guidelines were consulted in the preparation of this report:

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)* [NEPM] (NEPC, 2013);
- NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020);
- CRC CARE *Remediation Action Plan: Development - Guideline on Establishing Remediation Objectives* (CRC CARE, 2019a) and
- NSW Department of Planning and Environment, *Planning Guidelines, State Environmental Planning Policy (Resilience and Hazards)* 2021.

The remediation objectives, devised in accordance with CRC (2019a), are to:

- Address potentially unacceptable risks to relevant environmental values from contamination; and
- Render the site suitable, from a contamination perspective, for the proposed development.

The findings of the previous investigations relevant to the subject site (see Section 7) has established there is no evidence of widespread or significant contamination across the site. However, localised contamination in some areas of environmental concern (AECs) has been identified as remediation and/or management. These AECs requiring remediation and/or management are summarised in Table 1 (Section 8) and shown in Drawing 2, Appendix A.

This RAP is required to establish appropriate remediation objectives, strategies, methodologies, and validation processes to remediate AEC in accordance with EPA requirements.

Based on available information, it is considered that the remediation works outlined in this report constitute Category 2 Remediation in accordance with NSW DUAP/EPA *Managing Land Contamination, Planning Guidelines, SEPP 55 – Remediation of Land* (NSW DUAP/EPA, 1998). Under Clause 4.13 of *SEPP (Resilience and Hazards) 2021*, the Council should be notified of the proposed commencement of the remediation work at least 30 days before commencement.

It should be noted that this RAP does not form a detailed specification for the proposed site remediation works, but rather represents a planning document which outlines the means by which site remediation can be achieved.

2. Proposed Development

It is understood that the 280.5-hectare (ha) Burra Park site is to be developed for a mixture of land uses including transport and infrastructure corridors, employment lands and landscaped open space (refer to Figure 1).



Figure 1: Precinct Master Plan

Survey plans provided by BHL showing site boundaries are presented in Appendix B.

3. Objectives of the RAP

The main objective of the RAP is to facilitate the remediation of the site in an acceptable manner, with minimal environmental impact, to a condition suitable for the proposed development.

The specific objectives of this RAP are therefore to provide a strategy for site remediation which:

- Minimises impacts from the site on the environment and on public health and safety during site remediation;
- Maximises the protection of workers involved with site remediation;
- Renders the site safe, from an environmental perspective, for the proposed land use and substantially reduces potential exposure pathways to contaminants in accordance with remediation acceptance criteria (RAC) as define in this RAP; and
- Minimises impacts on the local environment during and following site remediation.

4. Scope of Work

The scope of the RAP has been established on the basis of the findings of the previous investigations and comprises:

- Summarise the findings of previous investigations used to inform the status of contamination and contamination risk at the site;
- Present a conceptual site model (CSM) to list potential and likely contamination source, pathway and receptor linkages to address potentially unacceptable risks to relevant environmental values from contamination;
- Define the anticipated extent of remediation;
- Assess, select and justify a preferred approach to remediation to render the site suitable for its proposed use, and which will minimise potentially unacceptable risk to human health and/or the environment and which includes the consideration of the principles of ecologically sustainable development;
- Select an appropriate remediation strategy to render the site suitable, from a contamination perspective, for the proposed development;
- Establish the RAC to be adopted for validation of remediation;
- Identify how successful implementation of the RAP will be demonstrated/validated;
- Outline waste classification, handling and tracking requirements;
- Outline environmental safeguards required to complete the remediation works;
- Include contingency plans and an unexpected finds protocol; and
- Identify the need for, and nature of, any long-term management and/or monitoring following the completion of management/remediation and, if required, provide an outline of an environmental management plan.

5. Site Description

Site Address	1953 - 2109 Elizabeth Drive, Badgerys Creek
Legal Description	Lot 1 on Deposited Plan (D.P) 1287712 (includes Stages 1 and 2)
Area	Whole site: 280.5 ha Stage 1: 74 ha Stage 2: 40.6 ha
Zoning	Primarily ENT Enterprise and ENZ Environment and Recreation along three creek lines and associated farm dams See Figure 2 below for current zoning
Local Council Area	Penrith City Council

Current Use	Grazing farm (eastern two-thirds of the site) and disused houses, sheds and other farm structures are scattered across the site. The majority of the site is grass-covered with tree growth along field perimeters and adjacent to riparian corridors.
Recent and historical land use	Recently (in 2020) a horse-riding school was situated in the remaining south-west third of the site. A portion of the site located near-centre (see Drawing 1 for location) was sub leased to a landscaping business for the purpose of the storage, processing and transportation of materials. The site was historically used primarily for rural residential and pastoral land use
Surrounding Uses	North – the remainder of Burra Park site East – rural Sydney University lands. The SUEZ Kemps Creek Resource Recovery Park and landfill (adjacent to Badgerys Creek) licenced waste facility is located approximately 1.3 km east of the site. South – Elizabeth Drive and commercial/rural residential lots within Badgerys Creek suburb West – Cosgroves and Oaky Creek, followed by commercial and rural residential properties (part of Luddenham)

The site boundary is shown in Figure 2.

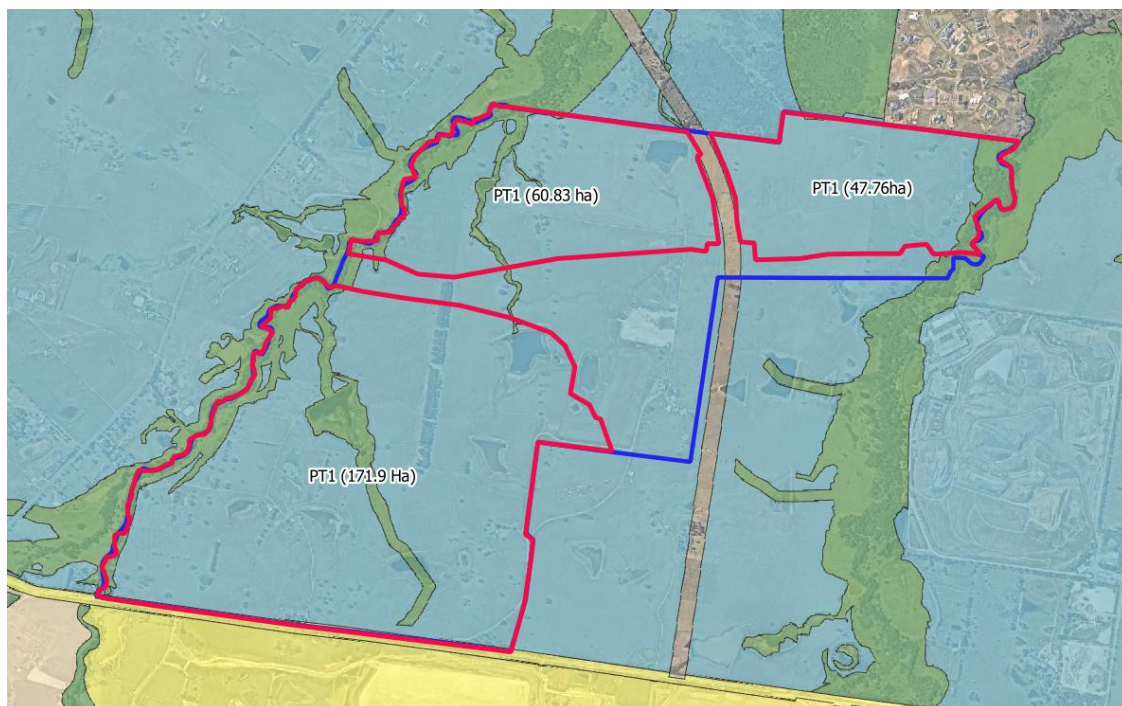


Figure 2: Current zoning including ENT (blue) and ENZ (green)

6. Environmental Setting

Regional Topography	The regional topography is generally characterised as gently undulating.
Site Topography	Gently undulating terrain with an overall relief of approximately 35 m from the highest part of the site (approx. RL 75, relative to Australian height datum – AHD) adjacent to Elizabeth Drive, to the lowest part of the site (approx. RL 40), in the north-east corner on the Badgerys Creek flood plain. Ground surface slopes within the site are typically less than five degrees. Ground surface slopes steepen considerably within the gullies, although the overall slope heights are generally less than 1 m. Topography is characterised by a central ridgeline running from the central portion of the southern boundary towards the north east. The ridge is drained by a series of minor tributaries (many of which are dammed) to either Cosgrove Creek in the north west or Badgerys Creek in the East. The local shallow groundwater system is expected to follow a similar pattern.
Soil Landscape	The site includes two soil landscape groups, including the Blacktown Soils and South Creek soil landscapes (Bannerman <i>et al</i> , 1990). The approximate soil landscape boundaries, as shown on the soil landscape maps, are shown on Figure 3, below.
Geology	The majority of the site is underlain by the Bringelly Shale Formation (refer Figure 3, below). This unit typically comprises shale, carbonaceous claystone, claystone, laminite, fine to medium-grained lithic sandstone, rare coal and tuff. Along Cosgroves Creek and Badgerys Creek the Bringelly Shale is overlain by fluvial deposits comprising fine-grained sand, silt and clay (NSW, DoM & E, 1991).
Acid Sulfate Soils	The site is not mapped within, or close to an area identified as a risk for acid sulphate soils (NSW DoE & CC, 1998).
Surface Water	Cosgroves Creek borders the site to the east, and Oaky Creek to the west
Groundwater	The unweathered shale rock unit has very low hydraulic conductivity and the few bores drilled into the unweathered shales in the Sydney area are generally dry or yielding small flows of saline groundwater, typically with total dissolved salts (TDS) contents of 10 000 mg/L to 30 000 mg/L (Old, 1942; McNally, 2004). Groundwater flow is likely to be dominated by fracture flow with resultant low yields (typically <1 L/s) in bores. A search of the NSW Department of Planning, Industry and Environment groundwater bore database undertaken by DP in July 2021 indicated that there are no registered groundwater bores on the site. Twelve ground water bores are located within 1.5 km of the site and toward the east on the SUEZ Recycling and Resource Recovery Waste Facility site. The total drill depth ranged from 17 m to 37 m depth though no groundwater information was available for the bores.

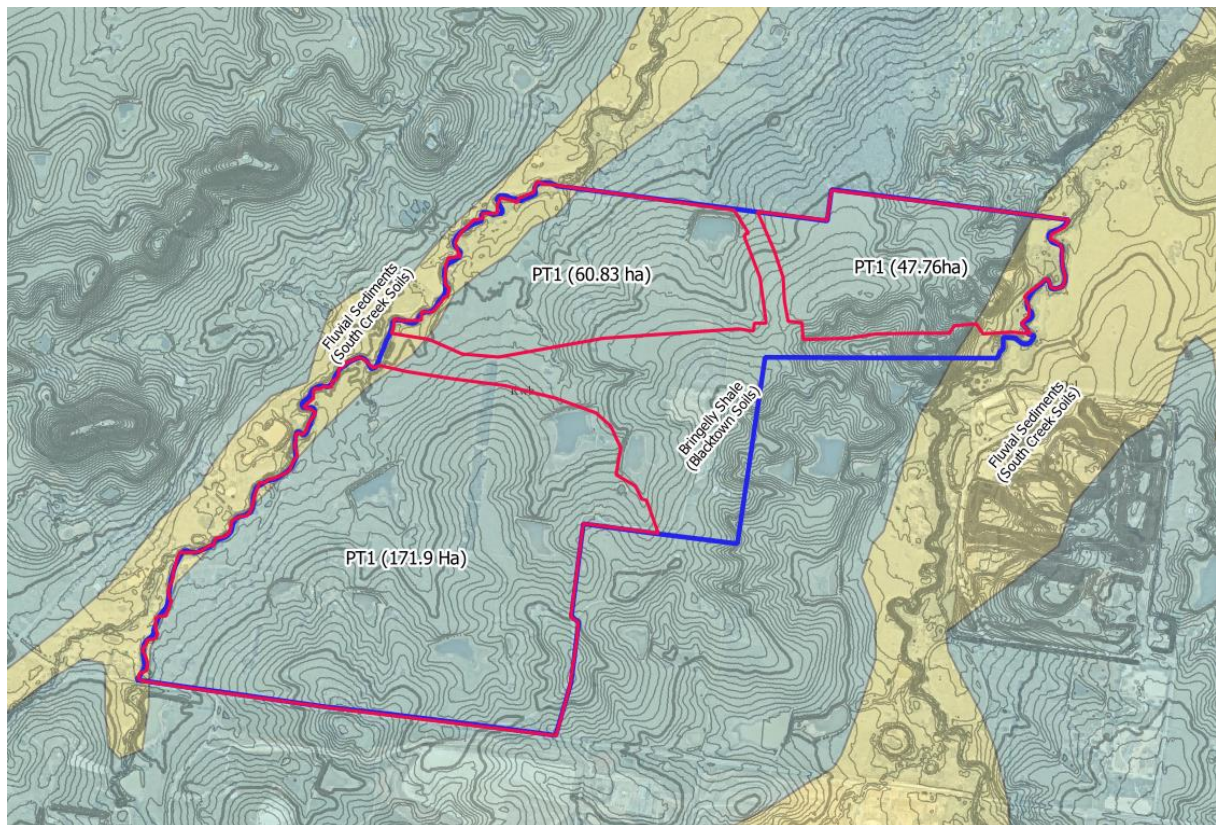


Figure 3: Geology and Soils Landscape Mapping

7. Previous Reports and Site History

The following previous reports are relevant to this RAP:

- DP Report on Soil Assessment, 1984 - 2107 Elizabeth Drive, Badgerys Creek, Project 36288, dated 16 January 2004 (DP 2004);
- EI Australia Pty Ltd (EI) Report on Preliminary Site Investigation, 1953-2109 Elizabeth Drive, Badgerys Creek, NSW, Report E23773.E.01_Rev0, dated 30 May 2018 (EI 2018).
- DP, Report on Geotechnical Land Capability Assessment, The Northern Gateway, 1953 – 2109 Elizabeth Drive, Badgerys Creek, Project 86548.00.R.001.Rev1, November 2019 (DP 2019a);
- DP, Report on Preliminary Site Investigation, The Northern Gateway, 1953 – 2109 Elizabeth Drive, Badgerys Creek, Project 86548.00.R.002.Rev1, November 2019 (DP 2019b);
- DP, Preliminary PFAS Investigation, The Northern Gateway, 1953 – 2109 Elizabeth Drive, Badgerys Creek, Project 86548.01.R.001, 27 February 2019 (DP 2019c);
- DP, Report on Sampling and Analysis Quality Plan, The Northern Gateway, 1953 – 2109 Elizabeth Drive, Badgerys Creek, NSW, Project 86548.03, Rev. 1 (DP, 2020); and
- Environmental Risk Assessors Pty Ltd (ERA), *Focused Site Remediation and Validation, 1753 – 2019 Elizabeth Drive, Badgerys Creek, NSW*, prepared for Roy & Patricia Medich Trust Fund, dated 10 July 2020.(ERA, 2020)

- DP Report on Hazardous Building Materials (HBM) Survey , The Northern Gateway, 1953 – 2109 Elizabeth Drive, Badgerys Creek, NSW, report reference 86548.07.R.001.Rev1 dated 8 December 2021 (DP, 2021 – ‘the HBM’)
- DP Report on Detail Site Investigation for Contamination, Stage 1 The Northern Gateway, 1953 – 2109 Elizabeth Drive, Badgerys Creek, NSW, report reference 86548.06.R.002.Rev2 dated 26 September 2022 (DP, 2022 – ‘the DSI’) and
- DP Report on Supplementary Contamination Investigation, The Northern Gateway, 1953 – 2109 Elizabeth Drive, Badgerys Creek, NSW, report reference 86548.14.R.001.Rev0 dated 30 June 2023 (DP, 2023 – ‘the SCI’)

Key findings of the review of relevance to this report are summarised below:

7.1 DP 2004 – Soil Assessment

The DP (2014) investigation was undertaken to evaluate the soil conditions within areas of the site which had been injected with food wastes. The scope of the assessment included the collection of three to five surface soil samples from eight paddock areas at the site and assessment of soil analytical results. Based on the results of the testing and site observations, it was considered that given the condition of the site, it would be compatible with a variety of land uses, including commercial and industrial developments. However, further investigation of hydrocarbons that were detected would be required to confirm this. It is noted that the DP (2014) investigation was undertaken prior to key guidance on per- and polyfluoroalkyl substance (PFAS) impact.

7.2 EI 2018 - Preliminary Site Investigation

The EI (2018) assessment comprised a qualitative assessment of the site from a contamination perspective. The scope of the assessment included a site inspection and site history search. The EI (2018) assessment generally concluded that the site could be made suitable for development subject to further investigations of possible localised contamination sources, including:

- A scientific animal research farm known as the McMaster Field Station operated by the CSIRO, where animal health, reproduction, parasitological and other pastoral issues were studied. From 1996 until present date the site has been used to graze cattle, and (more recently) for commercial purposes including firewood storage and mulching;
- Homesteads with associated sheds, yards and garages;
- Isolated dumping; and
- Two petroleum storage tanks were present on site, one underground (UST) and one above - ground (AST).

7.3 DP 2019b - Preliminary Site Investigation

DP (2019b) undertook a Preliminary Site Investigation (PSI) of the site to evaluate the contamination status of the site regarding its compatibility, from a contamination perspective, for the proposed mixed-use development. The scope of the PSI included a desktop review, a site walk over and limited intrusive soil sampling and analysis. Based on the desktop review, site walk over and geotechnical field observations, 73 areas were identified as Potential Areas of Environmental Concern (PAEC). Based on the findings of the limited intrusive investigation and the desktop assessment, 40 PAECs were declared Areas of Environmental Concern (AEC) which required further investigation (i.e. the DSI). The AECs generally fall within the following categories:

- Structures – i.e.: degradation and demolition of structures and leaks and spills;
- Ground disturbances/Fill;
- Asbestos pipes; and
- Other – i.e. UST, AST and wooden power poles.

7.4 DP 2019c - PFAS Investigation

DP (2019c) undertook a preliminary PFAS investigation for eight former agricultural fields which were previously injected with liquid wastes collected from food and beverage manufacturers, known as AEC 35 in DP (2019b). Based on the findings of DP (2019c), DP concluded that the likelihood for significant PFAS impact in AEC 35 excluding field 2 is low and acceptable at the time of reporting. Further assessment of PFAS in field 2 was recommended prior to the DA for the proposed subdivision or prior to bulk earthworks, with the possibility of remediation at later stages of the development. The further assessment of PFAS in field 2 was undertaken as part of this DSI.

7.5 DP 2020 - Sampling and Analysis Quality Plan

DP (2020) prepared a Sampling and Analysis Quality Plan (SAQP) for the DSI, the scope of which included a review of previous investigations, a site walk over and a data gaps assessment to establish what data is needed to assess whether or not the site is suitable for the proposed development, from a contamination assessment. The SAQP defined the number, type and locations for soil and groundwater sampling to assess the site in particular data gaps. The SAQP also presented a methodology for sample collection, preservation and storage and establish data quality objectives (DQOs) as well as quality assurance and quality control (QA/QC) procedures.

The SAQP documents the targeted sampling approach and analysis of the identified Areas of Environmental Concern (AEC) relevant to this initial RAP at the subject site as well as low density background testing for the remainder of the site.

7.6 ERA 2020 - Focused Site Remediation and Validation

The ERA (2020) report was prepared to document the findings of remediation works completed for two asbestos-impacted stockpiles located in a sub-lease portion of the site (and included in the PSI (DP, 2019b) – AEC 2) which was in active use at the time of the ERA (2020) report.

The remediation works were carried out after a waste classification report was prepared by AECOM on behalf of the EPA for 35 stockpiles located within the sub-lease area. The AECOM report was prepared in 2016 and discussed in the ERA (2020) report however it has not been sighted by DP. As discussed in the ERA (2020) report, the AECOM report established two stockpiles out of the 35 contained ACM that require remediation. The stockpiles were referenced No. 13 and No. 20 and the area of each stockpile footprint was approximately 170 m² and 150 m² respectively.

Stockpiles No. 13 and No. 20 were removed and disposed of by ERA and weighbridge dockets provided in their report show a total 505.68 tonnes of soil were disposed of. The stockpiles were removed and the footprints of the stockpiles after removal comprised 'virgin natural ground'. ERA collected eight validation samples from the stockpile footprints after removal of the stockpiles and analysed the samples for asbestos and no asbestos was reported.

7.7 DP 2021a - Hazardous Building Materials (HBM) Survey

The purpose of HBM (2021) survey was to assess the on-site buildings for potential hazardous building material existing within the subject site from a management perspective, and not for the purpose of pre-demolition.

The HBM survey comprised a walkthrough visual inspection of safely accessible areas to assess the location, extent, and condition of the following HBM:

- Asbestos containing materials (ACM);
- Lead paint;
- Lead dust in ceiling cavities and other selected locations;
- Synthetic mineral fibre (SMF) insulation; and
- Polychlorinated biphenyls (PCBs) in fluorescent light fittings

DP identified the following, based on the review of the survey

The HBM survey have identified hazardous materials in several structures within the subject site as follows:

- *Building 2* presented elevated lead dust concentration (≥ 0.5 mg/m²)
- *Building 11* contains Lead in interior and exterior paint(s), contains Non Friable Asbestos in interior walls and exterior eaves sheeting and SMF was detected through the ceiling cavity.
- *Building 23a* – the exterior is suspected to have asbestos containing material.
- *Building HS* contains Non Friable Asbestos in interior ceiling and walls sheeting. Lead was also detected in exterior and exterior paint from the building, and it presented elevated lead dust concentration (≥ 0.5 mg/m²); and
- *Building GS* contains lead in interior and exterior paint(s), elevated lead dust concentration (≥ 0.5 mg/m²) and SMF was detected through the ceiling cavity.

7.8 DP 2022 - Detail Site Investigation for Contamination

The scope of this DSI included a review of the SAQP, a detailed site walk over of AECs and an intrusive investigation including test pits in AECs and across the remainder (background) of the site relevant to the subject site, surface samples from near timber power poles, soil gas, soil vapour and groundwater sampling and analysis.

Soil, ground gas, soil vapour and groundwater analytical results were assessed against SAC and reviewed alongside observations made in the detailed site walk over. The findings of the DSI established there was evidence of widespread or significant contamination across the site. Localised contamination in some AECs was observed as requiring further investigation, delineation and/or remediation.

These AECs relevant to the subject site requiring further works are summarised below:

- Background areas – localised metal exceedances in surface soils in Pits 408 and 463 requiring further assessment.
- AEC 19 – ACM impact on the ground surface, a targeted investigation (double density, with reference to NSW EPA 1995 guidelines) should be undertaken to ascertain the extent of asbestos impact here. Where observed, ACM fragments on the surface should be removed by hand and the process documented in a RAP.
- AEC 22 – ACM was recorded in Pit 581. Further investigation of the areas is proposed to determine the ACM content (w/w%) and whether further remediation is required.
- AEC 26 – Crushed glass stockpiles impacted with lead should be removed and disposed of and the stockpile footprint validated. Further investigation is recommended to determine the potential leaching hazards associated with solid waste

ACM recorded in Pits 599 and 604 and in laboratory analysis for Pit 602, on AEC26. Further investigation of the areas is proposed to determine the ACM content (w/w%) and whether further remediation is required.

ACM pipes loose on the site surface should also be disposed of.

- AEC 30 – A SMF pipe is present here which should be removed and disposed of and the underlying site surface validated.
- AEC 31 – ACM pipes loose above ground should be removed and disposed of. There is the potential that ACM pipes are still present below ground in this area. The UXF protocol should be consulted if these are encountered during development works.
- AEC 35 – PFAS impacted soils are known to be present in near-surface soils here which could potentially be reused in commercial/industrial portions of the site, below hard standing or alternatively subject to remediation. However, additional investigations were required to better define the extent of PFAS impact here, including delineating known PFAs impacted soils at three pits (514, 515 and 522).

- AEC 36 – Several exceedances of metals, TRH, benzo(a)pyrene, total PAHs, total PCBs and asbestos were observed in surface samples around several power poles. The number of exceedances observed in this DSI indicate additional investigations of all power poles will be required around power poles at the site to establish and further define which are suitable to be retained on site and which will require remediation. A targeted investigation of 10 power poles would also be required and it will include step-out samples around the power poles.
- ACM Pipe network – an ACM pipe network has been sighted in several AECs (AEC 15, 16, 21 and 32). ACM pipe network to be removed, chased out and validated. Where observed, ACM fragments on the surface should be removed by hand.
- Service pits are known to contain asbestos and have been sighted at the site. If required to be decommissioned this should be undertaken in a manner that prevents damage. If service pits are damaged either in their existing condition or in the removal process, remediation and targeted validation will be required.
- Building footprints – Structures are known to be present at the site that contain hazardous materials. As well as following the recommendations of the HAZMAT, the footprints should be inspected by an Environmental Consultant after demolition for residual building materials and filling below the footprint. If filling is present, a targeted building footprint investigation should be undertaken.
- Septic tanks are present at the site that will require removal at some state to facilitate the proposed development. Inspection of the excavation after removal and, if required, targeted sampling for pathogens and metals should be undertaken by a suitably qualified Environmental Consultant.

Based on the results, the DSI considered that the site is suitable for rezoning and development from a contamination perspective subject to the above additional investigations and/or remediation works being undertaken prior to subdivision.

7.9 DP 2023 - Supplementary Contamination Investigation

The SCI was required to further investigate the AEC identified by the DSI and associated contaminants of potential concern (CoPC) relevant to subject site to determine the vertical and lateral extent of the contamination issues and/or whether remediation is required.

SCI fieldwork was completed at the site on 14 to 20 December 2022 and 7 to 9 February 2023 to assess the AEC identified as requiring further investigation and included targeted test pitting, trenching and drilling completed across the site during this SCI and collection of soil samples for laboratory analysis of the associated CoPC.

The results of SCI identified several AEC (as described in Table 1) at the site as requiring risk management and/or remediation. The identified AEC are considered typical of other rural properties in the area and are generally considered relatively localised, limited in extent and not representative of widespread gross contamination of the site. All identified of the identified AEC are readily amenable to clean-up through conventional remediation approaches.

Based on the results of the SCI, it was considered that the site can be made suitable for the proposed commercial/industrial development subject to implementation of the recommendations in Table 1.

8. Contamination Summary

The previous investigations at the site have identified the following AEC relevant as shown in the below Table 1 (and as presented on Drawing 2, Appendix A) as requiring remediation and/or management for the site to be suitable for the proposed land use.

Table 1: Summary of AECs Requiring Remediation and/or Management.

Location of Impact	Source	Risk Management Action / Remediation Action Required
AEC 19 (Drawing 3)	Filling/ACM impact on the ground surface – asbestos	DSI (2022)¹ identified ACM impact on the ground surface in the vicinity of pit 591. SCI (2023)² included a targeted investigation of the area which identified that the fill in the vicinity of pit 591 was considered suitable from a contamination perspective to remain onsite however minor remediation will be required to ensure no visible asbestos remains in surface soils in the vicinity of pit 591. The SCI sampling locations and the approximate extent of impact to surface soils in AEC19 as requiring remediation are presented on Drawing 3, Appendix A.
AEC 22 (Drawing 4)	Filling/ACM impact on the ground surface – asbestos	DSI DP (2022) identified ACM recorded in Pit 581. SCI (2023) included a targeted investigation of the area which identified that the fill in the vicinity of pit 581 was considered suitable from a contamination perspective to remain onsite however minor remediation will be required to ensure no visible asbestos remains in surface soils in the vicinity of pit 581. The SCI sampling locations and the approximate extent of impact to surface soils in AEC22 as requiring remediation are presented on Drawing 4, Appendix A.
AEC 26 (Drawings 5 and 6)	Stockpiles – lead impact from crushed glass	DSI DP (2022) identified lead in fill from a crushed glass stockpile (Pit 594) exceeds both human health and ecological criteria. SCI (2023) identified that the lead within the glass stockpiles was leachable. The glass stockpiles will either require remediation/management or further site-specific risk assessment to determine suitability for a specific proposed use onsite. The approximate extent of glass stockpiles is presented on Drawing 5, Appendix A.
	ACM pipes – asbestos	Loose and recycled ACM pipes present here should be removed and the underlying site surface validated. DSI DP (2022) identified ACM recorded in Pits 599 and 604 and in laboratory analysis for Pit 602, on AEC26.

¹ DP Report on Detail Site Investigation for Contamination, Stage 1 The Northern Gateway, 1953 – 2109 Elizabeth Drive, Badgerys Creek, NSW, report reference 86548.06.R.002.Rev1 dated 8 December 2021 (DP, 2021 – ‘the DSI’)

² DP Report on Supplementary Contamination Investigation, The Northern Gateway, 1953 – 2109 Elizabeth Drive, Badgerys Creek, NSW, report reference 86548.14.R.001.Rev0 dated 30 June 2023 (DP, 2023 – ‘the SCI’)

Location of Impact	Source	Risk Management Action / Remediation Action Required
		SCI (2023) identified an exceedance of ACM above the commercial/industrial SAC, in the soil within the stockpile at 602. The stockpile at 602 will require remediation for AEC26 and the site to be considered suitable for the proposed land use. Whilst the fill in the vicinity of pit 604 and FM-2 is considered suitable from a contamination perspective to remain onsite as part of the commercial/industrial portion of the developments, minor remediation will be required to ensure no visible asbestos remains in surface soils in the vicinity of pit TP604 and FM-2. Given that public open space criterion was exceeded by a sample collected from TP604 this soil is considered unsuitable be used in any public open space portions of site where soils are likely to be accessible. The SCI sampling locations and the approximate extent of soils within AEC26 as requiring remediation are presented on Drawing 6, Appendix A.
AEC 30	SMF pipe – SMF (irritant of the airway, possibly carcinogenic)	A SMF analysis confirmed SMF is present here which should be removed and disposed and the underlying site surface validated.
AEC 31	ACM pipes – asbestos	Loose ACM pipes should be removed and disposed of. There is the potential that ACM pipes are still present below ground in this area. The UXF protocol should be consulted if these are encountered during development works.
AEC 36	Timber Power Poles	DSI DP (2022) identified fill impacted soils with concentrations of TRH, benzo(a)pyrene, total PAHs and total PCBs and exceeding the HILs, ESLs and management limits at a number of timber power pole locations. SCI (2023) results of power pole delineation sampling (at power poles PP6, PP10, PP32, PP35, PP42, PP44, PP48, PP50, PP55 and PP71) generally identified the lateral extents of surface topsoil, as requiring remediation, to be limited to within 1 m (north, south, east and west) of each of the power poles across an approximate area of 4 m² to a vertical depth of approximately 0.3 m bgl. The vertical extent of impact to topsoils at power poles PP32 and PP44 can be confirmed with validation sampling at the time of remediation. The extent of impact to underlying clays can be confirmed at the time of remediation. Remediation will also be required of soil in the vicinity of power poles PP1, PP12, PP33, PP36, PP40, PP46, PP47, PP49, PP62, PP63, PP64, PP65, PP66, PP67, PP71. The lateral and vertical extents of impacted soil requiring remediation are expected to be similar to the delineation power poles however the extents can be confirmed with validation sampling at the time of remediation. Power pole locations are presented on Drawing 2, Appendix A.

Location of Impact	Source	Risk Management Action / Remediation Action Required
AEC 15, 16, 21, 32	ACM pipe network – asbestos	ACM pipes loose above ground should be removed and disposed of. The process of remediation and validation should be documented in the RAP.
General (whole site)	Septic tanks	Septic tanks are present at the site that will require removal at some state to facilitate the proposed development. Inspection of the excavation after removal and, if required, targeted sampling for pathogens and metals should be undertaken by a suitably qualified Environmental Consultant. Removal of septic tanks should be completed with reference to the NSW Government Department of Health Advisory Note 3 Destruction – Revised January 2017, <i>Removal and Re-use of Septic Tanks, Collection Wells, Aerated Wastewater Treatment Systems (AWTS) and other Sewage Management Facilities (SMF)</i>
	Building footprints -	Structures are known to be present at the site that contain hazardous materials.
	heavy metals, TRH, BTEX, OCP, OPP, PCB, PAH, phenols and asbestos	SCI (2023) results identified that no remediation works are warranted for soils in the vicinity of the onsite buildings in their current state. As well as following the recommendations of the HAZMAT ¹ , the footprints should be inspected by an Environmental Consultant after demolition for residual building materials and filling below the footprint. If filling is present, a targeted building footprint investigation should be undertaken.

¹: Hazardous materials building assessment reported under separate cover (reference 86548.07).

9. Conceptual Site Model

A conceptual site model (CSM) is a representation of the site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors (linkages). The CSM provides a framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or the future i.e. it enables an assessment of the potential source-pathway-receptor linkages.

A CSM was documented in the SAQP (DP, 2020), the DSI (DP, 2021) and updated during the SCI (DP, 2023). The data collected for this SCI confirmed that certain potential contaminant sources pose a potentially complete pathway to the identified receptor(s) whilst others do not. No other sources of contamination have been identified as a result of the testing results.

The CSM has therefore been updated from the findings of the SCI relevant to the subject site refer to Table below.

Table 2: Updated Summary of Potentially Complete Exposure Pathways (Proposed Land Use)

Source	Transport Pathway	Receptor	Remediation Action Required
AEC 19			
Filling/ACM impact on the ground surface – asbestos	Inhalation of dust	Future site users Adjacent land users	Whilst the fill in the vicinity of pit 591 is considered suitable from a contamination perspective to remain onsite, minor remediation will be required to ensure no visible asbestos remains in surface soils in the vicinity of pit 591.
AEC 22			
Filling/ACM impact on the ground surface – asbestos	Inhalation of dust	Future site users Adjacent land users	Whilst the fill in the vicinity of pit 581 is considered suitable from a contamination perspective to remain onsite, minor remediation will be required to ensure no visible asbestos remains in surface soils in the vicinity of pit 581.
AEC 26			
Stockpiles – lead impact from crushed glass	Direct contact of contaminated ground, ingestion and dermal contact with soil or water, inhalation of dust, leaching of contaminants and vertical migration into groundwater, lateral migration of groundwater.	Future site users Ecological receptors	Given that lead within the glass stockpiles has been identified as leachable and that concentrations of lead were identified during the DSI at levels exceeding commercial industrial health investigation levels (HILs) the glass stockpiles will either require remediation / management or further site-specific risk assessment to determine suitability for a specific proposed use onsite.
ACM pipes – asbestos	Inhalation of dust	Future site users Adjacent land users	Loose and recycled ACM pipes present here should be removed and the underlying site surface validated. Given the exceedance of ACM identified within stockpile 602 above the commercial / industrial SAC, the soil within the stockpile at 602 will require remediation for AEC26 and the site to be considered suitable for the proposed land use. Whilst the fill in the vicinity of pit 604 and FM-2 is considered suitable from a contamination perspective to remain onsite as part of the commercial/industrial portion of the developments, minor remediation will be required to ensure no visible asbestos remains in surface soils in the vicinity of pit TP604 and FM-2. Given that public open space criterion was exceeded by a sample collected from TP604 this soil is

Source	Transport Pathway	Receptor	Remediation Action Required
			considered unsuitable be used in any public open space portions of site where soils are likely to be accessible. The process of remediation and validation of soil in the vicinity of the stockpile at 602, pit 604 and FM-2 should be documented in the RAP.
AEC 30			
SMF pipe – SMF (irritant of the airway, possibly carcinogenic)	Inhalation of dust	Future site users Adjacent land users	The SMF pipe should be removed and the underlying site surface validated.
AEC 31			
ACM pipes – asbestos	Inhalation of dust	Future site users Adjacent land users	Loose ACM pipes should be removed and disposed of. There is the potential that ACM pipes are still present below ground in this area. The UXF protocol should be consulted if these are encountered during development works.
AEC 36			
Timber treatment and PCBs in transmission box(es): Metal, TRH, benzo(a)pyrene, total PAHs, total PCBs.	Direct contact of contaminated ground, ingestion and dermal contact with soil or water, inhalation of dust, leaching of contaminants and vertical migration into groundwater, lateral migration of groundwater.	Future site users Ecological receptors	The results of power pole delineation sampling (at power poles PP6, PP10, PP32, PP35, PP42, PP44, PP48, PP50, PP55 and PP71) generally identified the lateral extents of surface topsoil, as requiring remediation, to be limited to within 1 m (north, south, east and west) of each of the power poles across an approximate area of 4 m² to a vertical depth of approximately 0.3 m bgl. The vertical extent of impact to topsoils at power poles PP32 and PP44 can be confirmed with validation sampling at the time of remediation. The extent of impact to underlying clays can be confirmed at the time of remediation. Remediation will also be required of soil in the vicinity of power poles PP1, PP12, PP33, PP36, PP40, PP46, PP47, PP49, PP62, PP63, PP64, PP65, PP66, PP67, PP71. The lateral and vertical extents of impacted soil requiring remediation are expected to be similar to the delineation power poles however the extents can be confirmed with validation sampling at the time of remediation. The process of remediation and validation of soil in the vicinity of power poles requiring remediation should be documented in the RAP.

Source	Transport Pathway	Receptor	Remediation Action Required
AEC 15, 16, 21, 32			
ACM pipe network – asbestos	Inhalation of dust	Future site users Adjacent land users	ACM pipe network to be removed, chased out and validated. Where observed, ACM fragments on the surface should be removed by hand. There is the potential that an ACM pipe network not observed in the previous investigations is present at the site.
General (whole site)			
Building footprints - heavy metals, TRH, BTEX, OCP, OPP, PCB, PAH, phenols and asbestos	Inhalation of dust	Future site users Adjacent land users	Structures are known to be present at the site that contain hazardous materials. As well as following the recommendations of the HAZMAT ¹ , the footprints should be inspected by an Environmental Consultant after demolition for residual building materials and filling below the footprint. If filling is present, a targeted building footprint investigation should be undertaken.

¹: Hazardous materials building assessment reported under separate cover (reference 86548.07).

10. Remediation Goal

The goal/objective of the remediation programme is to render the site suitable for the proposed development.

11. Remediation Extent

The approximate extent of Remediation areas of identified AEC as part of previous investigations are shown in Drawings 2 to 6, Appendix A.

The actual extent (the final remediation extents) will be established at the completion of the remedial excavations or other remedial works completed within the AEC at the time of remediation.

12. Roles and Responsibilities

To achieve the objective remediation programme (refer to Section 15), the following roles and responsibilities have been identified:

The Developer

- Overall responsibility of the implementation of the RAP;
- Overall development project management;
- Safety of overall development project;
- Engage a suitably qualified Principal Contractor and Environmental Consultant;
- Final approval for the import of any contractor-nominated materials;
- Liaison with the Regulator (Council), Principal Contractor and Environmental Consultant during the remediation process; and
- Submission of validation report(s) to Penrith City Council (consent authority).

Principal Contractor (who must have appropriate experience in the remediation and management of contaminated sites)

- Overall earthworks and civil construction project management including material tracking procedures;
- Overall remediation project management;
- Ensure and manage safety of all personnel on site;
- Ensure appropriate health and safety plans are prepared prior to the works being undertaken;
- Ensure necessary approvals and notifications have been obtained prior to remedial works commencing and waste removal;
- Ensure that any asbestos remediation works must be undertaken by an appropriately licensed asbestos contractor and in accordance with *Work Health and Safety Regulation NSW 2011* and any other applicable Safe Work NSW or Safe Work Australia regulations or guidelines;
- Engage a surveyor to conduct surveys of the resultant remediation footprints; and
- Liaise with the Developer and Environmental Consultant during the remediation process.

Asbestos Contractor (can be the same entity as the Principal Contractor)

- Will be a suitably licensed and qualified contractor (AS A or AS B Licence holder); and
- Will be responsible for the handling / removal of the asbestos-cement fragments or any other ACM which would be classified as asbestos works.

Environmental Consultant

- Full time remediation supervision when required;
- Periodic inspections during remediation works;
- Preparation of amendments or variations to the RAP (if required);
- Undertake airborne asbestos monitoring (as required);
- Attendance following encountering unexpected finds and provision of advice;
- Sampling for waste classification of any materials requiring off-site disposal;
- Preparation of waste classification documentation;
- Validation sampling of remediation areas and assessment of laboratory reports;
- Review of documentation associated with any proposed imported materials;

- Approval for the import of any contractor nominated materials; and
- Provision of a site remediation and validation report with conclusions regarding overall site suitability.

Occupational Hygienist (can be the same entity as the Environmental Consultant)

- Should be suitably qualified/licenced in accordance with the WHS Regulations 2011
- Prepare any WHS plans and advice requested by the Contractor;
- Undertake airborne asbestos monitoring (as required);
- Undertake visual clearance inspections;
- Provide advice and recommendations arising from monitoring and/or inspections;
- Notify their client (either Principal Contractor or the Developer) with the results of any assessments and any observed non-conformances in a timely manner; and
- Issue clearance certification.

Prior to the commencement of remediation works, a site meeting between the Developer, the Principal Contractor and Environmental Consultant is recommended to confirm responsibilities and procedures in accordance with the agreed management plan.

13. Remediation Options Assessment

The objective of the remediation options assessment and evaluation is to establish a preferred remediation strategy. The process involves canvassing various remedial options which may be viable and then ranking each option based on a number of evaluation criteria. The remediation options assessment was undertaken with reference to CRC CARE *Remediation Action Plan: Development - Guideline on Performing Remediation Options Assessment* (CRC CARE, 2019b).

The remediation options assessment and evaluation is included in Appendix C.

14. Remediation Acceptance Criteria

The proposed development of the site is for primarily for commercial/industrial land use. The following investigation/screening levels for the land use, commercial/industrial (ASC NEPM), have been considered for the Remediation Acceptance Criteria (RAC) for the primary CoPC associated with the identified AEC.

Table 3: Remediation Acceptance Criteria for Asbestos in Soil (Applicable to AECs 19, 22, 26, 31 and other areas of the site where asbestos is identified)

Contaminant	RAC	Rationale
Asbestos	<u>500 ml Sample:</u> 0.05% w/w of asbestos in soil with bonded ACM generally comprising 15% asbestos; 0.001% w/w FA and AF; and - No visible asbestos on the ground surface. <u>50 g Sample:</u> - The presence or absence of asbestos at a limit of reporting of 0.1 g/kg	<u>500 ml Sample</u> NEPC (2013) defines the various terminology for asbestos: Bonded ACM: Asbestos containing material which is in sound condition, bound in a matrix of cement or resin, and cannot pass a 7 mm x 7 mm sieve. FA: Fibrous asbestos material including severely weathered cement sheet, insulation products and woven asbestos material. This material is typically un-bonded or was previously bonded and is now significantly degraded and crumbling. AF: Asbestos fines including free fibres, small fibre bundles and also small fragments of bonded ACM that pass through a 7 mm x 7 mm sieve. Given that the proposed land use is commercial/industrial, the 'Commercial/Industrial D' Asbestos Health Screening Levels (in accordance with Table 7, Schedule B1 of NEPC 2013) have been adopted. <u>50 g Sample</u> The presence or absence of asbestos at a limit of reporting of 0.1 g/kg has been adopted as the RAC for confirmation of footprints scraped to natural material

Table 4: – RAC for Power Pole (AEC36) Related CoPC

Contaminants		ASC NEPM HIL and HSL (Commercial/Industrial D)	NEPC (2013) Management Limit (Residential)	NEPC (2013) EIL or ESL (Commercial/Industrial) *	Adopted RAC
PAH	Benzo(a)pyrene	-	-	1.4 (172)*	1.4 (172)*
	Benzo(a)pyrene TEQ ¹	40	-	-	40
	Total PAH	4,000	-	-	4000
	Naphthalene	-	-	370	100
TRH	F1 (C ₆ – C ₁₀)	310	700	215	215
	F2 (C ₁₀ – C ₁₆)	NL	1000	170	170
	F3 (C ₁₆ – C ₃₄)	-	5000	2500	2500
	F4 (C ₃₄ – C ₄₀)	-	10000	6600	6600
PCB	PCB	7			7

¹ Sum of carcinogenic PAH

*high reliability ecological guideline of 172 mg/kg (95% confidence) for Commercial / Industrial as presented in the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC Care, 2017) Technical Report No. 39 - *Risk-based Management and Remediation Guidance for Benzo(a) pyrene*

For other CoPC and if any additional area(s) of contamination are encountered during the course of the remediation and/or site redevelopment other CoPC will be assessed using the SAC in Appendix D. The SAC are the same as the Tier 1 SAC adopted for the SCI (April 2023). This is on the provision that other considerations such as risks to groundwater are also taken into account. The broader list of contaminants and their SAC are included in Appendix D.

In the absence of RAC, the SAC should also be used as part of the assessment framework for imported soils (i.e. contaminant concentrations in imported soils must, as a minimum, comply with the SAC).

15. Remediation Strategies

Based on the results of the previous investigations completed as per Sections 7 and 8, any remediation is to be completed as per the most appropriate remediation strategy, determined by the Environmental Consultant and RJD. It is noted that one of, or a mix of, the remediation strategies may be utilised to achieve the desired outcomes (i.e. the suitability of the site for the proposed development).

It is noted that this RAP does not form a detailed specification for the proposed site remediation or construction works. As such, this report does not include estimation of the volume of material requiring handling and management at the site.

The detailed procedures and sequence for the remediation work will rest with the contractor and will depend upon the equipment to be used and the overall sequence of the remediation or development and also any residual impact resulting from the demolition of the buildings. It is the contractor's responsibility to devise a safe work method statement and to implement proper controls that enable the personnel undertaking the remediation, earthworks and construction works in a safe environment.

This RAP does not relieve the contractor(s) of their ultimate responsibility for occupational health and safety of their workforce and to prevent contamination of areas outside the immediate workspace.

This RAP sets out the minimum standards and guidelines for remediation that will need to be used in preparing a method statement.

Prior to the implementation of remediation, the site is to be established in accordance with all NSW legislative requirements.

Remediation and earthworks involving asbestos must be undertaken by an appropriately licensed asbestos remediation contractor, and in accordance with *Work Health and Safety Regulation NSW 2011* and any other appropriate SafeWork NSW regulations or Safe Work Australia guidelines. As per SafeWork NSW requirements, the licensed asbestos remediation contractor must give written notice to SafeWork NSW at least five days before remediation work commences.

For all works requiring a Class B asbestos removal license it is recommended that air quality monitoring for airborne asbestos fibres should be conducted on a daily basis when works involving the excavation and transport of ACM and potential asbestos impacted soils are being conducted within the site. Air quality monitoring must be undertaken by a licenced asbestos assessor for all works requiring a Class A asbestos removal license

15.1 Site Establishment

Prior to the implementation of remediation, the site is to be established in accordance with all NSW legislative requirements.

While not a requirement for Class B asbestos removal, it is recommended that air quality monitoring for airborne asbestos fibres using the Membrane Filter Method in accordance with the *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres* (NOHSC: 3003, April 2005) is undertaken prior to commencement of works (baseline) and on a daily basis when works involving the excavation, transport or stockpiling of asbestos impacted and potentially impacted soils/materials are being conducted within the site. If friable asbestos is recorded during the remediation works, air quality monitoring will be required to be carried out by a suitably licensed asbestos assessor.

In the event of detections of airborne asbestos fibres during the works, the Principal Contractor should make appropriate modifications to works methods, as required.

15.2 Remediation Supervision and Periodic Site Inspections

DP recommends that the remediation works should be undertaken under the full-time presence of an Environmental Consultant to reduce the potential for over excavation, the mixing of contaminated materials and the mixing of the various waste streams (e.g. General Solid Waste and Special Waste - Asbestos).

The Environmental Consultant will conduct regular periodic site inspections during remediation works, when any issues of concerns are identified and to facilitate inspection of the remediation progress. A record of the inspections, observations and remediation actions will be provided as part of the site remediation and validation report. This will include a photographic record of key moments.

15.3 On-site Treatment of Asbestos (ACM) in Surface Soils (such as AEC19, AEC22 and portions of AEC26, excluding stockpile at 602)

In AEC (such as AEC19, AEC22 and most of AEC26, with the exception the soil in stockpile at 602) where low concentrations of ACM have been or are encountered within surface soils (to maximum depths of 10 cm), treatment of the surface soils/filling may be adopted, and remediation should be conducted as follows:

1. The Environmental Consultant is to undertake air monitoring during the works.
2. Given that ACM is considered likely localised to the ground surface, the licensed asbestos contractor should hand-pick ACM from surface soils at the identified AEC locations. A thorough 1 m grid-based inspection should be undertaken to collect ACM.
3. The licensed asbestos contractor should mechanically rake/turn the surface at each AEC location, excavate the surface soil (topsoil), any fill and aggregate. Clods of clay must be broken down/crushed as part of the spreading process. Each raking event should be recorded, which will specify the date, time, location, volume of material being treated, description of the soil, number of passes, number of asbestos finds per pass, and photographed.
4. The raked surface should be re-inspected on a 1 m-grid based transect with any visible ACM hand-picked.
5. Steps 2 and 3 are to be repeated until no ACM is observed during three consecutive inspections by the Environmental Consultant.
6. Double bag bonded ACM fragments for temporary storage whilst on site in a secure designated area awaiting off-site disposal.
7. Following removal of the surface materials, the site surface will be validated by the environmental consultant as per Section 16.4.

15.4 On-site Treatment of Asbestos (ACM) – (ACM at high concentrations such as the stockpile at 602 within AEC26)

Where ACM has been identified at high concentrations exceeding landuse criteria such as portions of AEC26 (the stockpile at 602 as shown on Drawing 6), and if large volumes of bonded ACM impacted soil are identified during remediation and validation works, the following remediation procedure should be considered:

1. Dedication of a stockpiling area(s) and asbestos treatment area(s) (ATA), as required, within the site;
2. Excavation of impacted fill under the full-time monitoring of the environmental consultant. Full time monitoring by the environmental consultant may be required to assess the actual extent of the fill, and to segregate material with high concentrations of ACM;
3. Following removal of the ACM impacted soil, the site surfaces will be validated by the environmental consultant as per Section 16.5.
4. Excavation, transport and stockpiling of fill in approximate 10 m³ batches within the ATA;
5. Completion of a basic screen to remove oversized (>150 mm diameter) anthropogenic materials;
6. The material is to be spread out in a layer no thicker than 0.1 m and clods of clay manually broken down;
7. Layers are to be inspected by the asbestos contractor by walking a team on a 1 m transect grid. Observed ACM will be removed by hand, double bagged and stored on site in the secure designated ACM storage area;
8. Following the inspection, material in the ATA is to be re-worked, re-layered and re-inspected with removal of observed ACM. Re-inspections are to be made along the transect grid with a 90° direction change to the previous inspection;
9. The above three steps will be repeated until no ACM is observed during three consecutive inspections;
10. Each inspection will be documented by the environmental consultant with information including stockpile ID, date and time, number of passes and number of asbestos finds per pass.

Following treatment, fill should be placed as individual approximate 10 m³ stockpiles. Treated fill must be validated in accordance with Section 16.6, prior to onsite reuse in deep fill areas of the site. Following treatment and successful validation, treated fill must be covered with at least 0.5 m of suitably validated imported or site won fill. A survey of the placement area must be completed showing the lateral extent of the area, the top of the treated soil and the final design surface.

15.5 Excavation and Off-site Removal (Suitable for Glass Stockpile in AEC26 if Site Specific Risk Assessment Deems Unsuitable for Use Onsite or other COPC).

Excavation and off-site disposal is considered suitable for AEC where COPC have been identified at concentrations exceeding the land use criteria. This applies to the glass stockpile impacted with lead in AEC26 (in the event further site-specific risk assessment deems the material not suitable to remain onsite) or other AEC where COPC have been identified at concentration exceeding landuse criteria and found not suitable to remain onsite.

The remediation of impacted fill should be conducted as follows:

- Preparation of a waste classification report by the appointed Environmental Consultant to facilitate appropriate off-site disposal of the following identified issues to a licensed facility (the results obtained in DP [2022] and DP [2023] may be used to supplementary any waste classification):
- Undertake air monitoring during the works (Environmental Consultant), if asbestos related remediation, refer to Section 15;

- Excavation of impacted fill under the supervision of the Environmental Consultant. Excavation should progress to 0.1 m into the underlying natural soils;
- Disposal to a waste facility licensed to receive the waste;
- Validation inspection and sampling of the resultant remediation footprint as per Section 16.4 (for asbestos) or Section 16.7 (for other COPC such as the lead impact to the glass stockpile in AEC26);
- If a validation sample exceeds the RAC provided in Section 14, chase out the impacted soil as considered appropriate. Re-sample the resulting excavation and re-excavate as required until the RAC are met.
- Once the remediation areas / excavations have been successfully validated, survey the full extent of the remediation area or excavation and produce survey drawings showing the depth and extent of the remediation; and
- Disposal dockets for all material removed from the site are to be provided to the Environmental Consultant for inclusion in the validation report.

15.6 Buried ACM Pipe and SMF Pipe Remediation (AECs 15, 16, 21, 26, 30, 31 and 32)

The remediation of the buried ACM pipes (identified in AECs 15, 16, 21, 26, 31 and 32) and SMF pipes (AEC30) and associated soils (i.e. soils in direct contact with the pipe) is to be completed as per below:

- Preparation of a waste classification report by the appointed Environmental Consultant to facilitate appropriate off-site disposal of the following identified issues to a licensed facility (the results obtained in DP [2022] and DP [2023] may be used to supplementary any waste classification):
- Excavate the overburden fill from the ground surface to approximately 0.1 m above the top of the asbestos pipe (or to a shallower depth depending on site observations), taking care not to damage the pipe. Excavation works will:
 - o allow proper segregation of overburden fill;
 - o prevent mixing of backfilled material (that is present immediately around and in contact with the asbestos pipe and is deemed to contain asbestos) with the overburden fill; and
 - o prevent scraping of the asbestos pipe surface (and potential release of asbestos fibres or fines) during excavation of backfilled material around the asbestos pipe.
- Stockpile the excavated overburden fill along the trench length for re-use;
- Any backfill material that is in direct contact with and surrounds the asbestos pipe is deemed contaminated and should be stockpiled on the opposite side of the trench than the overburden fill;
- Extend the trench excavation along the pipe alignment to chase-out and expose the remainder of the pipe, taking care to minimise damage to the pipe;
- Visually assess the pipe condition and any potential to release asbestos fibres/fines;
- Remove the asbestos pipe and associated soils to its full extent and direct load onto awaiting trucks, or place it in double bagged heavy duty plastic bags, label the bags indicating they contains potential asbestos/ACM and store in a secure on - site designated asbestos storage area for later disposal to a licensed waste facility;

- Following the removal of the asbestos pipe, visually assess the trench surface for potential signs of ACM. Emu pick any visible ACM fragments until no ACM is observed within the trench. Scrape the base and the side walls of the trench to remove any remaining backfilled material from the trench excavation. The scraped soil from the trench excavation should be stockpiled along with the excavated backfilled material for waste characterisation and a later off-site disposal to a licensed waste facility;
- The asbestos pipe and the backfilled material that are in contact with the pipe (including any over-excavated material from the side walls and the base of the trench excavation) should be excavated and waste classified as per Section 15.10; and
- Validate the trench excavation as per Section 16.8.

15.7 Excavation of PAH Impacted Soils Surrounding Power Poles (AEC 36)

Several power poles onsite have been identified as requiring remedial works and excavation as listed in Table 2, Section 9. In addition, it is understood that most of the power poles will be removed for the proposed development.

The below is a general remediation strategy which will apply to any power pole identified as requiring remediation:

- Remove all power poles from the site as requiring remediation (Those listed in Table 2, Section 9). Given that the power poles are treated timber they are considered building and demolition waste and are therefore pre-classified as General Solid Waste (non - putrescible) in accordance with NSW Environment Protection Authority (EPA) Waste Classification Guidelines, Part 1: Classifying Waste, November 2014 (EPA, 2014). Disposal of power poles is required to a facility which can legally receive such waste. Given the chemical content of the power poles they would be deemed unacceptable for any recycling or resource recovery activities;
- Preparation of a waste classification report by the appointed Environmental Consultant to facilitate appropriate off-site disposal of the power pole impacted soil to a licensed facility (the results obtained in DP [2022] and DP [2023] may be used to supplementary any waste classification);
- Excavate the topsoil around the power poles to expose underlying natural clay and stockpile the excavated soils on an impermeable membrane. The lateral extent of the topsoil excavation is to extend to at least 1.0 m from the base of the power pole;
- Extend the excavation to a depth of 0.3 m below the base of the pole within an initial 0.3 m radius. DP has previously used a 0.6 m diameter augur to successfully remediate impacted clay from the base of power poles. Stockpile excavated material separately to the above topsoil;
- Collect validation samples from the bases and walls of the excavations as per the procedures outlined in Section 16.9. If a validation sample exceeds the RAC, chase out and resample the excavation as required until the RAC are met;
- Backfill excavations with either VENM or using a suitable material from within the site;
- If required, undertake waste classification sampling of the stockpiled excavated material as per Section 15.10 and dispose of the excavated material off-site to a licensed waste disposal facility; and

Survey the full extent of the remediation areas and produce survey drawings showing the lateral extent of remediation excavations, relative to the proposed final development layout.

15.8 Capping/Containment of Soils (if Preferred and / or Materials Deemed Suitable)

If the capping/containment contingency is adopted, any material which exceeds the RAC for asbestos and lead (if deemed suitable to remain onsite based on further site-specific risk assessment) can either be left in-situ or can be placed within a designated fill location and capped with an engineered barrier.

If excavation of the fill is to be completed in portions of the site for placement within a specific area of the site, then a designated stockpiling area should be established at the site so that all excavated material requiring containment can be consolidated in one area prior to placement within the containment cell.

The capping/containment area requires the following:

- If excavating and placement within a designated area of the site, the area should have a suitable size to house all impacted material and taking into account soil bulking factor;
- Survey of any excavated area selected as a containment area;
- The Remediation Contractor shall place any excavated impacted material into the area;
- The surface of the containment area, and after placement of any excavated impacted material, shall be covered using a coloured geotextile cover layer to act as a physical marker for any future excavation works. Geo-textile fabric requirements are discussed in Section 15.8.1;
- Suitable soil cover shall be placed above the geotextile cover **which meets the minimum requirements as set out in section 15.13 (Materials for use in backfilling and importing)**; and
- If areas of the site are proposed to be unsealed in the proposed development the top of the capping area (i.e. the geotextile cover) shall be a minimum 0.5 m below the final site level; or
- If areas of the site are proposed to be covered with either asphalt, concrete, “astroturf” or “soft-fall” safety surface material in the proposed development the top of the capping area (i.e. the geotextile cover) shall be a minimum 0.2 m below the final site level.

Any excavation of impacted materials should be conducted as follows.

- Excavation of the impacted fill to the underlying natural soils in the presence of the Environmental Consultant;
- Either (i) stockpiling in a designated location for future burial, or (ii) placement in the prepared containment/capping area;
- Collect validation soil samples from the base of any excavations as per Section 16.5 (for asbestos) and/or 16.7 (other COPC);
- If a validation sample result exceeds the RAC, chase out the impacted soil using an excavator/backhoe or a larger diameter auger as considered appropriate;
- Re-sample the resulting excavation and re-excavate as required until the RAC are met; and
- Once the excavation has been validated, backfill the excavation with validated virgin excavated natural material (VENM) or excavated natural material (ENM); or a suitable validated material from natural soil within the site. Refer to Section 15.13 for details on validation of backfill material.

The Remediation Contractor shall survey the base and top of the containment/capping area and confirm the construction with drawings/surveys. It will be necessary to include the survey as part of the Validation Report and the Environmental Management Plan (EMP). If capping is required, and after the containment area has been determined, a work method statement must be prepared by DP to provide clear instruction to the remediation contractor on the requirements for construction.

An EMP will need to be prepared and a notification on planning certificate will be required (Section 10.7 Certificate (formerly Section 149 Certificate). The EMP will provide ongoing control measures to aid in the management of the risks associated with impacted filling at the site to protect human health and the environment.

Consultation must be completed with the consent authority and owner to determine the most suitable enforcement mechanism for the implementation of the EMP however suitable enforcement mechanisms may include either:

- Making the completion and implementation of an EMP a condition of consent on the development application for the site; or
- Notating the EMP and the extent of remedial works on the land title for the property.

15.8.1 Geo-textile Fabric Requirements

A geo-textile barrier is to be incorporated into the capping layer to provide a warning of the underlying soil contamination. In accordance with Western Australian Department of Health *Guidelines for the Assessment, Remediation, and Management of Asbestos Contaminated Sites in Western Australia*, (DoH 2021) the geotextile fabric should meet the following conditions:

- Water permeable;
- Highly Visible;
- Rot-proof and chemically inert;
- High tensile strength;
- Coverage of the contaminated areas and 0.5 m beyond boundary if practical; and
- Parallel Sheets to be fixed together or overlaid by 0.2 m.

15.9 Stockpiling of Contaminated Material

It is recommended that material handling is minimised as much as possible. Where possible, the excavated contaminated soil should be appropriately classified and disposed of off-site directly to a waste facility licensed to receive it instead of stockpiling/storing them on site.

If required, contaminated soil shall be stockpiled at a suitably designated location. Dust control is recommended for all stockpiled materials and should include light conditioning with water for exposed materials or covering with an anchored geotextile or similar.

Should the stockpiled materials remain on-site for over 48 hours they should be appropriately managed to prevent fugitive dust leaving the site (e.g. light wetting or covering with anchored geotextile depending on weather conditions) and geotextile silt fences or hay bales should be erected around each stockpile to prevent losses by surface erosion.

Removal of stockpiles should include over excavation of underlying soils to a depth of 0.1 m. Following the removal of stockpiled soil, the footprint of the stockpiles should be validated by laboratory analysis in accordance with Section 16.4 and/or 16.7.

15.10 Waste Classification Assessment and Material Disposal

If materials are required to be disposed of at an off-site location, sampling and analysis of the materials at a frequency of 1 sample per 100 m³ of soil (dependent on stockpile volume) will be required to provide a classification of the materials for waste disposal according to the provisions of NSW EPA *Waste Classification Guidelines* (2014) (EPA, 2014b). Sample results obtained in the PSI, DSI and SCI may be utilised for waste classification purposes.

The material must be disposed of at a waste facility licensed to receive asbestos waste.

The tipping dockets will require to be provided to the Environmental Consultant for waste reconciliation purposes. In addition, any asbestos disposal must be tracked and reported to the EPA using WasteLocate.

15.11 Loading and Transport of Spoil

All transport of waste and off-site disposal to a waste facility licensed to receive it must be conducted in accordance with the requirements of the *Protection of the Environment Operations Act* (1997) (POEO Act 1997). All required licences and approvals required for disposal of the material must be obtained prior to removal of the materials from the site.

Removal and disposal of impacted soils shall only be carried out by a licensed contractor holding the appropriate licence, consent or approvals to dispose of the waste materials according to the classification outlined in EPA (2014) and with the appropriate approvals obtained from the NSW EPA (if required).

Transport of waste material shall be via a clearly delineated, pre-defined haul route at the site.

15.12 Disposal of Material

All waste material removed from the site shall be disposed in accordance with the POEO Act 1997 and to a facility/site legally able to accept the material. Copies of all necessary approvals from the receiving site shall be obtained by Principal Contractor prior to any contaminated material being removed from the site. A record of the disposal of materials will be maintained by the Principal Contractor. All relevant analysis results shall be made available to the contractor and proposed receiving site/waste facility to enable selection of a suitable disposal location. Details of all contaminated materials removed from the site shall be documented by the Principal Contractor with copies of weighbridge slips, trip tickets and consignment disposal confirmation (where appropriate) and provided to the Environmental Consultant. A site log will be maintained by the Principal Contractor to track disposed loads against on – site origin.

DP notes that Part 5.6, Section 143 of the POEO Act 1997 states that is an offence for waste to be transported to a place that cannot lawfully be used as a facility to accept that waste. It is the duty of the owner and transporter of the waste to ensure that the waste is disposed of appropriately. DP accepts

no liability for the unlawful disposal of waste materials from any site. DP accepts no responsibility for the material tracking, loading, management, transport or disposal of waste from the site. Before disposal of the material to a licensed landfill is undertaken, the waste producer will be required to obtain prior consent from the landfill.

15.13 Excavation Backfilling and Fill Importation

If imported fill is required to reinstate remedial excavations, or for other site uses, such material should be classified as VENM, ENM, or be in compliance with an appropriate NSW EPA Resource Recovery Order. It must be assessed as being suitable for use on site, from a contamination perspective, by the Environmental Consultant. As part of the Environmental Consultant's review of a proposed fill import source site, an imported material validation sampling plan should be nominated. The density of testing will be dependent on the source and type of the material and the proposed volume for importation. Anticipated sampling and analytical requirements are provided in Table 5.

Table 5: Sampling and Analytical Requirements for Imported Material

Type	Minimum Sample Number / Frequency*	Minimum analyte suite to include ¹	Additional analysis as required
VENM	1 per 1000 m ³ , with a minimum of three samples	Metals/metalloids, PAH, TRH/BTEX, phenol, PCB, OPP, OCP and asbestos	- Any contaminant considered potentially present in the material based on site information - Salinity as per the Salinity Investigation and Management Plan³ (the SMP) previously prepared for the site
ENM	Based on the Excavated Natural Material Order 2014 issued by NSW EPA	Mercury, cadmium, lead, arsenic, chromium (total), copper, nickel, zinc, electrical conductivity, pH, PAH, BTEX, TPH, rubber plastic bitumen paper cloth paint and wood and asbestos.	- OCP plus any contaminant considered potentially present in the material based on site information - Salinity requirements as per the SMP

Notes: 1: Not all samples necessarily require testing for all analytes.

Any VENM proposed for importation to the site must be accompanied by an appropriate classification report including information on the history of the source site, type of material and analytical results. Analytical results should be compared against published background criteria or analytical practical quantitation limits. The criteria are summarised in Table 6.

³ DP (2021) *Salinity Investigation and Management Plan* (Ref.86548.06.R.001.Rev3) dated 26 September 2022 (the SMP)

Table 6: VENM Importation Criteria (in mg/kg)

Contaminant¹	Berkman (2001)²	Olszowy (1995)³	Adopted Comparative Values⁴
Metals			
Arsenic (total)	1-50	<5-40	20
Cadmium	1	<0.5-14	1
Chromium (III)	5-1000	5-131	75
Copper	2-100	<5-466	100
Lead	2-200	3-1465	50
Mercury	0.03	<0.1-3.4	0.5
Nickel	5-500	<5-160	30
Zinc	10-300	5-3820	150
TRH	For all organic contaminants, the analytical practical quantitation limits are used as the reference levels for VENM assessment. Special consideration may be given to low levels of naturally-occurring TRH or PAH in shale.		
C ₆ – C ₁₀			
C ₁₀ – C ₁₆			
C ₁₆ – C ₃₄			
C ₃₄ – C ₄₀			
Total Phenols			
PAH			
Total			
Benzo(a)Pyrene			
PCB			
OCP			
aldrin			
dieldrin			
aldrin + dieldrin			
chlordane			
DDT (including DDD, DDE, DDT)			
Heptachlor			

Notes:

- Contaminant concentrations must also be evaluated against the RAC, where relevant.
- Berkman (2001) Field Geologists Manual
- Olszowy, H., P. Torr, and P. Imray. 1995. Trace element concentrations in soil from rural and urban areas of Australia. Contaminated Sites Monograph Series 4. South Australian Health Commission. Glenelg Press, Glenelg, Australia
- From the ENM Order

Where VENM, ENM, or other material in compliance with an appropriate NSW EPA Resource Recovery Order is proposed to be imported to the site, a source site inspection should be undertaken by the Environmental Consultant prior to importation to assess the consistency with the documentation and to assess whether any evidence of potential contamination is present. Inspection of material actually imported to the site should also be undertaken by the Environmental Consultant to assess the consistency with the source site inspection.

Consideration must also be given to the suitability of any material proposed for importation to the site based on both human health and ecological assessment criteria provided in DP (2021a) which have been adopted from the NEPM (2013).

Consideration must also be given to the geotechnical suitability of any material proposed for importation to the site.

16. Validation Plan

16.1 Data Quality Objectives

The objective of the validation plan is to assess the results of post remediation testing against the RAC stated within this RAP and to provide information on environmental impacts which may have resulted from the works.

The validation assessment will be conducted in accordance with Data Quality Objectives (DQOs) and Quality Assurance/Quality Control (QA/QC) procedures to demonstrate the repeatability and reliability of the results.

The following DQOs will be adopted based on those provided in Appendix B, Schedule B2 of NEPC (2013). The DQO process is outlined as follows:

- State the Problem;
- Identify the Decision;
- Identify Inputs to the Decision;
- Define the Boundary of the Assessment;
- Develop a Decision Rule;
- Specify Acceptable Limits on Decision Errors; and
- Optimise the Design for Obtaining Data.

A checklist of Data Quality Indicators (DQI) will be completed as part of the validation assessment.

16.2 Validation Assessment Requirements

The following site validation work will be required:

- Field assessment by the Environmental Consultant comprising:
 - o Visual inspection, including taking photographs for record purposes;
 - o Collecting validation samples from excavations resulting from the removal of contaminated soils; and
 - o Collecting validation/characterisation samples for materials to be re-used on site.
- Laboratory analysis of validation samples at a NATA accredited laboratory for:
 - o The COPC relevant to the remediation area; and
 - o Quality control (QC) samples in accordance with Section 16.8
- Comparison by the Environmental Consultant of the laboratory results with the SAC and/or RAC as appropriate (refer to Section 14); and

- Preparation by the Environmental Consultant of a validation report detailing the methods and results of the remediation works and validation assessment.

16.3 Visual Inspections

All areas to be assessed and validated will first be subject to a visual inspection by the Environmental Consultant. Any areas of fill/ACM/staining (as appropriate for the remediation) must be removed prior to validation sampling.

16.4 Validation of Areas of Treatment of ACM in Surface Soils (low concentrations of ACM such as AEC19, AEC22 and AEC26)

Where any ACM impacted surface soils have been hand-picked at the identified AEC locations as a result of the remediation works, the Environmental Consultant will be required to validate the remediated area as follows:

- A visual inspection for signs of fill and anthropogenic material (including ACM) within the area and any associated former stockpile footprint on a 2 m grid;
- Validation sampling for asbestos (500 ml samples) at a rate of one sample per 10 m by 10 m grid over the footprint excavation (minimum of one sample);
- All 500 mL samples will be analysed at a NATA accredited analytical laboratory for determination of AF and FA concentrations; and
- Where analytical results indicated the presence of asbestos, or visual results indicate the presence of filling, chase out excavation of the contaminated materials will be required, followed by further validation sampling as detailed above.

For any remediation areas where significant walls are formed by any excavations or additional ACM encountered at depth (> 0.1 m bgl) or significant demolition waste encountered, validation sampling should be completed from the resultant excavation as described in Section 16.5.

16.5 Validation of Areas of Excavations Associated with ACM Impacted Soil with Concentrations Exceeding Commercial / Industrial Criteria (such as Soil within the Stockpile at 602 in AEC26)

Following the remediation and /or excavation of any ACM impacted soils from portions of the site where concentrations of ACM has been identified in fill as exceeding land use criteria, the environmental consultant will validate remediation the surface soils and/or remedial excavations as follows:

1. Visual inspection for signs of anthropogenic material including ACM and construction and demolition waste. The visual inspection will be conducted from across the surface of the remediated area or the base of the remedial excavations on a 2 m grid.
2. The results of the visual inspection will be confirmed through soil sampling at the densities equivalent to that required by Western Australia Department of Health (2021) *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (WA DoH, 2021);

3. At each sample location a 500 ml sample of soil will be collected from exposed natural surface soils (0.0 – 0.1 mbgl) for asbestos identification and quantification in the soil sample;
4. Where 'walls' are formed by a remedial excavation, strip trenches will also be excavated, at a rate of one strip trench per 10 m horizontal length or a minimum of 1 per sidewall, to confirm the extent of filling has been excavated;
5. Sampling and analysis of any remaining fill soil in trenches completed in walls by the environmental consultant with reference to NEPC (2013) and WA DoH (2021) guidelines as follows:
 - o Collection of ~10 L bulk samples by the environmental consultant; and
 - o Collection of a 500 ml sample for each ~10 L bulk sample for laboratory analysis of AF and FA to calculate the asbestos %w/w and compare against the RAC.
6. Where impacted fill (ACM and/or construction and demolition waste) is observed, or analytical results identify asbestos above the RAC, further chase out of that location will be required and steps 1 to 3 will be repeated; and
7. A survey of the final remediation excavation areas is to be undertaken and provided to the environmental consultant prior to final validation.

Development works within the site (other than remediation works detailed in this RAP) should only progress following written confirmation by the environmental consultant.

16.6 Validation of Excavated ACM Impacted Soil Subject to Treatment (where high concentrations were previously identified such as such as Soil within the Stockpile at 602 in AEC26)

Asbestos impacted soil which requires treatment in accordance with Section 15.4 must be successfully validated prior to on-site re-use. The fill is to be validated as follows:

- Sampling and analysis of the soil by the environmental consultant with reference to NEPC (2013) and WA DoH (2021) as follows:
 - o Collection of ~10 L bulk samples by the environmental consultant a rate of one per 10 m³. If fragments of ACM are observed on the surface of the stockpiles, bulk sampling will target the location(s) where the fragments are most abundant;
 - o 10 L bulk samples will be weighed using pre calibrated scales and manually screened on site through a 7 mm sieve. All fragments of suspected ACM of 7 mm and larger will be collected and weighed, and the percentage asbestos in soil (% w/w) calculated in accordance with Section 4.1.7 of WA DoH (2021) and compared against the RAC;
 - o Collection of a 500 ml sample for selected ~10 L bulk sample (which pass the validation criteria in the above step) for laboratory analysis of FA and AF to calculate the asbestos %w/w and compare against the RAC. The frequency of 500 mL samples will be based on the potential for the material to contain concentrations of FA and AF and will be confirmed in consultation with the Site Auditor, as required;
- Upon receipt of the results, designation of each stockpile by the environmental consultant as:
 - o Suitable for **reuse** on site – ACM (and FA and AF, as required) are below the RAC;
 - o Requiring **further treatment** at the ATA – ACM exceeds the RAC but FA and AF are below the RAC (as required); or
 - o Requiring Disposal off-site to landfill – FA and AF exceed the RAC;=.

16.7 Validation of Remedial Excavation of Soils Impacted by Other COPC (Including Glass Stockpiles Impacted with Lead at AEC26)

Following the removal of impacted soils impacted by COPC (other than ACM), the environmental consultant will validate the remedial excavation footprint as follows:

1. Visual inspection of remedial excavation;
2. Sampling and analysis of the soil by the environmental consultant with reference to NEPC (2013) and guidelines as follows:
 - o For small to medium excavations (base <500 m²):
 - Base of excavation: one sample per 25 - 50 m² or part thereof; and
 - Sides of excavation, if walls are formed: one sample per 10 m length or part thereof. Additional samples will be collected at depths of concern where there is more than one depth of concern (e.g. multiple filling horizons).
 - o For Large excavations (>500 m²):
 - Base of excavation: sampling on a grid at a density in accordance with the EPA *Contaminated Sites: Sampling Design Guidelines* (2022); and
 - Sides of excavation, if walls are formed: one sample per 20 m length or part thereof. Additional samples will be collected at depths of concern where there is more than one depth of concern (e.g. multiple filling horizons).
3. Analysis of collected samples for COPC specific to the excavation/area of the site;
4. Where the reported concentration of the COPC are greater than the RAC, further chase out of that location will be required and steps 1 to 3 will be repeated. The additional soil generated during the chase out will require remediation with reference to either Section 15.5; and
5. A survey of the final remediation excavation areas is to be undertaken and provided to the environmental consultant prior to final validation.

Development works within the site (other than remediation works detailed in this RAP) should only progress following written confirmation by the environmental consultant.

16.8 Validation of Buried ACM Pipe and SMF Pipe Remediation Excavations (AECs 15, 16, 21, 26, 30, 31 and 32)

After removal of the in-situ ACM or SMF pipe networks identified, the following validation works will be necessary:

- Visual inspection of the trench excavation and any associated stockpile footprints if plastic sheeting was not applied;
- Collection of validation soil samples within the footprints of the excavation. In the event pipes are removed with limited damage validation samples are to be collected at a rate of one per 30 m linear metres of pipe excavation. Sample locations should target areas of joins or observed damage/breakages. At each sample location a 500 ml will be collected for asbestos identification and quantification with reference to the DoH (2021);

- If stockpiling of excavated impacted soil occurs on unsealed surfaces during remediation, the collection of 500 mL soil validation samples will also be required from the footprint of any removed stockpile at a rate of one sample per 25 m² of footprint area;
- Assessment of analytical results as per the RAC;
- If asbestos (ACM, FA or AF) is detected in the 500 mL samples, then scrape the trench surface (base and side walls) either side of the exceedance along a length of 30 m and repeat the validation sampling at a stringent sampling frequency (i.e one composite sample at every 10 m section of trench) until the RAC is met; and
- Once the trench is validated, backfill with either validated VENM/ENM or using a suitable validated material from within the site. Survey of the full extent of the remediation areas and produce survey drawings showing the extent of the remediation trench and placement of VENM or validated material from within the site relative to the proposed development layout (if known).

Once the trench is validated, backfill with either validated VENM/ENM or using a suitable validated material from within the site. Survey of the full extent of the remediation areas and produce survey drawings showing the extent of the remediation trench and placement of VENM or validated material from within the site relative to the proposed development layout (if known).

16.9 Validation of PAH Impacted Soil Surrounding Power Poles (AEC36)

In the event nearby fill or natural soil is to remain following removal of power poles and remediation of associated soils in the immediate vicinity of the former power poles the sampling strategy listed below is applicable for validating former power pole excavations:

- Excavation Side Walls - Topsoil Excavation: One sample per side wall within the topsoil layer (i.e. four samples);
- Base - Underlying Topsoil: One sample per base of excavations;
- Excavation Side Walls - Clay Excavation: One sample from the northern and southern side walls within the clay layer (i.e. two samples);
- Base - Underlying base of former pole: One sample per base of excavations;
- QA/QC samples: As per Section 16.11; and
- Sample Analysis: All power pole validation samples will be analysed for PAH with approximately 10% of samples analysed for TRH. Compare the results against the RAC listed in Table 4.

The results of previous investigations on the site indicated the detection of higher long chain TRH (in the range of TRH C₁₆ - C₃₄) generally correlated with detection of PAHs therefore only 10% of the total samples collected will be additionally analysed for TRH.

16.10 Sample Holding Times

Maximum recommended sample holding times are as follows:

- Asbestos – no maximum recommended holding time;
- Metals – six months; and
- Semi-volatiles - 14 days, and 40 days following extraction.

All chemical validation must be collected in appropriate cooled and sealed containers.

16.11 Quality Assurance Plan

16.11.1 Field QA

Quality Assurance (QA) and Quality Control (QC) procedures will be adopted throughout the field sampling programme to ensure sampling precision and accuracy and prevent cross contamination. The Environmental Consultant responsible for site validation should assess sampling accuracy and precision through the analysis of at least 5% field intra-laboratory replicate samples, 5% inter-laboratory replicate samples, as well as the collection of field rinsate samples of reusable sampling equipment at a rate of one per day of sampling operations.

Appropriate sampling procedures will be undertaken to minimise the potential for cross contamination, and will include the following:

- standard operating procedures are followed;
- site safety plans are developed prior to commencement of works;
- replicate field samples are collected and analysed;
- trip blanks and trip spikes are to be used when volatile contaminants are involved;
- equipment rinsate samples are analysed as part of the QC programme;
- samples are stored under secure, temperature controlled conditions; and
- chain of custody documentation is employed for the handling, transport and delivery of samples to the selected laboratory.

16.11.2 Laboratory QC

A National Association of Testing Authorities (NATA) accredited laboratory will undertake in-house QC procedures involving the routine testing of:

- reagent blanks.
- spike recovery analysis.
- laboratory duplicate analysis.
- analysis of control standards.
- calibration standards and blanks; and
- statistical analysis of QC data including control standards and recovery plots.

17. Management and Responsibilities

17.1 Site Management Plan

A general site management plan for the operational phase of site remediation is included in Appendix E. The management plan includes soil, noise, dust, work health safety (WHS), remediation schedule, hours of operation and incident response. The Remediation Contractor is to implement the general site management plan for the duration of remedial works by incorporating the plan into their over-arching construction environmental management plan (CEMP).

17.2 Site Responsibilities

The site management plan (Appendix E) provides a summary of the general program management and associated responsibilities. Contact details for key utilities are also included in the event of needing to respond to any incidents.

17.3 Contingency Plan and Unexpected Finds Protocol

Plans for contingency situations (e.g. encountering asbestos in fill), along with an unexpected finds protocol for dealing with unexpected finds during remediation work/earthworks, are included in Appendix F.

18. Validation Reporting

18.1 Documentation

The following documents will need to be collated and reviewed by the Environmental Consultant as part of the validation assessment (including those items that are prepared by the Environmental Consultant):

- Any licences and approvals required for the remediation works;
- Waste classification report(s);
- Transportation Record: comprising a record of all truck-loads of soil (including aggregate) entering the site, including truck identification (e.g. registration number), date, time, source site, load characteristics (e.g. type of material, i.e. quarried aggregate, etc.), approximate volume, use (e.g., general site raising, service trenches, etc.);
- Disposal dockets: for any soil disposed off-site. The Remediation Contractor will supply records of: transportation records, spoil source, spoil disposal location, receipt provided by the receiving waste facility/site. Note: A record of the building materials disposed off-site is also be kept and provided to the Principal, on request;
- Imported materials records: records for any soil imported onto the site, including source site, classification reports, inspection records of soil upon receipt at site and transportation records;
- Records relating to any unexpected finds and contingency plans implemented;
- Laboratory certificates and chain-of-custody documentation;

- Inspections records from the Environmental Consultant;
- Photographic records by all contractors and consultants of the works undertaken within their purview of responsibilities;
- Surveys pre- and post-installation of geotextile marker layer and clean fill cap;
- Airborne asbestos monitoring records (in the event that asbestos works are undertaken); and
- Interim/final visual and sampling clearances for any asbestos related works (in the event that asbestos works are undertaken).

18.2 Reporting

A validation assessment report will be prepared by the Environmental Consultant in accordance with NSW EPA (2020).

The validation report shall describe the remediation approach adopted, methodology, results and conclusion of the assessment and make a statement regarding the suitability of the site for the proposed development (primarily commercial / industrial).

19. Conclusions

This RAP provides the overarching general mechanism by which the site can be made suitable with the proposed development.

It is considered that remediation and validation of identified contamination at the site undertaken in accordance with this RAP will satisfy the provisions of clause 4.6 (1) of SEPP (*Resilience and Hazards*) for, and render the site suitable from a contamination perspective, with the proposed development.

In the event that contamination remains on site (i.e. contamination is capped), a LTEMP will be required to consider the site suitable for the proposed development. If required, the LTEMP is to be prepared and implemented in accordance with Table 2.7 of NSW EPA (2020) *Consultants Reporting on Contaminated Land: Contaminated Land Guidelines*. The LTEMP is to include:

- Provisions for the ongoing maintenance of the capping layer with associated recording of inspections/works completed;
- Methodology surrounding how to manage working with the cap and repairs to the cap when disturbed;
- Identifying who is responsible for the ongoing management of the cap; and
- Noting how the EMP is to be made legally enforceable (e.g. as a condition of consent).

20. References

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NSW EPA. (2020). *Guidelines for Consultants Reporting on Contaminated Land*. Contaminated Land Guidelines: NSW Environment Protection Authority.

21. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Elizabeth Drive, Badgerys Creek in accordance with DP's proposal dated 15 August 2022 and acceptance received from Roy Wang dated 2 November 2022. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Robert Jones Development Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the environmental components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

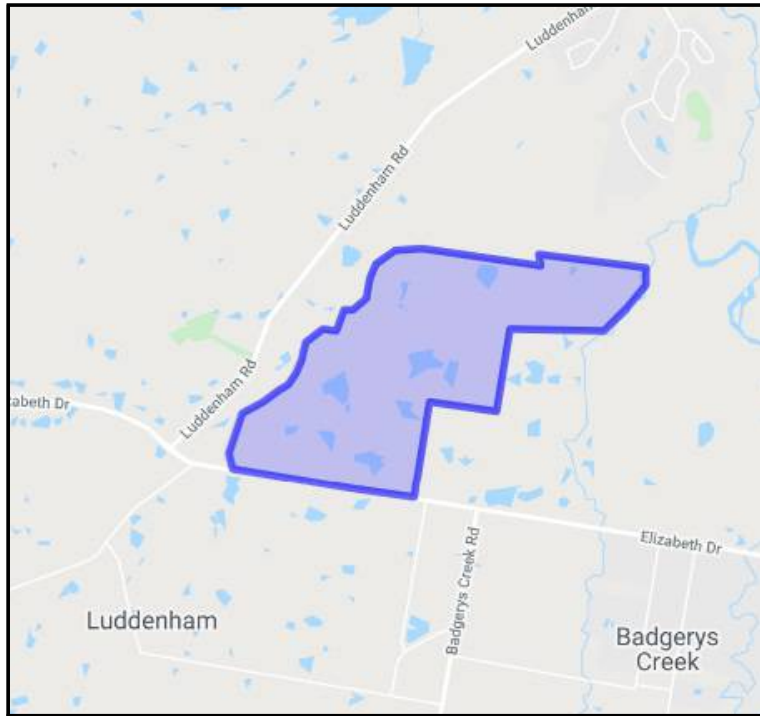
This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

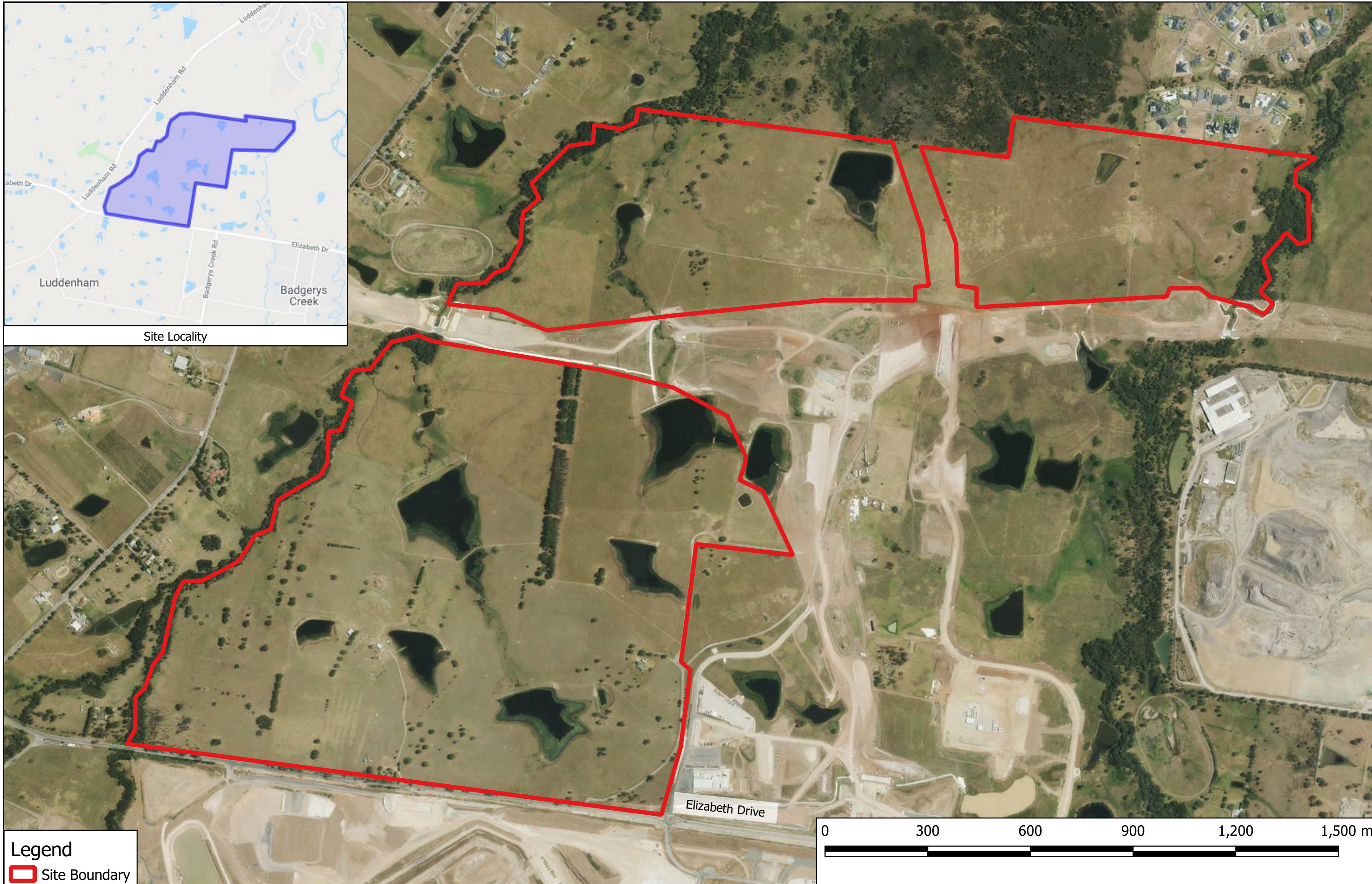
Douglas Partners Pty Ltd

Appendix A

Drawings
About This Report



Site Locality



Legend
 Site Boundary

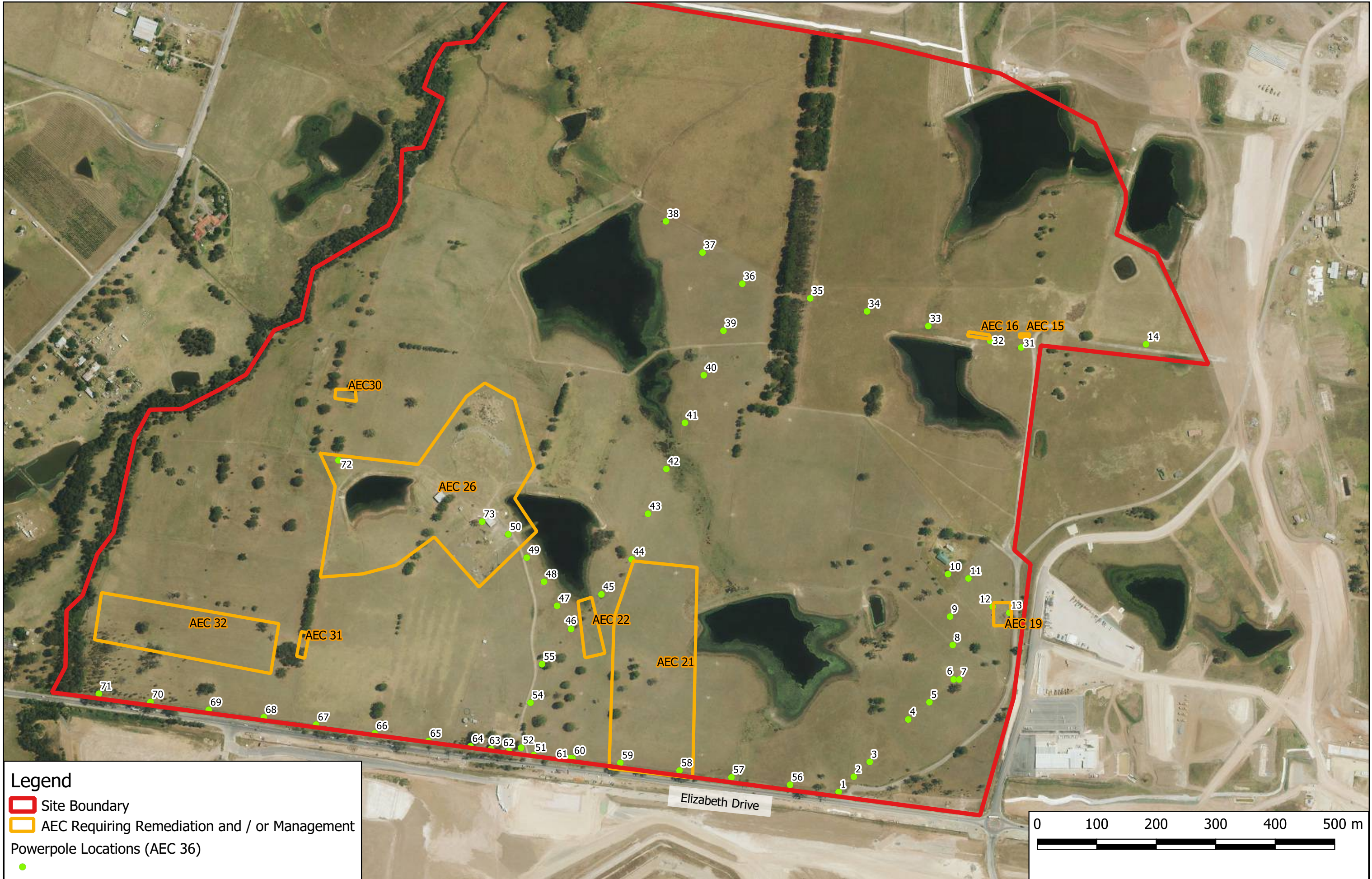


CLIENT: Robert Jones Developments Pty Ltd
 OFFICE: Macarthur DRAWN BY: GAR
 SCALE: As shown DATE: 3 July 2023

TITLE: Site Locality
 Remediation Action Plan
 1953 - 2109 Elizabeth Drive, Badgerys Creek, NSW



PROJ. #: 86548.14
 DRAWING No: 1
 REVISION: 0



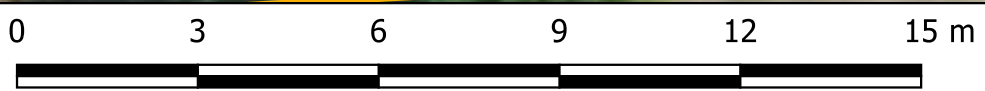
Legend

- Site Boundary
- AEC Requiring Remediation and / or Management
- Powerpole Locations (AEC 36)



Legend

- Site Boundary
- Further Investigation - TP591 (Asbestos) Sampling Locations
- Trenches
- AEC 19
- Approximate Extent of Required Remediation



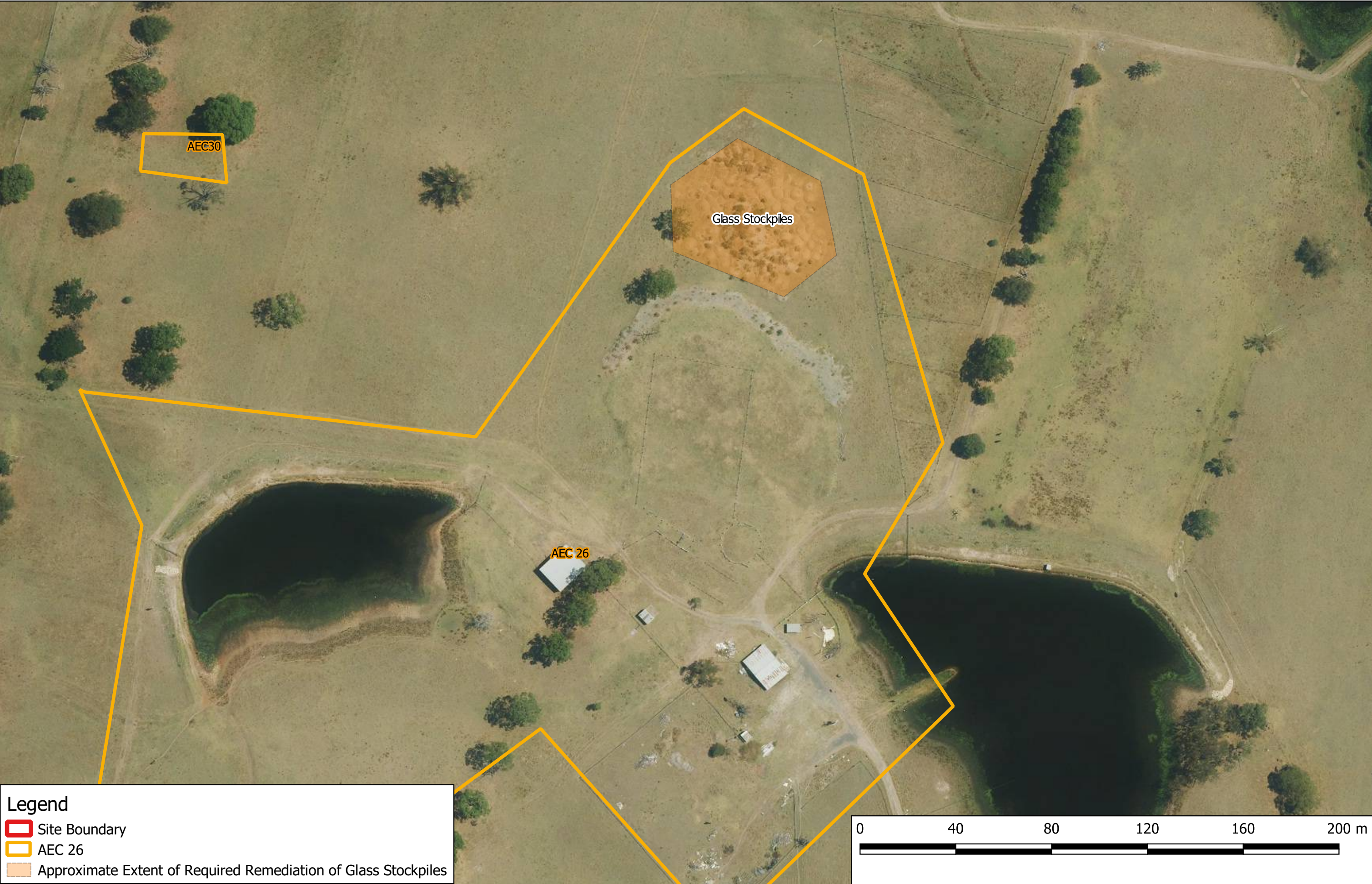


Legend

-  Site Boundary
-  Further Investigation - TP581 (Asbestos) Sampling Locations
-  Trenches
-  AEC 22
-  Approximate Extents of Required Remediation



 Douglas Partners <i>Geotechnics Environment Groundwater</i>	CLIENT: Robert Jones Developments Pty Ltd		TITLE: AEC22 - TP581 (Asbestos) Sampling Locations and Extents of Required Remediation Remediation Action Plan 1953 - 2109 Elizabeth Drive, Badgerys Creek, NSW	 MGA	PROJ. #:86548.14
	OFFICE: Macarthur	DRAWN BY: GAR			DRAWING No: 4
	SCALE: As shown	DATE: 3 July 2023			REVISION: 0



Legend

-  Site Boundary
-  AEC 26
-  Approximate Extent of Required Remediation of Glass Stockpiles

**Douglas Partners**
Geotechnics | Environment | Groundwater

CLIENT: Robert Jones Developments Pty Ltd	
OFFICE: Macarthur	DRAWN BY: GAR
SCALE: As shown	DATE: 3 July 2023

TITLE: AEC26 - Glass Stockpiles
Remediation Action Plan
1953 - 2109 Elizabeth Drive, Badgerys Creek, NSW


MGA

PROJ. #:86548.14	
DRAWING No:	5
REVISION:	0

About this Report

Douglas Partners



Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;

- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Appendix B

Site Survey Plans



NOTES:

CENTRELINE OF BADGERY'S CREEK IS BOUNDARY
CENTRELINE OF OAKY CREEK IS BOUNDARY
CENTRELINE OF COSGROVE CREEK IS BOUNDARY

SHORT LINES *-* INCLUSIVE ARE THE CENTRELINE OF BADGERY'S CREEK
SHORT LINES 94-123 INCLUSIVE ARE THE CENTRELINE OF OAKY CREEK
SHORT LINES 124-251 INCLUSIVE ARE THE CENTRELINE OF COSGROVE CREEK

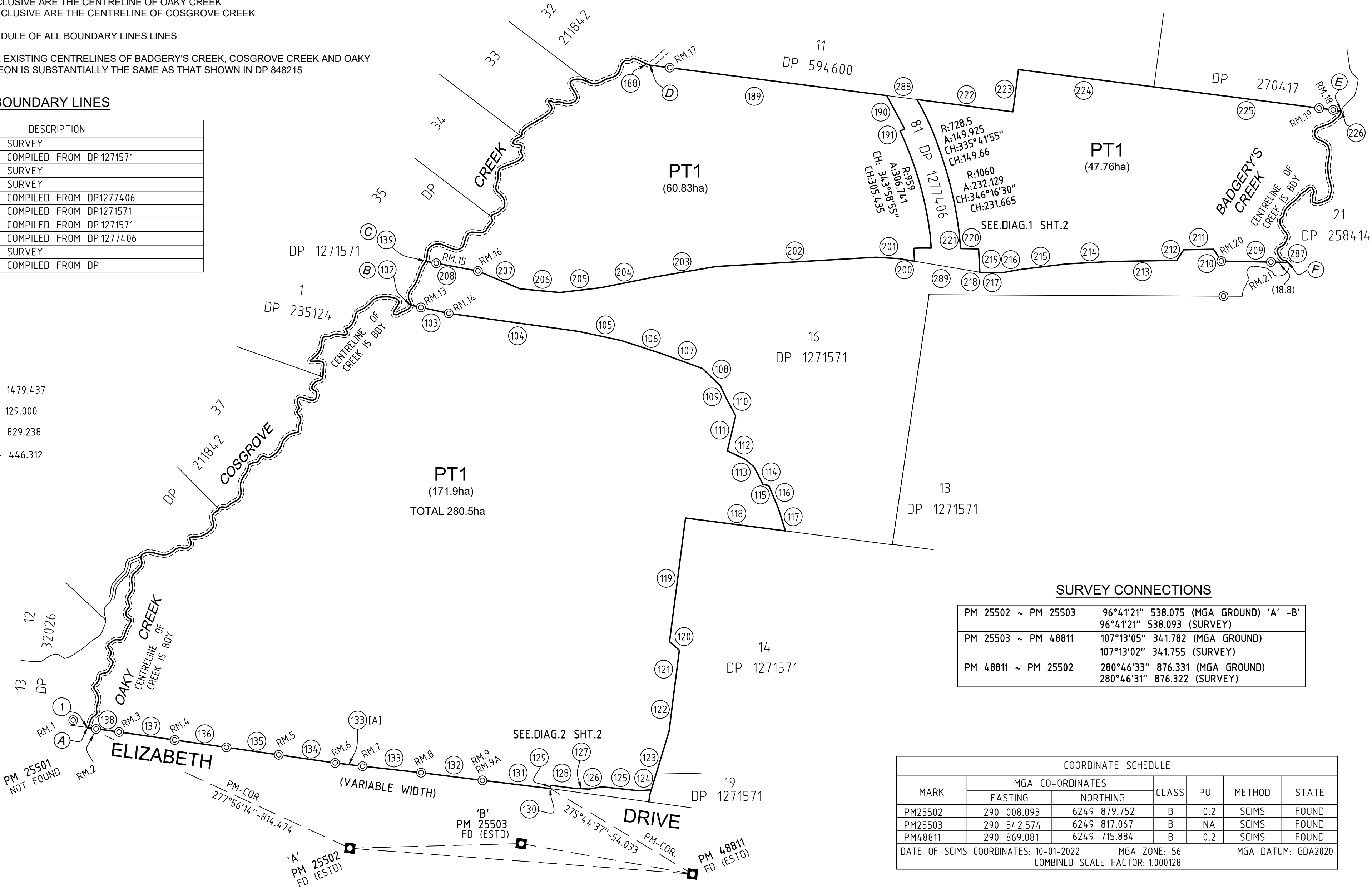
SEE SHEET 3 FOR SCHEDULE OF ALL BOUNDARY LINES LINES

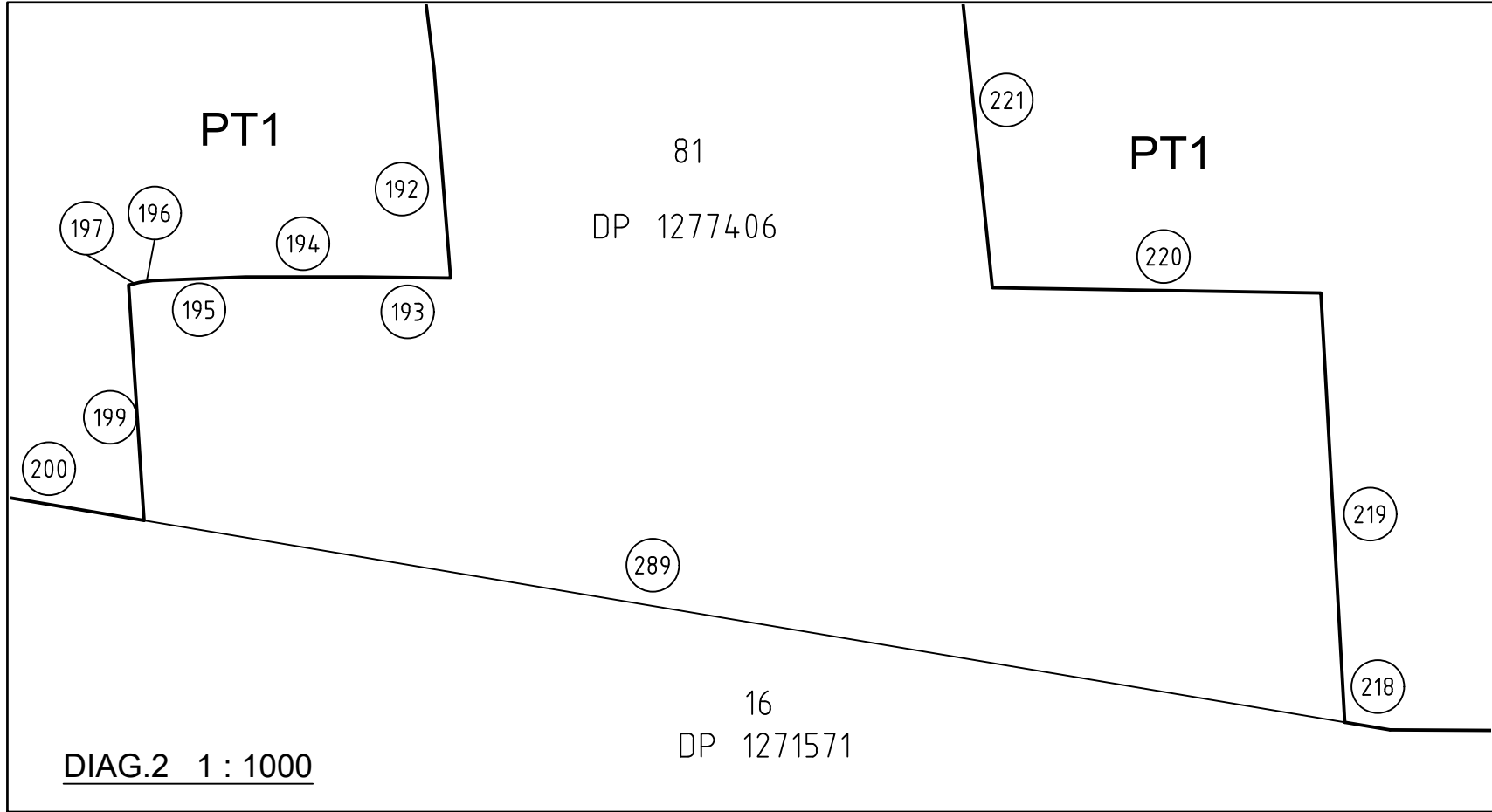
THE DEFINITION OF THE EXISTING CENTRELINES OF BADGERY'S CREEK, COSGROVE CREEK AND OAKY CREEK AS SHOWN HEREON IS SUBSTANTIALLY THE SAME AS THAT SHOWN IN DP 848215

ORIGIN OF BOUNDARY LINES

FROM LINE #	TO LINE #	DESCRIPTION
1	102	SURVEY
103	129	COMPILED FROM DP 1271571
130	138	SURVEY
139	188	SURVEY
189	200	COMPILED FROM DP1277406
201	208	COMPILED FROM DP1271571
209	218	COMPILED FROM DP 1271571
219	224	COMPILED FROM DP 1277406
225	287	SURVEY
288	289	COMPILED FROM DP

- (A) — (B) 37°23'39" - 1479.437
(B) — (C) 18°35'09" - 129.000
(C) — (D) 48°52'25" - 829.238
(E) — (F) 199°20'10" - 446.312

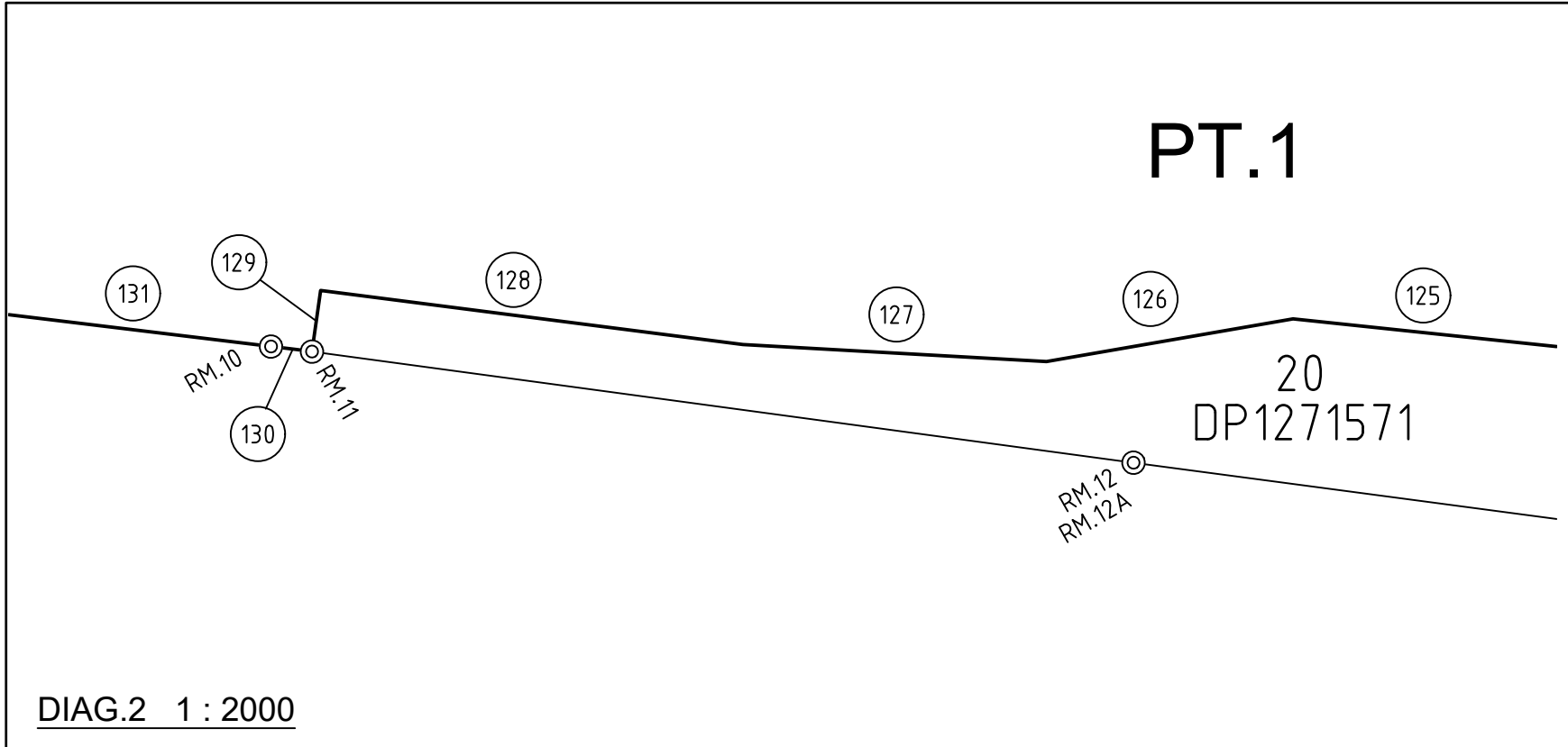




SCHEDULE OF REFERENCE MARKS

No.	BEARING	DISTANCE	MARK	STATUS	ORIGIN
1	21°59'35"	0.515	RM.GIP	NF	DP 32026
2	105°34'20"	21	RM.GIP	FD	DP JC
3	285°35'50"	3.255	RM.GIP	FD	DP JC
4	72°27'25"	4.145	STAR.PICKET	FD	DP JC
5	261°05'50"	4.64	RM.GIP	FD	DP JC
6	168°50'30"	2.7	RM.GIP	FD	DP JC
7	201°36'50"	2.72	STAR.PICKET	FD	DP JC
8	232°13'45"	4.01	STAR.PICKET	FD	DP JC
9	6°37'45"	0.685	RM.GIP	FD	DP 848215
9A	226°39'50"	8.685	STAR.PICKET	FD	DP JC
10	232°54'25"	2.885	STAR.PICKET	FD	DP JC
11	12°36'	0.945	RM.GIP	FD	DP 1271571
12	30°39'50"	1.8	RM.GIP	FD	DP JC
12A	248°01'	2.3	RM.GIP	FD	DP 164242,1271571
13	187°46'	0.935	RM.GIP	FD	DP 1271571
14	184°51'	0.59	RM.GIP	FD	DP 1271571
15	16°02'	0.78	RM.GIP	FD	DP 1271571
16	17°21'	1.12	RM.GIP	FD	DP 1271571
17	255°58'50"	9.765	RM.GIP	FD	DP 229193
18	195°14'40"	1	RM.GIP	FD	DP 1072756
19	277°45'10"	14.58	RM.GIP	FD	DP 848215
20	52°22'	1.095	RM.GIP	FD	DP 1271571
21	331°48'	2.4	RM.GIP	FD	DP 1271571

DPJC-DENOTES UNREGISTERED PLAN BY SURVEYOR CASEY
DATED 20-12-2019



SURVEYOR Name: JACEK IDZIKOWSKI Date of Survey: 2/02/2022 Surveyor's Reference: 50294 009DP 2021M7100(677) PARTIAL SURVEY	PLAN OF REDEFINITION OF LOT 82 IN DP1277406	LGA: PENRITH Locality : BADGERYS CREEK Reduction Ratio 1: 7500 Lengths are in metres.	Registered	DP
---	---	---	------------	----

Number	Bearing	Distance				SCHEDULE OF BOUNDARY LINES					
1	220°04'30"	7.075	61	23°58'25"	24.160	117	342°32'35"	66.670	173	84°02'15"	10.955
2	24°06'10"	27.125	62	56°47'50"	39.455	118	277°22'10"	280.260	174	100°27'35"	26.785
3	45°07'10"	14.035	63	74°11'	8.315	119	187°22'10"	347.140	175	65°26'30"	30.685
4	356°07'15"	9.290	64	6°50'45"	15.970	120	130°49'55"	36.110	176	340°18'50"	50.805
5	10°47'	20.820	65	20°57'40"	8.075	121	187°17'25"	118.875	177	72°16'45"	24.140
6	352°29'20"	27.670	66	3°46'30"	17.505	122	187°09'55"	108.030	178	107°48'35"	32.350
7	334°16'40"	17.995	67	332°45'05"	19.205	123	196°53'55"	170.620	179	85°28'30"	31.800
8	39°16'45"	20.050	68	36°19'55"	9.900	124	265°26'30"	33.850	180	29°18'05"	6.460
9	15°12'40"	19.315	69	339°42'45"	11.815	125	276°00'	104.190	181	79°14'	12.420
10	71°59'30"	17.105	70	7°08'35"	17.540	126	260°09'45"	36.700	182	71°05'25"	22.750
11	40°43'55"	20.595	71	94°36'25"	45.625	127	273°12'10"	44.610	183	34°32'20"	30.375
12	15°44'10"	17.465	72	5°45'15"	22.400	128	277°18'55"	62.460	184	35°50'05"	22.455
13	319°49'10"	12.770	73	305°57'10"	11.340	129	187°58'50"	9.075	185	85°45'05"	14.250
13[A]	19°24'45"	12.655	74	25°58'55"	22.420	130	97°42'15"	2.205	186	62°40'55"	10.965
14	335°54'40"	23.090	75	66°37'35"	18.440	131	96°54'15"	187.890	187	111°08'45"	34.365
15	42°48'05"	9.815	76	16°40'25"	9.275	132	97°06'25"	171.950	188	116°47'15"	12.970
16	62°31'45"	19.865	77	3°02'30"	21.115	133	96°21'25"	163.960	189	97°19'20"	665.260
17	93°59'25"	10.330	78	358°35'15"	15.820	133[A]	96°39'25"	76.645	190	331°48'25"	105.210
18	29°56'50"	39.385	79	276°46'30"	35.560	134	98°13'25"	158.630	191	65°00'20"	14.170
19	21°23'55"	25.400	80	42°38'05"	36.845	135	98°06'35"	147.015	192	355°30'30"	31.945
20	302°47'40"	10.595	81	19°54'50"	43.320	136	98°06'35"	145.585	193	90°44'	13.610
21	355°05'20"	20.190	82	86°58'50"	9.370	137	98°11'55"	156.295	194	90°00'35"	17.455
22	38°24'15"	10.570	83	71°16'20"	21.200	138	97°59'05"	88.405	195	87°46'30"	14.050
23	349°45'10"	22.565	84	96°03'40"	22.435	139	34°06'30"	6.340	196	82°34'50"	1.875
24	22°05'20"	12.730	85	81°08'40"	9.250	140	10°19'30"	28.305	197	75°55'15"	1.845
25	34°07'30"	11.835	86	358°14'	11.620	141	61°51'45"	31.765	199	356°14'	35.725
26	0°42'35"	39.760	87	327°19'10"	4.765	142	108°03'50"	26.545	200	99°32'50"	43.420
27	40°53'15"	27.320	88	66°00'35"	4.460	143	110°26'40"	17.605	201	93°31'40"	65.220
28	26°28'	21.965	89	51°58'25"	16.225	144	107°03'50"	5.245	202	86°39'05"	445.780
29	349°26'40"	16.010	90	24°22'35"	21.635	145	69°29'25"	21.530	203	80°18'40"	174.135
30	56°06'40"	21.860	91	17°40'20"	14.715	146	21°29'55"	19.460	204	78°47'20"	152.300
31	98°19'05"	27.495	92	60°46'25"	20.495	147	30°29'20"	24.860	205	83°20'55"	113.905
32	89°50'55"	32.760	93	51°09'40"	24.330	148	89°36'	20.940	206	95°16'05"	111.135
33	60°19'55"	34.085	94	50°00'	21.250	149	80°53'30"	21.685	207	112°53'55"	127.580
34	94°01'55"	19.270	95	77°50'45"	21.275	150	36°22'25"	19.475	208	100°34'10"	148.930
35	40°51'05"	19.810	96	91°32'15"	19.310	151	31°51'45"	18.060	209	91°03'55"	185.720
36	344°11'05"	13.515	97	118°11'45"	28.440	152	342°39'10"	10.200	210	146°37'15"	39.645
37	81°15'30"	23.860	98	201°09'55"	36.840	153	57°49'50"	25.850	211	88°53'10"	83.015
38	72°57'30"	12.965	99	96°53'15"	8.795	154	45°01'10"	6.165	212	33°04'10"	35.035
39	60°48'20"	17.540	100	58°32'50"	6.550	155	47°20'15"	12.180	213	89°01'	180.095
40	34°04'55"	27.510	101	64°29'50"	25.705	156	8°14'40"	14.635	214	86°55'05"	127.245
41	348°04'20"	20.770	102	33°02'50"	14.330	157	334°05'15"	20.495	215	83°09'30"	133.000
42	30°25'45"	15.230	103	282°12'35"	108.955	158	318°05'45"	22.545	216	79°34'40"	48.355
43	58°12'40"	10.885	104	277°53'45"	365.525	159	10°06'55"	27.215	217	90°19'05"	54.490
44	37°15'35"	9.815	105	282°07'50"	121.760	160	5°14'55"	24.810	218	99°32'50"	6.970
45	88°06'50"	16.330	106	288°01'15"	119.170	161	60°33'35"	38.505	219	176°49'40"	65.125
46	53°11'30"	12.180	107	290°00'30"	118.955	162	49°07'50"	42.425	220	90°56'05"	49.750
47	59°14'30"	21.450	108	314°08'25"	69.330	163	327°06'55"	5.310	221	174°06'50"	53.675
48	46°21'20"	12.395	109	334°34'05"	35.090	164	6°42'	18.170	222	97°19'20"	269.565
49	11°23'45"	18.100	110	332°04'10"	58.805	165	288°00'20"	25.705	223	7°29'	118.630
50	354°50'25"	15.990	111	13°22'15"	99.580	166	23°42'30"	8.690	224	97°17'15"	380.095
51	10°32'20"	12.205	112	295°48'25"	53.680	167	54°24'20"	26.785	225	97°20'20"	525.380
52	27°02'45"	43.395	113	309°23'50"	32.990	168	7°55'45"	11.250	226	16°09'35"	9.605
53	11°05'20"	4.120	114	332°55'50"	55.795	169	54°57'25"	96.050	227	43°20'15"	16.800
54	55°22'30"	13.780	115	279°51'30"	15.980	170	346°16'55"	28.375	228	54°29'50"	24.885
55	72°40'55"	16.875	116	337°06'25"	68.050	171	88°34'20"	6.240	229	69°31'40"	10.960
56	29°41'55"	10.640				172	118°19'20"	7.850			
57	59°52'40"	9.100									
58	108°19'15"	10.900									
59	69°53'20"	20.570									
60	43°10'50"	24.100									
						SURVEYOR			PLAN OF REDEFINITION OF LOT 82 IN DP1277406		
						Name: JACEK IDZIKOWSKI			LGA: PENRITH		
						Date of Survey: 2/02/2022			Locality : BADGERYS CREEK		
						Surveyor's Reference: 50294 009DP			Reduction Ratio 1: 7500		
						2021M7100(677) PARTIAL SURVEY			Lengths are in metres.		
									Registered		
									DP		

Appendix C

Remediation Options Assessment and Evaluation

Appendix C

Remediation Options Assessment

Elizabeth Drive, Badgerys Creek NSW

C1.0 Introduction

The following key guidelines and technical reports were consulted in the preparation of this remediation options assessment:

- NEPC National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM] (NEPC, 2013); and
- CRC CARE Remediation Action Plan: Development - Guideline on Performing Remediation Options Assessment (CRC CARE, 2019a).

The first stage of developing a remediation strategy is to establish clear and measurable remediation objectives and remediation criteria (clean-up levels). These will form the requirements against which remediation options are assessed.

The next stage of the remediation options assessment is to select technology and management options, or combinations of options, that have the potential to reduce contaminant concentrations and/or apply management controls as necessary so that the remediation objectives are achieved and no unacceptable risk is posed by the contamination in the context of the current and proposed site use. Where several viable options have been identified, an assessment of each of the options will be required to determine which option will most adequately and sustainably meet the remediation objectives (CRC CARE, 2019a).

The remediation objectives are to:

- Address potentially unacceptable risks to relevant environmental values from contamination (refer to the CSM in Section 9); and
- Render the site suitable, from a contamination perspective, for the proposed development (refer to Section 2).

C2.0 Hierarchy of Remediation Options

NEPC (2013) stipulates the preferred hierarchy of options for site clean-up (remediation) and/or management which is outlined as follows:

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

or, if these two options are not practicable;

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

or,

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

C3.0 Remediation Options Assessment

C3.1 Introduction

The findings of the previous investigations relevant to the subject site (see Section 7) has established there is no evidence of widespread or significant contamination across the site. However, localised contamination in some areas of environmental concern (AECs) has been identified as remediation and/or management. These AECs requiring remediation and/or management are summarised in Table 1 (Section 8).

C3.2 Remediation Options Assessment

NEPC (2013) stipulates the preferred hierarchy of options for site clean-up (remediation) and/or management which is outlined as follows:

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

or, if these two options are not practicable;

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

or,

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

When deciding which option to choose, the sustainability (environmental, economic and social) of each option should be considered, in terms of achieving an appropriate balance between the benefits and effects of undertaking the option. In cases where no readily available or economically feasible method is available for remediation, it may be possible to adopt appropriate regulatory controls or develop other forms of remediation (NEPC, 2013).

C3.3 Off-Site Disposal

Off-site disposal of contaminated soils comprises the excavation of the contaminated soils, waste classification of soil and disposal to a facility which can legally receive it. Based on current results all soils within identified AEC are suitable for off-site disposal without treatment, subject to appropriate waste classification.

Off-site disposal of any asbestos containing materials (ACM), would involve removal of all ACM fragments and any underlying impacted soils, under an appropriate waste classification to a facility which can legally receive it.

Disposal of the contaminated soils or ACM off-site is technically a straight forward option and could be completed in a relatively short time scale prior to development of the site. The option would remove from the site any maintenance and risk legacy associated with each AEC.

Off-site disposal is, however, an expensive option and the total volume of material that would require disposal would need to be determined through an initial delineation assessment.

C3.4 On-Site Re-Use (Burial)

On-site re-use through burial involves excavation, placement and appropriate burial (minimum 2 m below final ground surface) within suitable areas of the site. Geotechnical suitability is also a consideration for this option, based on the proportion of oversized (>150 mm) and organic material in each suitable AEC.

Over excavation of the proposed placement area may be required to achieve the proposed site level.

On-site re-use (burial) is not a suitable remediation strategy for any AEC which have been identified to present a potential risk to human health unless managed with an engineered designed containment cell with capping and associated environmental management plan (refer to Section B3.6).

On-site re-use (burial) maybe applicable to soils within AEC subject to testing showing that COPC identified present a potential risk to terrestrial ecology only or contain ACM as the only identified COPC at concentrations below commercial / industrial criteria.

C3.5 On-Site Treatment

In the case of surface soil (to maximum depths of 10 cm) impacted with asbestos, this management option entails physical treatment of the impacted soil on-site with the removal of the asbestos.

Generally, the physical treatment of surface soil impacted with ACM would comprise hand picking or “emu-bobbing” the ACM, with any ACM collected and disposed of at an appropriately licensed landfill¹

¹ Currently there are some uncertainties regarding the new EPA's position statement on “emu picking” in response of the revised Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia (the WA Asbestos Guidelines) by the West Australian Department of Health on 24 August 2021

The treatment is followed by validation sampling and lab analysis of each treated batch to validate that any remaining ACM within the treated soils are below the adopted land use criteria.

While the treated surface soils may be re-usable on site based on the validation inspections and ACM concentration in the validation samples being less than the adopted land use criteria, ACM may (most likely) still be present within the treated surface soils and as such the treated surface soil would still require covering with a minimum of 0.1 m of non-impacted materials (excluding topsoil).

If encountered the treatment of the petroleum contamination in soils is technically straight forward. The on-site remediation would generally comprise “landfarming” utilising micro-organisms naturally found in soils to reduce TRH concentrations and in accordance with NSW EPA *Best Practice Note: Landfarming*, April 2014.

Treatment of non-petroleum related PAH in soils is technically feasible, e.g. by direct fired thermal desorption, although treatment trials would need to be conducted to confirm the suitability of the subject material for treatment and costs to treat soil using this method can be high.

The advantages of the above on-site treatment options are the potential for reduction of concentrations of the contaminants to levels suitable for re-use on the site with minimal, if any, future management requirements. However, the above on-site treatment options would be comparatively expensive for the anticipated volumes, may be time consuming and may occupy large areas of the site during treatment.

C3.6 Capping and Containment

Capping and containment would involve the excavation and creation of an engineered containment cell followed by the placement of contaminated materials within the containment cell. A physical barrier over the cell would be required to minimise the potential for exposure to contaminated materials. The strategy would reduce the requirement for any off-site disposal with contaminated soil from suitable AEC to be placed within the containment cell.

The geotechnical suitability of the placed material would also need to be considered if the cell was located within a residential portion of the site or beneath a road.

The containment cell would likely require an associated long term environmental management plan, notice on title and agreement and/or planning consent from the local authority in accordance with section 3.4.6 NSW EPA *Guidelines for the NSW Site Auditor Scene (3rd Edition)*, April 2006. Natural material generated during the excavation of the cell could be used to reinstate site levels.

If the capping of a containment cell extends to a depth greater than 3 m below final ground level, the associated environmental management plan and notice on title may not be required (refer to NSW EPA *Guidelines for the NSW Site Auditor Scene (3rd Edition)*, April 2006).

1.0 Summary of Preferred Remediation Strategy

Discussion with representatives of BHL indicates the preferred remediation options for the contaminants (as summarised in Table 1 Section 8) is for a combination of remediation methodologies to be used which will be bespoke to each particular AEC and/or contaminant.

C4.0 References

CRC CARE. (2019a). *Remediation Action Plan: Development - Guideline on Performing Remediation Options Assessment*. National Remediation Framework: CRC for Contamination Assessment and Remediation of the Environment.

CRC CARE. (2019b). *Technology Guide: Soil - Excavation*. National Remediation Framework: CRC for Contamination Assessment and Remediation of the Environment.

CRC CARE. (2019c). *Technology Guide: Soil - Containment*. National Remediation Framework: CRC for Contamination Assessment and Remediation of the Environment.

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]*. Australian Government Publishing Services Canberra: National Environment Protection Council.

WA DoH. (2021). *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*. WA Department of Health.

WorkCover NSW. (2014). *Managing Asbestos in or on Soil*. March 2014: WorkCover NSW, NSW Government.

Appendix D

Site Assessment Criteria

Appendix D

Site Assessment Criteria

Elizabeth Drive, Badgerys Creek

D1.0 Introduction

D1.1 Guidelines

The following key guidelines were consulted for deriving the site assessment criteria (SAC):

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013).
- CRC CARE *Health screening levels for petroleum hydrocarbons in soil and groundwater* (CRC CARE, 2011).
- HEPA *PFAS National Environmental Management Plan (NEMP)* (HEPA, 2020).
- ANZG *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018).
- NHMRC *Guidelines for Managing Risks In Recreational Water* (NHMRC, 2008).
- NHMRC, NRMCC *Australian Drinking Water Guidelines 6 2011, Version 3.2* (NHMRC, NRMCC, 2016).
- ANZECC *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000).

D1.2 General

The SAC applied in the current investigation are informed by the CSM which identified human and environmental receptors to potential contamination at the site. Analytical results are assessed (as a Tier 1 assessment) against the SAC comprising primarily the investigation and screening levels of Schedule B1 of NEPC (2013).

The following inputs are relevant to the selection and/or derivation of the SAC:

- Land use: recreational/commercial/industrial.
 - o Corresponding to land use category 'C', public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. It does not include undeveloped public open space (such as urban bushland and reserves) which should be subject to a site-specific assessment where appropriate; and
 - o Corresponding to land use category 'D', commercial/industrial such as shops, offices, factories and industrial sites.
- Soil type: clay.

D2.0 Soils

D2.1 Health Investigation and Screening Levels

The generic health investigation levels (HIL) and health screening levels (HSL) are considered to be appropriate for the assessment of human health risk via all relevant pathways of exposure associated with contamination at the site. The adopted soil HIL and HSL for the contaminants of concern are in Table 1 and Table 2.

Table 1: Health Investigation Levels (mg/kg)

Contaminant	HIL-C	HIL-D
Metals		
Arsenic	300	3000
Cadmium	90	900
Chromium (VI)	300	3600
Copper	17 000	240 000
Lead	600	1500
Mercury (inorganic)	80	730
Nickel	1200	6000
Zinc	30 000	400 000
PAH		
B(a)P TEQ	3	40
Total PAH	300	4000
Phenols		
Phenol	40 000	240 000
Pentachlorophenol	120	660
OCP		
DDT+DDE+DDD	400	3600
Aldrin and dieldrin	10	45
Chlordane	70	530
Endosulfan	340	2000
Endrin	20	100
Heptachlor	10	50
HCB	10	80
Methoxychlor	400	2500
OPP		

Contaminant	HIL-C	HIL-D
Chlorpyrifos	250	2000
PCB		
PCB	1	7

Table 2: Health Screening Levels (mg/kg)

Contaminant	HSL-C	HSL-C	HSL-C	HSL-C
CLAY	0 m to <1 m	1 m to <2 m	2 m to <4 m	4 m+
Benzene	NL	NL	NL	NL
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	NL	NL	NL	NL
Naphthalene	NL	NL	NL	NL
TRH F1	NL	NL	NL	NL
TRH F2	NL	NL	NL	NL

Notes: TRH F1 is TRH C₆-C₁₀ minus BTEX

TRH F2 is TRH >C₁₀-C₁₆ minus naphthalene

The soil saturation concentration (C_{sat}) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds C_{sat}, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'

Table 3: Health Screening Levels (mg/kg)

Contaminant	HSL-D	HSL-D	HSL-D	HSL-D
CLAY	0 m to <1 m	1 m to <2 m	2 m to <4 m	4 m+
Benzene	4	6	9	20
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	NL	NL	NL	NL
Naphthalene	NL	NL	NL	NL
TRH F1	310	480	NL	NL
TRH F2	NL	NL	NL	NL

Notes: TRH F1 is TRH C₆-C₁₀ minus BTEX

TRH F2 is TRH >C₁₀-C₁₆ minus naphthalene

The soil saturation concentration (C_{sat}) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds C_{sat}, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'

The HSL for direct contact derived from CRC CARE (2011) are in Table 4.

Table 4: Health Screening Levels for Direct Contact (mg/kg)

Contaminant	DC HSL-C	DC HSL-D	DC HSL-IMW
Benzene	120	430	1100
Toluene	18 000	99 000	120 000
Ethylbenzene	5300	27 000	85 000
Xylenes	15 000	81 000	130 000
Naphthalene	1900	11 000	29 000
TRH F1	5100	26 000	82 000
TRH F2	3800	20 000	62 000
TRH F3	5300	27 000	85 000
TRH F4	7400	38 000	120 000

Notes: TRH F1 is TRH C₆-C₁₀ minus BTEX
 TRH F2 is TRH >C₁₀-C₁₆ minus naphthalene
 IMW intrusive maintenance worker

D2.2 Health Investigation Levels for Per- and Poly-Fluoroalkyl Substances in Soil

The laboratory analytical results for per- and poly-fluoroalkyl substances (PFAS) in soil have been assessed against HIL published in HEPA (2020). The HIL represent a nationally-agreed suite that should be used to inform site investigations. The HIL are intentionally conservative, and an exceedance of these criteria may not constitute a risk if other exposure pathways are controlled. An exceedance of the HIL should trigger further investigations, such as a site-specific risk assessment. At the time of this investigation, screening values were available only for perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and perfluorohexane sulfonate (PFHxS).

The HIL derived from Table 2 of HEPA (2020) are in Table 5.

Table 5: Health Investigation Levels (mg/kg)

Contaminant	HIL-C	HIL-D
PFOS and PFHxS *	1	20
PFOA	10	50

Notes: * Includes PFOS only, PFHxS only and the sum of the two.

D2.3 Asbestos in Soil

The HSL for asbestos in soil are based on likely exposure levels for different scenarios published in NEPC (2013) for the following forms of asbestos:

- Bonded asbestos containing material (ACM); and
- Fibrous asbestos and asbestos fines (FA and AF).

The HSL are in Table 6.

Table 6: Health Screening Levels for Asbestos

Form of Asbestos	HSL-C	HSL-D
ACM	0.02%	0.05%
FA and AF	0.001%	0.001%
FA and AF and ACM	No visible asbestos for surface soil *	No visible asbestos for surface soil *

Notes: Surface soils defined as top 10 cm.

* Based on site observations at the sampling points and the analytical results of surface samples.

D2.4 Ecological Investigation Levels

Ecological investigation levels (EIL) and added contaminant limits (ACL), where appropriate, have been derived in NEPC (2013) for arsenic, copper, chromium (III), nickel, lead, zinc, DDT and naphthalene. The adopted EIL, derived using the interactive (excel) calculation spreadsheet on the NEPM toolbox website are shown in Table 8, with inputs into their derivation shown in Table 7.

Table 7: Inputs to the Derivation of the Ecological Investigation Levels

Variable	Input	Rationale
Age of contaminants	"Aged" (>2 years)	Given the potential sources of soil contamination are from historic use, the contamination is considered as aged.
pH	6.6 pH Units	Based on the average of 54 soil analytical results (ranging from 4.6 to 7.8 pH units) from the DSI
CEC	5.94 cmol _c /kg	Based on the average of 4 soil analytical results (ranging from 3.8 to 11 pH units) from the DSI
Clay content	40 %	The soil at the site was dominantly silty clays

Variable	Input	Rationale
Traffic volumes	low	Majority of the site is not exposed to public road, with the site considered to be located within a low traffic area
State/Territory	NSW	

Table 8: Ecological Investigation Levels (mg/kg)

Contaminant	EIL-A-B-C	EIL-D
Metals		
Arsenic	100	160
Copper	120	180
Nickel	45	90
Chromium III	640	670
Lead	1100	1800
Zinc	330	490
PAH		
Naphthalene	170	370
OCP		
DDT	180	640

Notes: EIL-A-B-C urban residential and public open space
 EIL-D Commercial / Industrial

D2.5 Ecological Screening Levels

Ecological screening levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. The adopted ESL are shown in Table 9.

Table 9: Ecological Screening Levels (mg/kg)

Contaminant	Soil Type	ESL-A-B-C	ESL-D
Benzene	Fine	65	95
Toluene	Fine	105	135
Ethylbenzene	Fine	125	185
Xylenes	Fine	45	95
TRH F1	Coarse/ Fine	180*	215*
TRH F2	Coarse/ Fine	120*	170*
TRH F3	Fine	1300	2500
TRH F4	Fine	5600	6600
B(a)P	Fine	0.7	1.4

Notes: ESL are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability
 TRH F1 is TRH C₆-C₁₀ minus BTEX
 TRH F2 is TRH >C₁₀-C₁₆ including naphthalene
 ESL-A-B-C urban residential and public open space
 ESL-D Commercial / Industrial

D2.6 Ecological Soil Guideline Values

The interim ecological soil guideline values (EGV) derived from Table 3 of HEPA (2020) are in Table 10.

Table 10: Ecological Soil Guideline Values (mg/kg) – All Land Uses

Contaminant	Direct Exposure	Indirect Exposure
PFOS	1	0.01
PFOA	10	NC
PFHxS	NC	NC

Notes: NC no criterion

D2.7 Management Limits

In addition to appropriate consideration and application of the HSL and ESL, there are additional considerations which reflect the nature and properties of petroleum hydrocarbons, including:

- Formation of observable light non-aqueous phase liquids (LNAPL);
- Fire and explosion hazards;
- Effects on buried infrastructure eg: penetration of, or damage to, in-ground services.

The adopted management limits are in Table 11.

Table 11: Management Limits (mg/kg)

Contaminant	Soil Type	ML-A-B-C	ML-D
TRH F1	Coarse	700	700
TRH F2	Coarse	1000	1000
TRH F3	Coarse	2500	3500
TRH F4	Coarse	10 000	10 000
TRH F1	Fine	800	800
TRH F2	Fine	1000	1000
TRH F3	Fine	3500	5000
TRH F4	Fine	10 000	10 000

Notes: TRH F1 is TRH C₆-C₁₀ including BTEX
 TRH F2 is TRH >C₁₀-C₁₆ including naphthalene
 ML-A-B-C residential, parkland and public open space

D3.0 References

ANZECC. (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australia and New Zealand Environment and Conservation Council.

ANZG. (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Canberra, ACT: Australian and New Zealand Governments and Australian state and territory governments.

CRC CARE. (2011). *Health screening levels for petroleum hydrocarbons in soil and groundwater*. Parts 1 to 3, Technical Report No. 10: Cooperative Research Centre for Contamination Assessment and Remediation of the Environment.

HEPA. (2020). *PFAS National Environmental Management Plan (NEMP)*. Version 2.0: Heads of EPAs Australia and New Zealand and Australian Government Department of the Environment.

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]*. Australian Government Publishing Services Canberra: National Environment Protection Council.

NHMRC. (2008). *Guidelines for Managing Risks In Recreational Water*.

NHMRC, NRMCC. (2016). *Australian Drinking Water Guidelines 6 2011, Version 3.2*. Canberra: National Health and Medical Research Council, National Resource Management Ministerial Council.

Appendix E

General Site Management Plan

Appendix E

Site Management Plan

Elizabeth Drive, Badgerys Creek NSW

E1.0 Introduction

This general site management plan (SMP) has been developed to minimise potentially adverse impacts on the environment, and worker and public health as a result of the proposed remediation works.

The Remediation Contractor must have in place a construction environmental management plan (CEMP) (or similar) which is specific to the equipment used for the remediation and the proposed methods to be adopted by the Remediation Contractor. This SMP has been prepared to augment the Remediation Contractor's CEMP and contains general details for aspects of the work, as per reporting requirements for a remediation action plan (RAP) under NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020).

Apart from the management principles outlined in this SMP, the Remediation Contractor must also ensure compliance with all relevant environmental legislation and regulations, including (but not limited to) the following:

- *Contaminated Land Management Act 1997 NSW (CLM Act)*;
- *Protection of the Environment Operations Act 1997 NSW (POEO Act)*;
- *Protection of the Environment Legislation Amendment Act 2011 NSW*;
- *Protection of the Environment Operations Amendment (Scheduled Activities and Waste) Regulation 2008 NSW*.
- *Environmentally Hazardous Chemicals Act 1985 NSW*;
- *Environmental Offences and Penalties Act 1989 NSW*;
- *Pesticide Act 1999 NSW and Pesticides Regulation 2017*; and
- *Work Health and Safety Act 2017 NSW (WHS Act) and Work Health and Safety Regulations 2017 NSW*.

E2.0 Roles and Responsibilities

E2.1 Principal

The Principal is responsible for the environmental performance of the proposed remediation works, including implementation of acceptable environmental controls during remediation works. The Principal will retain the overall responsibility for ensuring this RAP is appropriately implemented. The Principal is to nominate a representative (the Principal's Representative), who is responsible for overseeing the implementation of this RAP. The actual implementation of the RAP will, however, be conducted by the Principal Contractor on behalf of the Principal.

The Principal is responsible for providing appropriate information to the Contractor to allow them to safely plan the required works. This includes the asbestos register for the site and this RAP.

The Principal is also responsible for implementing an appropriate communications plan.

E2.2 Remediation Contractor

The Remediation Contractor ('the Contractor') will be the party responsible for daily implementation of this RAP and shall fulfil the responsibilities of the Contractor as defined by SafeWork NSW. It is noted that the Contractor may appoint appropriately qualified sub-contractors or sub-consultants to assist in fulfilling the requirements of the procedures. The Contractor will appoint a Site Manager.

In addition to the implementation of the RAP it will be the Contractors responsibility to:

- Obtain/ensure relevant sub-contractors obtain specific related approvals as necessary to implement the earthworks including permits for removal of asbestos-containing material, SafeWork NSW notification etc.;
- Develop or request and review any site plans to manage the works to be conducted;
- Ensure that all remediation works and other related activities are undertaken in accordance with this RAP;
- Maintain all site records related to the implementation of this RAP;
- Ensure sufficient information is provided to engage or direct all required parties, including sub-contractors, to implement the requirements of the RAP other than those that are the direct responsibility of the Contractor;
- Manage the implementation of any recommendation made by those parties in relation to work undertaken in accordance with the RAP;
- Inform, if appropriate, the relevant regulatory authorities of any non-conformances with the procedures and requirements of the RAP in accordance with the procedures outlined in this document;
- Retain records of any contingency actions;
- On completion of the project, to review the RAP records for completeness and update as necessary; and
- Recommend any modification to general documentation which would further improve the environmental outcomes of this RAP.

E2.3 Surveyor

The project surveyor will be a registered surveyor engaged by the Contractor to undertake surveying works as required by this RAP.

E2.4 Asbestos Contractor

The Asbestos Contractor will be responsible for undertaking all asbestos work involving any asbestos impacted filling and will hold a Class A licence for the removal of asbestos (issued by SafeWork NSW), on the basis that the asbestos identified at the site to date has included both friable and bonded asbestos.

The Asbestos Contractor can be the same entity as the Remediation Contractor.

E2.5 Sub-contractors

All sub-contractors will be inducted onto the site, informed of their responsibilities in relation to this RAP and sign their agreement to abide by the RAP requirements. Where necessary, sub-contractors will also be trained in accordance with the requirements of this document. All sub-contractors must conduct their operations in accordance with the RAP as well as all applicable regulatory requirements.

E2.6 Environmental Consultant

The Environmental Consultant will provide advice on implementing the RAP. The Environmental Consultant will be responsible for:

- Undertake any required assessments where applicable (e.g. waste classification, validation);
- Provide advice and recommendations arising from monitoring and/or inspections, including unexpected finds; and
- Notify the Client with any results of assessments, and any observed non-conformances.

E2.7 Site Workers

All workers on the site are responsible for observing the requirements of this RAP and other management plans. These responsibilities include the following:

- Being inducted on the site and advised of the general nature of the remediation/environmental issues at the site;
- Being aware of the requirements of this plan;
- Wearing appropriate personal protective equipment (PPE) as required by this plan;
- Only entering restricted areas when permitted; and
- Requesting clarification when unclear of requirements of this or any other plans (e.g. safe work method statements (SWMS)).

E3.0 Water Management

E3.1 Stormwater

Stormwater must be managed during the remediation works such that potential adverse impacts from surface runoff (e.g. cross contamination, mobilisation of contaminants in soil particles, etc.) are appropriately mitigated. Accordingly, the Remediation Contractor will take appropriate measures which may include:

- Construction, where necessary, of stormwater diversion channels, bunding and linear drainage sumps with catch pits in and around the remediation areas to divert stormwater from the contaminated areas;
- Provision of appropriately located sediment traps including geotextiles; and
- Discharge of excess water in excavations / low points on a regular basis to limit the potential for flooding.

E3.2 Dewatering of Excavations

Any runoff or seepage water accumulated in site excavations that requires removal must initially be sampled and tested for suspended solids, pH and any contaminants of potential concern (CoPC) as identified by the Environmental Consultant. The options for management of excavation pump-out water, dependent upon the test results, are for disposal of the water as follows:

- Discharge to stormwater with prior approval from Council. Provided the test results comply with relevant ANZG *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018), or any other compliance requirements stipulated by Council. The Environmental Consultant must consider the most appropriate criteria to be used; or
- Discharge to sewer, as industrial trade wastewater, with prior approval from Sydney Water. This option would require the analysis of a larger list of analytes, and compliance with the Sydney Water acceptance standards; or
- Pumping by a liquid waste contractor for removal of the water off-site, in accordance with regulatory requirements.

Note that, depending on the type and scale of the dewatering required, a permit (water use approval) may need to be obtained through NSW Water.

E4.0 Soil Management Plan

The Contractor will develop a plan to mitigate cross contamination as part of the CEMP to be implemented throughout the works.

E4.1 Excavation and Stockpiling of Contaminated Material

Contaminated material shall be excavated and stockpiled at a suitably segregated location(s) away from sensitive areas (e.g. water bodies, drainage lines, stormwater pits, etc.) and ongoing excavations, and in a manner that will not cause nuisance to the neighbouring properties. Soil stockpiles are to be managed as follows:

- An impermeable membrane such as plastic sheeting should be provided at the surface by the Remediation Contractor prior to stockpiling. Plastic sheeting should be taped at joins, as necessary;
- All stockpiles of contaminated material shall be surrounded by star pickets and marking tape or other suitable material to clearly delineate their boundaries;
- Stockpiles shall be lightly conditioned by sprinkler or covered by geotextile or similar cover to prevent dust generation;
- Stockpiles impacted, or potentially impacted, with asbestos must be covered by geotextile;
- Any stockpile to remain on-site overnight should be adequately secured in order to reduce the risk of sediment runoff; and
- Measures should be taken by the remediation contractor to prevent the migration of stockpile materials (i.e. perimeter bunds, hay bales, silt fences, etc.);
- Should the stockpile remain on-site for over 24 hours, geotextile silt fences must be erected to prevent losses by surface erosion.
- A record of stockpile locations (stockpile register), dimensions, descriptions, environmental controls, etc. should be maintained by the Remediation Contractor.

All movement of soil within the site and off-site is to be tracked by the Remediation Contractor, from cradle to grave. Copies of tracking records must be provided to the Environmental Consultant.

E4.2 Loading and Transport of Contaminated Material

Transport of contaminated material from the site shall be via a clearly delineated haul route and this route shall be used exclusively for entry and egress of vehicles used to transport contaminated materials within and away from the site. The proposed waste transport route (to be determined by the Remediation Contractor) will be notified to Council and truck dispatch shall be logged and recorded by the Remediation Contractor for each load leaving the site. A record of the truck dispatch will be provided to the Environmental Consultant.

All haulage routes for trucks transporting soil, materials, equipment or machinery to and from the site should be selected to meet the following objectives:

- Comply with all road traffic rules;
- Minimise noise, vibration and dust to adjacent premises; and
- Utilise State roads and minimise use of local roads as far as practicable.

The remediation work will be conducted such that all vehicles:

- Conduct deliveries of soil, materials, equipment or machinery only during the specified hours of remediation;
- Have securely covered loads to prevent any dust or odour emissions during transportation; and
- Exit the site in a forward direction.

In addition, measures will be implemented to ensure no contaminated material is spilled onto public roadways or tracked off-site on vehicle wheels. Roadways will be kept clean throughout the remediation works and will be broomed, if necessary, to achieve a clean environment.

All loads will be securely covered and may be lightly wetted, if required, to ensure that no materials or dust are dropped or deposited outside or within the site. Prior to exiting the site each truck should be inspected by Remediation Contractor personnel and either noted as clean (wheels and chassis) or broomed prior to leaving the site. Any soil spilled onto surrounding streets will be cleaned by mechanical or hand methods, on a daily basis.

Removal of waste materials from the site shall only be carried out by contractors holding the appropriate license(s), consent or approvals to dispose of the waste materials according to the waste classification and with the appropriate approvals obtained from the EPA, where required.

E5.0 Noise and Vibration Control Plan

All equipment and machinery should be operated in an efficient manner to minimise the emission of noise. The use of any plant and/or machinery should not cause unacceptable vibrations to nearby properties and should meet Council requirements.

E6.0 Dust Control Plan

Dust emissions must be confined within the site boundary as far as is practicable. The following example dust control procedures could be employed to comply with this requirement, as necessary:

- Erection of dust screens around the perimeter of the site (as applicable);
- Securely covering all loads entering or exiting the site;
- Use of water sprays across the site to suppress dust;
- Covering of all stockpiles of contaminated soil remaining on site more than 24 hours;
- Include wheel wash (if applicable); and
- Keeping excavation and stockpile surfaces moist.

Regular checking of the fugitive dust issues is to be undertaken. Remedial measures are to be undertaken to rectify any cases of excessive dust.

E7.0 Odour Control Plan

No odours should be detected at any boundary of the site during remediation works by an authorised Council Officer relying solely on sense of smell. The following example procedures could be employed to comply with this requirement as necessary:

- Use of appropriate covering techniques such as plastic sheeting, polythene or geotextile membranes to cover excavation faces or stockpiles;
- Fine spray of water and/or hydrocarbon mitigating agent on impacted areas/stockpiles or loads to lightly condition the material;
- If required, restrict uncovered stockpiles to appropriate sizes to minimise odour generation;
- Ceasing works during periods of inclement weather such as high winds or heavy rain;
- Regular checking of the fugitive dust and odour issues to ensure compliance. Undertake immediate remediation measures to rectify any cases of excessive dust or odour (e.g. use of misting sprays or odour masking agent); and
- Adequate maintenance of equipment and machinery to minimise exhaust emissions.

E8.0 Work Health and Safety Plan

E8.1 General

It is the Remediation Contractor's responsibility to devise a SWMS¹ (or series thereof, for various respective tasks) and to implement proper controls that enable the personnel undertaking the remediation to work in a safe environment. This RAP and SMP does not relieve the Remediation Contractor or other contractors of their ultimate responsibility for occupational health and safety of their workforce and to prevent contamination of areas outside the 'remediation' workspace. This RAP and SMP sets out general procedures and the minimum standards and guidelines for remediation that will need to be used in preparing the safe work method statement.

This work health safety plan (WHSP) has been prepared with reference to CRC CARE *Remediation Action Plan: Implementation - Guideline on Health and Safety* (CRC CARE, 2019). The requirements of this WHSP must be incorporated into the Remediation Contractor's SWMS.

All site work must be undertaken in a controlled and safe manner with due regard to potential hazards, training and safe work practices. To attain this the SWMS developed by the Remediation Contractor must comply with policies specified in the Work Health and Safety Regulation 2011.

All appropriate permits, licences and notifications required for the remediation activities must be obtained prior to the commencement of remediation works.

¹ Either a SWMS or construction environmental management plan (CEMP), or other equivalent document incorporating health and safety aspects of the proposed remedial works.

E8.2 Site Access

Appropriate fencing and signage must be installed around and within the site to prevent unauthorised access and restrict access to remediation areas and/or deep excavations. Access restrictions and administrative arrangements for management of entry of workers or related personnel on site is the responsibility of the Remediation Contractor.

Any existing pits or unstable areas on site that may generate potential safety, or operational risk should be demarcated and taped off, with appropriate rectification action undertaken (e.g. backfilling of pits).

E8.3 Personnel and Responsibilities

Before undertaking works on site, all personnel will be made aware of the officer responsible for implementing WHS procedures. All personnel must read and understand this WHSP and over-arching SWMS prior to commencing site works and sign a statement to that effect. Contractors employed at the site will be responsible for ensuring that their employees are aware of, and comply with, the requirements of this WHSP and Remediation Contractor's SWMS.

E8.4 Chemical Contamination Hazards

Chemical compounds or substances that may be present in the soils at the site include the key CoPC TRH, BTEX, PAHs, metals and, given the presence of fill, asbestos. There is also a lower probability of other contaminants being present.

The risks associated with the identified contaminants to site personnel and workers involved in the remediation are considered to be low due to the concentrations within groundwater and soil vapour and limited exposure durations. These risks are associated with:

- Ingestion of contaminated soil and/or water;
- Dermal contact with contaminated soil and/or water; and
- Inhalation of dusts or vapours of the CoPC.

If asbestos is encountered in fill, this risk evaluation should be revised.

Personnel will endeavour, wherever possible, to avoid direct contact with potentially contaminated material. Workers must avoid the potential exposures listed above as far as is practicable. Appropriate personal protective equipment (PPE) must be used to mitigate potential risks.

E8.5 Physical Hazards

The following physical hazards are associated with conditions that may be created during remediation works:

- Heat exposure;
- Excavations;

- Buried services;
- Noise;
- Dust;
- Electrical equipment;
- Heavy equipment and truck operation; and
- Asbestos.

Safe work practices must be employed to manage the physical risks identified above. For the most part these risks can be managed through appropriate demarcation, access controls and the use of appropriate PPE.

E8.6 Safe Work Practices

The appropriate safe work practices should be clearly defined by the Remediation Contractor in their SWMS. As a minimum, all personnel on site will be required to wear the following PPE:

- Steel-capped boots (mandatory);
- High visibility clothing/vest (mandatory);
- Safety glasses or safety goggles with side shields requirements (as necessary);
- Hard hat (as necessary);
- Appropriate respiratory and protective equipment for any works involving asbestos (as necessary); and
- Hearing protection when working in the vicinity of machinery or plant equipment if noise levels exceed exposure standards (as necessary).

Each item of PPE should meet the corresponding relevant Australian Standard(s).

Specific safe work practices will be adopted when working with asbestos, in accordance with (but not limited to) the following codes of practice:

- SafeWork NSW *Code of Practice, How to Manage and Control Asbestos in the Workplace* (SafeWork NSW, 2019a)
- SafeWork NSW *Code of Practice, How to Safely Remove Asbestos* (SafeWork NSW, 2019b);
- WorkCover NSW *Managing Asbestos in or on Soil* (WorkCover NSW, 2014);
- NOHSC *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Ed* (NOHSC, 2005).

E9.0 Remediation Schedule and Hours of Operation

The remediation works will be conducted within the days and hours specified in the development consent.

E10.0 Response to Incidents

The key to effective management of incidents is the timely action taken before any situation reaches a reportable or critical level. Therefore, surveillance activities are extremely important, and should be conducted for the measures prescribed herein and any other measures prescribed in any additional environmental management plan developed subsequently. During construction activities on the site, the following inspection or preventative actions should be performed by the Remediation Contractor:

- Regular inspection of works;
- Completion of routine environmental checklists and follow-up of non-compliance situations;
- Maintenance and supervision on-site; and
- An induction process for site personnel involved in the remediation works that includes relevant information on the contamination status of the site, the remediation works being undertaken, worker health and environmental protection requirements and ensures that all site personnel are familiar with the site emergency procedures.

An emergency response plan will be in place for all aspects of site works. Any emergency will be reported immediately to the site office and/or the Site Manager (and Safety Officer), and the appropriate emergency assistance should be sought. The Site Manager should be responsible for initiating an immediate emergency response using the resources available on the site. Where external assistance is required, the relevant emergency services should be contacted. A table such as that below, containing contact details for key personnel who may be involved in an environmental emergency response should be completed and be readily available to personnel at all times. The table should be completed, and thereafter amended, as required.

The Remediation Contractor will be responsible for ensuring that site personnel are aware of the emergency services available and the appropriate contact details. A site Safety Officer should be contactable, or available, on-site during remediation and development works.

Contact details for key utilities are included in the event of needing to respond to incidents. Blank cells are 'to be confirmed' and should be completed prior to works commencing when all entities are confirmed.

Table 1: Summary of Roles and Contact Details

Role	Personnel / Contact	Phone Contact Details
Principal		
Principal's Representative		
Site Manager		
Remediation Contractor and Builder		
Site Office		
Environmental Consultant		
Consent Authority		
Regulator	NSW EPA (pollution line and general enquiries)	131 555
Utility Provider	Water (Sydney Water Corporation)	13 20 92
Utility Provider	Power (Ausgrid)	13 13 88
Utility Provider	Gas (Jemena Limited)	131 909
Utility Provider	Telecommunications (Telstra Corporation Limited)	13 22 03
Utility Provider	Telecommunications (Optus)	1800 505 777
Utility Provider	Telecommunications (NBN Co Limited)	1800 687 626

E11.0 References

ANZG. (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Canberra, ACT: Australian and New Zealand Governments and Australian state and territory governments.

CRC CARE. (2019). *Remediation Action Plan: Implementation - Guideline on Health and Safety*. National Remediation Framework: CRC for Contamination Assessment and Remediation of the Environment.

NOHSC. (2005). *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Ed*. Canberra, April 2005, NOHSC:3003: National Occupational Health and Safety Commission, Commonwealth of Australia.

NSW EPA. (2020). *Guidelines for Consultants Reporting on Contaminated Land*. Contaminated Land Guidelines: NSW Environment Protection Authority.

SafeWork NSW. (2019a). *Code of Practice, How to Manage and Control Asbestos in the Workplace*. August 2019.

SafeWork NSW. (2019b). *Code of Practice, How to Safely Remove Asbestos*. August 2019: SafeWork NSW, NSW Government.

WorkCover NSW. (2014). *Managing Asbestos in or on Soil*. March 2014: WorkCover NSW, NSW Government.

Appendix F

Contingency Plan and Unexpected Finds Protocol

Appendix F

Contingency Plan and Unexpected Finds Protocol

Elizabeth Drive, Badgerys Creek NSW

F1.0 General

Where the site conditions are found to be different than that anticipated during the remediation works, the proposed remediation approach may not be appropriate for the contamination encountered. In such cases the Environmental Consultant is to re-assess the contamination and remediation approach. Where necessary the Environmental Consultant will prepare an addendum to, or revision of, this RAP.

F2.0 Contingency Plan

This contingency plan has been developed to provide guidance on processes to follow if contamination (or indicators of contamination), other than that included in the remediation strategy, (Section 15) is encountered during the remediation works. Any such finds shall be surveyed and the location documented.

Although the site has been subject to previous investigation(s), there remains a potential for soil contamination to be present between sampled locations. In the event that signs of soil contamination, other than that included in the remediation strategy, are encountered during remediation e.g. evidence of asbestos containing material (ACM), petroleum, or other chemical odours which weren't previously identified the following protocols will apply:

- The Site Manager is to be notified and the affected area closed off by the use of barrier tape and warning signs;
- The Environmental Consultant is to be notified to inspect the area and assess the significance of the potential contamination and determine extent of remediation works (if deemed necessary) to be undertaken. An assessment report and management plan detailing this information will be compiled by the Environmental Consultant and provided to the Principal's Representative;
- The assessment results together with a suitable management plan shall be provided by the Principal's Representative to the Consent Authority (if required by the development consent);
- The agreed management/remedial strategy, based on the RAP and relevant guidelines (e.g. WA DoH (2021), for asbestos issues), shall be implemented; and
- All details of the assessment and remedial works are to be included in the site validation report.

F3.0 Unexpected Finds Protocol

This unexpected finds protocol (UFP) has been developed to provide guidance on processes to follow if any unexpected find is encountered during the remediation or future civil and construction works. Any unexpected finds should be surveyed and the location documented.

All site personnel are to be inducted into their responsibilities under this (UFP), which should be included or referenced in the Contractors Environmental Management Plan.

All site personnel are required to report unexpected signs of environmental concern to the Site Manager if observed during the course of their works e.g. presence of potential unexploded ordinance, unnatural staining, potential contamination sources (such as buried drums or tanks) or chemical spills.

Should signs of concern be observed, the Site Manager, as soon as practical, will:

- Stop work in the affected area and ensure the area is barricaded to prevent unauthorised access;
- Notify authorities needed to obtain emergency response for any health or environmental concerns (e.g. fire brigade);
- Notify the Principal's Representative of the occurrence;
- Notify any of the authorities that the Contractor is legally/contractually required to notify (e.g. EPA, Council); and
- Notify the Environmental Consultant.

The Principal's Representative is to notify any of the authorities which the Principal is legally/contractually required to notify (e.g. EPA, Council). Where appropriate the Principals Representative will also implement appropriate community consultation in accordance with the Communications Plan (if required).

The Environmental Consultant will assess the extent and significance of the find and develop an investigation, remediation or management approach using (where possible) the principles and procedures already outlined in the RAP. Where a Site Auditor is involved, the proposed approach will be discussed and agreed with the Site Auditor prior to implementation.

F4.0 References

WA DoH. (2021). *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*. WA Department of Health.