ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

26 September 2022

CPB Contractors-Ghella JV
C/O Road and Rail Excavations Pty Ltd
2/17 Mount Erin Road
Campbelltown NSW 2560

Attention: [redacted]

Remediation Action Plan –
1 - 17 Gipps Street Claremont Meadows NSW

Please find enclosed a copy of our report titled as above. Thank you for the opportunity to undertake this work. Should you have any queries, please do not hesitate to contact us on (02) 9922 1777.

For and on behalf of
Environmental Earth Sciences NSW

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Version History

Version	Dated	Issued By	Comments
1	18-Aug-22	Environmental Earth Sciences	Initial version for CPBG.
2	19-Aug-22	Environmental Earth Sciences	Minor revision in response to comments from CPBG.
3	15-Sep-22	Environmental Earth Sciences	Revised to address Site Auditor comments.
4	26-Sep-22	Environmental Earth Sciences	Revised to address Site Auditor comments.

EXECUTIVE SUMMARY

Introduction and objectives

Environmental Earth Sciences NSW was engaged by Road & Rail Excavations Pty Ltd (Road & Rail) on behalf of CPB Contractors-Ghella Joint Venture (CPBG) to prepare this remediation action plan (RAP) for 1-17 Gipps Street, Claremont Meadows, NSW (the "site").

The site is being used to support the delivery of the Sydney Metro – Western Sydney Airport (SM-WSA) Station Boxes and Tunnels (SBT) project (the "project").

The objectives of this RAP are:

- To present a summary of the site investigation works completed to date and outline existing data gaps that require addressing.
- Identify unacceptable contamination at the site (if any) and outline the impacted areas and uncertainty of asbestos within fill material at the site.
- Identify and evaluate the potential remediation options to remediate and/ or manage potential contamination at the site.
- Detail how the most suitable remediation options must be implemented to successfully reduce the potential risk to identified receptors.
- Outline the applicable criteria from relevant legislation and sampling/ assessment requirements for validating any site remediation.
- Identify management plans required to be implemented during site remediation, or prepared following completion of site remediation (if required).

Findings

Intrusive investigations associated with the overarching project and specific to the site have not identified an immediate requirement to undertake site remediation works. It is recognised that potential exists for unexpected finds and therefore a RAP was prepared to assist in managing these and ensure that the site is made suitable for the intended use as a construction site. This use is analogous to the generic land-use scenario 'D' for commercial/ industrial as described in ASC NEPM (2013).

Four potentially suitable remediation technologies/ options were identified and evaluated in accordance with ASC NEPM (2013) and the National Remediation Framework, from the current understanding of contamination at the site the following preference (most to least preferred) were identified:

1. **Option 1** – Picking and treating of soils.
2. **Option 3** – Off-site disposal as waste.

3. **Option 2** – On-site encapsulation and management.

4. **Option 4** – Do nothing.

It is recognised that there is potential for beneficial re-use of material in accordance with the prepared HHERA (Cardno, 2021c) and further consideration of the identified re-use scenarios is potentially required along with appropriate approvals.

It is understood that on other project sites of the Sydney Metro Western Sydney Airport (SMWSA) a different re-use procedure has been considered including materials meeting the requirements set out under the *Airport Environment Protection Regulations 1997* (AEPR) and the Federal Material Import and Reuse Procedures. In view of this, any material proposed to be reused will need to consider the requirements of the receiving site.

Conclusion

Through the course of site works potential unexpected finds can be appropriately managed through the correct implementation of this RAP such that no unacceptable risk to site users/ workers and/ or the environment would remain.

Any remediation works undertaken should be appropriately documented and reported such that a final overarching validation report for all unexpected finds and site remedial activity can be prepared to demonstrate there are no residual unacceptable risks.

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1 INTRODUCTION AND SITE IDENTIFICATION

Environmental Earth Sciences NSW was engaged by Road & Rail Excavations Pty Ltd (Road & Rail) on behalf of CPB Contractors-Ghella Joint Venture (CPBG) to prepare this remediation action plan (RAP) for 1-17 Gipps Street, Claremont Meadows, NSW (the "site").

The site is being used to support the delivery of the Sydney Metro – Western Sydney Airport (SM-WSA) Station Boxes and Tunnels (SBT) project (the "project"). The site is referred to as the Claremont Meadows Services Facility (CMSF) and is to be used for construction purposes, including materials lay-down areas, site facilities and amenities, a dive shaft to access the tunnels and housing a water treatment plant. The site identification details have been provided in **Table 1**.

Table 1: Site identification details

Aspect	Details
Address	1-17 Gipps Street, Claremont Meadows, NSW 2747
Lot & Plan number	Part Lot 100 on DP1275138
Area	~4.0 Ha
Local Government Area (LGA)	Penrith City Council
Zoning	R3 (Medium Density Residential) and B6 (Enterprise Corridor)
Local Environmental Plan (LEP)	Penrith Local Environmental Plan 2010
Current land use	Cleared vacant land
Proposed land use	Commercial / Industrial – construction site
Site location and proposed layout	**Figure 1** and **Figure 2**

2 OBJECTIVES

The overarching objective of this RAP is to provide guidance to remediate potential contamination and manage unexpected finds and/ or residual risks such that no unacceptable risk based on the proposed commercial/ industrial land use scenario is present to identified receptors.

The specific objectives of this RAP are:

- To present a summary of the site investigation works completed to date and outline existing data gaps that require addressing.
- Identify unacceptable contamination at the site (if any) and outline the impacted areas and uncertainty of asbestos within fill material at the site.

- Identify and evaluate the potential remediation options to remediate and/ or manage potential contamination at the site.
- Detail how the most suitable remediation options must be implemented to successfully reduce the potential risk to identified receptors.
- Outline the applicable criteria from relevant legislation and sampling/ assessment requirements for validating any site remediation.
- Identify management plans required to be implemented during site remediation, or prepared following completion of site remediation (if required).

3 APPLICABLE LEGISLATION

3.1 Legislation

Remediation planning has referred to the following specific legislation:

- Work Health and Safety Act 2011 (WHS Act), and Regulation 2017.
- Environmental Planning and Assessment Act 1979 (EP&A Act).
- Contaminated Land Management Act 1997 (CLM Act).
- Protection of the Environment Operations Act 1997 (POEO Act).
- State Environmental Planning Policy (Resilience and Hazards) 2021.

3.2 Guidelines

Remediation planning has referred to the following statutory and technical guidelines:

- Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (2017) – *Technical Report No.39, Risk-based Management and Remediation Guidance for Benzo(a)pyrene* (CRC Care, 2017).
- Environmental Health Standing Committee (enHealth) (2005) – *Management of Asbestos in the Non-Occupational Environment*.
- National Environment Protection Council (NEPC) – *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as Amended 2013)* (ASC NEPM, 2013).
- NSW EPA (1995) – *Sampling Design Guidelines* (the “Sample Design Guidelines”).
- NSW EPA (2014) – *Waste Classification Guidelines: Part 1 Classifying Waste* (the “Waste Guidelines”).

- NSW EPA (2015) – *Guidelines on the Duty to Report Contamination Under the Contaminated Land Management Act 1997* (the "Duty to Report Guidelines").
- NSW EPA (2017) – *Guidelines for the NSW Site Auditor Scheme (3rd edition)* (the "Auditor Guidelines").
- NSW EPA (2020) – *Contaminated Land Guidelines: Consultants Reporting on Contaminated Land.*
- EPA Victoria (2009) - Environment Protection (Industrial Waste Resource) Regulations 2009 (Publication IWRG702).
- Western Australian (WA) Department of Health (DoH) (2021) - Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.

3.3 Standards

The following Australian Standards (AS) are relevant to this remediation planning:

- AS 4801 – Occupational health and safety management systems – Specification with guidance for use.
- AS1141.3.1:2012 – Methods for Sampling and Testing Aggregates.
- AS4482.2:1999 – Guide to the sampling and investigation of potentially contaminated soil: Part 2: Volatile substances.
- AS4482.1:2005 – Guide to the sampling and investigation of potentially contaminated soil: Part 1: Non-volatile and semi-volatile compounds.
- AS / New Zealand Standard (NZS) 1716:2009 - Selection, Use and Maintenance of Respiratory Protective Devices.

3.4 Codes of practice

The following codes of practice are considered relevant to this remediation planning:

- Landcom (2004) - Managing Urban Stormwater: Soils and Construction - Volume 1, 4th Edition (New South Wales Government) (the "Blue Book").
- NSW WorkCover (2014) – Managing Asbestos In or On Soil (March 2014).
- SafeWork NSW (2019a) – How to Manage and Control Asbestos in the Workplace (August 2019);
- SafeWork NSW (2019b) – How to Safely Remove Asbestos (August 2019);
- SafeWork NSW (2019c) – Demolition Work (August 2019);

- SafeWork NSW (2019d) – Hazardous Manual Tasks (August 2019);
- SafeWork NSW (2019e) – How to Manage Work Health and Safety Risks (August 2019);
- SafeWork NSW (2019f) – Managing the Risks of Plant in the Workplace (August 2019);
- SafeWork NSW (2019g) – Managing the Work Environment and Facilities (August 2019);
- SafeWork NSW (2019h) – Managing the Risks of Plant in the Workplace (August 2019);
- SafeWork NSW (2019i) – Work Health and Safety Consultation, Cooperation and Coordination (August 2019);
- SafeWork NSW (2020) – Excavation Work (January 2020).

4 SUMMARY OF SITE INVESTIGATIONS

The following known investigations have been undertaken at the site for assessment of contamination, which have been used to inform contamination management aspects for the project:

- General project reports and investigations:
    - Cardno (2021a), *Contamination Assessment Report, Sydney Metro Western Sydney Airport* (Ref. 80021888; 5 May 2021).
    - Cardno (2021b), *Contamination Assessment Report – Phase D/E, Sydney Metro Western Sydney Airport* (Ref. 80021888 Rev.B; 22 November 2022).
    - Golder and Douglas Partners (2021), *Factual Contamination Report – Preliminary Site Investigation* (Ref. 19122621-003-R-Rev3; 19 February 2021).
    - M2A Joint Venture (M2A) (2020), *Sydney Metro – Western Sydney Airport, Technical Paper 8: Contamination*.
- Site specific reports and investigations:
    - Environmental Earth Sciences NSW (2022), *Detailed Site Investigation for Claremont Meadows Services Facility* (Ref. 122045RP01V2, dated 27 July 2022).
    - EDP Consulting (2022), *Waste Classification and On-site Re-Use Assessment of Stockpiled Soil Material 1-17 Gipps Street, Claremont Meadows NSW* (Ref. S-03958.WCC.001 V3, dated 13 April 2022).

4.1 General project reports and investigations

M2A (2020) was a technical paper akin to a broad preliminary site investigation (PSI) to support the project's environmental impact statement (EIS). M2A (2020) presented the site's history interpreted from historic aerial imagery and land titles, which indicated that the site was used for private residence and market-garden scale agricultural uses before being purchased in 1974 and then transferred/ sold between various NSW state government entities including:

- The Housing Commission of NSW;
- The Land Commission of NSW;
- Roads and Maritime Services (now Transport for NSW).

M2A (2020) considered that a structure adjacent the north boundary with connected access driveways from Great Western Highway was likely a green-grocer from the combined interpretation of historic aerial images and land-titles.

The factual reports prepared for the project (Cardno, 2021a and 2021b and Golder and Douglas Partners, 2021) advanced a limited number of investigation locations at the site, as a combination of test pits and bore-holes including installing groundwater monitoring bores and sub-surface gas bores as summarised in **Table 2**.

Table 2: Summary of relevant investigation locations

Location ID	Type of location	Comments
SMGW-BH-A109	Soil/ rock bore – converted to groundwater monitoring bore	Two soil samples collected. All samples below adopted site assessment criteria
SMGW-BH-A109s	Soil bore – converted to groundwater monitoring bore	No soil samples analysed.
SMGW-BHA110	Soil/ rock bore	One soil/ rock sample analysed. Zinc reported above adopted EIL.
SMGW-BH-A304	Soil/ rock bore – converted to groundwater monitoring bore	No soil samples analysed.
SMGW-BH-A365	Soil/ rock bore – converted to groundwater monitoring bore	All samples below adopted site assessment criteria
SMGW-BH-A366	Soil bore – converted to ground gas monitoring bore	All samples below adopted site assessment criteria
SMGW-SMGW-TPA303	Test pit to 3 mBGL.	All samples below adopted site assessment criteria

Soil samples collected from locations listed in **Table 2** during the factual investigations were submitted for a wide suite of analytes including inorganic and organics and following analysis, were reported below the adopted site assessment criteria considering a commercial/ industrial land-use scenario (Setting D) from ASC NEPM (2013).

One exceedance of an ecological investigation level (EIL) for zinc was reported from bore BH-A110 collected at 29 m depth, however as this was below the rhizosphere (i.e., top 2m of soil within root growing zone) this was precluded as posing any unacceptable risk.

Cardno (2021a and 2021b) also reported concentrations of the following chemicals of potential concern (COPC) from rock cores > 6 mBGL, where impacts were not anticipated:

- Total recoverable hydrocarbons (TRH).
- Benzene, toluene, ethylbenzene and total xylenes (BTEX).
- Per- and polyfluoroalkyl substances (PFAS).

Cardno considered that these detections were a result of cross-contamination of the submitted samples during the sample collection process with potential drilling additives and/ or greases and were therefore not representative of the contamination status of the samples.

4.2 Site specific reports and investigations

4.2.1 DSI (Environmental Earth Sciences ,2022)

Environmental Earth Sciences (2022) was a detailed site investigation, assessing the site's soils and groundwater for potentially unacceptable contamination due to the site's historic use or potential off-site sources of contamination.

Environmental Earth Sciences (2022) assessed shallow soils and advanced 31 test pits (IDs: TP1 - TP31) across the site and following removal of a soil stockpile, advanced a further eight test pits (IDs: TP201 - TP208) and collected six samples from a small soil/ material stockpile (IDs: MP1 - MP6). Test pits were advanced to a maximum depth of ~3.9 mBGL, while beneath the former soil stockpile, a maximum of 1.0 mBGL was assessed, although only samples from the top 0.5 mBGL were analysed.

Fill material was generally found to be shallow (< 0.5 mBGL), however in the location of former sediment basins in the north west of the site, deep fill material up to ~2.9 mBGL was encountered. Fill material was noted to broadly be clayey in nature, however with anthropogenic materials (e.g., glass, brick and tile fragments) although asbestos/ ACM was not visually observed in any of the test pits. In the footprint of the former soil stockpile, a vinyl tile was observed and submitted for laboratory analysis but reported as negative for asbestos (Environmental Earth Sciences, 2022).

Field screening of samples via a calibrated photoionisation detector (PID) meter indicated that there was very low potential for volatile organic compounds within collected samples.

Three deep soil/ rock bores (IDs: BH-1235, BH-1236 and BH1237) were advanced to a depth of ~21 mBGL at the location of the proposed dive shaft to facilitate the assessment of material to be excavated for waste classification purposes.

All COPC were reported below the laboratory limit of reporting (LOR) or the adopted site assessment criteria considering a commercial/ industrial land-use scenario 'Setting D' (ASC NEPM, 2013).

Two detections of asbestos in the form of friable asbestos (FA) (sample ID: TP15_0.15) and asbestos fines (AF) (sample ID: TP207_0.05) were reported and quantified at the laboratory. The quantification of FA/ AF was reported below the adopted site screening levels for all land-use scenarios and therefore not considered to present an unacceptable risk to site users/ workers.

4.2.2 Waste classification (EDP, 2022)

EDP (2022) was a waste classification letter for the soil stockpile (~1,100 m^3) that was initially located within the site and adjacent the western boundary. The soil material was described as a gravelly, silty brown clay with crushed concrete, brick, terracotta, igneous gravels, plastics and 'minor' amounts of ACM. EDP (2022) collected 12 samples from the stockpile and submitted ten for laboratory analysis to derive a waste classification for off-site disposal of the stockpile and to provide advice on the potential for on-site re-use of material (if deemed suitable).

The soil waste achieved a chemical characterisation of General Solid Waste – Special Waste (non-putrescible) in accordance with NSW EPA (2014) and was subsequently disposed from the site.

4.2.3 Asbestos clearance (Airsafe, 2022)

Following removal of material, a clearance certificate was issued for the footprint area of the former soil stockpile by Airsafe (2022). This clearance was a visual inspection, and no sampling of soils was undertaken.

It must be noted that no details or receipts regarding the disposal facility were provided for review to date, thus no comment can be made whether material was disposed offsite appropriately.

5 CONCEPTUAL SITE MODEL

The conceptual site model (CSM) was developed following completion of the DSI (Environmental Earth Sciences, 2022) considering the potentially complete risk linkages based upon the intrusive assessment and sampling undertaken. The CSM has been presented in **Table 3**.

Table 3: Conceptual site model & risk linkages

Source/ CoPC	Pathway	Receptor	Risk linkage	Notes
Onsite				
Soil soils and fill materials: Historic site uses indicates potential for application of pesticides and herbicides at the surface. Storage of pesticides may have occurred. Localised uncontrolled fill may have historically occurred. Includes AEC5 from M2A (2020). **CoPC:** • Heavy metals/ metalloids • OCP/ OPP. • TRH / TPH • BTEX • PAH • Asbestos	Direct contact with contaminated materials. Application of CoPC to site surfaces along with spills and leaks into environmental media and downward migration into the sub-surface.	**Soils:** Human Health: Site workers/ visitors and intrusive maintenance workers Ecological: Flora, fauna and soil processes. **Groundwater**: Shallow groundwater system.	NO LINKAGE	Analytical results did not exceed the assessment criteria adopted based on the proposed land use.
	Lateral migration with groundwater flow toward receptors.	Ecological: Surface water bodies of South Creek	NO LINKAGE	Groundwater flow is likely slow due to the underlying soils being clay dominated derived from shale bedrock. Furthermore, environmental receptors are relatively distal, which means natural attenuation would occur even if contamination was present.
	Inhalation of vapour from soil and/ or groundwater	Human health: Current and future workers/ visitors along with intrusive maintenance workers	NO LINKAGE	Volatile CoPC are not present at concentrations above the assessment criteria.
	Inhalation of asbestos fibres	Human health: Current and future workers/ visitors along with intrusive maintenance workers	NO LINKAGE	Friable asbestos was identified in one soil sample collected at TP15 from the top 150 mm of the soil profile. However, the reported concentration was below the asbestos HSL.
Historic building footprints: Use of hazardous building materials and poor demolition practices **CoPC:** • Heavy metals/ metalloids • OCP/ OPP • Asbestos	Direct contact with contaminated materials.	**Soils:** Human Health: Site workers/ visitors and intrusive maintenance workers Ecological: Flora, fauna and soil processes.	NO LINKAGE	Analytical results did not exceed the assessment criteria adopted based on the proposed land use.
	Vertical migration of CoPC from soils/ fill materials leaching into shallow groundwater.	**Groundwater**: Shallow groundwater.	NO LINKAGE	Analytical results did not exceed the assessment criteria adopted based on the proposed land use.
	Inhalation of asbestos fibres	**Human Health:** Site workers/ visitors and intrusive maintenance workers.	NO LINKAGE	Friable asbestos was identified in one soil sample collected at TP15 from the top 100 mm of the soil profile. However, the reported concentration was below the asbestos HSL.
Potential former service station • Lead • TRH / TPH • BTEX • PAH (including naphthalene)	Direct contact with contaminated materials.	**Soils:** Human Health: Site workers/ visitors and intrusive maintenance workers Ecological: Flora, fauna and soil processes.	POTENTIALLY INCOMPLETE	All CoPC were reported below the LOR or adopted site assessment criteria. It is noted that the number of test pits advanced in the location of the potential former service station was low. Further assessment would increase confidence that no unacceptable risk exists.
	Vertical migration of CoPC from soils/ fill materials leaching into shallow groundwater.	**Groundwater**: Shallow groundwater.	POTENTIALLY COMPLETE	Groundwater was not found to contain elevated CoPC. It must be noted that location of groundwater bores were not located so as to close-out this potential risk pathway. Prior to assessing groundwater, further assessment of soils (as above) would determine if additional sampling of groundwater via targeted bores in this area would be warranted.

Source/ CoPC	Pathway	Receptor	Risk linkage	Notes
Former on-site retention/ sediment basins: **CoPC (see overleaf):** • Heavy metals/ metalloids • OCP/ OPP. • TRH / TPH • BTEX • PAH • Asbestos	Direct contact with contaminated materials.	**Soils:** Human Health: Site workers/ visitors and intrusive maintenance workers Ecological: Flora, fauna and soil processes.	NO LINKAGE	Site investigations identified deep fill material in two test pits (IDs: TP4 and TP5), which from Nearmap imagery is interpreted to be the location of earlier on-site retention/ sediment basins. These basins were associated with constructions activities either at the site or nearby and were constructed c. 2016 and then backfilled c. 2018. Anthropogenic material was identified within these test pits and laboratory assessment indicated there were no unacceptable risks posed by contaminants in soil to identified receptors.
	Vertical migration of CoPC from soils/ fill materials leaching into shallow groundwater.	**Groundwater**: Shallow groundwater.	NO LINKAGE	
	Inhalation of asbestos fibres	**Human Health:** Site workers/ visitors and intrusive maintenance workers.	NO LINKAGE	
Contaminated groundwater: Migration of contaminated groundwater beneath the site. Includes AEC6 from M2A (2020). **CoPC:** • Heavy metals/ metalloids • TRH. • BTEX and Naphthalene. • VOC. • pH • Nutrients • Hazardous ground gases	Downward vertical migration of CoPC from soils/ fill materials leaching into shallow groundwater.	**Human Health:** Current and future workers/ visitors along with intrusive maintenance workers. **Ecological:** Flora, fauna and soil processes, groundwater.	NO LINKAGE	Groundwater migration is anticipated to be slow due to the underlying soils and geology. Potential interaction between site workers/ visitors with groundwater is considered unlikely given depth to groundwater and proposed construction activities. The exception may be where dewatering is required, however this is considered a specific and temporary activity.
	Inhalation and accumulation of groundwater vapours (including hazardous ground gases).	**Human health:** Current and future workers/ visitors along with intrusive maintenance workers.	POTENTIALLY COMPLETE	Hazardous ground gas within the subsurface is comprised of carbon dioxide with low/ no oxygen with no flow or pressure, however no assessment of background conditions is available therefore results may indicate migration onto the site. Any works below ground as part of proposed construction are likely to be well ventilated.
Stockpiled material: Storage of waste materials, including soils/ fill that may be contaminated. **CoPC** • Heavy metals • PAHs • TRH • BTEX • Asbestos • PFAS	Direct contact with contaminated materials. Leaching of chemicals/ compounds over time.	**Human Health:** Current and future workers/ visitors along with intrusive maintenance workers. **Ecological:** Flora, fauna and soil processes, groundwater.	POTENTIALLY COMPLETE	The on-site stockpile was excluded from the assessment under the understanding that this would be managed and removed by others. Anecdotal information indicated potential for asbestos and PFAS to be present within the stockpile. Soils underlying the stockpile should be validated to be free from unacceptable concentrations of CoPC following removal.
Offsite				
Former Gipps Street Landfill: Historic waste disposal via landfilling. Includes AEC7 from M2A (2020). **CoPC:** • Heavy metals. metalloids • TRH/ TPH • BTEX	Leaching of CoPC from waste into groundwater which may migrate beneath the site.	**Human Health:** Current and future workers/ visitors along with intrusive maintenance workers. **Ecological:** Flora, fauna and groundwater.	NO LINKAGE	Beneficial use of groundwater considered unlikely due to low porosity and permeability. Given depth to groundwater, direct contact is not likely to occur. Concentrations of heavy metals/ metalloids considered representative of background and not due to site contamination. Other COPC do not exceed the adopted assessment criteria.

Source/ CoPC	Pathway	Receptor	Risk linkage	Notes
• Naphthalene • PFAS	Lateral migration of hazardous ground gases	**Human Health:** Current and future workers/ visitors along with intrusive maintenance workers.	**POTENTIALLY COMPLETE**	Hazardous ground gases may migrate a great distance from the source area along preferential pathways which can include natural stratigraphic variations. The highly limited assessment to date is not suitable to close out migration from off-site sources on to the site.
Nearby service stations: • TRH • BTEX • Naphthalene • Lead	Leaks and spills from bulk hydrocarbon storage and dispensing systems impacting groundwater.	**Human Health:** Current and future workers/ visitors along with intrusive maintenance workers. **Ecological:** Flora, fauna and soil processes, groundwater.	**NO LINKAGE**	The service stations are down-hydraulic gradient of the site, meaning contamination would migrate away from the site rather than towards it.

Notes:
NO LINKAGE – desktop review and site investigation did not identify a current risk(s) that was considered unacceptable.
POTENTIALLY COMPLETE – desktop review and site investigation identified a partially complete linkage that can be managed to ensure no unacceptable risk.
COMPLETE LINKAGE – desktop review and site investigation identified a complete risk linkage that presents an unacceptable risk and further assessment/ delineation is required.

M8	Heavy metals/ metalloids denote arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc
TRH	Total recoverable hydrocarbons
PAH	Polycyclic aromatic hydrocarbons
OCP	Organochlorine pesticides
OPP	Organophosphorus pesticides
PCB	Polychlorinated biphenyls

6 IDENTIFIED DATA GAPS

Environmental Earth Sciences (2022) identified several data gaps that require further assessment to determine that there are no unacceptable risks under the proposed use of the site for construction purposes under a commercial/ industrial land-use scenario (e.g. generic scenario 'D' from ASC NEPM., 2013). From the CSM (**Section 5**) the following data gaps, being potentially complete risk linkages are recognised:

- Alleged historic use of a small portion of the site, near the northern boundary, as a potential service station.
- Potential hazardous ground gas migration beneath the site from the adjacent (off-site) former Gipps Street Landfill.

Actions to close out the above identified complete risk linkages are provided in the following sub-sections.

6.1 Potential former service station area

An area near the northern boundary of the site was potentially used as a service station between c. 1970 and c. 1985 with historic aerial imagery presenting evidence suggestive of forecourt-like access to the site. The available land titles (M2A, 2020) indicate that the site owner's occupation during this period was a green-grocer, not a service station proprietor.

The potential forecourt was shaped with access and egress from Great Western Highway with a square shaped building located on the southern extent of the potential forecourt. From the site layout, any bulk hydrocarbon fuel storage and associated distribution would likely have been within the forecourt area, or potentially in an area between the forecourt and boundary of Great Western Highway. It is noted that Great Western Highway has undergone several extensive upgrades since 1985, such that a portion of the historic site is now located outside of the current site boundary. That is, it is possible that the land which is alleged to have been a service station may not be part of the current site.

To assess for residual impacts to underlying soils and determine if underground storage tanks are present, additional intrusive investigation should be completed. The estimated footprint of the data gap area is less than 0.1 Ha and therefore six intrusive assessment locations are considered appropriate for investigation this area in accordance with NSW EPA (1995). It is noted that NSW EPA (1995) have been recently superseded. However the investigative work consisting of six locations was completed prior to the release of revised sampling design guidelines (NSW EPA 2022b).

Intrusive sampling should consider the sources and exposure pathways identified in the CSM for this area of the site namely:

- Potential distribution of hydrocarbon fuels at the surface
- Bulk hydrocarbon storage below ground.

Noting that the site's soils are clay and fuel distribution (if any) ceased prior to 1985, impacts to the site's surface and shallow sub-surface are considered low risk, likely to have been relatively minor and naturally degraded. If it hasn't already been remediated or otherwise dealt with during upgrade to the highway.

The greatest potential risk is associated with bulk hydrocarbon fuel storage below the ground surface within a UST farm (if any). SafeWork NSW could be contacted to determine if a license application was ever submitted for the storage of hazardous chemicals upon the premise. Considering that bulk hydrocarbon storage at the site (if any) was likely to commence c. 1970 and potentially for a relatively minor volume of fuels, it is considered unlikely that accurate records may exist.

Intrusive assessment should therefore consider potential indications of an abandoned or former UST farm, namely backfilled pits, potentially residual accessories (e.g. distribution/ vent lines) or stained and odorous soils.

Soil samples for analytical assessment should be collected from depth seeking to assessed commensurate with the base of any potential former UST farms. A maximum assessment depth of 3.0 mBGL would likely serve to identify impacts to soil (if any) associated with former UST farms.

Assessment of groundwater is not considered a requirement to address this data gap currently, however if stained or odorous soils are identified and laboratory results confirm a secondary source of potential contamination (e.g. fuel impacted soils) a groundwater investigation may be required. Furthermore, the identification of groundwater during the investigation may also trigger the need for groundwater assessment.

6.2 Hazardous ground gas migration

A hazardous ground gas assessment should be completed in accordance with NSW EPA (2020b) *Contaminated land guidelines: Assessment and management of hazardous ground gas* adopting a staged approach of preliminary screening (desk study), risk classification and prioritisation, and risk analysis and assessment.

The preliminary screening should be completed first., considering the potential sources of hazardous ground gas. The results of which will determine whether further hazardous ground gas assessment is needed. If so, a sampling analysis and quality plan (SAQP) should be prepared for the assessment in accordance with the requirements of NSW EPA (2020 and 2022b).

7 EXTENT OF REMEDIATION

The results from the site-specific investigations (Environmental Earth Sciences, 2022; and EDP, 2022) indicate that there is no need for immediate remediation as identified risks were consisted acceptable.

The site history indicates that there is potential for asbestos/ ACM to be present within the sub-surface which is considered to be more likely in certain areas of the site, including where asbestos impacts were identified during sampling activities.

Environmental Earth Sciences (2022) reported two detections of asbestos one as AF (bonded fragments < 7mm in size, AF) and one as FA. Both these detections were quantified at the NATA accredited laboratory and report below the applicable health screen levels (HSL) for FA/ AF (0.001 %w/w) in soils for all site uses from ASC NEPM (2013).

The two areas where AF/ FA were identified have been summarised on **Figure 3** also presenting the areas on the site that are considered to have elevated potential for further asbestos/ ACM impacts from the site investigation.

8 REMEDIATION OPTIONS EVALUATION

8.1 National Remediation Framework / remediation hierarchy

The preferred hierarchy for soil remediation, from most to least preferred in accordance with ASC NEPM (2013) and the National Remediation Framework (NRF) is as follows:

1. Onsite treatment of the contamination so that it is destroyed, or the associated risk is reduced to an acceptable level.

2. Offsite 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.

3. Consolidation and isolation of the soil onsite by containment with a properly designed barrier.

4. Removal of contaminated material to an approved site of facility, followed, where necessary, by replacement with appropriate material.

5. 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 to reduce potential risks.

8.2 Remediation options evaluation process

The following items have been considered to determine the most suitable methodology for management of impacted fill material:

- **Regulatory acceptance** – compliance to meet regulatory and other stakeholder expectations.

- **Technical suitability** – whether the method chosen is capable of meeting the stated objectives.

- **Practicality** – refers to the practicality of applying the option given site- specific constraints such as access availability, geology etc;
- **Cost** – refers to the initial financial outlay of the remedial technique and associated level of risk reduction.
- **Timeframe** – refers to the duration required to deliver remedial goals.
- **Sustainability** – including greenhouse gases, energy consumption, collateral environmental damage and the overall (net) benefit considering the entire project (e.g., safety of workers, effect on neighbours, transportation, movement of wastes, etc).

8.3 Evaluation and selection

Potential remediation options have been presented and evaluated for project suitability on the basis of the hierarchy presented (**Section 7.1**) and the ability to address the items outlined in **Section 7.2**.

As site impacts identified to date are related to the physical presence of asbestos/ ACM in fill/ soils, only the remediation options/ technologies that are suitable for managing this impact have been considered in this remediation options evaluation. In addition, the 'do nothing' approach has been presented within the context of the project's requirements.

The remediation options/ technologies that are considered suitable for the impacts identified at the site are:

- Option 1 - Picking and treating of soils impacted with ACM (i.e., 'emu picking').
- Option 2 - On-site encapsulation and management.
- Option 3 - Offsite disposal of impacted soils/ fill as waste
- Option 4 - Do nothing.

The options are then ranked relative to the other options to indicate which ones are most appropriate for the site. This qualitative scoring / ranking system uses a score of '0' to '2' for each criterion being assessed; with '0' corresponding to the lowest score and '2' as the highest. The remedial options evaluation and screening matrix and the scoring system that has been applied for suitability considerations at this site are presented in **Table 5**.

8.3.1 Option 1 - Picking and treating of soils impacted with ACM

Regulatory acceptance

Picking of visible asbestos fragments is an accepted remediation methodology for specific types of impact. Due to potential for FA/ AF at the site, samples of soils will need to be collected to demonstrate that treatment has been effective and there is no unacceptable risk to site users/ workers. Any asbestos removal works should be undertaken in accordance with relevant Codes of Practice and by a suitably licensed asbestos removalist.

To mitigate against potential risks, the re-use of treated material may require a physical barrier where uncertainty regarding potential FA/ AF may exist. This technology therefore scores '1'.

Technical suitability

Asbestos impacts identified to date have been both visible bonded fragments (EDP, 2022) and AF/FA (Environmental Earth Sciences, 2022). Visible fragments can be removed from soils, however AF/ FA impacts could be missed and remain after a visual clearance has been issued.

In accordance with WA DOH (2021), picking and treating is considered to be suitable where asbestos impacts are identified at and restricted to the surface. Where impacts are identified extending to depth, this remediation technology is not considered suitable. It is noted that NSW EPA has not endorsed WA DOH (2021) and consultation with NSW EPA may be required before any treatment is undertaken to confirm the regulator's acceptance of this methodology.

Considering they clay-nature of soils at the site, potential for AF/ FA and relatively limited depth of fill material (with exception to former sediment basins), this technology is considered as potentially technically suitable and therefore scores a value of '1'.

Practicality

Picking and treating of soils is considered potentially practical at the site, considering the anticipated localised and unexpected nature of impacts, however consideration should be given to the nature of impacts (i.e. visible bonded-ACM fragments compared to AF/ FA) and the clay nature of soils. This method therefore scores a value of '1' for practicality.

Cost

Picking and treating of small localised asbestos impacts is considered to be a low-cost exercise and therefore scores a value of '2'.

Timeframe

Picking and treating is flexible and can be quickly implemented as required by delineating any potential areas of impacts including unexpected finds (e.g., visually) and setting up temporary exclusion zones to manage on a case-by-case basis.

Due to the flexibility of this method and the anticipated localised site impacts, this method scores a value of '2'.

Sustainability

Picking and treating of soils is a highly sustainable technology with low carbon and waste footprints. The waste generated by this method is restricted to the fragments removed from the site and any equipment/ materials used during the removal such as personal protective equipment (PPE) that cannot be cleaned and re-used.

This technology scores a value of '2'.

8.3.2 Option 2 - On-site encapsulation and management

Regulatory acceptance

On-site encapsulation is an accepted treatment technology provided an appropriate environmental management plan is prepared and suitable documentation of the encapsulation process is provided.

This may require notification of the area of encapsulation on the land title which could impacted on the potential for future use of the site for particular sensitive uses (e.g. residential or generic land-use scenario 'A' from ASC NEPM, 2013).

This technology scores a value of '2'.

Technical suitability

On-site encapsulation is suitable for implementation at the site as a remediation method and therefore scores 2.

Practicality

Although the site has space to facilitate on-site encapsulation of impacted material (if required), it is recognised that the final use of the site has not been determined. If on-site encapsulation was undertaken along with memorandum of an EMP onto the land title, these would need to be considered for future re-development of the site.

Due to uncertainties associated with the temporary use of the site as a construction site, encapsulation is not considered a practical solution for the site currently and therefore scores a value of '0'.

Cost

On-site encapsulation is considered a low-cost option, however is likely to be more expensive than other options and potentially restricts the future use of the site and therefore scores a value of '1'.

Timeframe

Successful implementation of on-site encapsulation at the site would require all bulk earthworks to be completed prior to prevent multiple areas of encapsulation occurring in the event of unexpected finds. A temporary asbestos impacted soils storage area/ facility would need to be prepared, where material could be consolidated and managed prior to a final encapsulation facility being designed and implemented.

This method scores a value of '1'.

Sustainability

On-site encapsulation is a highly sustainable remediation technology resulting in potentially no waste material being sent to landfill. Carbon emissions are relatively high due to the requirements for heavy vehicles to excavate and move impacted materials and create the encapsulation facility.

This technology scores a value of '1'.

8.3.3 Option 3 - Off-site disposal of impacted soils/ fill as waste

Regulatory acceptance

Off-site disposal of asbestos waste is an accepted remediation technology in NSW, resulting in a complete removal of the potential risks provided appropriately undertaken and validated.

Therefore this technology scores a value of '2'.

Technical suitability

Off-site disposal is technically suitable for the site as bulk excavation is understood for various phases of proposed works.

This technology scores 2.

Practicality

Off-site disposal is practical, ensuring that no residual impacts will remain and require management at the site into the future, while also not impacting on the future use of the site.

This technology scores a value of '2'.

Cost

Off-site disposal is expensive with only suitably licensed landfills available to accept any asbestos waste generated at the site.

This technology scores 0.

Timeframe

Off-site disposal can be implemented rapidly and flexibly.

This technology scores a value of '2'.

Sustainability

The off-site disposal of waste containing asbestos is a highly un-sustainable practice resulting in increased waste to landfill and increase carbon emissions.

This technology therefore scores a value of '0'.

8.3.4 Option 4 - Do nothing

Regulatory acceptance

Where an acceptable level of risk exists following appropriate assessment of the risk then it is considered appropriate from a regulatory approach that no remediation is required. Based on the risk, an environmental management plan (EMP) may need to be prepared as outlined in **Section 11**.

Considering that identified impacts at the site have been assessed below the relevant Tier 1 criteria from ASC NEPM (2013) then the 'do nothing' approach scores the maximum of 2.

Technical suitability

From the current CSM, there is no requirement to remediate the site.

Therefore, the do-nothing approach is a suitable technology, however this could change in response to potential unexpected finds.

This technology therefore scores a value of '1'.

Practicality

Bulk earthworks are required at the site associated with the temporary use of the site as a construction facility. These bulk earthworks have potential to generate waste that must be removed from the site and there is no acceptable concentration of asbestos in waste.

From a practicality perspective and considering the requirements for the site it is considered that the do-nothing approach is not practical and may result in unacceptable outcomes including financial and reputational damage (see below).

This technology therefore scores a value of '0'.

Cost

The cost associated with the 'do nothing' approach is zero, however it must be considered that current waste guidelines (NSW EPA, 2014) do not have an allowable concentration for asbestos and that any detection results in a "special waste" classification.

Potential costs implications associated with the 'do nothing' approach are therefore:

- monetary fines, penalties and potential prosecution associated with incorrect classification, handling and disposal of waste materials.
- reputational damage resulting from publication of penalty notices and/ or prosecution.
- contractual breaches due to incorrect disposal of waste materials.

Due to the above financial and non-financial costs, the 'do nothing' approach scores 0 for cost.

Timeframe

The 'do nothing' approach has no associated timeframe and therefore scores 2.

Sustainability

The 'do nothing' approach is highly sustainable with no waste generated and no carbon emissions.

This technology scores a value of '2'.

8.3.5 Remediation options evaluation matrix

The above evaluation of the options identified as suitable for remediating the identified impacts has been presented in a matrix in **Table 4** and fell generally into two categories:

- Low total scores between ‘0’ and ‘7’; and
- Total scores between ‘8’ and ‘9’.

Due to the close scores as evaluated, all methods are considered potentially suitable to ensure that there is no unacceptable risk to site users/ workers, however it is noted that the least suitable option is considered to be the ‘do nothing’ approach.

This is due to the potential non-financial costs which may result and may outweigh any perceived benefits from not undertaking any site remediation/ management.

From the calculated total scores the following remediation options/ technologies are preferred at the site:

- **Option 1** – Picking and treating of soils.
- **Option 3** – Off-site disposal as waste.
- **Option 2** – On-site encapsulation and management.
- **Option 4** – Do nothing.

Table 4: Remediation options evaluation and screening assessment

Issue / Potential Options	Selection Criteria						Total score
	Regulatory Acceptance	Technical Suitability	Practicality	Cost	Timeframe	Sustainability	
Pertinent remediation options							
Option 1: Treatment via 'emu-picking' for visible asbestos and reuse of material under a barrier (e.g. road seal).	1	1	1	2	2	2	**9**
Option 2: Onsite management in containment cell; ongoing management through EMP on Title.	2	2	0	1	1	1	**7**
Option 3: Excavation of contaminated material with offsite disposal to landfill	2	2	2	0	2	0	**8**
Option 4: Do Nothing	2	1	0	0	2	2	**7**

Notes:

1. Selection criteria minimum score of 0 and maximum score of 2.
2. Preferred methods are highlighted in YELLOW shading.

8.4 Additional considerations

It is acknowledged that a human health and environmental risk assessment (HHERA) was completed for the project reported in Cardno (2021c), *Human Health and Ecological Risk Assessment: Spoil Re-use Sydney Metro and Western Sydney Airport* (ref. 80021888; 29 June 2021).

Cardno (2021c) identified that determination of reuse criteria for a range of spoil reuse scenarios was one of the objectives to demonstrate that reuse of material would not pose an unacceptable risk to human health or the environment under these considered scenarios.

Cardno (2021c) suggested that it may be possible to further evaluate potential risk posed by contamination at the site and determine if the material could be reused under the encapsulation and management scenario presented as 'Option 2'. The reuse of spoil on other area of the project in accordance with Cardno (2021c) would present a more sustainable outcome, however some consideration must be given to the regulatory approvals that may be required to transport material for reuse.

It is recognised that linear infrastructure projects comprised of smaller individual sites can at times be considered as one larger site and transport of material along the length of this is potentially acceptable.

9 REMEDIATION ACTION PLAN

Upon identifying a need for remediation at the site and determining the most appropriate remediation technology/ option (refer to **Section 7.3.5** for guidance), the following sub-sections should be utilised to assist in implementing remediation.

9.1 Remediation of asbestos finds

1. The initial step in implementing site remediations is to obtain appropriate approvals in accordance with the project's Planning Approval SSI-10051, or similar planning approvals/ assessments.

2. It should then be considered if works are 'Category 1' or 'Category 2' remediation works and therefore may require development consents and notification to the respective authorities under State Environmental Planning Policy (Resilience and Hazards) 2021.

3. All sub-contractors engaged for remediation works should be licensed as required, noting that either a Class 'A' or Class 'B' licensed asbestos removalist could potentially be engaged pending the nature of asbestos impacts (e.g., bonded or friable).

4. Exclusion zones should be established around the area requiring remediation (refer to **Section 10.2** for further guidance). Exclusion zones should consider if the impacts have been delineated or if additional investigation is required.

5. Control measures should be identified for suppression of dust during any remediation activities noting that at no point should a high-pressure water source be utilised (including hoses or jets from water carts).

6. Where any material is to be removed from the site, appropriate waste classification must be demonstrated prior to material being removed from the site (refer to **Section 12**). It may be suitable to undertake waste classification as either *in situ* or *ex situ*, provided appropriate control measures are maintained at all times.

7. Following completion of any remediation works, documentation of the works completed, validation sampling of soils and potentially asbestos clearance certificates should be undertaken/ prepared, potentially on a case-by-case basis.

8. At the completion of bulk earthworks (including importation of any material) all remediation works, results from sampling and any clearance certificates should be formally documented within a validation report.

Note: It may be prudent to prepare a Sampling Analysis Quality Plan (SAQP) to determine specific data quality objectives (DQOs), sampling frequencies and analytical suites to ensure validation can be suitably demonstrated.

9.2 Exclusion zones

Any remediation undertaken at the site should be clearly segregated from general site works to reduce potential risks to site workers not involved in remedial works. Exclusion zones should be established with suitable barriers (e.g., flagging, jersey kerbs or temporary fencing) and clear signage to convey potential risks to site workers.

All plant and equipment to be used in the course of (extended) remedial works should be stored within the exclusion zone(s) and a decontamination area established to prevent impacts being inadvertently removed from the exclusion zone.

Prior to any plant or equipment leaving the exclusion zone, decontamination should be undertaken and demonstrated. Methods to demonstrate suitable decontamination measures have been implemented will vary pending the type/ nature and extent of contamination.

9.3 Contingency measures

Where the adopted remediation method fails to reduce the potential risk for any reason it may be required to re-evaluate the suitability of identified remediation options with regard to the failings.

Potential contingency options (in no particular order) include the following:

- Adjust the adopted remediation method to one that is more suited to the specific scenario encountered.
- Conduct a Tier 2 or Tier 3 risk assessment to derive site specific criteria.
- Cease remediation attempts and seek to implement an environmental management plan (if appropriate).

Where unexpected finds of contamination occur, the project's Contamination and PASS Management Plan (ref. WSASBT-00-10-PRC-CPBG-EM-09) is to be implemented. This has been included as **Appendix A** for reference purposes, but may be revised outside of this document.

Unexpected finds are considered to be isolated occurrences of relatively small impacts such that remediation/ management can be completed simply. If an area of the site has repeated unexpected finds, additional assessment to delineate the extent of impacts should be undertaken. Such impacts may be constitute a widespread impact that is being uncovered due to the staged and sporadic nature of site works.

10 VALIDATION PROCESS AND CRITERIA

Validation of any site remediation works are required to demonstrate that risk have been appropriately remediated or managed in accordance with relevant legislation, guidelines and Codes of Practice.

10.1 Soil sampling

To demonstrate that remediation has been completed and that there is no unacceptable risk to site users soil sampling may be required. Examples of scenarios where soil sampling is required are:

- Visibly stained/ odorous material was encountered and determine to be chemically contaminated such that a risk to site users/ workers (or the environment) existed and was remediated.
- FA/ AF impacted soil was identified and remediated.
- An incident occurred at the site, resulting in an uncontrolled release of chemicals (e.g., fuels and/ or lubricants) that impacted soils.
- Extensive bonded ACM impacts are identified within the sub-surface.

The sampling frequency will vary based upon the nature and extent of impacts with a higher frequency of sampling required where unacceptable asbestos impacts are identified. A general guide to validation sampling has been presented in **Table 5**.

Table 5: Guidelines for validation soil sampling frequency

Type of soil remediation	Base	Walls	Comments
Shallow excavations (<200 mm depth)	5 m by 5 m grid	N/A	Consider need to demonstrate appropriate lateral delineation of impacts (e.g. sampling outside of the excavation area).

Type of soil remediation	Base	Walls	Comments
Medium excavations (up to 1 m depth)	5 m by 5 m grid (see comments)	Linear: Every 5 m Vertically: Representative of contamination depth.	Consider safe access to excavations.
Deep excavations (> 1 mBGL)	5 m by 5 m grid (see comments)	Linear: Every 5 m Vertically: Representative of contamination depth.	Safe access to deep excavations will determine how validation can be completed. Mechanical excavation adjacent the excavation may be required.

Note: Validation sampling of excavation walls where the depth is >200 mm should consider a minimum of one sample per wall.

10.2 Validation criteria

The validation criteria have been selected from ASC NEPM (2013) considering that the proposed use for the site is a construction site, commensurate with the sensitive receptors and exposure durations for generic land-use scenario 'D' for commercial/ industrial activities (ASC NEPM, 2013).

Typically for contaminant concentration to be considered acceptable for the respective land use criteria, the data set must conform to the following requirements:

- No single sample analytical result is greater than 250% of the site criteria.
- The 95% upper confidence limit (UCL) of the arithmetic mean of analytical results is below the site criteria.
- The arithmetic (or geometric in cases where the data is log-normally distributed) mean is below the site criteria.
- The standard deviation is less than 50% of the site criteria.

10.2.1 Health investigation levels

Applicable Tier 1 human-health criteria for commercial / industrial land use scenario (Setting 'D') from ASC NEPM (2013) are presented in **Table 6**.

Table 6: Health investigation level threshold criteria

Analytes	Health Investigation Level[1] (mg/kg)
	Commercial / industrial Setting D
Metals and Inorganics	
Arsenic [2]	3,000
Cadmium	900
Chromium (VI)	3,600
Copper	240,000

Analytes	Health Investigation Level[1] (mg/kg)
	Commercial / industrial Setting D
Lead [3]	1,500
Mercury (inorganic)	730
Nickel	6,000
Zinc	400,000
Polycyclic Aromatic Hydrocarbons (PAHs)	
Carcinogenic PAHs (as BaP TEQ) [4]	40
Total PAHs [5]	4,000

Notes:

1. Generic land uses are described in detail in Schedule B7 Section 3 of ASC NEPM (2013). HIL D - Commercial/industrial, includes premises such as shops, offices, factories and industrial sites.
2. Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability may be important and should be considered where appropriate (refer Schedule B7).
3. Lead: HIL is based on blood lead models (IEUBK for HILs A, B and C and adult lead model for HIL D where 50% oral bioavailability has been considered. Site-specific bioavailability may be important and should be considered where appropriate.
4. Carcinogenic PAHs: HIL is based on the 8 carcinogenic PAHs and their TEFs (potency relative to B(a)P) adopted by CCME 2008 (refer Schedule B7). The B(a)P TEQ is calculated by multiplying the concentration of each carcinogenic PAH in the sample by its B(a)P TEF, given below, and summing these products.
5. Total PAHs: HIL is based on the sum of the 16 PAHs most commonly reported for contaminated sites (WHO 1998). The application of the total PAH HIL should consider the presence of carcinogenic PAHs and naphthalene (the most volatile PAH). Carcinogenic PAHs reported in the total PAHs should meet the B(a)P TEQ HIL. Naphthalene reported in the total PAHs should meet the relevant HSL.

PAH species	TEF	PAH species	TEF
Benzo(a)anthracene	0.1	Benzo(g,h,i)perylene	0.01
Benzo(a)pyrene	1	Chrysene	0.01
Benzo(b+j)fluoranthene	0.1	Dibenz(a,h)anthracene	1
Benzo(k)fluoranthene	0.1	Indeno(1,2,3-c,d)pyrene	0.1

10.2.2 Health screening levels

The Health Screening Levels (HSL) for commercial / industrial land use scenario (Setting 'D') for volatile petroleum hydrocarbons in soil are based on vapour intrusion risk associated with material type and depth of contamination (ASC NEPM, 2013). The HSLs are for assessing human health risk associated with inhalation, and depend on specific soil properties and depths, types of land use and characteristics of buildings for each land use scenario. Refer to the summary of Tier 1 HSLs in **Table 7**.

Table 7: Health screening level threshold criteria

Analyte	Soil type	0 m to <1 m	1 m to <2 m	2 m to <4 m	≥4 m
TRH (C_6-C_{10}) (F1) (minus BTEX)	Clay	310	480	NL	NL
TRH (>C_{10}-C_{16}) (F2) (minus naphthalene	Clay	NL	NL	NL	NL

Analyte	Soil type	0 m to <1 m	1 m to <2 m	2 m to <4 m	≥4 m
Benzene	Clay	4	6	9	20
Toluene	Clay	NL	NL	NL	NL
Ethylbenzene	Clay	NL	NL	NL	NL
Total xylenes	Clay	NL	NL	NL	NL

Notes:
mg/kg Milligrams per kilogram
NL No applicable risk-based limit applies
F Short for 'Fraction' such that F1 is 'Fraction 1'.

10.2.3 Management limits

The adopted management limits (MLs) and for petroleum hydrocarbons in soil for commercial / industrial land use scenario have been applied to be protective of human health from dermal contact (ASC NEPM, 2013). Refer to **Table 8** for a summary of these ML threshold concentrations.

Table 8: Site-specific management limits

Analyte	Soil texture	Management limits for Commercial / industrial land use
		mg/kg
TRH (C_6-C_{10}) (F1)	Fine	800
TRH (>C_{10}-C_{16}) (F2)	Fine	1,000
TRH (>C_{16}-C_{34}) (F3)	Fine	5,000
TRH (>C_{34}-C_{40}) (F4)	Fine	10,000

Note: fine textured soils adopted based upon the predominantly clay materials encountered at the site.

10.2.4 Asbestos

HSLs for asbestos soil contamination within a commercial / industrial land use scenario are adopted from ASC NEPM (2013). Thresholds are summarised in **Table 9**.

Table 9: HSLs for asbestos in soil

HSL concentration (%w/w)	Commercial / industrial D
Bonded ACM	0.05 % w/w
FA and AF	0.001 % w/w
ACM on surface	Any visible asbestos[4]

Notes:
1. FA denotes friable asbestos
2. AF denotes asbestos fines
3. The screening level of 0.001% w/w asbestos in soil for FA and AF (i.e. non-bonded/friable asbestos) only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres.
4. Surface soils should be free from visible asbestos/ ACM impacts.

10.2.5 Ecological investigation levels

The ecological investigation levels (EILs) assigned by ASC NEPM (2013) - *Schedule B5a: Guideline on Ecological Risk Assessment* are adopted for this assessment. This guideline presents the methodology for deriving terrestrial EILs using both fresh and aged (i.e., >2 years old) contamination for soil in urban residential / public open space and commercial / industrial scenarios.

The methodology has been developed to protect soil processes, soil biota (flora and fauna) and terrestrial invertebrates and vertebrates. Adopted EILs for this assessment will be protective of commercial / industrial land use scenarios. Applicable EILs derived comprise the sum of ambient background concentrations (ABCs) and added contaminant limits (ACLs). The ACL concentrations are ascertained for representative locations based on site-specific results for either pH alone, or pH and cation exchange capacity (CEC) in accordance with procedures in ASC NEPM (2013) - *Schedule 5c: - EILs for As Cr Cu DDT Pb Naphthalene Ni Zn*.

Site specific EILs were calculated by using the average cation exchange capacity (CEC) and pH for soils encountered at the site (Environmental Earth Sciences, 2022). Baseline EILs are presented in **Table 10**.

Table 10: EIL threshold criteria

Chemical	Adopted EILs (mg/kg)
	Commercial / industrial
Arsenic	160 [1]
Chromium (III)	670 [2]
Lead	1,800 [3]
Nickel	210 [2]
Copper	260 [2]
Zinc	630 [2]
DDT	640 [1]
Naphthalene	370 [1]

Notes:
1. Generic EIL adopted
2. Site-specific derived EIL (using average CEC and pH)
3. Generic ACL adopted

10.2.6 Ecological screening levels

Adopted ESL criteria for assessment are summarised in **Table 11** for fine soil textures encountered (ASC NEPM, 2013).

Table 11: Ecological screening level threshold criteria

Analyte	Commercial / industrial land use (mg/kg)
TRH (C_6-C_{10}) (F1) (minus BTEX)	215 *
TRH (>C_{10}-C_{16}) (F2) (minus naphthalene)	170 *
TRH (>C_{16}-C_{34}) (F3)	2,500
TRH (>C_{34}-C_{40}) (F4)	6,600
Benzene	95
Toluene	135
Ethylbenzene	185
Total Xylenes	95
Benzo(a)pyrene	172 **

Notes:
* ESLs are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability
** Threshold adopted from CRC Care (2017) Technical Paper No.39

10.2.7 Cardno (2021c) specific re-use criteria

Where results of any validation sampling exceed the criteria detailed above, the criteria derived by the HHERA (Cardno, 2021c) could be considered to demonstrate that there is no unacceptable risk by identified exceedances under the specific scenario.

Section 6.2 Risk Characterisation – Human Health within Cardno (2021c) provides greater detail for various scenarios considered during the preparation of the HHERA along with specific re-use criteria.

Due to the complexity of the specific scenario evaluation and risk assessment process, it is not considered suitable to provide the criteria herein and the original reference (Cardno, 2021c) should be sourced and reviewed to assess the potential risks where Tier 1 criteria from ASC NEPM (2013) are exceeded.

11 ENVIRONMENTAL MANAGEMENT PLAN

An environmental management plan (EMP) is required where contaminated material is retained on-site either within an engineered cell or beneath a capping/ hardstand layer so

that the long-term risks are managed and unable to present a potentially unacceptable risk to receptors.

Greater detail on preparing environmental management plans can be found within NSW EPA (2022) *Practice Note: Preparing environmental management plans for contaminated lands*, however a brief outline is provided below:

- Any EMP should concisely describe the nature and location of residual contamination at the site, along with any containment measures implemented including relevant site plans/ drawings.
- The extent of long-term site management to protect human health/ the environment should be presented including whether active or passive management measures/ controls are to be implemented.
- An EMP should be made legally enforceable and detail how this will be achieved
- The key stakeholders including the site owner(s), those responsible for effective implementing and ensuring compliance of the EMP along with identifying the appropriate regulatory authority.
- A monitoring checklist, corrective actions and potential triggers for corrective actions should be included.
- Details for notification/ communication of any monitoring to the relevant stakeholders and notification to the regulator regrading amendments or potentially cessation of management along with a schedule for the EMP review should be included.

12 MATERIAL MANAGEMENT

12.1 On-site re-use

On-site re-use of material generated by site works (including preliminary works such as topsoil stripping) is considered acceptable as the assessment to date has indicated that contamination does not present an unacceptable risk under a commercial/ industrial land-use scenario.

Where material is observed to visually be impacted with anthropogenic materials, additional assessment may be required to confirm that material is suitable for on-site re-use due to the potential for ACM impacts. Where material is confirmed to be impacted with asbestos/ ACM, the extent of impacts should be compared to the validation criteria (**Section 10**) and potential ongoing management requirements should be considered. Caution should be used when excavating into areas identified as being elevated risk either due to identified asbestos/ ACM impacts or deeper fill extents.

Reuse of material should consider potential geotechnical suitability (for desired purposes) and aesthetic issues such as poor visual amenity due to significant foreign materials (e.g.

plastic, glass, brick, concrete, paper etc) or odour which may negatively impact the site or neighbouring sites.

Where sampling of material is required to provide confidence that material is suitable to remain on-site, recommended sampling frequencies for *in situ* and *ex situ* (stockpile) sampling from ASC NEPM (2013) and EPA Victoria (2009)[1] have been provided in **Table 12** (**Section 12.2**). Due to the potential for material at the site to contain asbestos/ ACM, sampling to demonstrate suitability to remain on-site should be conducted in accordance with the methodology presented in ASC NEPM (2013) and WA DoH (2009 and 2021) giving due consideration to *NSW EPA Position statement – WA guidelines for asbestos contaminated sites* (NSW EPA 2022d).

It is understood that on other project sites of the Sydney Metro Western Sydney Airport (SMWSA) a different re-use procedure has been considered including materials meeting the requirements set out under the *Airport Environment Protection Regulations 1997* (AEPR) and the Federal Material Import and Reuse Procedures. In view of this, any material proposed to be reused will need to consider the requirements of the receiving site.

12.2 Off-site waste management

All materials removed from the site are considered to be waste and therefore must be appropriately assessed before being removed from the site. Under the POEO Act the beneficial re-use of waste materials from the site is restricted to the following classifications of waste:

- Virgin excavated natural material (VENM).
- Excavated natural material (ENM).
- Material classified under a Resource Recovery Order (RRO) and Resource Recovery Exception (RRE).

An appropriate assessment must be undertaken to demonstrate that the material is suitable to meet the definition of VENM in accordance with the POEO Act. Where waste is to be classified as ENM the requirements of the ENM Order (2014) and the ENM Exemption (2014) must be demonstrated through appropriate assessment.

Where material is classified under a RRO and RRE, it must be demonstrated that this material can be beneficially re-used and meets the requirements for the RRE and RRO and all materials disposal/ tracking records must be retained as specific within the RRO and RRE.

Material that does not meet the definitions of VENM/ ENM or does not qualify for a RRO and RRE must be classified in accordance with NSW EPA (2014) for off-site disposal to a suitably licensed waste disposal facility (e.g., landfill).

[1] Although *Sampling design part 1 – application* (NSW EPA 2022b) would be more relevant, EPA Victoria (2009) has been retained on the basis that it is referenced in the deed and project approval.

Where soil/ fill materials are to be removed from the site as waste, chemical assessment is likely required to derive a waste classification in accordance with NSW EPA (2014). The number of samples required to derive an appropriate waste classification has been summarised in **Table 12**.

Table 12: Minimum number of samples for waste classification of soils

Soil Volume (m^3)	*In situ* sampling	*Ex situ* sampling
≤25	3	3
≤50	3	3
≤75	4	3
≤100	5	4
≤125	7	5
≤150	8	6
≤175	9	7
≤200	10	8
>200	1:25 ratio	1:25 ratio

Notes:
1. m^3 is metres cubed
2. *Ex situ* refers to soils that have been excavated and stockpiled at the site prior to being assessed.
3. Sample frequencies after VIC EPA (2009) Industrial Waste Resource Guidelines (702).

12.3 Material importation

Prior to material being imported to the site, the suitability of the material should be confirmed. To confirm that material is suitable to be imported the following approvals process should be implemented:

- Has appropriate documentation (e.g. VENM certificate) from the generating facility location been supplied and reviewed prior to material arriving at the site?
- If required, has the supplied documentation provided a site history, the results of any chemical characterisation with appropriate consideration of potential likely CoPC and sampled at an appropriate frequency?
- Have appropriate descriptions of material being supplied and has an inspection been completed to confirm material is as described?
- The above process should be implemented by someone who is suitable experienced and able to identify potential inconsistencies between material being described/ assessed and arriving at the site.

Any material imported to the site must be fit for purposes noting that in accordance with the POEO Act, only material that meets the definition of VENM or ENM is suitable to be imported to the site. An exception to this is where the material is imported under a RRO and RRE.

Material that is imported under a RRO and RRE must meet the specifications and requirements including the reporting and record keeping requirements as stipulated within the RRO and RRE documentation.

Upon arrival at the site, material should be assessed via confirmatory sampling and analysis to determine it is suitable to be beneficially re-used at the site. if any uncertainty exists as to the provenance of material imported to the site, the material should be segregated and assessed (both visually and chemically) before being used for any purpose on-site. Material that is considered unsuitable or not as described should not be allowed to be re-use on-site and should be removed either to the supplying/ generating facility or a suitable licensed waste disposal facility.

Samples should be collected and analysed at a minimum of 1 sample per 25 m^3 of material, however for larger volumes (e.g. >200 m^3) it may be appropriate to utilise a statistic based approach where 1 sample per 250 m^3 and calculation of 95% upper confidence limits of the arithmetic mean could be used to demonstrate material is suitable.

The minimum recommended analytical suite for material being imported to site is:

- Priority heavy metals/ metalloids (As, Cd, Cr_{TOTAL}, Cu, Hg, Ni, Pb and Zn).
- Total recoverable hydrocarbons (TRH) – (ASC NEPM 2013 fractions).
- Benzene, toluene, ethylbenzene and total xylenes (BTEX).
- Polycyclic aromatic hydrocarbons (PAH).
- Asbestos (in accordance with ASC NEPM 2013 requirements).

Note that the above minimum recommended analytical suite is not exhaustive and additional analysis should be considered with regard to the imported materials source site as well as requirements of relevant RRO and RRE.

Records should be retained for all material imported to the site including at a minimum the following details:

- Time and date.
- Registration of vehicles used to import material.
- Originating site.
- Weight/ Volume of material.
- Details of material classification (i.e., VENM/ ENM or under RRO and RRE).
- Description of material and location of use.

13 DELIVERABLES

13.1 Management Plans

To mitigate against potential environmental risks from the proposed use of the site to support the delivery of the project it is necessary to implement a series of management plans. The management plans along with their status have been summarised in **Table 13**.

Table 13: Management plans

Management Plan Type	Status	Document number/ Reference
Construction Environment Management Plan (CEMP) [1]	Complete for preparatory works.	SMWSASBT-CPG-1NL-EV-PLN-000002
Asbestos Management Plan (AMP)	Complete	SMWSASBT-CPG -1NL-NL000-SF-PLN-000024
Unexpected Finds Protocol[2, 3, 4] **(UFP)**	Complete	WSASBT-00-10-PRC-CPBG-EM-09
Spoil and Waste Management Plan (SWMP)	Complete	SMWSASBT-CPG-SWD-SW000-EN-PLN-202027
Asbestos Removal Control Plan	As required	N/A

Notes:

1. The Construction Environment Management Plan should detail all required erosion and sediment controls to prevent potential off-site migration of excavated materials as a result of rain, wind or material/ vehicle movements.
2. The Unexpected Finds Protocol can be a sub-plan, included in other management plans such as the CEMP.
3. The Unexpected Finds Protocol should detail a clear process to be implemented in the event of unidentified contamination being encountered during site works. This may include visually impacted/ stained or odours material.
4. CPBG's prepared UFP is included within the Contamination and PASS Management Plan (ref. WSASBT-00-10-PRC-CPBG-EM-09) and included as **Appendix A**.
5. All plans are considered as living documents and should be reviewed regularly and updated as required, including in response to changes in site conditions or required works.

Asbestos Removal Control Plans (ARCPs) may be required where a suitably licensed asbestos removalist has been engaged to remove asbestos from the site. Under SafeWork NSW (2019), any licensed asbestos removal works requires an ARCP and SafeWork NSW must be notified in writing at least five days prior to undertaking removal works.

13.2 Clearance certificates

Where any asbestos removal works are undertaken a clearance certificate must be obtained following completion of removal works to demonstrate that the area is safe to be re-occupied without requiring elevated PPE (e.g., P2 or P3 masks, Tyvek suits, boot covers and potential decontamination areas).

If removal works required a Class 'A' license, then only a licensed asbestos assessor (LAA) may provide a clearance certificate. Clearance certificates should be issued by an independent entity who is at a minimum considered a 'competent person'.

Pending the type of removal works being completed, clearance certificates may require results of air monitoring and soil sampling to be included to demonstrate the area is free from asbestos impacts.

13.3 Validation report

Following completion of site bulk earthworks including excavation and off-site disposal and importation of fill materials an overarching validation report should be prepared in accordance with NSW EPA (2020).

To support the validation report, the following details will be required:

- Details of any asbestos removal works and associated clearance certificates.
- Documentation to support the correct and appropriate disposal of waste from the site (e.g. landfill dockets).
- Documentation to support the suitability for use of material imported to the site.
- Any details of additional assessments undertaken in response to unexpected finds.

The validation report should be prepared as a formal overarching document, outlining all site works completed that can be considered as site investigation, remediation or validation and have not been formally reported previously.

13.4 Environmental management plan

An EMP is only required where any residual material at depth that if disturbed may present a potentially unacceptable risk (e.g. exceeds adopted criteria) to current and future site users/ the environment is retained and encapsulated at the site.

The requirement for an EMP may form part of contingency measures where remediation attempts have failed to reduce the risk and an residual risk exists. It must be determined that the residual risk can be managed through the effective implementation of a legally enforceable EMP.

14 CONCLUSION

Intrusive investigations associated with the overarching project and specific to the site have not identified an immediate requirement to undertake site remediation works. It is recognised that potential exists for unexpected finds and therefore a RAP was prepared to assist in managing these and ensure that the site is made suitable for the intended use as a construction site. This use is analogous to the generic land-use scenario ‘D’ for commercial/ industrial as described in ASC NEPM (2013).

Four potentially suitable remediation technologies/ options were identified and evaluated in accordance with ASC NEPM (2013) and the NRF, from the current understanding of contamination at the site the following preference (most to least preferred) were identified:

- **Option 1** – Picking and treating of soils.
- **Option 3** – Off-site disposal as waste.
- **Option 2** – On-site encapsulation and management.
- **Option 4** – Do nothing.

It is recognised that there is potential for beneficial re-use of material in accordance with the prepared HHERA (Cardno, 2021c) and further consideration of the identified re-use scenarios is potentially required along with appropriate approvals.

Through the course of site works potential unexpected finds can be appropriately managed through the correct implementation of this RAP such that no unacceptable risk to site users/ workers and/ or the environment would remain.

Any remediation works undertaken should be appropriately documented and reported such that a final overarching validation report for all unexpected finds and site remedial activity can be prepared to demonstrate there are no residual unacceptable risks.

15 LIMITATIONS

This report has been prepared by Environmental Earth Sciences NSW ACN 109 404 006 in response to and subject to the following limitations:

1. The specific instructions received from Road and Rail Excavations Pty Ltd on behalf of CPB Contractors-Ghella Joint Venture;

2. May not be relied upon by any third party not named in this report for any purpose except with the prior written consent of Environmental Earth Sciences NSW (which consent may or may not be given at the discretion of Environmental Earth Sciences NSW);

3. This report comprises the formal report, documentation sections, tables, figures and appendices as referred to in the index to this report and must not be released to any third party or copied in part without all the material included in this report for any reason;

4. The report only relates to the site referred to in the scope of works being located at 1-17 Gipps St, Claremont Meadows, NSW 2747 (“the site”);

5. The report relates to the site as at the date of the report as conditions may change thereafter due to natural processes and/or site activities;

6. No warranty or guarantee is made in regard to any other use than as specified in the scope of works and only applies to the depth tested and reported in this report;

7. Fill, soil, groundwater and rock to the depth tested on the site may be fit for the use specified in this report. Unless it is expressly stated in this report, the fill, soil and/or rock may not be suitable for classification as clean fill, excavated natural material (ENM) or virgin excavated natural material (VENM) if deposited off site;

8. This report is not a geotechnical or planning report suitable for planning or zoning purposes; and

9. Our General Limitations set out at the back of the body of this report.

16 REFERENCES

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SafeWork NSW (2019b) – How to Safely Remove Asbestos (August 2019);

SafeWork NSW (2019c) – Demolition Work (August 2019);

SafeWork NSW (2019d) – Hazardous Manual Tasks (August 2019);

SafeWork NSW (2019e) – How to Manage Work Health and Safety Risks (August 2019);

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ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

ENVIRONMENTAL EARTH SCIENCES GENERAL LIMITATIONS

Scope of services
The work presented in this report is Environmental Earth Sciences response to the specific scope of works requested by, planned with and approved by the client. It cannot be relied on by any other third party for any purpose except with our prior written consent. Client may distribute this report to other parties and in doing so warrants that the report is suitable for the purpose it was intended for. However, any party wishing to rely on this report should contact us to determine the suitability of this report for their specific purpose.

Data should not be separated from the report
A report is provided inclusive of all documentation sections, limitations, tables, figures and appendices and should not be provided or copied in part without all supporting documentation for any reason, because misinterpretation may occur.

Subsurface conditions change
Understanding an environmental study will reduce exposure to the risk of the presence of contaminated soil and or groundwater. However, contaminants may be present in areas that were not investigated, or may migrate to other areas. Analysis cannot cover every type of contaminant that could possibly be present. When combined with field observations, field measurements and professional judgement, this approach increases the probability of identifying contaminated soil and or groundwater. Under no circumstances can it be considered that these findings represent the actual condition of the site at all points.

Environmental studies identify actual sub-surface conditions only at those points where samples are taken, when they are taken. Actual conditions between sampling locations differ from those inferred because no professional, no matter how qualified, and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden below the ground surface. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from that predicted. Nothing can be done to prevent the unanticipated. However, steps can be taken to help minimize the impact. For this reason, site owners should retain our services.

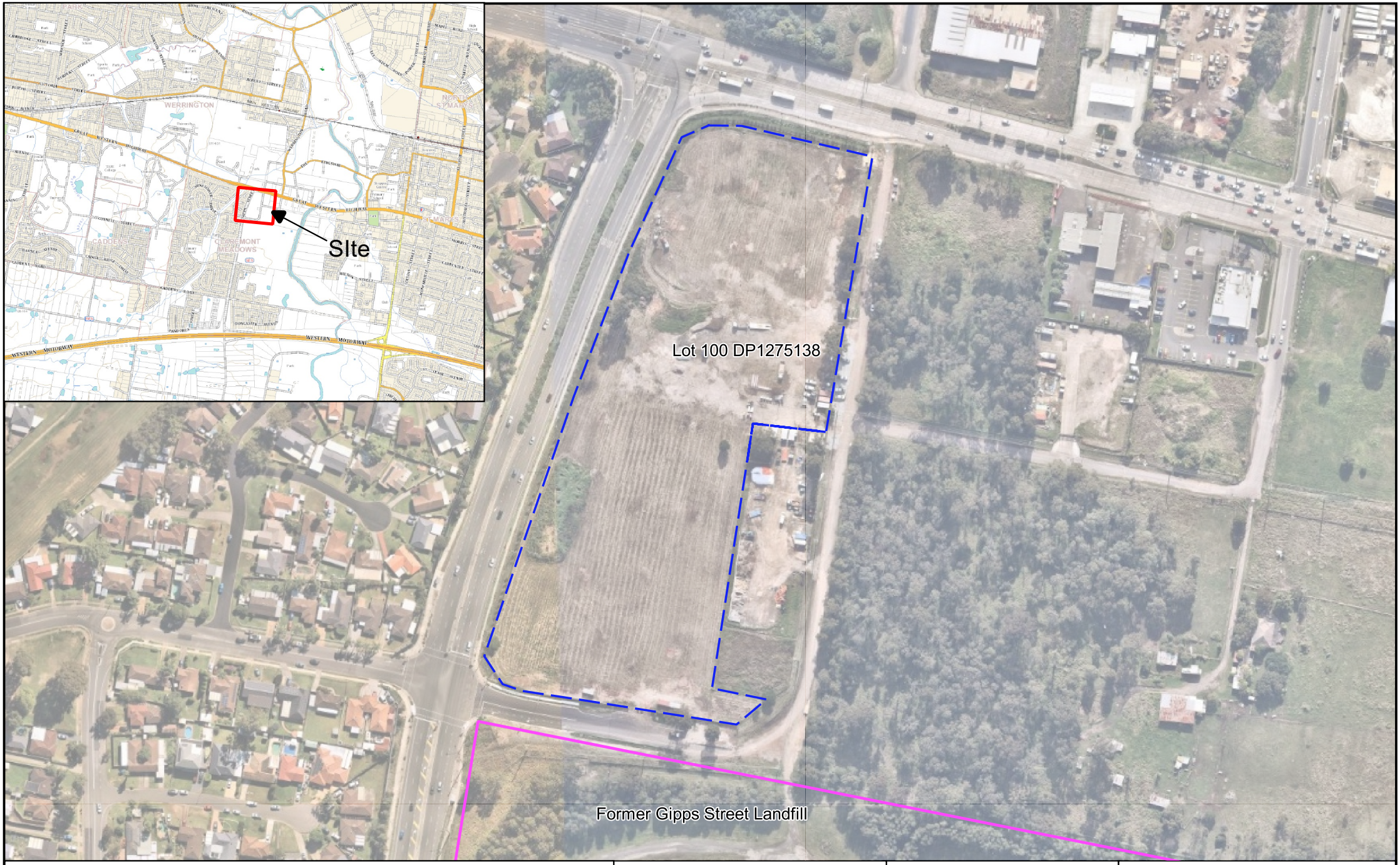
Problems with interpretation by others
Advice and interpretation is provided on the basis that subsequent work will be undertaken by Environmental Earth Sciences NSW. This will identify variances, maintain consistency in how data is interpreted, conduct additional tests that may be necessary and recommend solutions to problems encountered on site. Other parties may misinterpret our work and we cannot be responsible for how the information in this report is used. If further data is collected or comes to light we reserve the right to alter their conclusions.

Obtain regulatory approval
The investigation and remediation of contaminated sites is a field in which legislation and interpretation of legislation is changing rapidly. Our interpretation of the investigation findings should not be taken to be that of any other party. When approval from a statutory authority is required for a project, that approval should be directly sought by the client.

Limit of liability
This study has been carried out to a particular scope of works at a specified site and should not be used for any other purpose. This report is provided on the condition that Environmental Earth Sciences NSW disclaims all liability to any person or entity other than the client in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by any such person in reliance, whether in whole or in part, on the contents of this report. Furthermore, Environmental Earth Sciences NSW disclaims all liability in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by the client, or any such person in reliance, whether in whole or any part of the contents of this report of all matters not stated in the brief outlined in Environmental Earth Sciences NSW's proposal number and according to Environmental Earth Sciences general terms and conditions and special terms and conditions for contaminated sites.

To the maximum extent permitted by law, we exclude all liability of whatever nature, whether in contract, tort or otherwise, for the acts, omissions or default, whether negligent or otherwise for any loss or damage whatsoever that may arise in any way in connection with the supply of services. Under circumstances where liability cannot be excluded, such liability is limited to the value of the purchased service.

FIGURES



Legend

- Site Boundary
- Overview Extent
- Former Gipps Street Landfill

0 25 50 75 m

N

Details approximate only.
Datum: GDA 2020

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

Title: Site Locality Map

Client: Road and Rail Excavations

Location: 1-17 Gipps St, Claremont Meadows, NSW 2747

Project Manager: SG	Scale: As Shown	Job No: 122045
Drawn By: SG	Date: August 2022	

Figure 1

Legend

- Site Boundary
- Excluded Area
- Carpark
- Crane Pad and Spoil Bin
- Laydown Areas
- Offices/ Workshop
- Sediment Basins
- Shaft
- Water Treatment Plant

0 25 50 75 m

N

Details approximate only.
Datum: GDA 2020

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

Title: Proposed Site Layout

Client: Road and Rail Excavations

Location: 1-17 Claremont Meadows, NSW 2747

Project Manager: SG	Scale: As Shown	Job No: 122045
Drawn By: SG	Date: August 2022	

Figure 2

Legend

Identified Risk Areas

- Deep Fill
- ACM (AF) Exclusion Zone
- FA Exclusion Zone
- Site Boundary
- Former Gipps Street Landfill (approximate)

0 25 50 75 m

N

Details approximate only.
Datum: GDA 2020

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

Title: Areas of Elevated Environmental Risk

Client: Road and Rail Excavations

Location: 1-17 Claremont Meadows, NSW 2747

Project Manager: SG	Scale: As Shown	Job No: 122045
Drawn By: SG	Date: August 2022	

Figure 3

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

30 September 2022

CPB Contractors-Ghella JV
c/- Road and Rail Excavations Pty Ltd
2/17 Mount Erin Road
Campbelltown NSW 2560

Attention: [redacted]

Data gap assessment for additional targeted investigation near the north boundary at the Claremont Meadows Services Facility –
1-17 Gipps St, Claremont Meadows NSW 2747

Please find enclosed a copy of our report titled as above. Thank you for the opportunity to undertake this work.

1 Introduction and background

Environmental Earth Sciences was engaged by Road and Rail Excavations Pty Ltd (R&R) to undertake a data gap assessment near the north boundary at the Claremont Meadows Services Facility – 1-17 Gipps St, Claremont Meadows NSW (the 'site') to address potential unidentified impacts due to an alleged bulk fuel storage and distribution that is alleged to have occurred in the 1970s. The site locality is shown in **Figure 1**.

A sampling and analysis quality plan (SAQP) was prepared by Tetra Tech Coffey (TTC, 2022) that identified a potential former service station along the northern boundary of the site from a review of historical aerial imagery. The SAQP was reviewed and approved by NSW EPA-accredited Site auditor, Mr Tom Onus of Ramboll. Environmental Earth Sciences prepared an SAQP Addendum (Environmental Earth Sciences, 2022a) and noted that when combined with historic land titles provided in M2A (2020), this part of the site was more likely to have been used as a greengrocer owned by a market as there were no visible fuel bowsers or a clear refuelling area present in available aerials.

Environmental Earth Sciences completed a detailed site investigation (DSI) that included with intrusive test pitting and sampling of soils across the site including one test pit (ID: TP3) within the area potentially identified as being a former service station (Environmental Earth Sciences, 2022b). The results of the DSI in relation to location TP3 did not indicate the presence of hydrocarbon impact. However, upon review of the DSI, the Site auditor considered there to be uncertainty regarding potential impacted associated with the alleged former service station (considered to be an area of concern [AOC]) and requested a data gap assessment be completed to address this matter.

This letter report was prepared to document the data gap assessment into the AOC near the northern site boundary, having been identified as the footprint of an alleged former service station and should be read in conjunction with Environmental Earth Sciences (2022b) and the limitations detailed in **Section 10** and Environmental Earth Sciences NSW's general limitations.

2 Objective

The objective was to complete a data gap investigation to address potential risks associated with possible historic use of part of the site as a service station which may have resulted in hydrocarbon impact from bulk storage and distribution of hydrocarbon fuels.

3 Scope of work

The scope of work for the data gap assessment included:

- Supervision of borehole drilling, advancing six boreholes for soil assessment targeting the AOC (IDs: BH1 – BH6).
- Logging and field-screening of soils.
- Collection of representative soil samples.
- Laboratory analysis for chemicals of potential concern.
- Evaluation of field and laboratory data and preparation of this letter report.
- Preparation of this letter report.

4 Investigation criteria

The investigation criteria (Tier 1 thresholds) were adopted from *National Environment Protection (Assessment of Site Contamination) Measure 1999* (ASC NEPM) published by the National Environment Protection Council (NEPC, 2013) for the industrial / commercial land use (Setting 'D') in accordance with the DSI (Environmental Earth Sciences, 2022b) and included the following:

- Health screening levels (HSLs) setting 'D' (HSL-D) for volatile petroleum hydrocarbons in soil of clay texture (ASC NEPM, 2013).
- Health screening levels (HSLs) setting 'D' (HSL-D) for asbestos soil contamination (ASC NEPM, 2013).

- Health investigation levels (HILs) setting 'D' (HIL-D) for contaminants in soil (ASC NEPM, 2013), in particular total PAH and benzo(a)pyrene TEQ.
- Management limits (MLs) for petroleum hydrocarbon fractions in soil in commercial / industrial land use.
- Site specific ecological investigation levels (EILs) for heavy metals and fresh naphthalene in soil.
- Ecological screening levels (ESLs) for petroleum hydrocarbon fractions in soil in industrial/ commercial land use (ASC NEPM, 2013), and benzo(a)pyrene (CRC Care, 2017).

5 Methodology

5.1 Intrusive investigation

The intrusive investigation was completed on 9 September 2022 with six boreholes (IDs: BH1 – BH6) advanced using a 350 mm diameter auger mounted on an excavator. The location of boreholes is presented in **Figure 2** and were advanced as follows:

- two boreholes to a depth of 1.00 metre (m) below the base of the sediment basin that had already been excavated adjacent the northern site boundary (IDs: BH1 and BH2); and
- four boreholes to a depth of 3.00 m below ground level (BGL) to the south of the sediment basin (IDs: BH3 – BH6).

Soils were logged in the field including colour, texture and indications of potential contamination (e.g. visual and/ or olfactory, if any).

5.1.1 Sample collection

Representative samples of soil material were collected at pre-determined intervals down the soil profile (i.e., 0.1 mBGL, 0.5 mBGL, 1.0 mBGL then one sample for each additional meter below) or where changes in the soil profile were noted.

One intra- and one inter-laboratory duplicate sample were collected for quality assurance and quality control (QA/QC) purposes.

Soil samples were collected wearing a fresh pair of disposable nitrile gloves, changed between samples. For sampling purposes, the auger was advanced to the target depth, screwed into the soil and then pulled up to the surface to extract the soil from the target depth. Samples were collected from the auger, ensuring to exposure a fresh representative soil surface and exclude material not from the target depth.

The samples were placed into laboratory supplied glass jars and transported to the laboratory in a chilled container under full chain-of-custody documentation. The laboratory was accredited by National Association of Testing Authorities (NATA) for each analytical method used. Sampling of soil was conducted in accordance with the following:

- Standards Australia (1999) *Guide to the investigation and sampling of sites with potentially contaminated soil, Part 2: Volatile substances* (AS 4482.2), Standards Australia, Homebush, NSW
- Standards Australia (2005), *Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds* (AS 4482.1), Standards Australia, Sydney, NSW
- Environmental Earth Sciences NSW (2010), *Procedures for field, laboratory and reporting quality assurance and quality control manual*.
- Environmental Earth Sciences (2011), *Soil, gas and groundwater sampling manual*, 7th Edition (Unpublished).

5.1.2 Field testing

Soils were field screened using a calibrated photoionisation detection (PID) device to provide a semi-quantitative assessment of volatile organic compounds (VOC) within soil pore spaces that may indicate potential contamination. The calibration certificate is included in **Appendix A**.

10 litre samples collected from the fill layer from BH3 – BH6) were spread out the soil across a white plastic sheet for assessment of asbestos fragments before collecting a 500 gram sample for laboratory analysis of potential asbestos fines (FA) and fibrous asbestos (FA).

5.2 Laboratory analysis

Sixteen primary samples and one field duplicate (intra-laboratory) sample were submitted to ALS Environmental Pty Ltd (ALS), and one split duplicate (inter-laboratory) sample was submitted to Envirolab Services Pty Ltd (Envirolab) for analysis.

Four samples of fill materials were submitted to Australia Safer Environment and Technology (ASET) for asbestos analysis.

The primary and duplicate soil samples were assessed for the following CoPC:

- Eight priority heavy metals/ metalloids (As, Cd, C_{TOTAL}, Cu, Hg, Pb, Ni and Zn).
- Total Recoverable Hydrocarbons (TRH) (C_6 – C_{40}) (ASC NEPM, 2013 Fractions).
- Benzene, toluene, ethylbenzene and total xylenes (BTEX).
- Polycyclic aromatic hydrocarbons (PAH, including naphthalene).
- Asbestos in soil (presence/ absences).

- Asbestos weight/weight quantification (if required).

6 Results

6.1 Field observations

At the time of the investigation, grassy vegetation had been removed and earthworks were progressing at the site/ AOC with the excavation of a trench (~3-3.5 m deep) to create an emergency spillway to the existing swale drain along Great Western Highway to the north. The area to the east of the AOC had its surface engineered with hard-packed sandy and gravelly clay to accommodate the installation of a water treatment plant.

The field conditions can be described as:

- The sediment basin was excavated ~3.0 m into natural soils which were observed to be a firm, dry brown clay with orange-grey mottles at the base of the excavation. It is understood that evidence of hydrocarbon impact was not noted during excavation of this material (pers. comm. Shane Coleman, September 2022).
- Boreholes advanced into the base of the sediment basin (locations BH1 and BH2) identified a firm, dry light brown clay with white-orange mottles and inclusions of red ironstone cobbles ~1 m below the base.
- Boreholes BH3 to BH6 adjacent the south of the sediment basin encountered the following:
    - Fill/ reworked natural brown clay with trace inclusions of concrete gravels and black gravels to ~1 mBGL
    - Undisturbed, natural material was observed from ~1.0 mBGL consisting of firm brown-red clay with light grey mottling
    - Becoming a stiff, light grey clay at ~2.2 mBGL with trace red mottling/ red ironstone cobbles to 3 mBGL.
- Groundwater was not encountered in any of the borehole excavations.
- Evidence of gross contamination (including potential asbestos containing materials (ACM) or staining was not evidenced at the site surface or during the intrusive soil assessment. No evidence of potential sources of contamination such as areas fuel/ chemical storage were observed.
- The highest PID reading was 0.8 ppm.

Detailed borehole logs, including PID readings are presented in **Appendix B** with photo plates of the site investigation presented in **Appendix C**. The calibration certificate for the PID is provided in **Appendix A**.

6.2 Analytical results

The laboratory reported concentrations for CoPC were below the adopted site assessment criteria or the laboratory's limit of reporting (LOR) except for asbestos.

Asbestos fines were detected in one surface sample (ID: BH6_0.2) which was quantified at 0.00005% w/w and is below the adopted HSL which is applicable to all land uses.

Tabulated laboratory results are presented in **Table 1** and **Table 2** (at the end of this report) and full laboratory certificates of analysis and chain of custody documentation are provided in **Appendix D**.

7 Quality assurance and quality control

Field QA/ QC was evaluated through the collection of field and split duplicate samples with comparison of the relative percentage difference (RPD) between the reported results.

Internal laboratory QA/QC included the evaluation of method blanks (MB), matrix spikes (MS) recovery, laboratory control samples (LCS) and surrogate spike recovery. The split duplicate sample also serves to assess for reproducibility of results between analytical laboratories. To minimise potential QA/ QC related issues due to low quality analytical assessments all laboratories engaged were suitably accredited by NATA.

The overall assessment of the data is as follows:

- All samples were analysed within recommended holding times;
- Inter and intra laboratory duplicates RPD results were within acceptable limits.
- The internal laboratory QA/QC indicated:
    - No method blank outliers reported for all samples.
    - No surrogate outliers reported for all samples.
    - Recoveries for matrix spike samples were reported in acceptable limits for the laboratory.
    - Recoveries for laboratory control samples were reported in acceptable limits for the laboratory.
    - RPDs for internal laboratory duplicate samples were reported within acceptable ranges for the laboratory (RPD <20 – 70%).
- With regard to the above the dataset as a whole is considered reproducibly and reliable and is therefore suitable for use.

The evaluation of QA/ QC is provided in **Appendix E**.

8 Discussion and CSM

The following discussion and conceptual site model (CSM) pertain to the AOC along the northern site boundary, having been identified as the footprint of an alleged former service station. It is noted that from the aerial images presented in M2A (2020) the potential service station was present for a relatively short period of time between ~1965 to 1978. After this time, the site boundaries have been altered via widening the Great Western Highway, such that part of the area in question is partially located outside the current site boundary.

No potential hydrocarbon odours were identified during the intrusive investigation and PID readings (<1 ppm) were indicative of ambient background conditions.

The reported concentrations of hydrocarbon-related CoPC were below the laboratory's LOR or the adopted site assessment criteria for commercial/ industrial land-use.

9 Conclusion and recommendations

Based upon the results of the intrusive assessment, the following key findings were made:

- Earthworks were in progress at the site as a sediment basin (approx. 20 m long, 10 m wide and ~3-3.5 m deep) was being excavated near the northern site boundary and within the AOC.
- Natural, firm dry, brown-grey clay was exposed at the base of the sediment basin with orange-grey mottling (ID: BH1 and BH2).
- Fill material consisting of brown clay with trace anthropogenic inclusions present at locations BH3 to BH6 from surface to ~1 mBGL.
- Natural material from ~1 mBGL at locations BH3 to BH6 consisted of brown/ red mottled clay becoming stiff, red/ yellow, pale grey mottled clay from ~2 mBGL with very dry, crumbly pale grey clay with red mottles/ red ironstone cobbles observed from 2.5 to 3 mBGL.
- Observations of subsurface soils at the locations assessed did not note any visual / olfactory indications of contamination or asbestos.
- Results of soil laboratory analyses for CoPC were either below the laboratory's LOR and/or within acceptable thresholds for ongoing commercial / industrial land use (Setting D) (ASC NEPM, 2013).
- Asbestos was detected one surface sample (ID: BH6_0.2) which was quantified at 0.00005% w/w and below the adopted HSL.

Based upon results and findings from this assessment, Environmental Earth Sciences concludes there is no unacceptable risk to human health or the environment for ongoing commercial / industrial land use (Setting D) due to the alleged former service station. As such additional assessment and/ or remediation is considered not necessary.

10 Limitations

This report has been prepared by Environmental Earth Sciences NSW ACN 109 404 006 in response to and subject to the following limitations:

1. The specific instructions received from CPB-Ghella Joint Venture c/- Road and Rail Excavations Pty Ltd;

2. The specific scope of works set out in email communications dated 9 September 2022 issued by Environmental Earth Sciences NSW for and on behalf of Road and Rail Excavations Pty Ltd, is included in Section 3 of this report;

3. May not be relied upon by any third party not named in this report for any purpose except with the prior written consent of Environmental Earth Sciences NSW (which consent may or may not be given at the discretion of Environmental Earth Sciences NSW);

4. This report comprises the formal report, documentation sections, tables, figures and appendices as referred to in the index to this report and must not be released to any third party or copied in part without all the material included in this report for any reason;

5. The report only relates to the site referred to in the scope of works being located at 1-17 Gipps Street, Claremont Meadows NSW 2747 (“the site”);

6. The report relates to the site as at the date of the report as conditions may change thereafter due to natural processes and/or site activities;

7. No warranty or guarantee is made in regard to any other use than as specified in the scope of works and only applies to the depth tested and reported in this report;

8. Fill, soil, groundwater and rock to the depth tested on the site may be fit for the use specified in this report. Unless it is expressly stated in this report, the fill, soil and/or rock may not be suitable for classification as clean fill, excavated natural material (ENM) or virgin excavated natural material (VENM) if deposited off site;

9. This report is not a geotechnical or planning report suitable for planning or zoning purposes; and

10. Our General Limitations set out at the back of the body of this report.

Should you have any queries, please do not hesitate to contact us on (02) 9922 1777.

For and on behalf of
Environmental Earth Sciences NSW

Author	**Internal Reviewer**
[redacted]	[redacted]

122045RP02V01

11 References

Assessment of Site Contamination National Environment Protection Measure (ASC NEPM) 2013, Schedule B (1): Guidelines on the Investigation Levels for Soil and Groundwater.

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (2017), *Technical Report No.39, Risk-based Management and Remediation Guidance for Benzo(a)pyrene* (CRC Care, 2017).

Environmental Earth Sciences NSW (2022a) *Detailed Site Investigation for Claremont Meadows Services Facility* (ref. 122045RP01V3, dated 20 September 2022).

Environmental Earth Sciences NSW (2022b) *Sampling Analysis and Quality Plan Addendum – Claremont Meadows Services Facility, Sydney Metro- Western Sydney Airport (ref. 122045_SAQP Addendum V1, dated 27 May 2022).*

M2A Joint Venture (M2A) (2020) Sydney Metro – Western Sydney Airport, Technical Paper 8: Contamination.

NSW EPA (2015) *Sample Design Guidelines* (note recently superseded by NSW EPA, 2022a and 2022b).

NSW EPA (2017), *Guidelines for the NSW Site Auditor Scheme* (3rd edition) (the "Site Auditor Guidelines").

NSW EPA (2020), Contaminated Land Guidelines: Consultants Reporting on Contaminated Land.

NSW EPA (2022a) *Contaminated Land Guidelines – Sampling design part 1 – application*.

NSW EPA (2022b) *Contaminated Land Guidelines – Sampling design part 2 – interpretation.*

Tetra Tech Major Projects (TTMP) (2022), *Claremont Meadows – Sampling Analysis Quality Plan – Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works* (ref. SMWSASBT-CPBJV-SWD-SW000-GE-RPT-040501 RevA, dated 30 March 2022).

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

ENVIRONMENTAL EARTH SCIENCES GENERAL LIMITATIONS

Scope of services
The work presented in this report is Environmental Earth Sciences response to the specific scope of works requested by, planned with and approved by the client. It cannot be relied on by any other third party for any purpose except with our prior written consent. Client may distribute this report to other parties and in doing so warrants that the report is suitable for the purpose it was intended for. However, any party wishing to rely on this report should contact us to determine the suitability of this report for their specific purpose.

Data should not be separated from the report
A report is provided inclusive of all documentation sections, limitations, tables, figures and appendices and should not be provided or copied in part without all supporting documentation for any reason, because misinterpretation may occur.

Subsurface conditions change
Understanding an environmental study will reduce exposure to the risk of the presence of contaminated soil and or groundwater. However, contaminants may be present in areas that were not investigated, or may migrate to other areas. Analysis cannot cover every type of contaminant that could possibly be present. When combined with field observations, field measurements and professional judgement, this approach increases the probability of identifying contaminated soil and or groundwater. Under no circumstances can it be considered that these findings represent the actual condition of the site at all points.

Environmental studies identify actual sub-surface conditions only at those points where samples are taken, when they are taken. Actual conditions between sampling locations differ from those inferred because no professional, no matter how qualified, and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden below the ground surface. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from that predicted. Nothing can be done to prevent the unanticipated. However, steps can be taken to help minimize the impact. For this reason, site owners should retain our services.

Problems with interpretation by others
Advice and interpretation is provided on the basis that subsequent work will be undertaken by Environmental Earth Sciences NSW. This will identify variances, maintain consistency in how data is interpreted, conduct additional tests that may be necessary and recommend solutions to problems encountered on site. Other parties may misinterpret our work and we cannot be responsible for how the information in this report is used. If further data is collected or comes to light we reserve the right to alter their conclusions.

Obtain regulatory approval
The investigation and remediation of contaminated sites is a field in which legislation and interpretation of legislation is changing rapidly. Our interpretation of the investigation findings should not be taken to be that of any other party. When approval from a statutory authority is required for a project, that approval should be directly sought by the client.

Limit of liability
This study has been carried out to a particular scope of works at a specified site and should not be used for any other purpose. This report is provided on the condition that Environmental Earth Sciences NSW disclaims all liability to any person or entity other than the client in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by any such person in reliance, whether in whole or in part, on the contents of this report. Furthermore, Environmental Earth Sciences NSW disclaims all liability in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by the client, or any such person in reliance, whether in whole or any part of the contents of this report of all matters not stated in the brief outlined in Environmental Earth Sciences NSW's proposal number and according to Environmental Earth Sciences general terms and conditions and special terms and conditions for contaminated sites.

To the maximum extent permitted by law, we exclude all liability of whatever nature, whether in contract, tort or otherwise, for the acts, omissions or default, whether negligent or otherwise for any loss or damage whatsoever that may arise in any way in connection with the supply of services. Under circumstances where liability cannot be excluded, such liability is limited to the value of the purchased service.

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

FIGURES

Legend

- Area of concern (AOC) - Approximate footprint of potential historical service station
- Site boundary

0 5 10 15 m

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

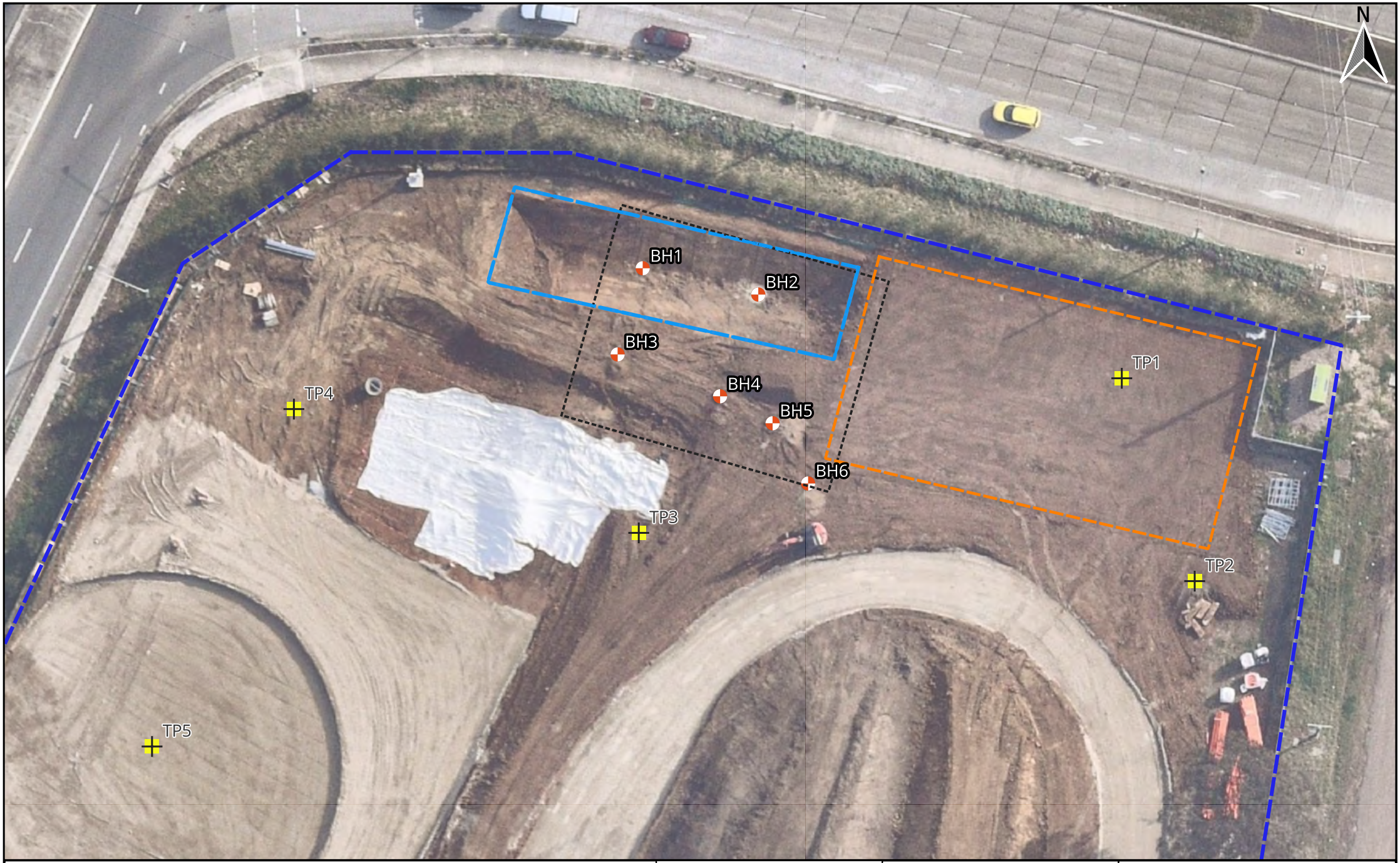
Title: Site locality

Client: Road and Rail Excavations

Location: Claremont Meadows Services Facility - 1-17 Gipps St, Claremont Meadows NSW

Project Manager: Sam Goldsmith	Scale: As Shown	Job No: 122045
Drawn By: Karin Azzam	Date: September 2021	

Figure 1



Legend

- Borehole locations - Data gap investigation
- Test pit locations (EES, Mar 2022)
- Approximate footprint of potential historical service station
- Trench
- Location of proposed water treatment plant
- Site boundary

0 5 10 15 m

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

Title: Sampling locations

Client: Road and Rail Excavations

Location: Claremont Meadows Services Facility - 1-17 Gipps St, Claremont Meadows NSW

Project Manager: Sam Goldsmith | Scale: As Shown | Job No: 122045

Drawn By: Karin Azzam | Date: September 2021

Figure 2