# Stage 1 Preliminary Site Investigation

221-227 and 289-311 Luddenham Road, Orchard Hill, NSW, 2748

5046200067

Prepared for HB+B Property Pty Ltd
1/07/2020

Construction Sciences

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# Document Information

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# Executive Summary

Construction Sciences Pty Ltd (CS) was engaged by HB+B Property Pty Ltd, to undertake a Stage 1 preliminary site investigation (PSI) for land located at 221-227 and 289-311 Luddenham Road, Orchard Hills, NSW, 2748 (the site).

The site is legally identified as part Lot 1 in Deposited Plan (DP) 1099147 and part Lot 242 in DP 1088991. At the commencement of this project, CS understood that the Site is currently a rural residential property with open space agricultural land attached. The Site is proposed for development into a commercial and industrial land use comprising of large warehouses and industrial units. This PSI is required to provide information regarding the land contamination risks at the site for due-diligence purposes, and to support a future development application in accordance with the State Environmental Planning Policy (SEPP) No. 55.

The objectives of the project are to assess the presence of contamination on-site, and provide conclusions regarding the suitability of the site for future land use scenario, consistent with 'Commercial / Industrial' as defined in the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended May 2013 ('NEPM', NEPC, 2013)

The primary objectives of the project were to assess the potential for contamination to be present on site, provide advice on the suitability of the site for the proposed commercial/industrial land use scenario and provide recommendations for further investigation, management and/or remediation of the site (if warranted).

The scope of work undertaken to address the project objectives included a desktop review of readily available documentation pertaining to the site, a site walkover, intrusive works involving excavation of 25 test pits, soil sampling and screening of results against the proposed commercial/industrial land use scenario.

A number of areas of environmental concern were identified on the site and are presented in the table below.

| ID | Description | Contaminants of Potential Concern |
|---|---|---|
| AEC01 | Imported Fill | Hydrocarbons, pesticides, metals, asbestos |
| AEC02 | Stained soils and incomplete combustion | Asbestos, PAH and metals |
| AEC03 | Green house and adjacent crops | Pesticides, asbestos, PAH and metals |
| AEC04 | Former Crops | Pesticides and metals |
| AEC05 | Previous motor vehicle storage | Hydrocarbons, metals |
| AEC06 | Soil stockpiles with foreign material inclusions (SP1-SP4) | Hydrocarbons, metals, PAH, pesticides, asbestos |
| AEC07 | Soils adjacent to above ground diesel tank | Hydrocarbons, PAH, asbestos and metals |
| AEC08 | ACM fragments stacked on surface | Asbestos |
| AEC09 | Oil intermediate bulk container (IBC) | Hydrocarbons, PAH and metals |
| AEC10 | Old fibro cottage walls broken | Asbestos |
| AEC11 | Household/Demolition surface waste | Asbestos and metals |
| AEC12 | Two underground septic tanks | Coliforms, enterococci, E.coli, metals, OCP |

Based on CS's assessment in the context of the proposed land use scenario, CS makes the following conclusions:

> Bonded asbestos contamination was identified in fill, at sample location TP21, which may present an unacceptable human health exposure risk;

> Bonded asbestos was identified on the surface near TP16 and the old fibro cottage, which may present an unacceptable human health exposure risk and unacceptable aesthetics risk;

> It is likely that other buildings located onsite may contain hazardous building materials, including asbestos, lead and zinc, which may present an unacceptable human health exposure risk and currently pose an aesthetics risk;

> Potential underground septic tanks are considered likely, which may pose an aesthetic risk;

> The above ground diesel tanks, surface household/demolition waste and IBC containing waste engine, may pose an aesthetic risk;

> Potential unexpected finds of underground asbestos containing infrastructure may pose an unacceptable human health exposure risk;

> The site could be made suitable for the proposed land use scenario, subject to:

  - A hazardous building material survey of all buildings prior to demolition;
  - Validation sampling of soils around the footprints of buildings, following demolition;
  - Decommissioning of septic tanks and above ground tanks;
  - Inspection and removal of all household/demolition waste; and
  - Management and/or remediation of the bonded ACM and potential friable asbestos / asbestos fines in soil at TP21; and
  - Procedures being detailed for management and/or remediation of unexpected finds of asbestos infrastructure.

Based on these conclusions, CS makes the following recommendations:

> Undertake a supplementary assessment of the identified asbestos risks, in order to delineate the lateral and vertical extent of the identified asbestos at TP21;

> A remedial action plan (RAP) should be prepared to include, but not limited to:

  - Remediation methodology;
  - an unexpected find protocol for potential unidentified asbestos contamination or additional contamination found during earthworks;
  - supplementary validation of building footprints post-demolition;
  - validation inspections of footprints of locations which were identified as an aesthetic risk; and
  - Import protocol which will validate material to be imported and guide material tracking.

A site validation report (SVR) should be prepared at the completion of all management / remedial works, confirming that the site has been made suitable for the proposed land use scenario

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# 1 Introduction

## 1.1 General

Construction Sciences Pty Ltd (CS) was engaged by HB+B Property Pty Ltd, to undertake a Stage 1 preliminary site investigation (PSI) for land located at 221-227 and 289-311 Luddenham Road, Orchard Hills, NSW, 2748 (the site). For the site location and locality, refer to **Figure 1**.

The site is legally identified as Lot 1 in Deposited Plan (DP) 1099147 and Lot 242 in DP 1088991. At the commencement of this project, CS understood that the Site is currently a rural residential property with open space agricultural land attached. The Site is proposed for development into large warehouses and industrial units, which would classify as commercial and industrial land use. This PSI is required to provide information regarding the land contamination risks at the site for due-diligence purposes, and to support a future development application in accordance with the State Environmental Planning Policy (SEPP) No. 55.

This Stage 1 PSI is hereafter referred as the 'project'. The report has been prepared utilising information obtained as part of the assessment process, and from experience, knowledge, and current industry practice in the assessment of similar sites.

This report must be read in conjunction with the explanatory notes, limitations and general notes, as set out in **Appendix A**

## 1.2 Objectives

The objectives of the project are to assess the presence of contamination on-site, and provide conclusions regarding the suitability of the site for future land use scenario, consistent with 'Commercial / Industrial' as defined in the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended May 2013 ('NEPM', NEPC, 2013)

Specifically, the objectives of the contamination assessment will be to:

> assess the potential for contamination to be present on site, as a result of past and current land uses;

> provide advice on the suitability of the site (with respect to contamination) for the proposed commercial/industrial land use scenario;

> provide advice on contamination risks for the purpose of due diligence; and

> provide recommendations for further investigation, management and/or remediation of the site (if warranted).

## 1.3 Scope of Work

The scope of work undertaken to address the project objectives included:

> Desktop review of readily available documentation pertaining to the site including current and historical aerial photographs, land title records, Section 10.7 (2) planning certificates, land contamination record information in the NSW Environmental Protection Authority (EPA) online public registers;

> Review of the environmental condition of the site and surrounding area including topography, geology and hydrogeology;

> Site walkover to assess the current site condition and land use, as well as surrounding land uses;

> Review of site history and results of walkover to assess areas of environmental concern (AEC);

> Excavation of test pits in AECs identified following desktop review and the site walkover;

> Judgemental soil sampling based on locations of AECs and potential soil contamination issues, if any;

> Laboratory testing of soil samples for a suite of selected potential organic and inorganic contaminants;

- Interpretation of the results of laboratory testing in the context of the adopted investigation criteria, field observations, local geology and hydrogeology, and site history;
- Development and documentation of a site-specific Conceptual Site Model (CSM) based on the available information; and
- Preparation of this report which provides an assessment of the soil contamination, and discusses the suitability of the site for its intended land use.

Note: the intrusive works, soil sampling and analysis are intended to be supplementary to the site history review and walkover that comprises a Stage 1 PSI, to gain a preliminary understanding of analyte concentrations and subsurface soil conditions. The sampling density undertaken in this investigation does not satisfy the NSW EPA *Contaminated Sites: Sampling Design Guidelines* (NSW EPA, 1995) and is not intended for complete characterisation or validation of the site.

The report and scope of works was developed in general accordance with industry and NSW Environment Protection Authority (EPA) guidelines, particularly the *Contaminated Land Guidelines: Consultants reporting on Contaminated Sites Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2020) and the NEPM (NEPC, 2013).

# 2 Site Identification

## 2.1 Site Location and Description

The site is an irregular shaped area of land, located at the corner of Patons Lane and Luddenham Road, approximately 1.3km west of Mamre Road. The locality of the site is presented in **Figure 1**.

The site currently comprises of the following general layout:

> Lot 1 DP1099147: caretaker housing, a large residential property on Luddenham road, a warehouse, a small unoccupied cabin (the 'Cabin'), horse stables and associated facilities, and a rectangular network of fenced yards for horse and sheep agistment.

> Lot 242 DP1088991: comprises of a residential building, a detached old abandoned fibro cottages (the 'Old fibro cottages'), open space paddocks for cattle grazing and four dams.

For purposes of clarity throughout the report, the 'Old fibro cottages' and the 'Cabin' are references to the building structures identified in the general site layout provided in **Figure 2**.

Table 2-1 provides a summary of the Site description and identification and details:

**Table 2-1 Site Description Details**

| Items | Description |
|---|---|
| Site Address | 221-227 and 289-311 Luddenham Road, Orchard Hills, NSW, 2748 |
| Legal Identification | Lot 1 in DP 1099147 and Lot 242 in DP 1088991 |
| Local Government Area | The City of Penrith |
| Current Zoning | Lot 1 in DP 1099147:<br>– E2: Environmental Conservation<br>– RU2: Rural Landscape<br>Lot 242 in DP 1088991<br>– RU2: Rural Landscape<br>Under the Penrith Local Environmental Plan 2010 refer to **Figure 4** |
| Site Area | 816,260m$^2$ (approximately 82 hectares) refer to the site plan **Appendix B** |
| Geographical Coordinates | 33°49'10" S and 150°45'36" E. (*Source: Google Earth*) |

# 3 Geology, Hydrogeology, Topography and Acid Sulfate Soils

## 3.1 Topography and Elevation

A review of Nearmap aerial images indicates most native vegetation has been cleared and the site is predominantly covered in grasses with small patches of scattered tress throughout, with the exception of a residual dense natural bushland corridor, in the north west corner of the site. There are four dams visible across the site, located in Lot 242 DP 1088991.

A search of Google Earth indicates the site is relatively flat with an overall slope towards the north west. The site lies at elevations between approximately 36 m (northern boundary), 41m (eastern boundary), 37m (western boundary) and 50m (southern boundary), Australian Height Datum (AHD). A detail and level survey of site was not provided.

## 3.2 Geology and Soils

The Department of Mineral Resources Geological Survey of NSW Penrith 1:100,000 Geological Series Sheet 9030 (Edition 1) 1991, indicated that the site is likely to be underlain by Triassic-aged Ashfield Shale of the Wianamatta Group. This formation comprises shale, carbonaceous claystone, claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff.

The 1:100,000 'Penrith Soil Landscape Map' indicates that the site lies within the Blacktown residual soil group. This group typically comprises friable brownish black loam to clay loam, over light grey silty clay to heavy clay which occurs as deep subsoil above shale bedrock. Limitations associated with the soil group include localised seasonal waterlogging, water erosion hazard, surface movement potential.

The 'Acid Sulfate Soil Risk Map' available on eSpade https://www.environment.nsw.gov.au/eSpade2Webapp indicates that there are no known occurrences of acid sulfate soils (ASS) in the vicinity of the site. Land management activities are not likely to be affected by acid sulfate soil materials. Furthermore, no evidence of suspected ASS was observed on-site during fieldwork. Therefore, further assessment of ASS is considered unwarranted.

The department of Infrastructure, Planning and Natural Resources 'Salinity Potential in Western Sydney 2002' indicates the Site lies in an area of moderate salinity potential.

## 3.3 Hydrogeology and Hydrology

A search of Australian Government Bureau of Meteorology, Australian Groundwater Explorer (http://www.bom.gov.au/water/groundwater/explorer/map.shtml) and WaterNSW (https://realtimedata.waternsw.com.au/water.stm) indicated that there is one registered groundwater bore (ID: GW105382.1.1) located within a 500m radius of the site. There were no registered bores for authorised extraction purposes within a 2km radius of the site

Summary information presented for the registered groundwater bore, GW105382.1.1, revealed the following:

> The bore was drilled in 2004 to depths of 252m below ground level (bgl) at a reference elevation of 40.9 m AHD;

> The geology encountered during drilling included CLAY (0-5m bgl), SHALE (5-80m bgl). Rock was encountered at a depth of 80m, and was comprised of SANDSTONE;

> The salinity in groundwater was measured at 2500 TDS mg/L indicating very high salinity water – not suitable for irrigation under ordinary conditions; and

> The depth to standing water level was reported at 24m bgl.

For a record of the groundwater bore search, refer to **Appendix C.**

There are four main dams located across the site, presumably used for onsite irrigation and agricultural feed purposes.

A review of readily available maps held on file by CS, indicated the nearest receiving surface water bodies included:

> Natural drainage channel, located within the preserved bushland corridor in the north west of the site, extending from Patons Lane on the northern boundary through the north west corner of the site and feeds into a dam west of the site, and extends diagonally south west;

> Blaxland Creek located approximately 1.6km north west of the site; and

> South Creek, located approximately 500m to the east of the site.

The surface water is expected to infiltrate permeable soils into underlying groundwater or flow over land into the nearest dam, natural drainage lines and creeks which ultimately discharge into the Hawkesbury River.

Based on the location of the identified surface water courses and site topography, the inferred groundwater flow direction at the site is considered likely to be towards the north.

# 4 Regulatory Records

## 4.1 Contaminated Land Management (CLM) Act 1997

### 4.1.1 Record of Notices

A search of the NSW EPA online contaminated land record of notices indicated that the site (and land located immediately adjacent to the site) was not the subject of:

> orders made under Part 3 of the Contaminated Land Management Act 1997;

> notices available to the public under section 58 of the CLM Act

> an approved voluntary management proposal under the CLM Act that has not been fully carried out and where NSW EPA approval has not been revoked;

> site audit statements provided to the NSW EPA under section 53B of the CLM Act that relate to significantly contaminated land;

> where practicable, copies of anything formerly required to be part of the public record; or

> actions taken by NSW EPA (or the previous State Pollution Control Commission) under section 35 or 36[1] of the Environmentally Hazardous Chemicals Act 1985.

A copy of the NSW EPA search record for the Penrith LGA is presented in **Appendix D**.

### 4.1.2 Register of Notified Sites

A search of the NSW EPA online list of NSW contaminated sites notified to NSW EPA indicated that the site (and land located immediately adjacent to the site) was not on the list.

## 4.2 Protection of the Environment Operations (POEO) Act 1997

### 4.2.1 Register of Licences, Applications, Notices, Audits or Pollution Studies and Reduction Programs

A search of the NSW EPA online POEO public register indicated that the site (and land located immediately adjacent to the site) was not the subject of an application, notice, audit, pollution study or reduction program.

The records revealed two NSW EPA protection licenses currently issued to SRC Operations Pty Ltd (the licensee), for the premises identified as Patons Lane Resource Recovery Centre and Patons Lane Landfill, located at 123-129 Patons Lane Orchard Hills, NSW, approximately 500m north-west of the Site.

The following details were listed for each environment protection license record:

> License no. 21259: The scheduled activity is resource recovery and waste storage. Wastes permitted to be processed and recovered includes, but not limited to; Excavated Natural Material (ENM), building and demolition waste, paper and cardboard, asphalt waste, and wood.

> License no. 21259: Extractive activities and waste disposal. Waste permitted includes Special Waste Asbestos, (includes only emplacement of material already on the premises) and General Solid Waste (non-putrescible).

CS considers this landfill unlikely to pose a risk to the site under the proposed land use scenario due to the following:

> All areas of the landfill are likely to be bunded, and aerial imagery indicates a number of surface water retention basins are located in the south eastern portion of the landfill;

> Regular monitoring of the groundwater is required under the NSW EPA license and there was no record of pollution incidents under the above contaminated land record search.

[1] Sections 35 and 36 of the Environmentally Hazardous Chemicals Act 1985 have been repealed. Notices under these sections are treated by the CLM Act as management orders.

> Furthermore, any potential offsite migration would likely flow into the natural drainage channel to the northwest of the site and flow in an inferred north-easterly direction, away from the site.

A copy of the search record is presented in **Appendix D**.

## 4.3 Environmental Planning and Assessment (EP&A) Act 1979

### 4.3.1 Section 10.7 Planning Certificate

A copy of the planning certificates issued under section 10.7(2) of the EP&A Act was obtained for Lot 1 DP11099147 and Lot 242 DP1088991, within the Site. The certificates provided the following information:

> Confirmed the zoning is E2 Environment Conservation and RU2 Rural Landscape (Lot 1 DP11099147) and RU2 Rural Landscape (Lot 242 DP1088991). The E2 zoned portion includes prohibition for development of warehouses or distribution centres;

> All or part of the land is identified in the Penrith Local Plan 2010, Clause 7.2 Flood Planning, which requires development consent prior to development;

> An item of environmental heritage is not situated on the land and the land is not located in a heritage conservation area;

> The land is not affected by any of the matters contained in Clause 59(2) as amended of the Contaminated Land Management Act 1997;

> The land has not been proclaimed to be within a mine subsidence district;

> Some of the land is bushfire prone land;

> The land is affected by the Asbestos Policy adopted by Penrith City Council. This infers asbestos, in bonded form, is suspected in building materials onsite; and

> The land is not advised as including or comprising an area of outstanding biodiversity value.

A copy of the certificates is presented in **Appendix E**.

## 4.4 Work Health and Safety (WHS) Regulation 2017

### 4.4.1 Schedule 11 Hazardous Chemicals

A site search with SafeWork NSW for Schedule 11 hazardous chemicals (dangerous goods)[2] on the site was not within the scope of work undertaken for this site.

CS's review of historical aerial photography and historical land title ownership records (refer Section 5.1 and 5.2 of this report), did not indicate a potential for licensable quantities of Schedule 11 hazardous chemicals (dangerous goods) to have been stored on the site.

CS considers that further assessment of the storage of licensable quantities of Schedule 11 hazardous chemicals (dangerous goods), within the context of this project, is considered not warranted.

[2] Under the Work Health and Safety Regulation

# 5 Site History

## 5.1 Aerial Photography

A selection of historical aerial photographs of the site were reviewed. A copy of each historical aerial photograph reviewed is provided in **Appendix F**.

CS notes, the aerial imagery 'site boundary' represents the entire lots cadastral boundaries (Lot 1 DP1099147 and Lot 242 DP 1088991) including the area west of the site outside the 'site' as defined in **Figure 2** for this investigation. Hence, the 'site observations' in column 2 of Table 5-1, exclude this area west of the site and any changes to this area are discussed in 'Surrounding Land Observations' column Table 5-1.

Observations made during the review (considered relevant to this project) are presented in Table 5-1.

**Table 5-1 Aerial Photography**

| Photo Date | Site Observations | Surrounding Land Observations |
|---|---|---|
| 1947 | The land appears undeveloped, cleared of most trees and predominantly open space paddocks, indicative of land for grazing, and surface is covered in low lying vegetation.<br>Possible fence lines visible dividing some areas of the site.<br>A drainage line is visible intercepting north western corner of the site.<br>A straight line of raised soils dissects the centre of Lot 242 DP1088991, potentially an underground pipe, which ends on the boundary of Lot 1 DP1099147 | Stockdale Road, Paton's lane and Luddenham Road visible;<br>Land is predominantly open space rural paddocks;<br>Water pipe network visible south of the site running east to west;<br>Residential building structures in south eastern corner; and<br>South creek visible on the east. |
| 1956 | The 'old fibro cottages' are now visible in the south eastern corner of Lot 242 DP1088991. | Low density residential development immediately east of the middle of the site, and on south eastern boundary.<br>Luddenham Road more defined.<br>Possible dams located west of the site |
| 1961 | The following buildings appear erected:<br>– Three small building structures and round yards in the location of the current horse stables;<br>– the 'cabin', is visible in the north;<br>– Rectangular excavation east of the cabin<br>– Unknown structure in south eastern portion of Lot 1 DP1099147<br>Large oval shaped line of ground disturbance, possible some type of track on the eastern boundary of Lot 1 DP1099147 and patches of ground disturbance to the west | Scattered low density residential developments in the south east and west of the site.<br>Large round excavation immediately west of the site, possible dam and patches of other ground disturbance |

| Photo Date | Site Observations | Surrounding Land Observations |
|---|---|---|
| | Southern portion (Lot 242 DP1088991) low lying vegetation has spread to the east | |
| 1965 | Lines of cleared vegetation in the southern paddocks.<br>Rectangular network of fences for yards now erected in north eastern corner with dirt roadways | Various small ground disturbances appears to be for the construction of dams in immediate surrounding paddocks |
| 1970 | Southern portion of the site cleared of all low lying vegetation<br>Large residential building is now erected near the main entrance, immediately adjacent to Luddenham Road. Adjacent horse stables to the west and various facilities now visible<br>The current warehouse is now erected<br>Small structure, possibly above ground storage tanks now visible to the south west of the horse stables.<br>Fenced yards and horse stables attached at regular intervals, now extended to present day layout. All accessed by a network of dirt roadways.<br>Ground disturbance in the centre of the site and a round small structure visible to the north of the cabin<br>Unknown structure in south eastern portion of Lot 1 DP1099147 now not visible<br>Transmission line easement now visible | Minor ongoing low density residential development.<br>Dams further developed and horse track now visible west of the site.<br>Kennett's Airfield now visible to the south |
| 1978 | Dams 1-4 now clearly visible<br>Large building structure in north eastern area of Lot 242 DP 1088991 and small containers or machinery visible to the south<br>Small container like structures and machinery, immediately west of small residential dwellings in Lot 242 DP 1088991<br>Various ground disturbance activities in the north western corner of the site | Large dam now visible in the south |
| 1982 | Ground disturbance in the north western corner of the site beneath the high voltage transmission line with evidence of anthropogenic materials on the surface | No significant change since previous image. |

| Photo Date | Site Observations | Surrounding Land Observations |
|---|---|---|
| | Small container like structures immediately north of the building, possible machinery and vehicles parked around the old cottage in Lot 242 DP 1088991 | |
| 1986 | No significant change since previous image. | No significant change since previous image. |
| 1991 | Further ground disturbance in the north west corner of the site below the transmission line and evidence of anthropogenic materials stored on surface.<br>Rectangular container like structure north of the cabin<br>Vehicles parked west of the old fibro cottage | No significant change since previous image. |
| 1998 | Container not visible north of cabin | No significant change since previous image. |
| 2007 | Ground disturbance in locations including:<br>– north western corner of the site,<br>– Excavation below transmission line, adjacent to Paton's Lane<br>– central eastern section of Lot 1 DP 1099147<br>– possible stockpile east of above ground diesel tanks<br>– Surface stripped of vegetation and tilled to the west of dam 4<br>Asphalt rectangular sealed surface to the south east of the building in Lot 242 DP1088991 and asphalt sealed driveway leading from the same building to Luddenham Road.<br>Gravel upgrade to surface of main entry driveway extending from Luddenham Road to the warehouse.<br>Small structure visible to the north of Dam 4, in location of current chicken coupe | Paton's Lane quarry now visible north west of the site<br>Possible stockpiling and storage of containers north-west of the drainage channel |
| 2014 | Rectangular surface area stripped of vegetation south of dam 1, possible location of crops.<br>Possible rows of crops west of Dam 4<br>Building in Lot242 DP 1088991 renovated with extension on southern side. Gravel sealed surface around the perimeter of the | Further low density residential development to the east<br>Filling has occurred in the location of the quarry |

| Photo Date | Site Observations | Surrounding Land Observations |
|---|---|---|
| | western and southern border of the building<br><br>Filling possibly complete in north western corner of the site as the surface now looks level with no excavations<br><br>Small stockpiles visible at four locations in yards in Lot 1 DP1099147<br><br>Stockpile previously east of above ground diesel tanks now removed<br><br>Possible filling approximately 60m west of the building in Lot 242 DP1088991. Approximately 20 vehicles stored 50m south of the building.<br><br>Materials stored on surface around old fibro cabin | |
| 2019 | Warehouse now has hard stand around boundary<br><br>Anthropogenic material visible on surface:<br>– approximately 50m west of warehouse;<br>– immediately north of Dam 1<br>– north of the cabin; and<br>– vehicles and other containers on hardstand around the warehouse<br><br>Shipping containers now visible at the location of the current residential tenancy on eastern boundary of Lot 1 DP1099147 | No significant change since previous image. |

A review of the recent historical images accessed on Nearmap was also undertaken for the period November 2009 and April 2020. The images revealed the following potential contamination activities onsite:

> A market garden with rows of plants and possible greenhouse erected in the southern area of Lot 1 DP1099147, between 5th May 2016 and 26 March 2019;

> Filling in the north of the site, on the entry roadway at Paton's Lane, which looks to be related to resurfacing of dirt roadways, between 28th February 2020 until 25th April 2020;

> Ground disturbance and potential small stockpiles in four locations in the agistment yards, southern portion of Lot 1 DP1088991, between 5th May 2016 and 26th March 2019;

> Filling approximately 60m west of building in Lot 242 DP1088991 between 3rd July and 19th September 2013;

> Three stockpiles (identified as SP2, SP3 and SP4 in Figure 2) appeared between 12th September and 27th October 2019;

> Another small stockpile (identified as SP1 in Figure 2) appeared between 22nd January 2020 and 28th February 2020.

> Three additional stockpiles appear between 28th February and 25th April 2020, one near Patons Lane entry and another two south of the building in Lot 242 DP 1088991 (identified as SP5, SP6 and SP7 in Figure 2)

The images revealed the following relevant observations to surrounding land:

> Large stockpiles of materials in Lot 1 DP1099147, west of the boundary of the site, between 29th October 2019 and 25th April 2020

The review of historical aerial photography indicated a potential for land contaminating activities to have been undertaken on the site, specifically:

> Storage of containers and machinery which may resulted in chemical or hydrocarbon leaks, predominantly in the immediate surrounds of the buildings in Lot 242 DP 1088991;

> Potential uncontrolled filling and stockpiling sporadically between 1971 until present;

> Storage of containers and/or vehicles on unsealed surfaces between 1971 until present;

> Growing of crops between the 2007 and 2014; and

> Market garden between 2016 and 2019.

Further assessment of these identified potential land contaminating activities, in the context of other historical evidence reviewed during this project, and observations made during the site walkover (refer Section 6 of this report), is considered warranted.

## 5.2 Historical Land Titles

A selection of historical land title ownership records of the site, were reviewed for Lot 1 DP 1099147 and Lot 242 DP 1088991 and are discussed independently below.

### 5.2.1 Lot 1 DP1099147:

Observations made during that review (considered relevant to this project), indicated that registered proprietors of the site since 1925, have included:

> private individuals between 1900 and 1966. Occupations of relevance listed included farmers, graziers, merchants and hotel proprietors;

> S & M Fox Investments Pty Limited between 1966 to 1998;

> Ingham's Enterprises Pty Limited between 1998 to 2008;

> Darley Australia Pty Limited between 2008 and 2016

> Atilol Holdings Pty Ltd 2015 until present.

Darley Australia Pty Ltd is known for horse breeding which aerial imagery suggests and the site was later acquired by Atilol Holdings Pty Ltd for similar purposes.

There were no leases listed for the site.

There were two easements listed:

> Easement for Water Pipes

> Easement for Transmission Line 200 feet wide

The review of historical land titles indicated a potential for land contaminating activities to have been undertaken on the site, specifically:

> Agricultural activities between 1925 and 1955;

> Horse breeding and various agricultural activities between 2008 until present;

These activities may have resulted in use of pesticides, heavy metal contamination of soils from poor farming practices and hydrocarbon contamination from leaks from machinery and onsite refuelling. Based on site

observations, the current owner collects and refurbishes vintage cars, which may also result in isolated oil and fuel spills from 2015 until present.

#### 5.2.2 Lot 242 DP1088991:

Observations made during that review (considered relevant to this project), indicated that registered proprietors of the site, since 1900, have included:

> private individuals between 1900 and 2006. Occupations of relevance listed included farmers, sales and services managers;

> a Trustee of the Lebanese Maronite Missionary between 2006 and 2015; and

> Atilol Holdings Pty Ltd 2015 until present.

There were no leases or easements reported for this portion of the site.

The review of historical land titles indicated a potential for land contaminating activities to have been undertaken on the site, specifically:

> Farming activities between 1958 and 1975; and

> Mechanics activities between 2015 until present.

These activities may also have resulted in use of pesticides, heavy metal contamination of soils from poor farming practices and hydrocarbon contamination from leaks from machinery and onsite refuelling.

Further assessment of these identified potential land contaminating activities, in the context of other historical evidence reviewed during this project, and observations made during the site walkover (refer Section 6 of this report), is considered warranted.

A copy of the historical land title search record is presented in **Appendix G**.

## 5.3 Complaints

There was no evidence provided to CS during the project, regarding historical complaints about the site.

## 5.4 Incident Reports

There was no evidence provided to CS during the project, regarding historical incidents at the site.

## 5.5 Previous Contamination Assessments

A copy of a previous investigation report, pertaining partly to the site, was provided to CS for review during this project.

Parsons Brinckerhoff (PB) 2009, 'Phase 1 Environmental Site Assessment, 289 Luddenham Rd, Orchard Hills, NSW', dated September 2009, ref: 2136798A PR_0742

#### 5.5.1 Parsons Brinckerhoff (2009)

The report (PB, 2009) was limited to an investigation of Lot 242 DP 1088991, which includes an area of land to the west, outside the site. The objective was to carry out a Stage 1 Contamination Assessment in order to assess the risk of site contamination for the proposed development of the land into a cemetery.

The scope of work undertaken to address the project objective included the following:

> Review of regional topography, landscape and geology;

> Review of historical aerial photographs, title records, Section 149 information provided directly by Penrith City Council and other publicly available information;

> Walkover assessment of the subject site and its surrounds to identify potentially contaminated areas.

> Preparation of a report presenting the findings and recommendations.

PB (2009) made the following conclusions:

> Historical ownership of the land was predominantly by private proprietors which used the land for cattle and sheep grazing;

> Due to the previous land use, risk of widespread contamination is low;

> Stockpiles were noted in the west (the location was not provided on a figure in then report), which were likely generated from construction of dams;

> Surface rubbish identified in the west (again the location was not provided to CS);

> Hazardous building materials (asbestos, zinc and lead) likely in building structures onsite;

> Isolated hydrocarbon contamination may be present from maintenance of vehicles around buildings and sheds;

> The use of chemicals against termites may be present in soils around buildings;

> Site conditions are unlikely to “present a constraint to the construction of the cemetery”.

PB (2009) made the following recommendation:

> Widespread sampling is not required, however, “limited environmental works” should be carried out prior to redevelopment, including:

  - Hazardous building material surveys of structures prior to demolition;
  - Surface soil sampling around the buildings and analysis of scheduled chemicals, hydrocarbon contamination and residual hazardous building materials; and
  - Classification of materials which require offsite disposal.

## 5.6 Anecdotal Evidence

Anecdotal evidence and observations suggests:

> the site’s potable water was previously sourced from bore water and currently rainwater;

> Water supply for agricultural feed is sourced from onsite dams and/or bore water;

> Water supply to horse feeds is through polypropylene pipes

> The sewage is treated onsite, most likely in underground septic tanks;

> Previous heavy rainfall and flooding have eroded the roadways and therefore the site owner has recently importing suitable engineering fill to restore the surfaces, where required; and

> The current site owner collects and refurbishes vintage cars.

Hence, the presence of septic tanks and hydrocarbon contamination in soils likely, however, the potential for underground asbestos containing infrastructure is not likely or widespread.

# 6 Site Condition at Site Walkover

A site walkover/drive over, which involved driving and disembarking at accessible locations for walkover, was undertaken by a suitably experienced environmental consultant from CS, on 28th April 2020. During the walkover, observations were made of land use activities being undertaken on the site, as well as on the properties located immediately adjacent to the site.

## 6.1 Current Land Use

The land use scenario at the time of the walkover appeared to be rural residential with open space yards and paddocks used for agistment purposes.

## 6.2 Buildings and Infrastructure

The following buildings and infrastructure were observed during the walkover and key features are provided in **Figure 2**:

> Lot 1 in DP 1099147, on the main entry Luddenham Road, described from east to west is the following:
  - A single storey brick house with surrounding lawn and garden, located at the main entry to the site, on Luddenham Road;
  - West of the house is an asphalt sealed carpark, with adjacent large u-shaped building structure, comprising of living premises, horse stables and caretaker facilities;
  - Further to the west there are two round and one long rectangular shaped structures consisting of horse training facilities;
  - North west of the horse facilities is a large rectangular shaped warehouse located on concrete hardstand, with two round agricultural feed silos located to the south of the warehouse;
  - North of the warehouse is an unoccupied single bedroom cabin with subsurface concrete structure, possibly a septic tank, to the north;
  - Approximately 120m south of the warehouse is above ground diesel tank storage area on concrete bund, with low lying besser block walls;
  - Approximately 100m south of the diesel tanks is a group of shipping containers, converted to residential housing;
  - Rectangular network of fenced yards for horse and sheep agistment throughout.

> Lot 242 DP1088991:
  - A large single storey house with gravel access roadway leading to Luddenham road on the east and subsurface concrete structure, possibly a septic tank, immediately north of the house;
  - Approximately 60m south east of the house is a rectangular asphalt sealed area with above ground 240V power outlets;
  - Approximately 100m east of the asphalt sealed area, along the gravel road towards Luddenham Road is an abandoned old fibro cottage;
  - Approximately 50m south of the fibro cottage is an unknown small metal structure, most likely a redundant chicken pen;
  - Four dams located throughout paddocks;
  - Large rectangular area of open space paddock to the south west, used for cattle grazing.

**Image 6.2.1 View of horse stable facilities**

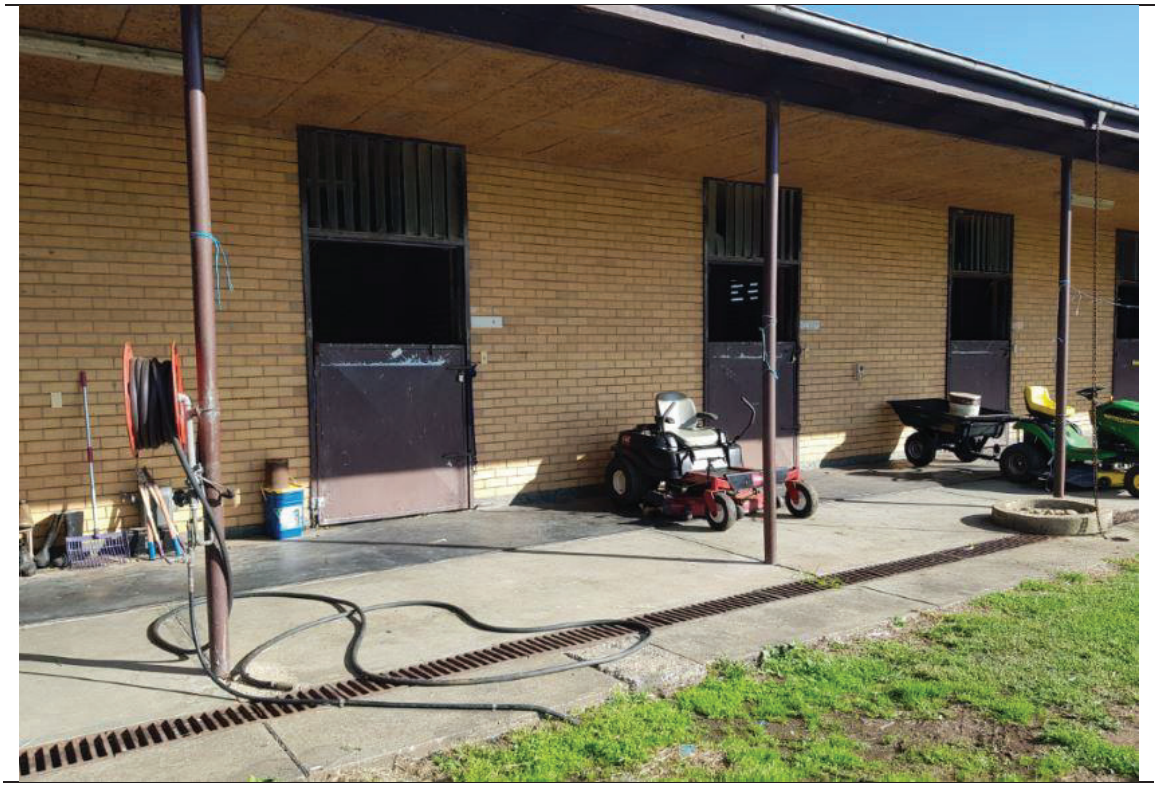


**Image 6.2.2 View of warehouse on concrete hardstand**

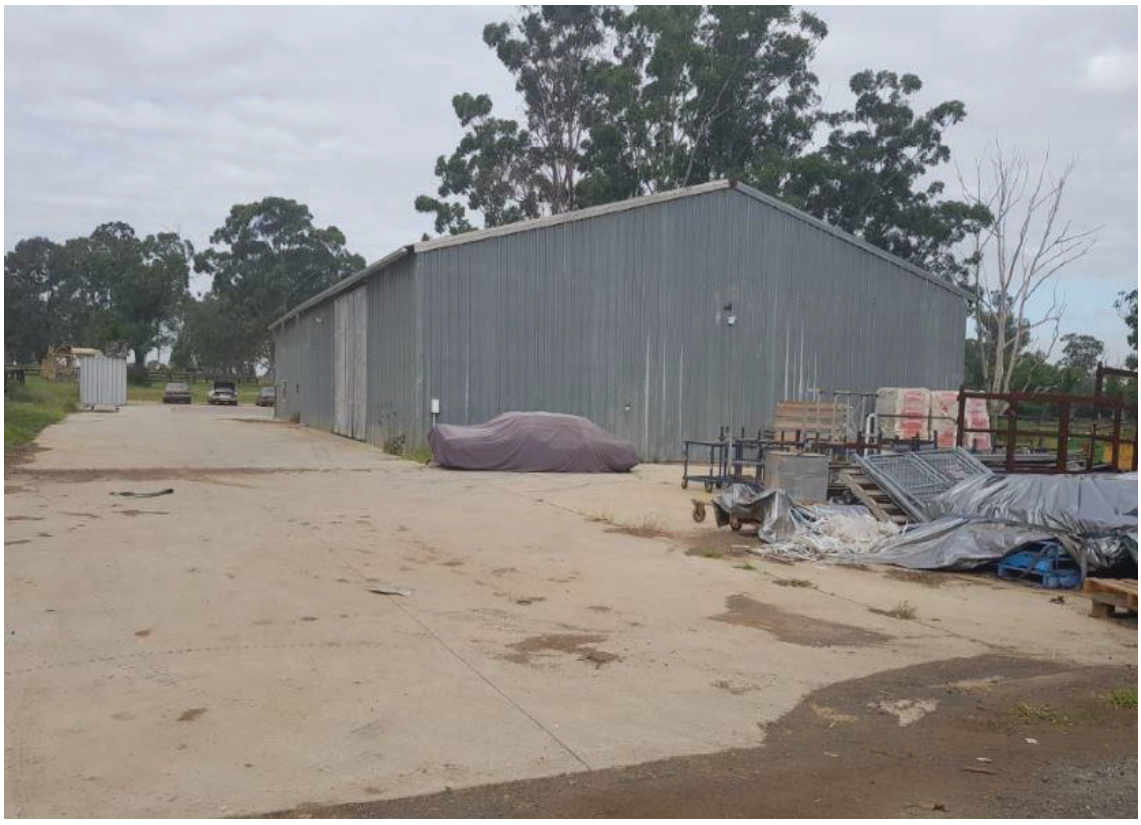


**Image 6.2.3 View of horse yards**

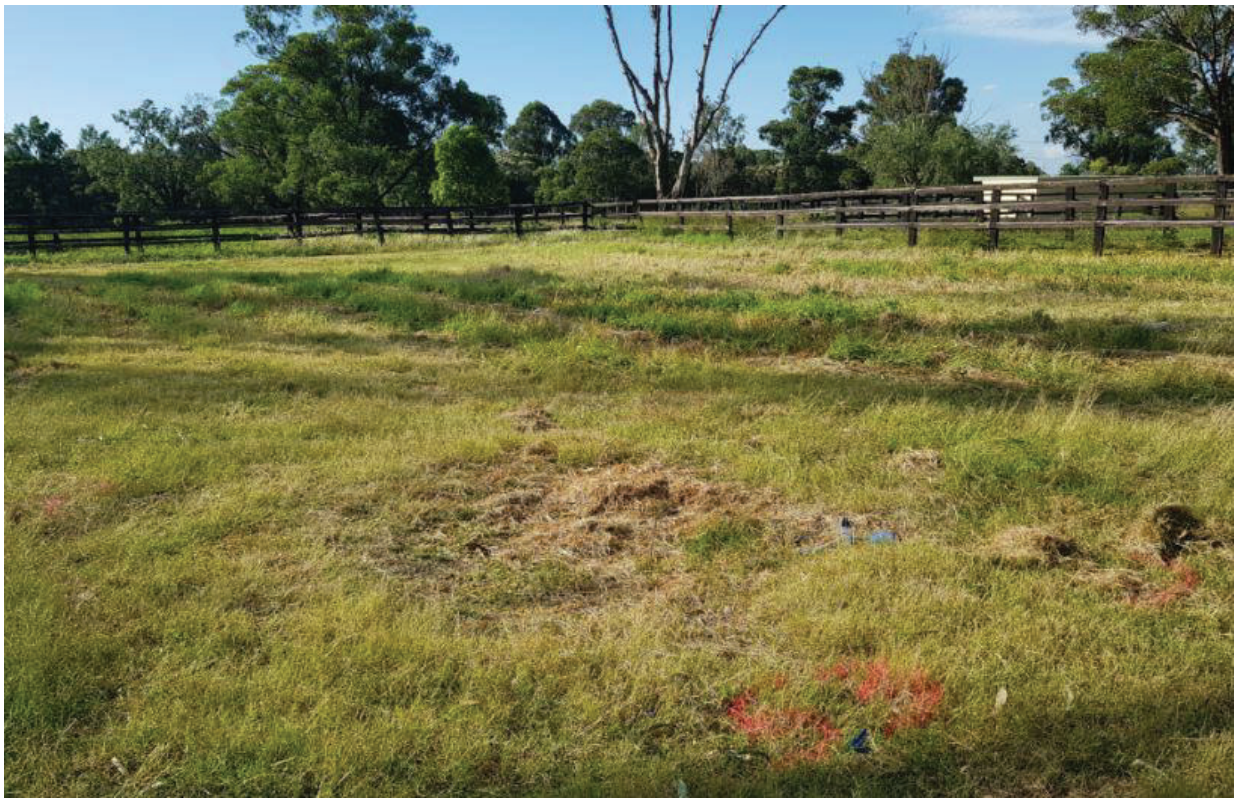


**Image 6.2.4 View of the old fibro cottages**

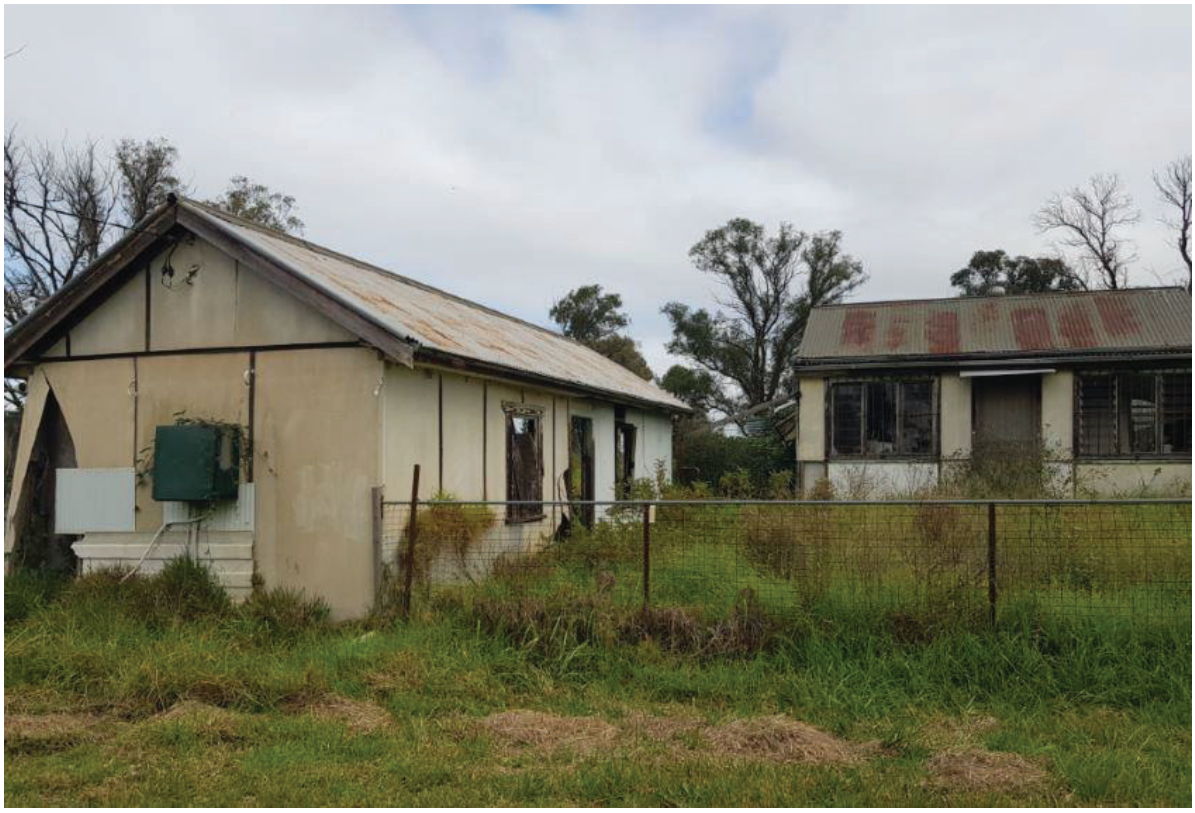


**Image 6.2.5 View of Dam 1**

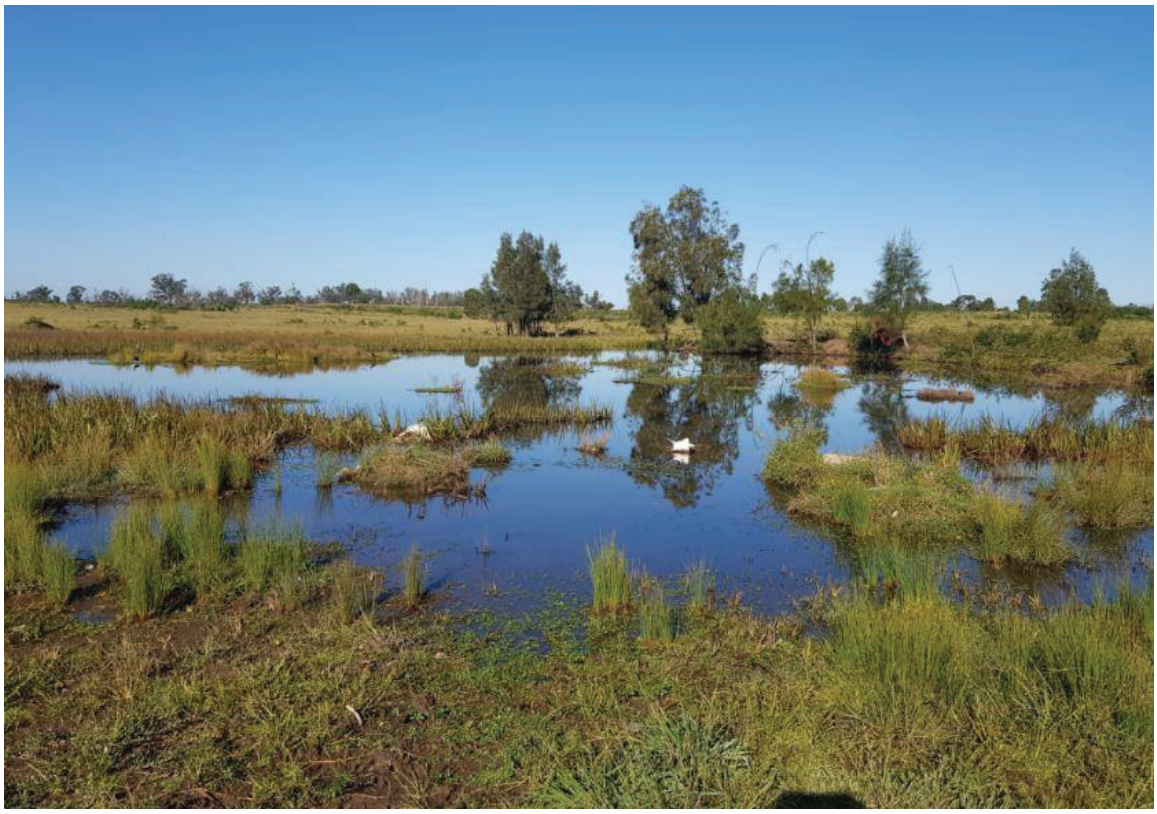


**Image 6.2.6 View of the asphalt sealed area, power outlets and empty containers**

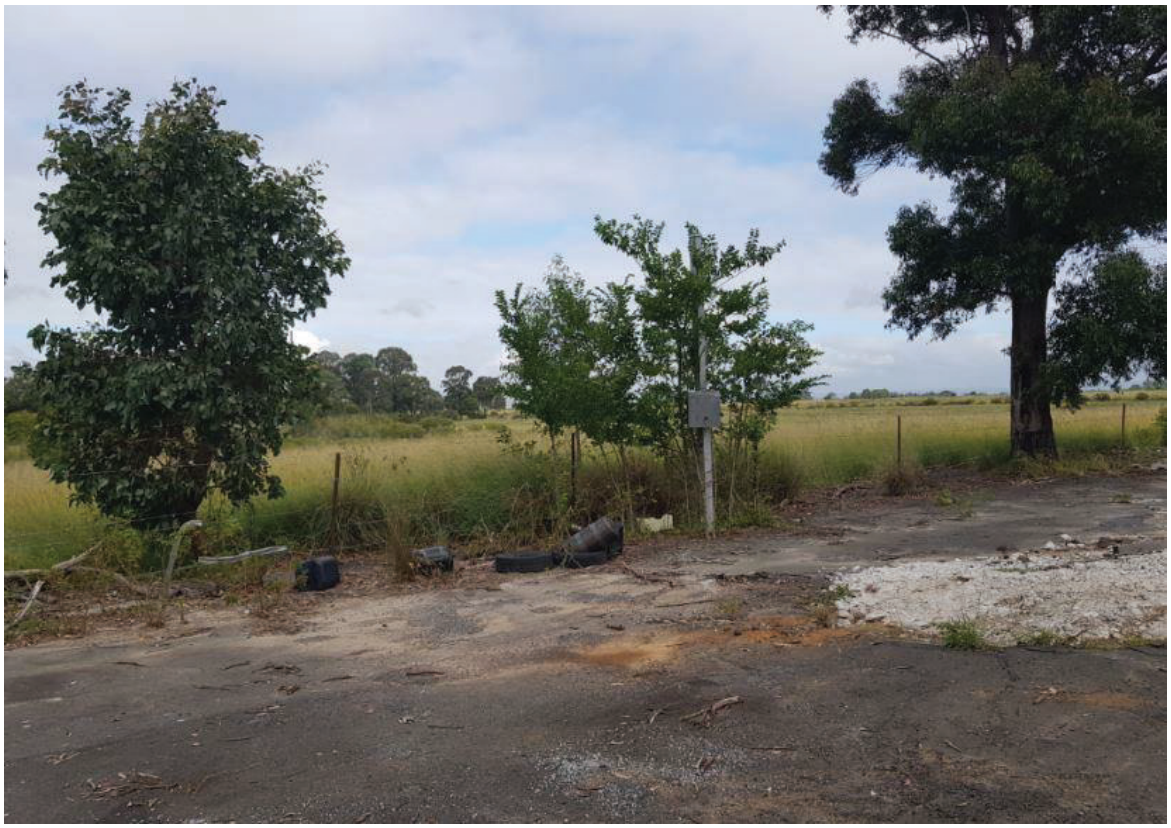
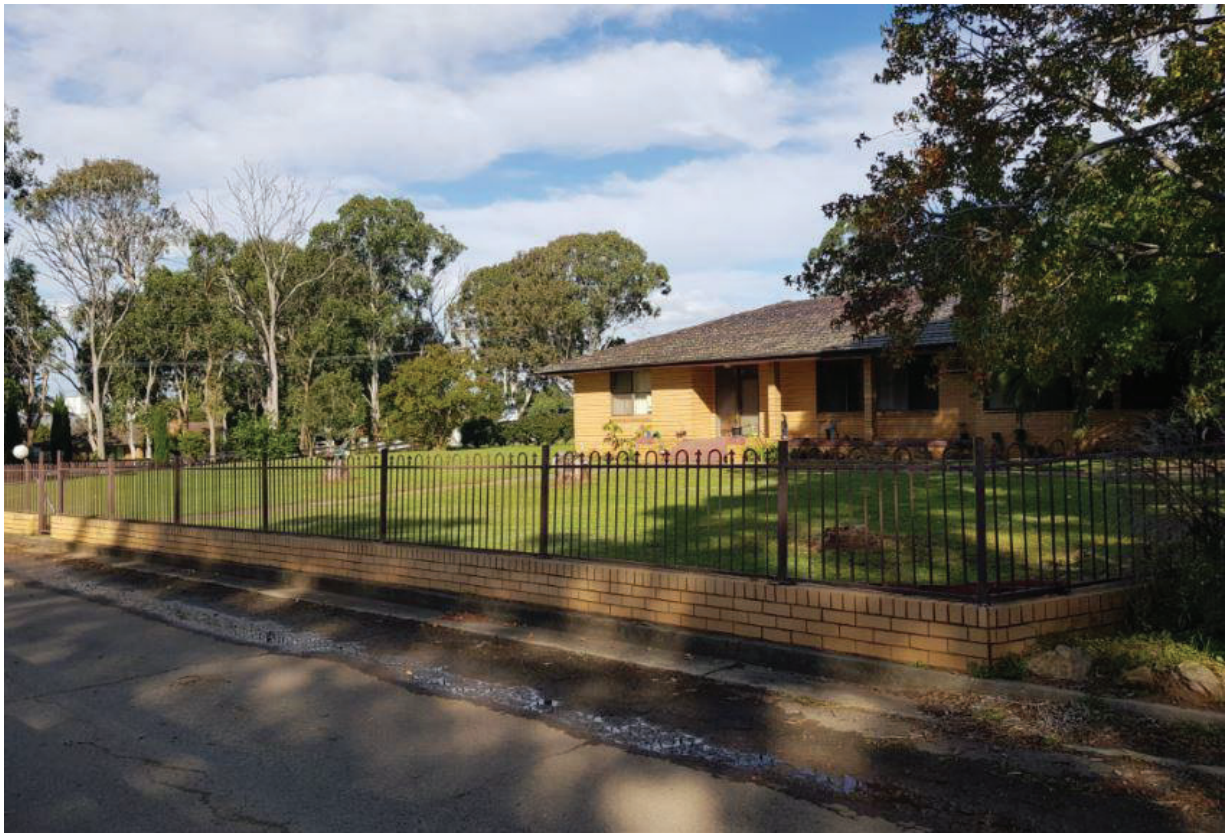


**Image 6.2.6 View of the cabin**

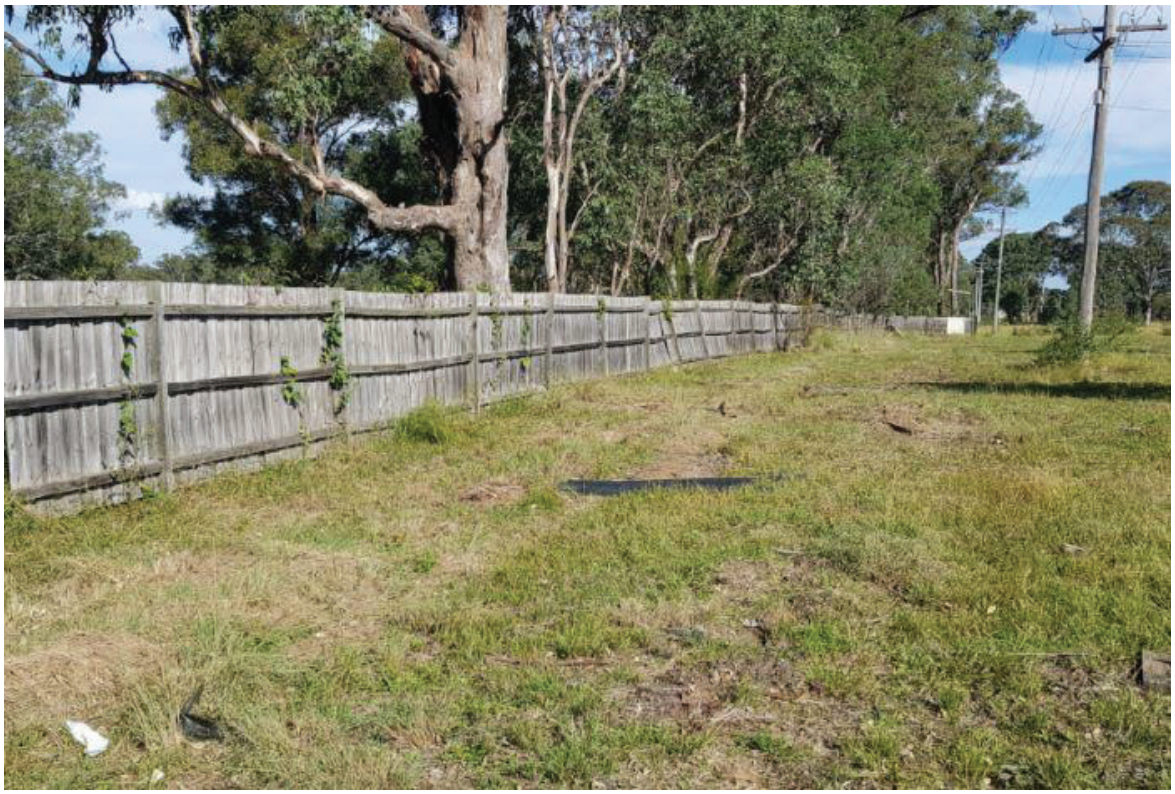
**Image 6.2.7 View of the residential building at the entrance to the site, off Luddenham Road**



## 6.3 Site Boundaries

All site boundaries were fenced with timber or wire fences, in sound condition. There were three access points to the site, two on Luddenham Road, the main access gate in the north and one in the south, with an additional access gate on Paton's Lane side boundary, used for heavy vehicle access. All entry points were locked with the exception of the main access gate. This would all help prevent unlawful dumping of materials onsite from surrounding land and road access.

**Image 6.3.1 View of eastern site boundary fencing**



## 6.4 Drainage

Based on observations made during the walkover, site drainage mechanisms on site are considered likely to include:

> Infiltration into permeable site soils;

> Overland surface flow following site topography, towards natural drainage lines (including the drainage channel in the north west) and onsite dams; and

> Inflow to downpipes attached to building roofs and gutters, into water storage tanks or directly into the ground.

## 6.5 Staining and Odours

There was no significant widespread staining observed during the walkover, with the exception of the following localised areas:

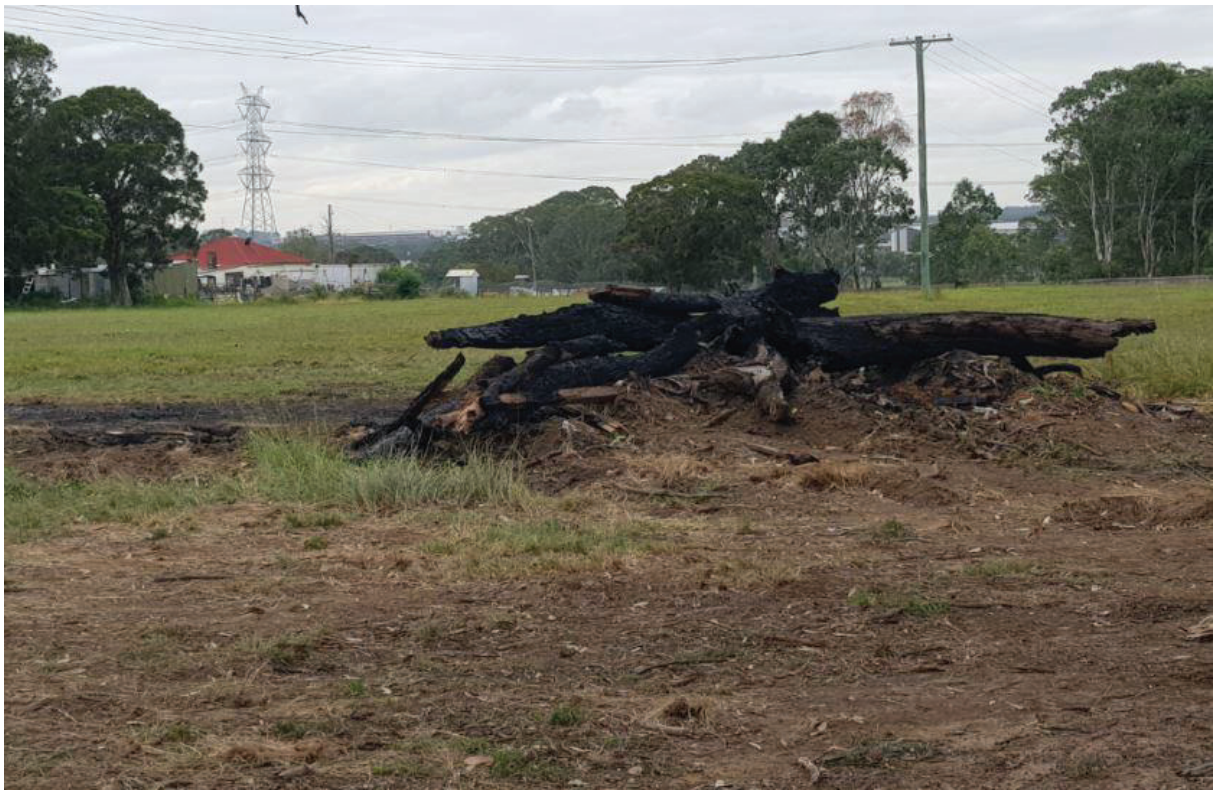
> a slight valve leak from an intermediate bulk storage container of engine oil, located on a concrete hardstand north of the warehouse.

> A localised burnt area of ground, most likely used for a bonfire, with residual burnt tree logs and plastics – located approximately 70m east of the residential house in Lot 242 in DP 108899.

There was no olfactory evidence detected of significant or widespread odours at the site.

**Image 6.5.1 View of oil stored in IBC, with slight leak**

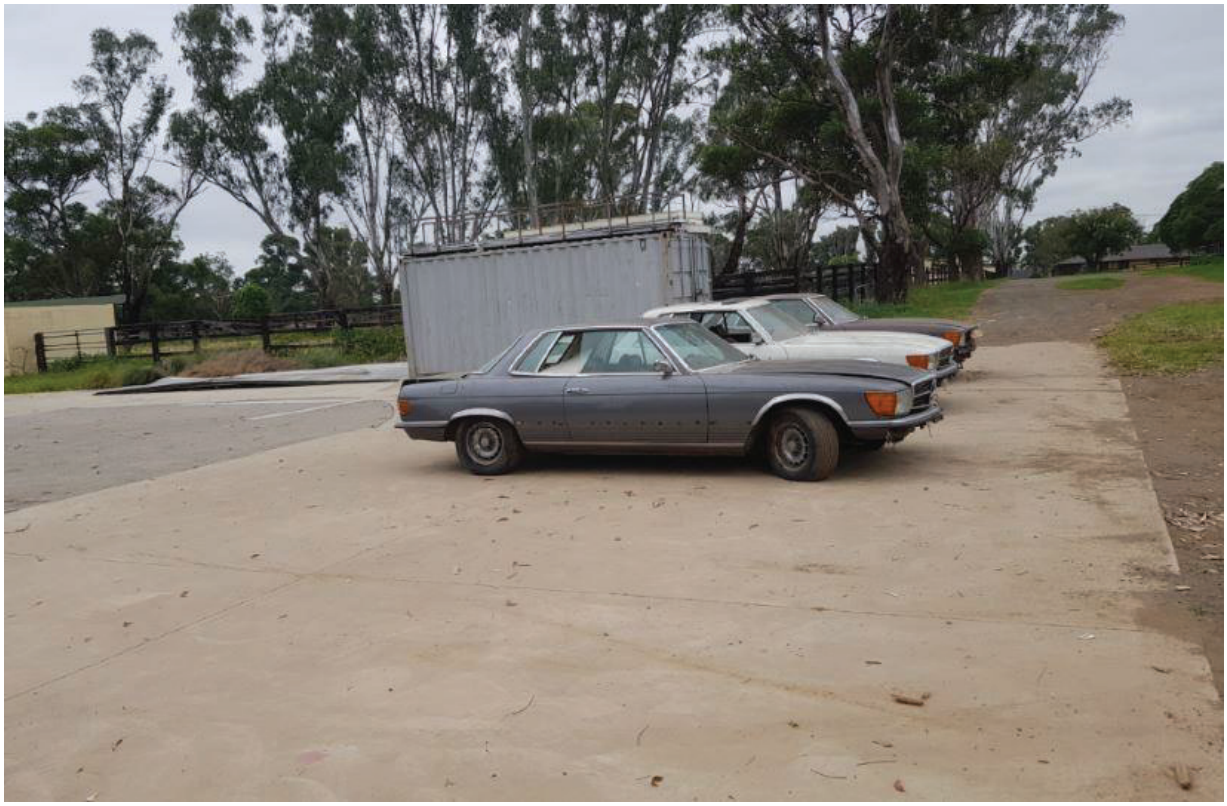
**Image 6.5.2 View of bon fire and stained ground**



## 6.6 Chemical Handling and Storage

There was no visual evidence of chemical handling and storage during the site walkover, however, anecdotal and visual evidence suggests the owner restores vintage cars and therefore small quantities of chemical storage within the warehouse cannot be dismissed.

**Image 6.6.1 View of vehicle wrecks adjacent to warehouse on concrete hardstand**



## 6.7 Aboveground and Underground Storage Tanks

There was visual evidence observed during the walkover, of two aboveground storage tanks (AST) of diesel located together in a concrete bund, approximately 120m south of the warehouse (refer to Figure 2), most likely used for refuelling purposes.

There was evidence of two possible underground concrete capped septic tanks:

> One subsurface concrete structure located north of the cabin in Lot 1 DP1099147;

> One subsurface concrete structure located north of the residential building in Lot 242 DP1088991.

Main sewer lines could not be found at the site and due to the age of the buildings most likely all raw sewage is captured and treated onsite in septic tanks. The site also contains two other residential tenancies, therefore, it is likely additional underground septic tanks are located onsite.

**Image 6.7.1 View of above ground diesel tanks**

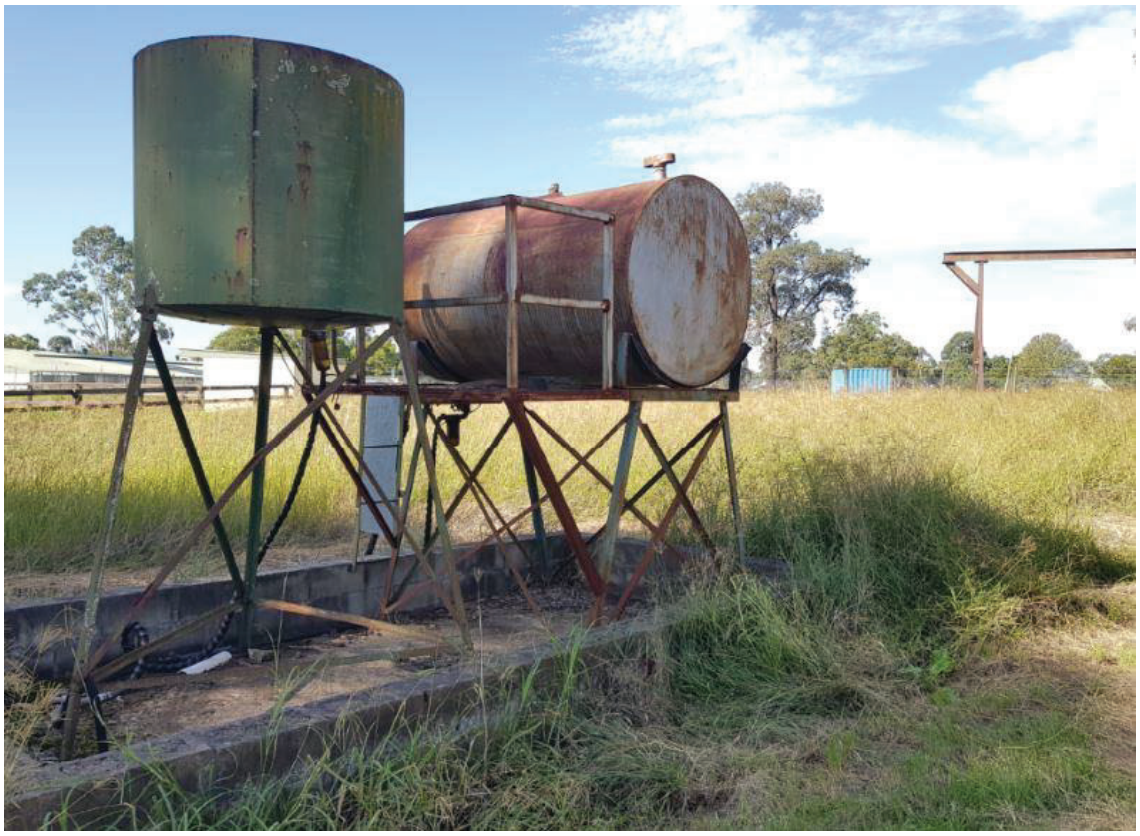


**Image 6.7.2 View of potential underground septic tank adjacent to the cabin**

## 6.8 Wastes

There was visual evidence observed during the walkover, to indicate the storage of wastes on the site, specifically:

> Vehicle wrecks, stored on concrete hardstand around and inside the warehouse,

> a 1000 litre intermediate bulk container (IBC) half filled with waste engine oil;

> household and demolition wastes stockpiled in various yards including timber, metal, plastic, tyres and other material.

**Image 6.8.1 View of demolition and household waste, west of the warehouse**

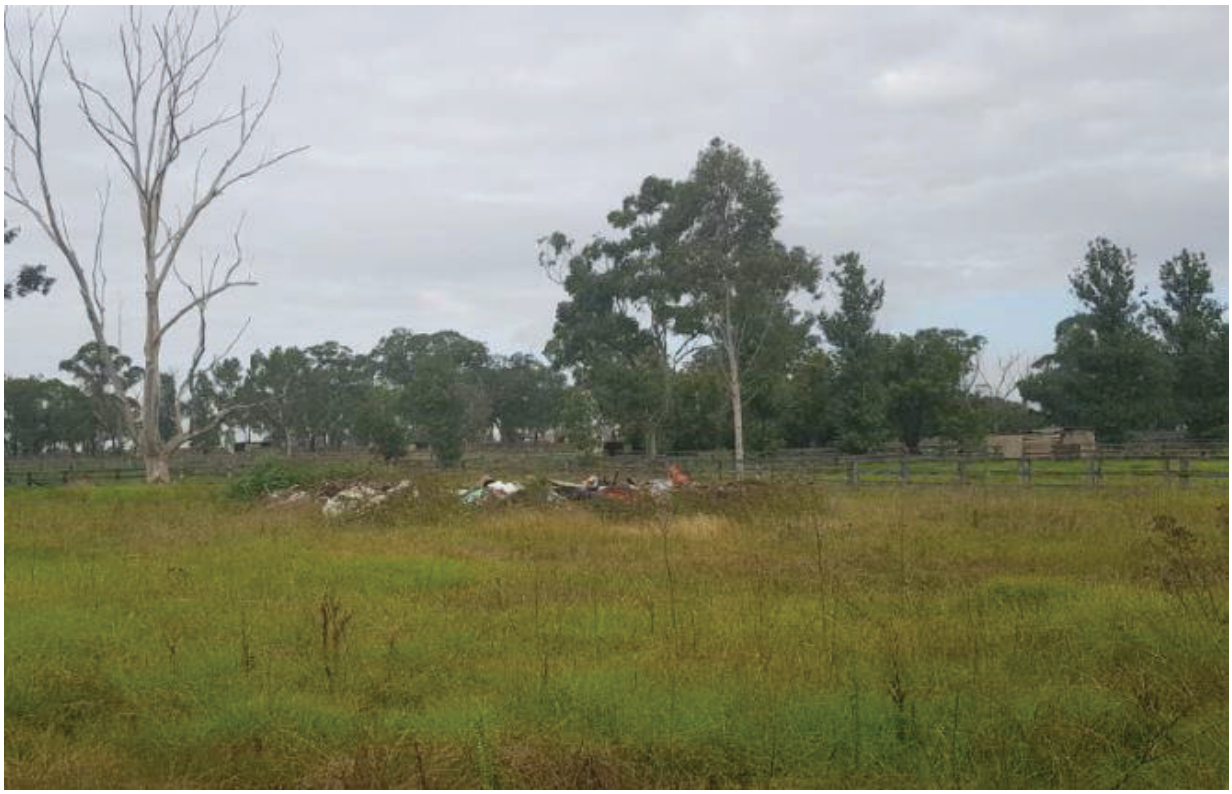
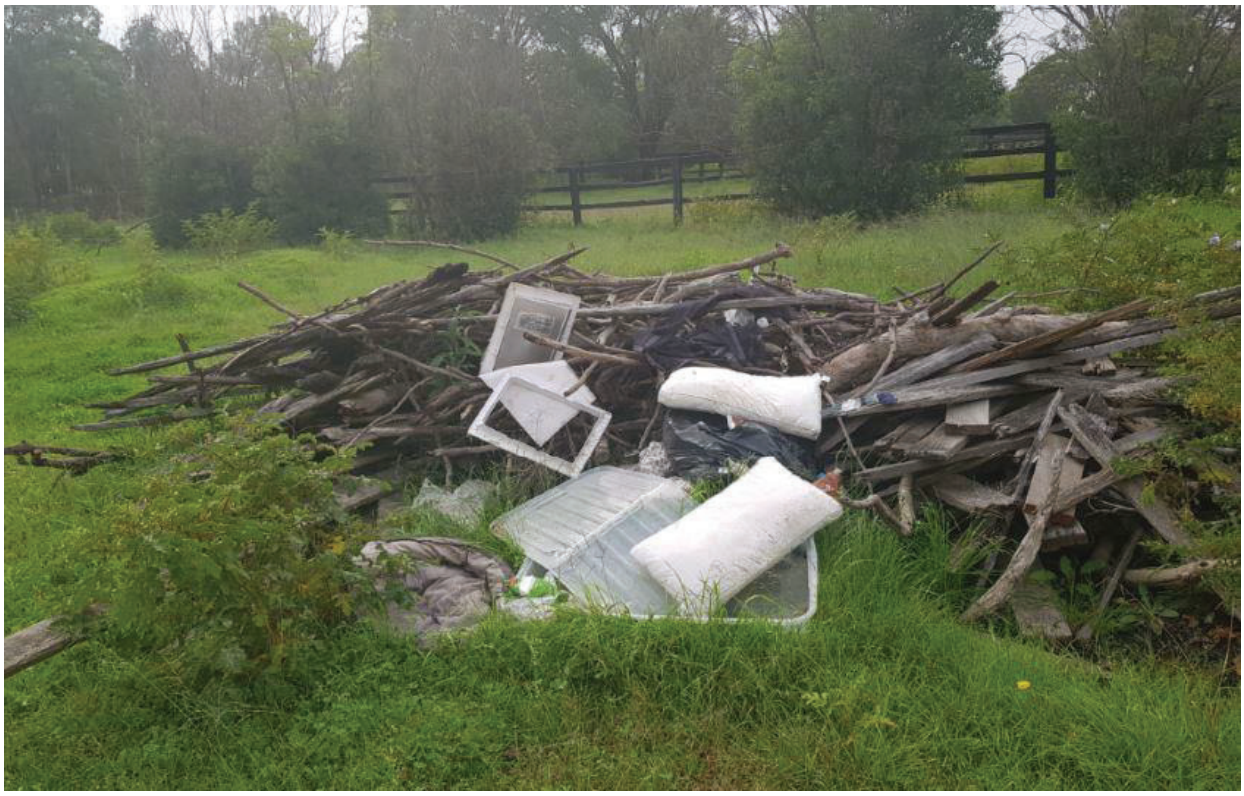


**Image 6.8.2 View of household waste and timber north of the cabin**



## 6.9 Hazardous Materials

There was visual evidence of potential asbestos containing materials on the surface of the site in the following areas:

> Broken fibro walls of the old fibro cottage; and

> Broken fibro sheeting in a small stack on the surface, located 60m south east of the residential property in Lot 242 in DP 1088991.

A hazardous building materials survey was not within the scope of this project and all building structures will require further investigation due to the Section 10.7 (2) planning certificate identifying the presence of asbestos building materials onsite.

**Image 6.9.1 View of broken walls of old fibro cottage**

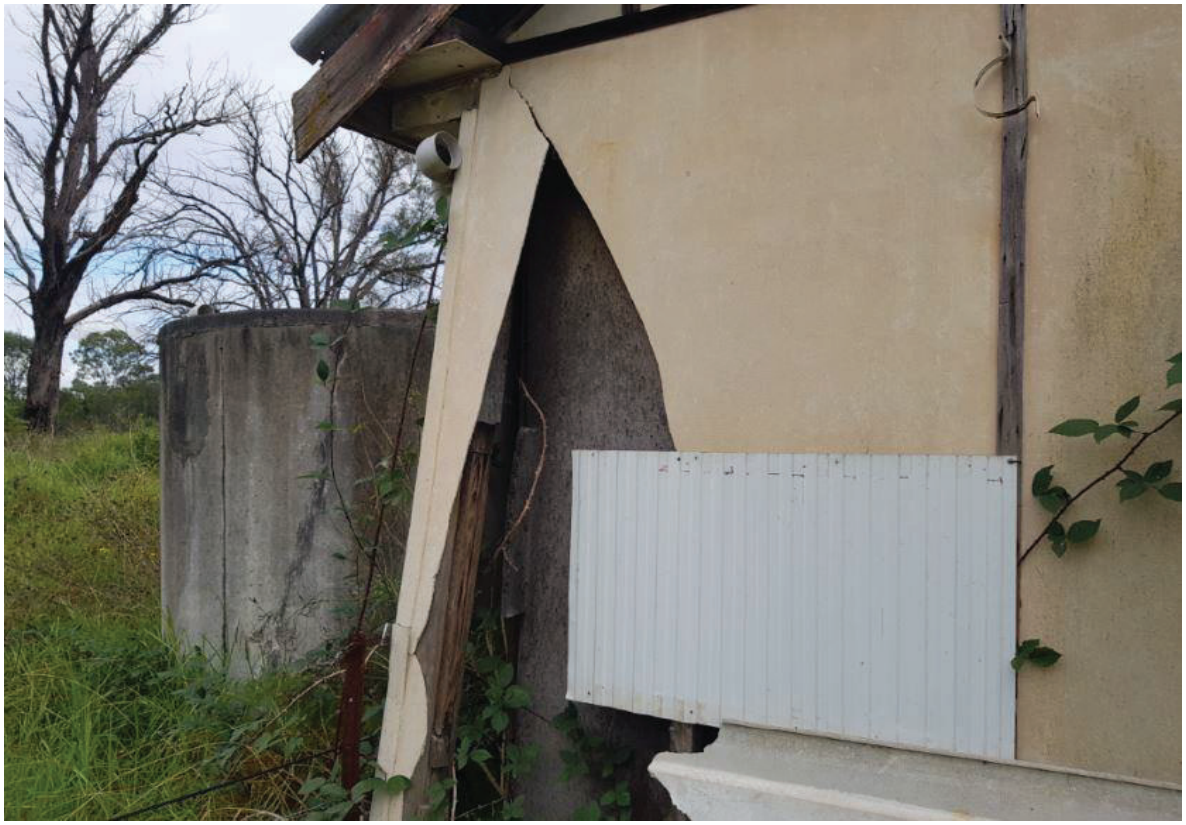
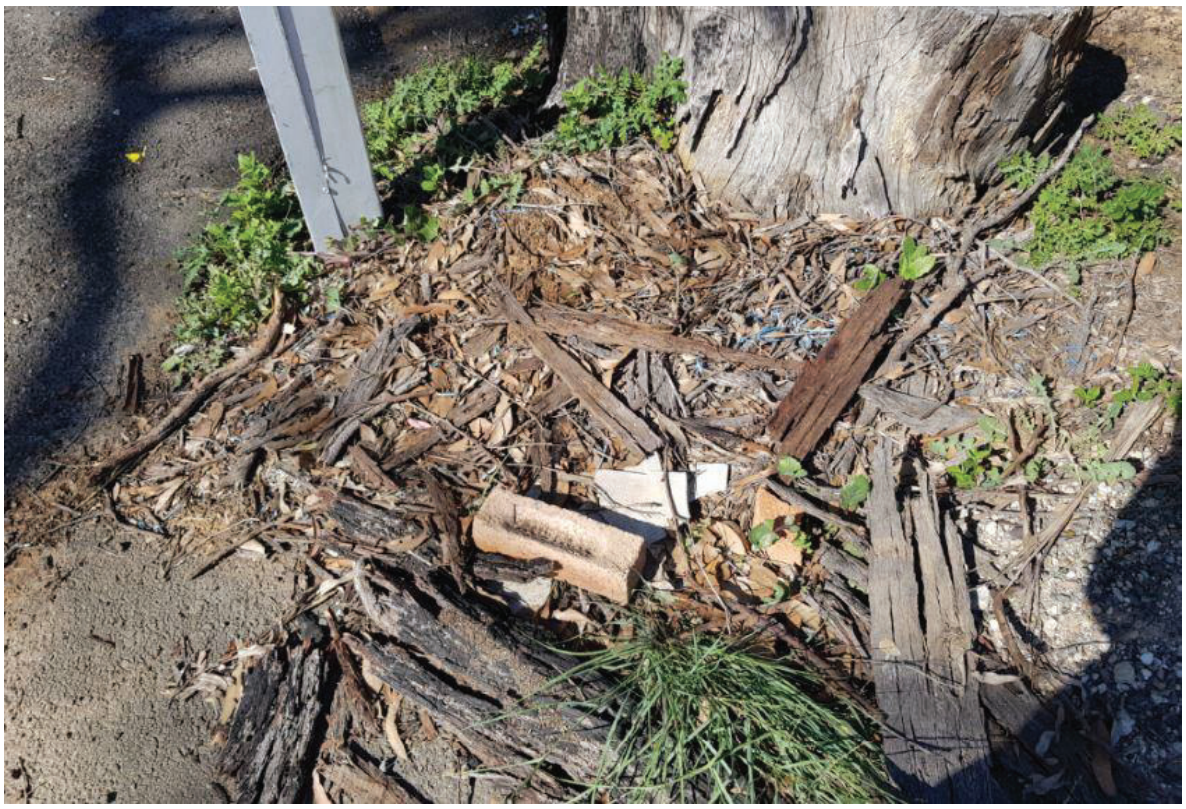


**Image 6.9.2 View of potential asbestos containing fibrous cement sheeting**



## 6.10 Stockpiles and Fill Material

There was no visual evidence observed to suggest widespread or significant filling across the site. However, there was localised evidence of filling in the following areas:

> on sections of roadways and surrounding areas, near Paton's Lane access gate in the north. The fill was noted to comprise of brown silty clays and white to grey crushed sandstone. This filling was most likely for surface stabilization and restoration roadways.

> Approximately 150m$^2$ localised area of filling, 100m west of the residential building in Lot 242 DP1088991. The area was covered in weeds and grasses and consisted of obvious unnatural mounds in the surface with concrete and other anthropogenic materials visible

Seven stockpiles of various sizes were observed across the site (SP1-SP7) comprising of the following characteristics:

> Lot 1 DP1099147:

- Approximately 75m$^3$ stockpile (SP5) of white to grey crushed sandstone in the north, near Paton's lane entry
- Approximately 5m$^3$ stockpile (SP1) of white to brown sand with demolition wast inclusions, located on the southern boundary of the Lot 1 DP1099147;
- Three stockpiles (SP2 to SP4), each approximately 5m$^3$ of brown silty sand and gravel with demolition waste inclusions, located adjacent to the gravel roadways (material is consistent with the gravel roadway material) in the central portion of Lot 1 DP1099147;

> Lot 242 DP1088991:

- Approximately 100m$^3$ of white to grey crushed sandstone (SP6), located approximately 80m south of the residential building in this area;
- Approximately 75m$^3$ stockpile (SP7) of grey to brown sand, adjacent to SP6, approximately 80m south of the residential building in this area.

The consultant from CS at the time of the walkover noted various areas of the site were heavily vegetated with grasses, which restricted visual assessment of surface soils and potential fill. The potential for additional stockpiles and filled areas to be present cannot be precluded.

**Image 6.10.1 View of crushed sandstone stockpile (SP5)**

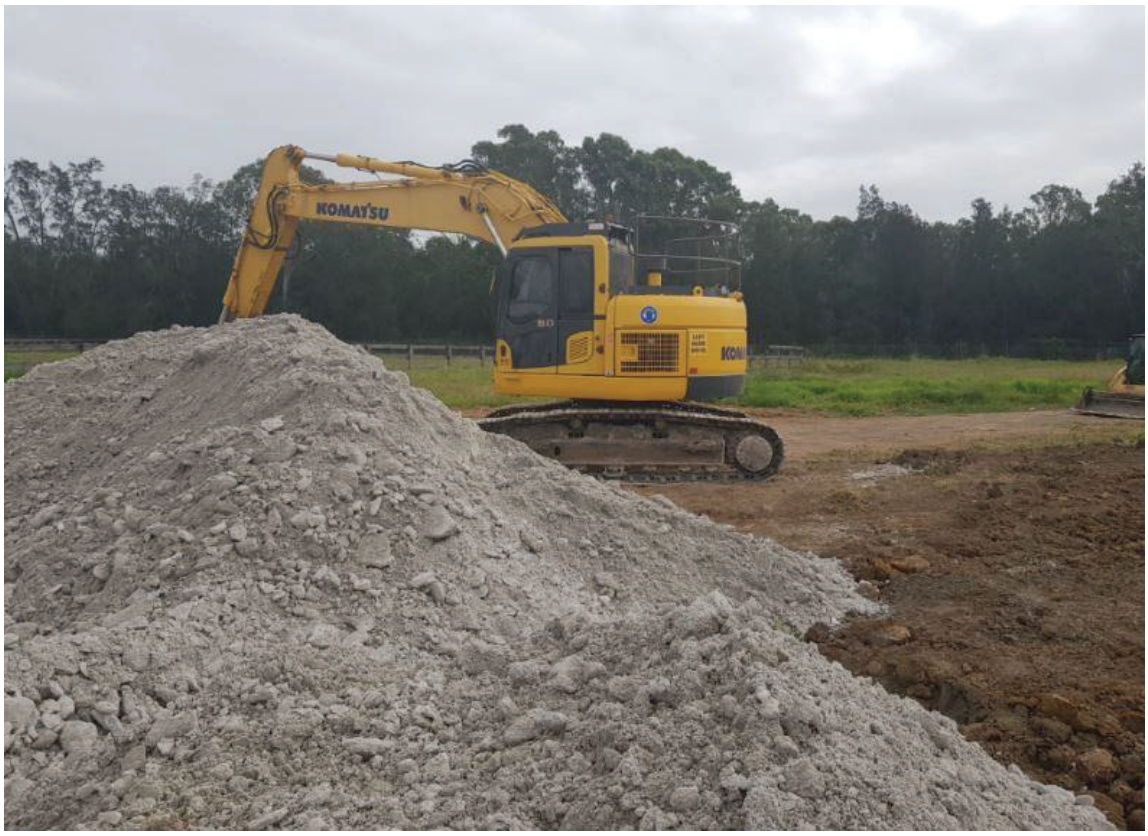



**Image 6.10.2 View of disturbed ground, along roadway, northern area of Lot 1 DP1099147**

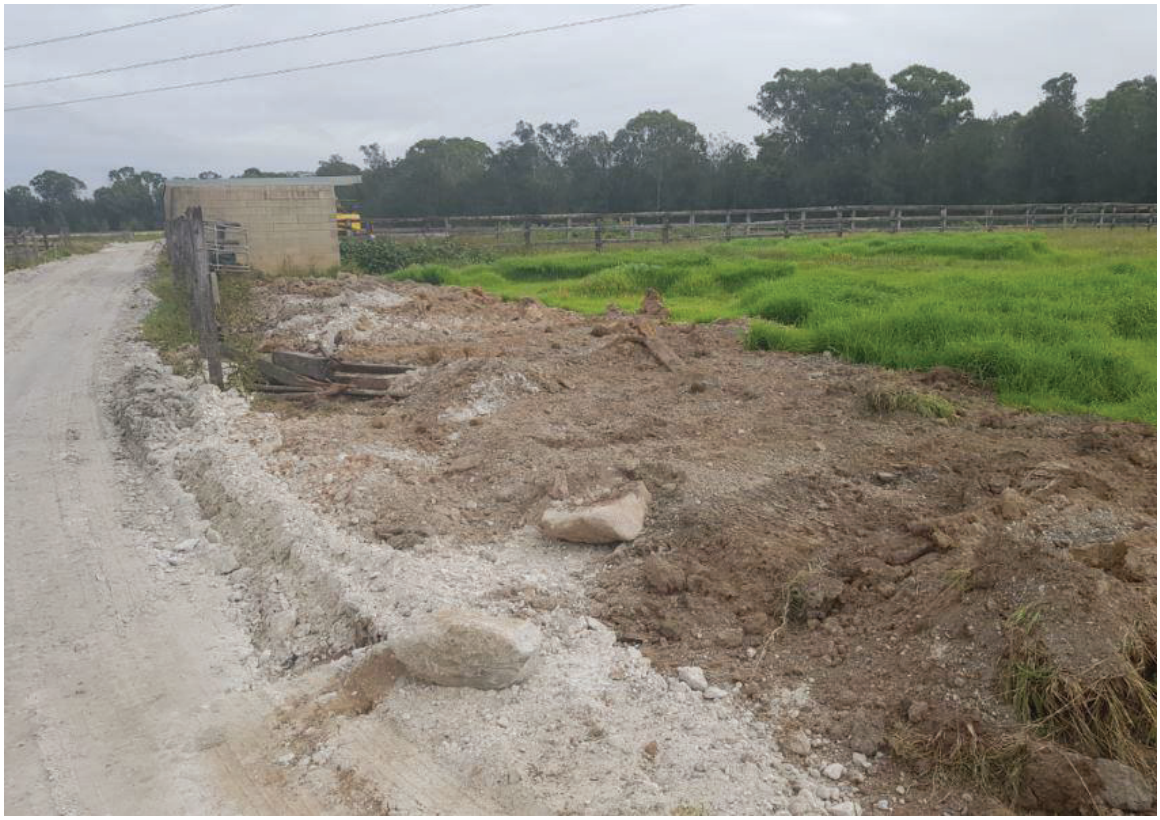


**Image 6.10.3 View of sand stockpile (SP7) in Lot 242 DP1088991**

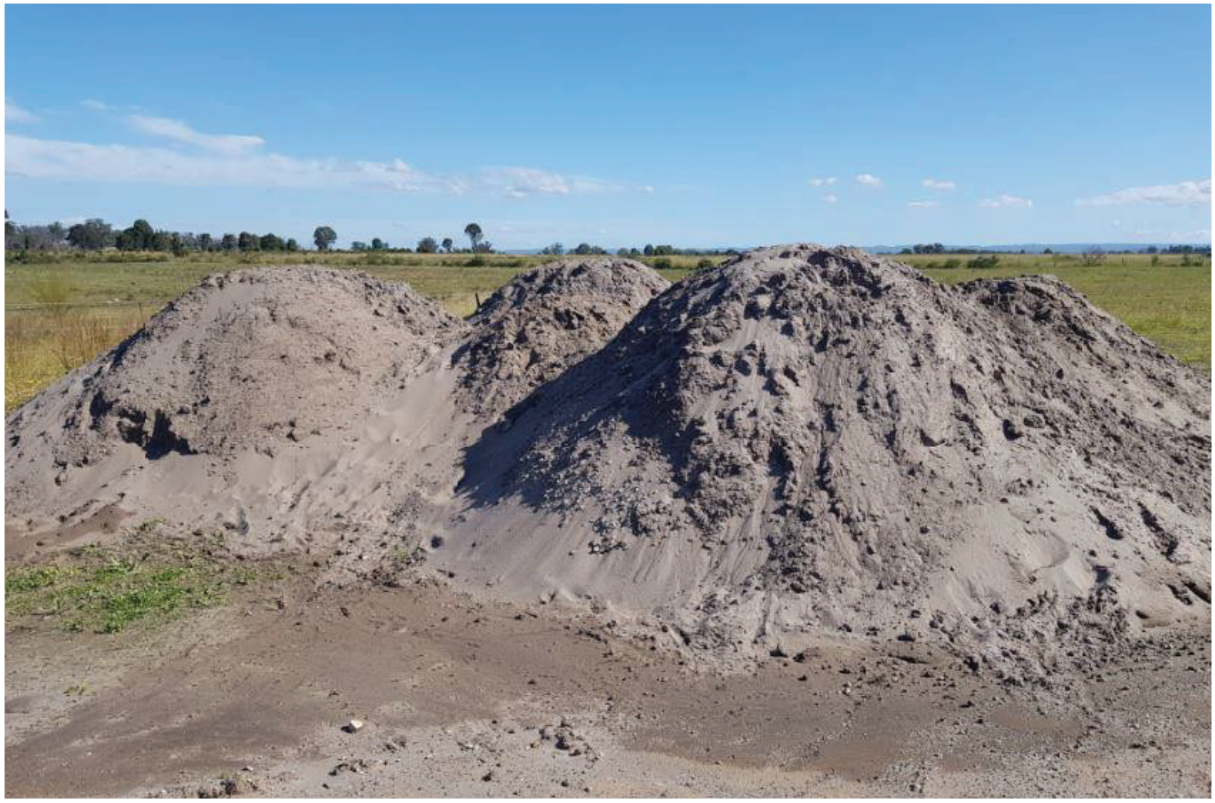


**Image 6.10.4 View of sand stockpile with demolition waste inclusions (SP1)**

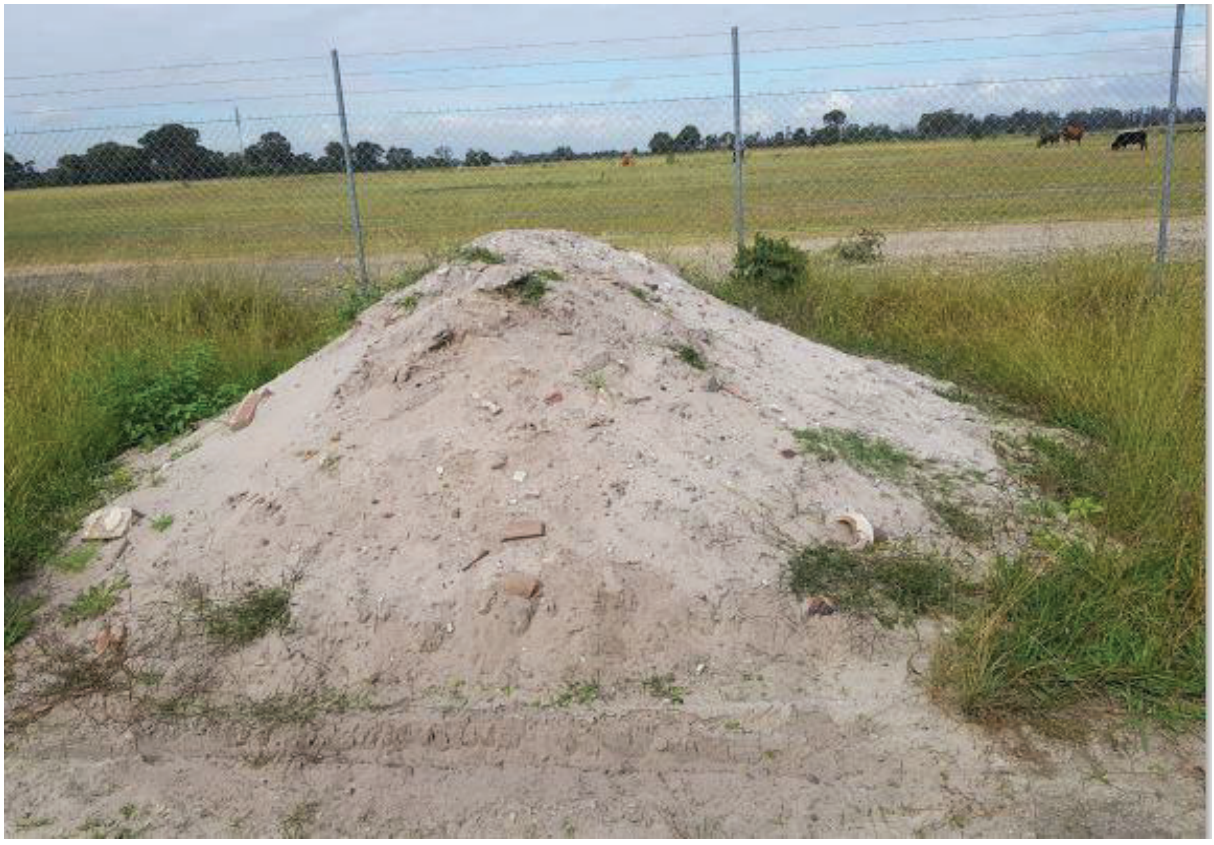


**Image 6.10.5 View of stockpiles (SP2 and SP3) containing silt and aggregate with demolition waste inclusions**

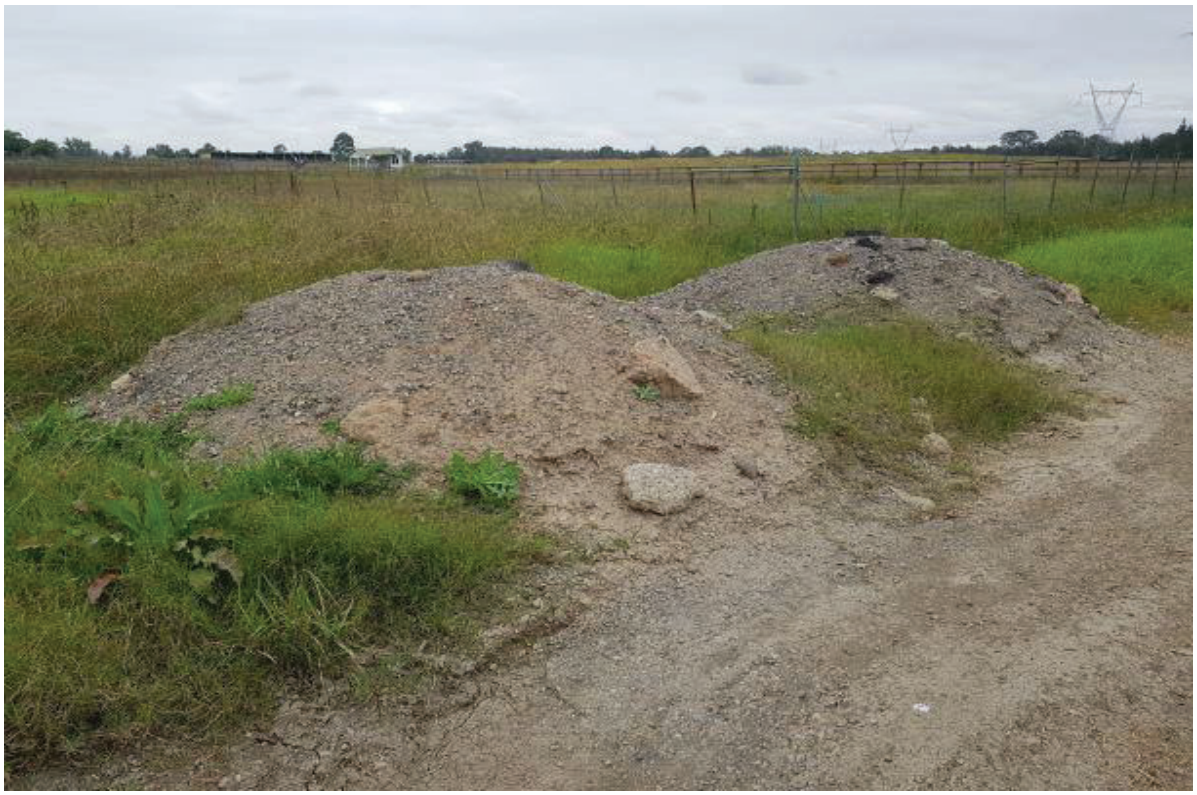
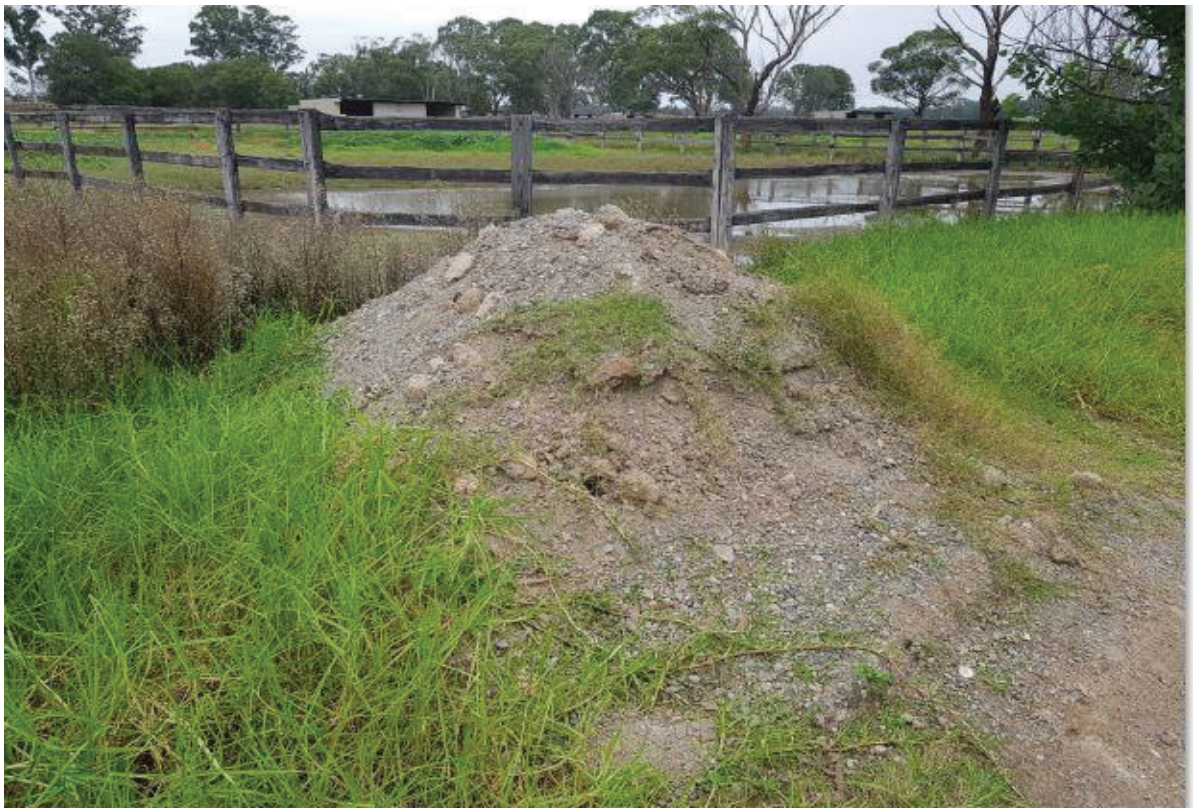


**Image 6.10.6 View of stockpiles (SP4) containing silt and aggregate with demolition waste inclusions**



## 6.11 Phyto-toxicity

There was no visual evidence observed to suggest widespread or significant phytotoxic impact in the form of plant stress and/or dieback in vegetation present on the site. Similar observations were made of vegetation on land immediately beyond the site boundaries.

## 6.12 Activities on Adjacent Land

Observations made from the site boundary, indicated land use activities on adjacent properties were comprised of the following:

> **North** – Paton's Lane, then predominantly open space rural land, with the exception of a former quarry converted to 'Paton's Lane Landfill', located approximately 500m north west of the Site;

> **East** – Luddenham Road, then low density residential rural properties, South Creek and industrial estate beyond;

> **West** – bushland corridor with drainage channel, Stockdale Road and rural properties beyond; and

> **South** – above ground high pressure water pipe network, extending from the Nepean River in the west to the prospect Reservoir in the east, St Mary's Kennett's Airfield approximately 300m south, open space rural land and low density residential beyond.

# 7 Emerging Contaminants of Concern and Chemical Control Orders

## 7.1 Per and Poly-Fluoroalkyl Substances (PFAS)

Per and Poly-Fluoroalkyl Substances (PFAS) are a group of chemicals that are manufactured for their unique properties. There are numerous PFASs that may be present in the environment. Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) are two major PFASs, that were originally found as components in products used to provide stain resistance or as firefighting foams.

Some PFASs have been recognised as highly persistent, potentially bio-accumulative and toxic, and have been detected in the environment, wildlife, people and food.

CS uses the decision matrix presented in Table 7-1 (based on EnRisk (2016)), to facilitate an assessment of the potential for PFAS to be present on site.

**Table 7-1 PFAS Decision Matrix**

| Preliminary PFAS Screening Question | Decision |
|---|---|
| Is there evidence of fire training occurring at the site | No |
| Is there evidence of fire training occurring, or the presence of an airport or fire station, up-gradient of, or adjacent to, the site | Yes |
| Is there evidence of fuel[3] fires having occurred on site | No |
| Is there evidence to suggest PFAS being stored, or used, for manufacturing on site | No |

St Mary's Kennett's Airfield located 300m south, up gradient of the site, however, surface water is expected to be captured onsite in retention ponds or flow into natural drainage channel north of the airport which intercepts the direct path to the site. The potential for migration of PFAS impacted groundwater to the site is considered to be low. However, a search of the NSW EPA PFAS investigation programs did not reveal any land under investigation within a 2km radius of the site to have been declared as impacted by PFAS.

CS also considered guidance in the PFAS National Environmental Management Plan (NEMP) 2018 as prepared by HEPA. Section 9 of the NEMP advises that consideration should be given to the presence of primary sources of PFAS, including firefighting training areas, landfills and waste water treatment plants. The Paton's Lane Landfill and Resource Recovery Centre is located approximately 500m north west of the site. The landfill is licensed to accept General Solid Waste (non-putrescible) and various resource recovery materials including demolition wastes and paper. There is the potential for PFAS contamination to be present within the landfill, however, all areas of the landfill are likely to be bunded, there are a number of surface water retention basins and regular monitoring of groundwater is required under the NSW EPA license. Furthermore, if any contamination did migrate offsite it would likely flow into the natural drainage channel to the northwest of the site and flow in an inferred north-easterly direction, away from the site.

The historical records reviewed for this project, and the observations made during the site walkover, did not indicate a potential for PFAS contamination onsite or migration onto site from adjacent lands, which warrants further investigation.

[3] Fuels could include solvents, petrol, diesel and kerosene.

## 7.2 Chemical Control Orders

Chemical control orders (CCO) are created under Part 3, Division 5 of the Environmentally Hazardous Chemicals Act 1985, and are used to selectively and specifically control particular chemicals or chemical wastes to limit their potential or actual impact on the environment. CS uses the decision matrix presented in Table 7-2 (based on the NSW EPA CCO available at the time of this project), to facilitate an assessment of the potential for those control chemicals to be present on site.

**Table 7-2 CCO Decision Matrix**

| Preliminary CCO Screening Question | Decision |
|---|---|
| Were aluminium smelter wastes used or stored on site?[4] | No |
| Were dioxin contaminated wastes generated or stored on site?[5] | No |
| Were organotin wastes generated or stored on site?[6] | No |
| Were polychlorinated biphenyls (PCB) used or stored on site?[7] | No |
| Were scheduled chemicals[8] used, or wastes stored, on site?[9] | Possibly |

Due to the history of the site and the previous land use being for farming and the building structures onsite, there is the potential for scheduled chemicals to be used for herbicide and pesticide treatment. However, CS considers any use of these chemicals is unlikely to be widespread and limited to immediate soils surrounding buildings and locations of potential crops, identified in the aerial imagery.

The site walkover did not identify any visual indicators of these chemicals, however, test pits and analysis of pesticides in soils have been targeted in areas where potential contamination may have occurred, with the exception of locations close to buildings.

Further investigation of soils surrounding the buildings should be undertaken following demolition of structures.

[4] SPCC 1986, 'Chemical Control Order In Relation to Aluminium Smelter Wastes Containing Fluoride and/or Cyanide' dated 21 March 1986
[5] NSW EPA 1986, 'Chemical Control Order In Relation to Dioxin-Contaminated Waste Materials' dated 14 March 1986
[6] NSW EPA 1989, 'Chemical Control Order In Relation to Organotin Wastes' dated 11 March 1989
[7] NSW EPA 1997, 'Polychlorinated Biphenyl Chemical Control Order' dated 20 June 1997
[8] Primarily organochlorine pesticide (OCP) compounds, with some industrial by-products
[9] NSW EPA 2004, 'Chemical Control Order in Relation to Scheduled Chemical Wastes

# 8 Material Import Document Review

CS was provided with the following material classification documents pertaining to stockpiles imported and currently stored on site:

> Douglas Partners (DP) 2019, 'In Situ Waste Classification & ENM Assessment Hordern Oval Cranbrook School, Bellevue Hill', dated 30th October 2009, ref: 84944.02.R.010

> JM Environments (JME) 2019, 'M4-M5 Link Tunnel Spoil Order Assessment, Pyrmont Bridge Road Civil Site', dated 14th October 2019, Ref: JME18057-97.

CS has reviewed these documents and provided a summary of the details, relevant to this project, in the following sections. For details of the reports refer to **Appendix H**.

## 8.1 Douglas Partners (2019)

The objective of the investigation (DP, 2019) was to provide a classification of in-situ materials, in accordance with the requirements of the excavated natural material order 2014 (the ENM Order). The scope of works included:

> Review previous soil sample results collected from bore holes drilled in 'Hordern Oval' by DP in 2015 (BH2 and BH4) and 2017 (BH101- BH107, and BH111-BH130);

> Undertake sampling from 16 additional test pits (TP01-TP04; TP08-TP18 and TP23) also excavated in Hordern Oval;

> Forward the samples to a NATA accredited laboratory for analysis, in accordance with the ENM Order;

> Preparation of the classification report.

The report made the following conclusions:

> The material was classified as ENM with the exception of samples collected from locations BH2 and BH113, which excluded this material from the classification.

> The material described as ENM consisted of brown silty SAND and silty CLAY, and yellow-brown SAND with cemented sand/coffee rock and silty clay inclusions.

The truck run sheets were also provided to CS for review. The run sheets provide information of registration numbers of trucks which transported the material, dates of import and approximate tonnages of each load of material. The run sheets indicate approximately 680 tonnes of material was imported to the site, including the wider development, from Bellevue Hill. A consignment note has also been provided by the client which confirms this Sand material was sourced from the same location as detailed in the material classification certificate provided by DP (2019).

## 8.2 JM Environments (2019)

The objective of the investigation (JME, 2019) was to provide a classification of stockpiled material in accordance with the requirements of the M4-M5 Link tunnel spoil order 2019 (the Spoil Order). The scope of works included:

> Collection of five primary samples from one 2,000 tonne stockpile of 'tunnel spoil';

> Forward the samples to a NATA accredited laboratory for analysis, in accordance with the Spoil Order

> Preparation of the classification report.

The report made the following conclusions:

> All five samples reported no detections of BTEX, TRH or PAH and heavy metal results indicated the material has not been contaminated with manufactured chemicals or processed residues.

> The stockpiled material, described as 'crushed light grey to light grey brown to yellow brown fine to medium grained quartzose sandstone', meets the requirements of the Spoil Order NSW EPA resource recovery exemption.

CS has reviewed the laboratory results and confirmed the analyte levels are below the adopted land use criteria for the site.

The truck run sheets were also provided to CS for review. The run sheets provide information of registration numbers of trucks which transported the material, dates of import and approximate tonnages of each load of material. The run sheets indicate approximately 4,900 tonnes of material was imported to the site, including the wider development, from the Pyrmont Bridge Road (PBR) compound. A consignment note has also been provided by the client which confirms this crushed sandstone material was sourced from the same location as detailed in the material classification certificate provided by JME (2019).

## 8.3 Import Review Summary

CS has reviewed the previous reports and makes the following remarks:

> The material described in DP 2019 is consistent with the stockpile of SAND material observed onsite identified as SP7 (Figure 2);

> The material described in JME 2019 is consistent with the two stockpiles of crushed SANDSTONE material observed onsite, identified as SP5 and SP6 (Figure 2);

> The laboratory results provided in the reports indicate the analyte levels in the materials classified are all below the site investigation criteria of ‘Industrial/Commercial’.

> The run sheets have been provided and a consignment note provided by the client which confirms the material source sites as detailed in the material classification certificates.

Based on the evidence provided and the observations made during the site walkover, CS considers that these stockpiles are unlikely to pose an unacceptable risk to future receptors based on the site’s adopted land use scenario. However, CS understands further material will be required to raise the entire site to specific design levels and therefore a material import protocol may be required.

# 9 Conceptual Site Model

A Conceptual Site Model (CSM) is a representation of an environmental system and the processes that determine the transport of contaminants from sources through environmental media to human or environmental receptors. The CSM, hereafter, is the assessment of plausible mechanisms by which receptors may be exposed to contamination at the site. For exposure to be considered possible, a given 'source' must exist, as well as a mechanism ('pathway') to an identified 'receptor'. Such complete 'source-pathway-receptor' exposure mechanisms are commonly termed 'SPR linkages'.

The Site desktop review and observations made during the Site walkover, were assessed in the context of the project objectives, in order to develop an initial CSM for the Site. An assessment of complete SPR linkages will be conducted and the CSM further developed based on laboratory results, which will be documented in the report.

## 9.1 Areas of Environmental Concern

A number of areas of environmental concern (AEC) on the site, and contaminants of potential concern (COPC) associated with those AEC, were identified for the site.

The identified AEC are presented in **Figures 3A and 3B**, and the COPC associated with those AEC are presented in Table 9-1.

**Table 9-1 AEC and COPC**

| ID | AEC Description | Land Use Activity | COPC |
|---|---|---|---|
| AEC01 | Imported Fill | Uncontrolled filling | Hydrocarbons, pesticides, metals, asbestos |
| AEC02 | Stained soils and incomplete combustion | Burning off waste | Asbestos, PAH and metals |
| AEC03 | Green house and adjacent crops | Growing crops and demolition of structure | Pesticides, asbestos, PAH and metals |
| AEC04 | Former Crops | Growing crops | Pesticides and metals |
| AEC05 | Previous motor vehicle storage | Storing on unsealed surfaces | Hydrocarbons, metals |
| AEC06 | Soil stockpiles with foreign material inclusions (SP1-SP4) | Unregulated importation and stockpiling | Hydrocarbons, metals, PAH, pesticides, asbestos |
| AEC07 | Soils adjacent to above ground diesel tank | Potential spills when refuelling and location where potential filling has occurred | Hydrocarbons, PAH, asbestos and metals |
| AEC08 | ACM fragments stacked on surface | Hazardous building materials broken – possibly collected from old fibro cottage | Asbestos |

| ID | AEC Description | Land Use Activity | COPC |
|---|---|---|---|
| AEC09 | Oil intermediate bulk container (IBC) | Draining car oil sumps – IBC slight leak on hardstand but area not bunded | Hydrocarbons, PAH and metals |
| AEC10 | Old fibro cottage walls broken | Use of hazardous building materials now deteriorated | Asbestos |
| AEC11 | Household/Demolition surface waste | Incorrect storage of wastes | Asbestos and metals |
| AEC12 | Two underground septic tanks | Onsite capture and treatment of sewage | Coliforms, enterococci, E.coli, metals, OCP |

CS identified seven stockpiles onsite (SP1-SP7) during the site walkover, as detailed in Section 6.10. The client has since provided compliance documents for importation of three of the seven stockpiles (SP5-SP7). These documents were reviewed (Section 8) and CS confirmed the stockpiles of crushed sandstone and grey-brown sand were consistent with the material descriptions in the compliance documents. Furthermore, visual or olfactory evidence of contamination were not observed on the surface of the materials during the site walkover assessment. Therefore, further assessment of these stockpiles were considered unwarranted and are therefore not included as an AEC.

CS understands stockpiles SP1-SP4 (**Figure 3A and 3B**) were generated from grading and restoration of the site roadways. However, on inspection the stockpiles contained foreign materials inclusions, which warrants further investigation.

Investigation of AEC08-AEC12 is beyond the scope of this project as there was no indication of potential contamination of immediate surrounding soils, resulting from contamination migrating from these AECs, which warrants soil analysis. Following, appropriate inspection and management, subsequent soil validation sampling may be required at the development phase of the project.

AEC12 is currently considered an aesthetic risk, as the concentrations of COPC listed above, could only potentially pose a risk to human health from ingestion or secondary contact through recreational activities in surrounding water bodies. Furthermore, these septic tanks will likely be removed prior to redevelopment of the site.

CS also notes the presence of buildings onsite which may contain hazardous building materials including asbestos and lead paint. However, a building materials survey is beyond the scope of the current investigation and will be required in the future, prior to demolition. A post demolition contamination assessment of the building footprints will be required to assess contamination status of underlying soils.

## 9.2 Land Use Scenario

At the time of the development of this SAQP, CS understands the proposed development for the site includes three development areas, identified as Stages 1-3, comprising of large warehouses and industrial units, asphalt sealed roadways for light and heavy vehicle access and minimal in ground designed garden beds for aesthetic purposes. Furthermore, the proposed development details include:

> The site is proposed to be an overall fill site; with fill to be imported and placed above existing soils, to raise the surface to required design levels;

> The proposed development footprint is predominantly hardstand including warehouse footprints consisting of concrete slab directly on ground, asphalt sealed road ways, with only minimal direct soil access in garden beds.

> Stage 1-3 development excludes the north western transmission line easement and E2: environmental conservation zoned area beyond;

## 9.3 Receptors

There were no fauna or flora of ecological significance listed in the Section10.7 (2) planning certificates and none were observed during the site walkover. However, CS has considered the possibility of transitory wildlife as a future receptor and potential aquatic biota receptors in dams and surrounding ecological ecosystems. The following has been considered for ecological receptors:

> Due to the proposed industrial/commercial land use scenario and development to consist of most surfaces of the site to be capped and sealed with concrete or asphalt, with minimal soil access, CS considers further assessment of impacts to terrestrial ecological receptors unwarranted.

> The proposed development will include filling all dams and importing fill to raise the site to specific design levels. Therefore, onsite aquatic receptors are unlikely;

> Groundwater remains a potential pathway for consideration of migration of contaminants, which may have an impact on surrounding aquatic ecological systems including South Creek and potential biota in drainage lines. Prior to analysis of soil contaminant concentrations, potential migration of contaminants in soils into groundwater is considered a possibility. However, this potential migration will depend on:

- The soil contamination concentrations and characteristics of the contaminants including leachability;
- Depth to groundwater and distance to off-site aquatic ecological receptors.

Assessment of soil laboratory results and field observations during site walkover and test pitting will help determine if there is likely to be unacceptable levels of risk to offsite aquatic receptors.

CS considers human receptors at the site may include construction workers, future tenants and visitors, which are unlikely to include children.

## 9.4 Exposure Pathways

### 9.4.1 Human Health – Direct Contact

Site history information and walkover observations indicated a potential for contaminants that may present a direct contact exposure risk, may be present on site. The proposed land use scenario is likely to include sealed hardstands; therefore, direct contact exposure pathway may be complete only for future construction workers, during earthworks and installation of services during the development.

### 9.4.2 Human Health – Vapour Intrusion / Inhalation

Vapour intrusion / inhalation exposure risks can occur when a primary or secondary vapour source[10] is present.

Site history information and walkover observations indicated a likelihood for oil leaks from motor vehicles, past diesel leaks from onsite above ground storage tanks and uncontrolled filling which may include volatile contaminants. There were no indications of underground storage tanks, which likely contain volatile compounds and pose a vapour risk.

CS considers that:

> the transport, placement and spreading of uncontrolled filling typically includes significant disturbance of soils, which would typically result in the volatilisation of contaminants that might normally present an intrusion / inhalation risk;

> the potential for contaminants to be present in uncontrolled filling at concentrations which could present an intrusion / inhalation risk, is low; and

[10] Primary sources can include underground storage tanks, while secondary sources can include significantly contaminated soil or groundwater.

> The diesel tanks identified onsite appeared empty with little residual diesel remaining. If leaks have occurred into surrounding soils, natural attenuation by micro-organisms and evaporation is likely which may reduce the vapour intrusion potential.

Therefore, significant vapour intrusion / inhalation exposure pathway, associated with the identified sources, is unlikely to be complete. However, further soil analysis is required to increase confidence in this assumption.

### 9.4.3 Human Health – Asbestos

Bonded asbestos containing materials (ACM) comprises asbestos which is in sound condition, although possibly broken or fragmented, and where the asbestos is bound in a matrix such as cement or resin.

Fibrous asbestos (FA) comprises friable asbestos material and includes severely weathered cement sheet, insulation products and woven asbestos material, which can be broken or crumbled by hand pressure.

Asbestos fines (AF) include free fibres, small fibre bundles and small fragments of bonded ACM that can pass through a 7mm x 7mm sieve.

Asbestos poses a risk to human health when asbestos fibres are made airborne and inhaled. The assessment of sites contaminated with asbestos in soil should aim to describe the nature and quantity of asbestos in soil in sufficient detail to enable a risk management plan to be developed for the proposed land use scenario.

Site history information and walkover observations indicate a potential for uncontrolled filling and degradation of ACM in walls of the old fibro cottage. Additional broken ACM fragments were identified, in good condition, collected and stacked nearby the old cottage, which is likely to be sourced from the broken walls of this building. Therefore, presence of asbestos in the form of FA and AF in selected areas of the site cannot be dismissed.

Hazardous building material inspections is beyond the scope of this investigation, hence, further investigation and assessment is warranted, prior to demolition.

The proposed land use scenario is likely to include limited access to soils. Therefore, an asbestos exposure pathway may be complete only for future construction workers.

### 9.4.4 Human Health – Aesthetics

Section 3.6.3 of NEPC (2013a) indicates that there are no specific numeric aesthetic guidelines, however site assessment requires balanced consideration of the quantity, type and distribution of foreign material or odours in relation to the specific land use and its sensitivity. For example, higher expectations for soil quality would apply to residential properties with gardens compared with industrial settings.

Site history information and walkover observations indicated a potential for contaminants, which may present an aesthetics exposure risk, may be present on site, including storage of demolition and household wastes, underground septic tanks and isolated burnt areas of former bon fires.

The proposed development will require removal of all surface wastes and subsurface structures which pose a risk to the environment or health. The proposed development will include importation of fill to raise areas of the site and the footprint of the Site will be predominantly capped with hardstand, therefore an aesthetic risk is unlikely, following completion of the development.

However, CS considers an aesthetics exposure pathway may be complete, with the site in its current condition. Appropriate remediation and management is expected during the earthworks stage of development.

### 9.4.5 Groundwater – Drinking

Site history information and walkover observations did not indicate a potential for contaminants, which may present a drinking water risk on site or potential for migration into deep drinking water sources. Anecdotal evidence suggests the current tenants of the site are using bore water for drinking purposes, however this hasn’t been confirmed.

No registered drinking water extraction bores were located within a 1km radius of the site, furthermore, bore water extraction for drinking purposes is not proposed for the development and is unlikely under the industrial/commercial land use scenario.

A drinking water exposure pathway is unlikely to be complete.

### 9.4.6 Groundwater – Recreational

Site history information and walkover observations did not indicate a potential for contaminants, which may present a recreational water risk on site or to nearby receiving water bodies.

The nearest receiving surface water bodies include four dams onsite, a drainage line in the north western corner of the site and South Creek, located approximately 500m east of the site. Recreational use of South Creek for fishing and swimming purposes cannot be dismissed. However, it is unlikely for the identified COPC in the AECs to migrate into these receiving water bodies.

CS considers a recreational water exposure pathway is unlikely to be complete.

### 9.4.7 Groundwater – Agricultural (Irrigation and Stock Watering)

Site history information and walkover observations indicated a potential for contaminants, which may present an agricultural water risk, may be present on site. Four dams located within the site may be currently used for stock irrigation purposes. However, the future development does not include agricultural elements and the dams are proposed to be filled. Further, Section 3.3 of this report did not identify any registered groundwater bores within a 1km radius of the site, authorised for irrigation or stock purposes. There is the potential for South Creek to be used for irrigation purposes, however, CS considers it unlikely for migration of COPC in AECs to migrate to this receptor at this distance.

CS considers an agricultural groundwater exposure pathway is unlikely to be complete.

### 9.4.8 Groundwater – Aquatic Ecosystems

Site history information and walkover observations indicated a potential for contaminants, which may present a risk to the aquatic ecosystem. The nearest receiving surface water bodies include four dams onsite, a drainage line in the north western corner of the site and South Creek, located approximately 500m east of the site. The dams are proposed to be filled as part of the proposed development plans. However, the other receiving surface water bodies are likely to contain aquatic species.

CS considers an aquatic ecosystems groundwater exposure pathway may be complete. This will be further assessed based on laboratory results and observations obtained from test pits.

### 9.4.9 Ecological – Terrestrial Ecosystems

Site history information and walkover observations indicated a potential for contaminants, which may present a terrestrial ecological risk.

Section 3.4.2 of NEPC (2013a) indicates that:

> a pragmatic risk-based approach should be taken when assessing ecological risk in residential and commercial / industrial land use settings;

> in existing residential and urban development sites, there are often practical considerations that enable soil properties to be improved by addition of ameliorants with a persistent modifying effect or by the common practice of backfilling or top dressing with clean soil;

> in other cases, all of the site soils will be removed during site development works or relocated for the formation of new land forms;

> sites may also be backfilled with clean soil/fill and the fate of any excavated contaminated soil should be considered in process; and

> commercial and industrial sites may have large building structures and extensive areas covered with concrete, other pavement or hardstand materials and may have limited environmental values requiring consideration while in operational use.

The proposed land use scenario is proposed to include imported fill above existing soils for required design levels and sealed surfaces for building footprints and roadways.

Therefore, CS considers an ecological exposure pathway for terrestrial ecosystems is unlikely to be complete.

### 9.4.10 Management Limits for Petroleum Hydrocarbons

Section 2.9 of NEPC (2013a) indicates that there are a number of policy considerations which reflect the nature and properties of petroleum hydrocarbons:

> Formation of observable light non-aqueous phase liquids (LNAPL);

> Fire and explosive hazards; and

> Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services by hydrocarbons.

Section 2.9 of NEPC (2013a) notes that CME (2008) includes management limits to avoid or minimise these potential effects. Application of management limits requires consideration of site specific factors such as depth of building basements and services, and depth to groundwater, to determine the maximum depth to which the limits should apply. NEPC (2013a) also states that:

> management limits may have less relevance at operating industrial sites (including mine sites) which have no or limited sensitive receptors in the area of potential impact.

> the presence of site total petroleum hydrocarbon (TPH) contamination at the levels of the management limits does not imply that there is no need for administrative notification or controls in accordance with jurisdiction requirements.

Site history information and walkover observations did not indicate any one of these policy considerations to be associated with relevant identified AEC at the site, in the context of the proposed future land use scenario. Furthermore, the site is proposed to be raised with imported fill and there are no basements proposed for the development.

# 10 Sampling and Analysis Quality Plan

## 10.1 Data Quality Objectives

Appendix B in NEPC (2013b) provides guidance on the data quality objective (DQO) process, which is a seven step iterative planning approach that can be used to define the type, quantity and quality of data needed to inform decisions relating to the environmental condition of a site.

### 10.1.1 Step 1: State the problem

The reasons the project is being undertaken, is set out in Section 1.1 of this report.

The objectives of this project are set out in Section 1.2 of this report.

The project team and technical support experts identified for the project include the CS project director, CS project manager, CS field staff and CS's subcontractors.

The design and undertaking of this project will be constrained by the client's financial and time budgets.

The regulatory authorities associated with this project include NSW EPA and the local Penrith City Council.

### 10.1.2 Step 2: Identify the decision/goal of the study

The decisions that need to be made during this project, to address the project objectives, include:

> Is the data collected for the project, suitable for assessing land contamination exposure risks?

> Do the detected concentrations of contaminants of potential concern identified in the CSM, present an unacceptable exposure risk to the receptors identified in the CSM, based on the proposed land use scenario?

> Is the site suitable, in the context of land contamination, for the proposed land use scenario?

### 10.1.3 Step 3: Identify the information inputs

The information inputs required to make the decisions for the project set out in Section 10.1.2, include:

> Data obtained during the site history review and site walkover;

> Compliance documents supplied by the client;

> The proposed development plans for the site;

> Identification of sample media that needs to be collected, as set out in Section 10.2.2;

> Parameters that will be measured in each relevant sample, as set out in Section 10.2.3;

> The analytical methods required for each identified COPC, so that assessment can be made relative to adopted site criteria;

> The basis for decisions to be made from field screening, including photo-ionisation detector (PID) data, and what action is to be taken if a defined concentration is attained, as set out in Section 10.2.2.1; and

> The adopted site investigation criteria for the media of concern. This criteria is set out in Section 10.3 and will be adopted based on the proposed land use scenario[11] and identified receptors.

[11] The land use scenarios in Section 2.2 of NEPC (2013a) will be considered when adopting human health assessment criteria. The land use scenarios in Section 2.5 of NEPC (2013a) will be considered when adopting ecological assessment criteria.

### 10.1.4 Step 4: Define the boundaries of the study

The geographical and spatial extent of the project will be limited to:

> the site as defined by the boundaries set out in Section 2; and

> physical constraints or existing infrastructure on site that prevents safe and reasonable access by the project team and/or typical industry equipment used for projects of this nature.

The time and budget constraints of the project will be as per those set out in the contract (and subsequent variations) between CS and the client.

The temporal boundaries of the project will include the date of initial walkover on 28th May 2020 until the last day of intrusive works, 7th May 2020. The temporal boundaries may be impacted by:

> Weather conditions including rain, wind, heat and cold, which may adversely affect execution of fieldwork tasks and/or data quality;

> Availability of the site for access to execute fieldwork tasks; and

> Availability of project team members to execute the project.

The lateral and vertical intervals in which contamination distribution is believed to be uniformly distributed, based on the CSM, will be:

> The lateral boundary of the site, as defined in **Figure 2**, based on advice from the client;

> The inferred lateral boundaries of each AEC, including groundwater down gradient of primary / secondary sources (where applicable);

> The inferred vertical extent of each AEC, which is likely to be to the base of fill material,

The scale of the decisions required will be based on the site, as defined by its boundaries.

### 10.1.5 Step 5: Develop the analytical approach

#### *10.1.5.1 Duplicates and Triplicates*

Soil chemical field duplicates and triplicates will be collected at a rate of one set per 20 samples collected (i.e. a duplicate and a triplicate sample set for every 20 samples - an equivalent of minimum 5%). Sample collection will include splitting of one bulk sample across three separate sample containers. Soil samples will not be homogenised, particularly where the COPC are volatile or semi volatile in nature.

Analysis of the duplicate and triplicates will be based on at least one of the analytes that the parent sample is being analysed for (excluding asbestos).

The relative percent difference (RPD) of the detected concentrations in the parent and duplicate, and the parent and triplicate, will be calculated.

#### *10.1.5.2 Trip Blanks and Trip Spikes*

One trip blank and trip spike will be used for each day of sampling[12]. A minimum of one trip blank and one trip spike will be scheduled for BTEX analysis, during the project, to provide an indication of the potential loss or transfer of volatiles from samples during storage and transport.

#### *10.1.5.3 Rinsate Blanks*

One rinsate and rinsate blank will be collected for each day of sampling[13].

Laboratory analysis of the rinsates will be limited to heavy metals, which will provide a sufficient indication of the quality of the decontamination procedures between sampling.

[12] Where samples being collected on that day are expected to be analysed for BTEX and/or TRH C6-C10.
[13] Where non-disposable sampling equipment is being used on that day.

#### *10.1.5.4 Laboratory Quality Assurance and Quality Control*

The quality assurance and quality control (QA/QC) program of the primary analytical laboratory will typically include analysis of method blanks, matrix spikes, surrogate spikes, laboratory control samples and laboratory duplicates. The laboratory will report on whether the QA/QC analysis meets the laboratory's adopted data quality objectives.

#### *10.1.5.5 Data Quality Indicators*

Data quality indicators (DQI) will be adopted to facilitate an assessment of the completeness, comparability, representativeness, precision and accuracy (bias) of the field and laboratory data collected. These DQI are set out in Table 10-1.

**Table 10-1 Data Quality Indicators**

| **Completeness**[14] | | | |
|---|---|---|---|
| **Field Considerations** | **Assessment Criteria** | **Laboratory Considerations** | **Assessment Criteria** |
| Critical locations sampled | 95% | Critical samples analysed | 95% |
| Critical samples collected | 95% | Analysis addresses COPC | 95% |
| SOPs appropriate | SOPs used | Methods and LORs | Refer Section 10.2.3 |
| Experienced sampler | Experienced CS staff | Sample documentation | SRA and COA supplied |
| Documentation complete | Logs, calibration, COC | Holding times | Refer Section 0 |
| **Comparability** | | | |
| **Field Considerations** | **Assessment Criteria** | **Laboratory Considerations** | **Assessment Criteria** |
| Same SOPs used | SOPs used | Comparable methods | Refer Section 10.2.2.3 |
| Experienced sampler | Experienced CS staff | Comparable LORs | Refer Section 10.2.2.3 |
| Climatic conditions | Sampling not affected by weather | Same laboratories | Primary samples to one lab |
| Same sample types | Same collection, preservation and handling | Same units of measure | Refer Section 10.2.2.3 |
| **Representativeness** | | | |
| **Field Considerations** | **Assessment Criteria** | **Laboratory Considerations** | **Assessment Criteria** |
| Appropriate media sample | Refer Section 10.2.2 | Samples analysed | Refer Section 10.2.2.3 |
| Identified media sampled | Refer Section 10.2.2 | | |

[14] Percentage criterion adopted is reflective of the significance level adopted for the decision, e.g. significance level of 0.05 indicates a 95% confidence level that the data is adequate for decision making (Ref: Section 18.3 in NEPC (1999b))

| **Precision**[15] | | | |
|---|---|---|---|
| **Field Considerations** | **Assessment Criteria** | **Laboratory Considerations** | **Assessment Criteria** |
| SOP compliance | SOPs used | Laboratory duplicates | 95% pass |
| Duplicate / triplicate RPD | Minimum 10% duplicates<br>Minimum 5% triplicates<br>No RPD limit <10 times LOR<br>50% RPD limit 10-20 times LOR<br>30% RPD limit >20 times LOR | | |
| **Accuracy (bias)** [16] | | | |
| **Field Considerations** | **Assessment Criteria** | **Laboratory Considerations** | **Assessment Criteria** |
| Trip blanks | Analytes less than LOR | Method blanks | 95% pass |
| Trip spikes | Recoveries between 60% and 140% | Matrix spikes | 95% pass |
| Rinsate blanks | Analytes less than LOR | Surrogate spikes | 95% pass |

#### *10.1.5.6 If/Then Statements*

1. If field and laboratory analytical dataset is within the DQI assessment parameters, then the data may be considered to be adequately complete, comparable, representative, precise and accurate, for decision making within the objectives of this project.
2. If field and laboratory analytical dataset is outside the DQI assessment parameters, then additional data may be collected to address identified data gaps.

The Site Assessment Criteria, for soil chemical contamination is determined by the following decision rules:

> The 95 % Upper Confidence Limit (UCL) of the arithmetic mean for each contaminant of concern complies with the respective site investigation criteria;

> The individual contaminant concentration should not exceed the adopted site investigation criteria by more than 250%; and

> The standard deviation of individual contaminants should not exceed 50% of the adopted site investigation criteria.

Therefore,

3. If field and laboratory analytical results for soils are below the site investigation criteria, then the site may be considered suitable for the proposed land use scenario.

[15] Percentage criterion adopted is reflective of the significance level adopted for the decision, e.g. significance level of 0.05 indicates a 95% confidence level that the data is adequate for decision making (Ref: Section 18.3 and Section 19.5 in NEPC (1999b))
[16] Percentage criterion adopted is reflective of the significance level adopted for the decision, e.g. significance level of 0.05 indicates a 95% confidence level that the data is adequate for decision making (Ref: Section 18.3 and Section 19.5 in NEPC (1999b))

However, CS notes the sampling density does not intend to meet the requirements for site characterisation as defined in the NSW EPA (1995). Hence, regardless of whether the laboratory results exceed the adopted land use scenario, any elevated chemical detections or identification of asbestos may warrant further investigation to increase statistical confidence in the results.

4. If field and laboratory soil chemical analytical results exceed the site investigation criteria, and further statistical assessment indicates results exceeds the Site Assessment Criteria, then the site may be considered unsuitable for the proposed land use scenario and further site assessment may be warranted.

### 10.1.6 Step 6: Specify the performance or acceptance criteria

There are two types of decision error:

> sampling errors occur when the sampling program does not adequately detect the variability of a contaminant from point to point across the site. That is, the samples collected are not representative of site conditions (e.g. an appropriate number of representative samples have not been collected from each stratum to account for estimated variability); and

> measurement errors occur during sample collection, handling, preparation, analysis and data reduction.

In the assessment of land contamination, these errors can result in either:

> a **Type I** error, where contamination exposure risks are considered to be acceptable, when they are not; or

> a **Type II** error, where contamination exposure risks are considered to be not acceptable, when they are.

In order for decision rules to be sound, they should be designed to minimise decision errors. The risk of decision error will be mitigated by:

> Increasing the sampling density in locations where elevated chemical contamination is identified;

> Ensuring fieldwork tasks are undertaken by suitably experienced field staff and sub-contractors, with reference to the DQO presented in this report;

> Ensuring laboratory analyses are undertaken by NATA accredited laboratories;

> Ensuring a robust statistical analysis and interpretation of the results, suitable for the proposed Judgmental sampling plan; and

> Ensuring interpretation of data is undertaken by suitably experienced environmental consultants and/or outsourcing interpretation to technical experts (if warranted).

### 10.1.7 Step 7: Develop the plan for obtaining data

The sampling is conducted based on the feasibility of the investigation agreed by the client, the timeframe given to CS to obtain the results, the proposed less sensitive land use scenario and the physical access to site media for assessment. This was achieved in accordance with the minimum requirements set out in the relevant statutory guidelines to provide a due diligence contamination assessment for the development application.

The DQOs were developed based on a review of existing data, and discussions with the relevant project stakeholders. If information gathered during the assessment process indicates that the objectives of the works are not being met, then this will be communicated to the Client to enable the appropriate steps to be made to rectify the issue, prior to completion of the project.

The following section outlines the sampling methodology and analytical strategy to achieve the DQOs for this investigation.

## 10.2 Sampling Methodology

The sampling methods are based on a number of factors that are relevant to this project, based on site history, and include:

> The identified COPC;

> The assessed laydown mechanisms for COPC in each AEC;

> The assessed likely lateral and vertical extent of potential contamination in each AEC; and

> Constraints on site which may restrict the use of certain sampling techniques.

Prior to excavation, the subsurface of the site was screened for the presence of underground services by a qualified and experienced cable locator under the supervision of an experienced consultant from CS.

### 10.2.1 Soil Investigation Procedure

Section 3.1 of NSW EPA (1995) states that judgemental or stratified sampling methods can be used if there is sufficient information about the probable distribution of the contamination. Additionally, Section 6.2.1 in NEPC (2013b) states that judgemental sampling, the selection of samples (number, location and timing, etc.) is based on knowledge of the site and professional judgement. Sampling would be expected to be localised to known or potentially contaminated areas identified from knowledge of the site either from the site history or an earlier phase of site assessment.

The scope of this project has included limited soil sampling from specific locations identified as AECs in the CSM, to supplement the preliminary site investigation. These locations were derived from information obtained from the desktop site history review and site conditions during the site walkover. On that basis, it is considered reasonable to adopt a judgemental sampling pattern to investigate sub-surface contamination issues as a preliminary site assessment for due diligence purposes. CS notes the sampling density does not intend to meet the requirements for site characterisation as defined in the NSW EPA (1995).

Twenty-five test pit locations have been chosen based on the identified AECs to obtain a preliminary understanding of the possible extent of soil contamination. The locations of the in-situ sampling points are presented in **Figure 3A and 3B**.

The four stockpiles of unknown origin (SP1-SP4) will also be investigated with three samples per stockpile to be collected, in accordance with the sampling density specified in the EPA Victoria 2010, Industrial Waste Resource Guidelines, Sampling and Analysis: Soil Sampling and the NEPM (NEPC, 2013b).

### 10.2.2 Soil Sampling

At each of the 25 sample locations, test pits will be excavated to a minimum of 0.3m into natural ground using a 5.5 tonne excavator. One discrete soil jar sample for chemical analysis and a bulk soil bag sample for asbestos analysis, will be collected from the fill at each test pit location, at a minimum 0.2m below ground level, representative of the subsurface fill. Additional samples may be collected at each test pit location, at vertical depth intervals, if there is additional visual or olfactory evidence of contamination.

At each stockpile a minimum three discrete chemical and asbestos samples will be collected from 0.3m below the surface of the stockpile, at three random sample points, equal distance apart.

Chemical samples will be collected in general accordance with the NEPM (NEPC, 2013) and with the methods specified by the *AS 4482.1-2005 Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil Part 1: Non-Volatile and Semi-Volatile Compounds* (AS 4482.1-2005). In order to minimise the potential for cross contamination, soil samples will be collected by hand directly from the excavator bucket or from soils stockpiled adjacent to the test pit. All sampling will be conducted by suitably trained field staff wearing protective clothing and disposable nitrile gloves.

Asbestos soil samples will be collected as a grab sample in general accordance with the NEPM (NEPC, 2013). Any ACM or suspect fibrous material identified within the soils will be collected in a separate zip lock bag for analysis.

**Note: Groundwater and surface water assessment is beyond the scope of the project and therefore omitted from the SAQP.**

#### *10.2.2.1 Field Screening*

When identified COPC include volatiles (e.g. BTEX, TRH or VOC), soil samples will be screened for ionisable volatile organic compounds using a photo-ionisation detector (PID). A sub sample from each sample collected at each sampling point will be placed in a zip lock bag, sealed, and shaken. Each zip lock bag will then be pierced with the tip of a PID and the results recorded on the relevant sampling point log.

#### *10.2.2.2 Decontamination*

Non-disposable sampling equipment will be decontaminated between sampling points to mitigate potential for cross contamination of samples. The decontamination method to be used will be:

> Wash of the non-disposable sampling equipment with a solution of potable water and phosphate free detergent (e.g. Decon 90), noting that Decon 90 will not be used on equipment used for collection of samples that will be analysed for PFAS compounds;

> Rinse the washed equipment with distilled or de-ionised water; and

> Air dry the rinsed equipment.

#### *10.2.2.3 Sample Identification, Preservation, Handling and Transport*

Soil samples will be identified using the CS project number, sampling point identification number and sampling depth interval (e.g. TP01-0.0-1.0), and date the sample was collected.

Chemical samples will be placed in laboratory prepared glass jars and asbestos samples in zip lock bags.

Soil chemical samples will be stored in insulated containers with ice.

Samples will be transported to the analytical laboratory by CS field staff or a third party courier, using the analytical laboratory's chain of custody (COC) documentation.

Samples were transported to NATA accredited laboratories for analysis by CS field staff or a third party courier, using the analytical laboratory's chain of custody (COC) documentation.

### 10.2.3 Analytical Schedule

Samples collected from test pits scheduled for laboratory analysis will be selected based on:

> The COPC identified for the AEC the sample was collected from;

> Observations made of the sample when collected (including staining, odour and discolouration); and

> The results of PID headspace screening (if applicable).

The proposed laboratory analytical schedule (including upper limiting sample quantities) for test pit samples is set out in Table 10-2.

**Table 10-2 Laboratory Analytical Schedule**

| AEC ID | Location ID | TRH / BTEX | PAH | OCP | OPP | Asbestos | Metals (8) |
|---|---|---|---|---|---|---|---|
| AEC01 | TP01 | X | X | X | | X | X |
| | TP02 | | X | | | X | X |
| | TP04 | | X | | | X | X |
| | TP05 | | X | X | | X | X |
| | TP06 | | X | X | | X | X |
| | TP07 | | X | | | X | X |
| | TP09 | | X | | | X | X |

| AEC ID | Location ID | TRH / BTEX | PAH | OCP | OPP | Asbestos | Metals (8) |
|---|---|---|---|---|---|---|---|
| | TP10 | | X | | | X | X |
| | TP11 | X | X | X | X | X | X |
| | TP12 | | X | | | X | X |
| | TP14 | | X | X | X | X | X |
| | TP15 | | X | | | X | X |
| | TP18 | X | X | | | X | X |
| | TP21 | X | X | | | X | X |
| | TP22 | | X | | | X | X |
| | TP23 | | X | | | X | X |
| | TP24 | | X | | | X | X |
| | TP25 | X | X | X | | X | X |
| AEC02 | TP03 | X | X | | | X | X |
| | TP17 | X | X | | | X | X |
| AEC03 | TP13 | X | X | X | X | X | X |
| AEC04 | TP19 | | X | X | X | X | X |
| | TP20 | | X | X | X | X | X |
| AEC05 | TP16 | X | X | | | X | X |
| AEC06 | SP1-SP4 | X | X | X | | X | X |
| AEC07 | TP08 | X | X | | | X | X |

X = indicates to be analysed

The samples collected from stockpiles will be forwarded to the laboratory for the following analytical suite:

> Heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn);

> Total Recoverable Hydrocarbons (TRH);

> Benzene, Toluene, Ethylbenzene, Xylene;

> Polycyclic Aromatic Hydrocarbons (PAH);

> Pesticides (OCP); and

> Asbestos 500ml samples.

### 10.2.4 Laboratory Analytical Details

Sample holding times, laboratory analytical methods and limits of reporting applicable to this project, are set out in Table 10-3.

**Table 10-3 Laboratory Holding Times, Analytical Methods and Limits of Reporting**

| Analyte | Holding Time | Method | LOR (mg/kg) | LOR (µg/L) |
|---|---|---|---|---|
| BTEX and TRH C6-C10 | 14 days | USEPA 5030, 8260B and 8020 | 0.2-0.5 | 1-2 and 50 |
| TRH C10-C40 | 14 days | USEPA 8015B & C | 20-100 | 50-500 |
| PAH | 14 days | USEPA 8270 | 0.1-0.2 | 0.5-10 |
| OCP/OPP | 14 days | USEPA 8081 | 0.2 | - |
| Metals | 6 months | USEPA 8015B & C | 0.05-2 | 0.1-5 |
| Asbestos ID | No limit | AS4926 | Absence / presence | - |
| Asbestos (WA DoH) | No Limit | In-house | 0.001%w/w | - |

## 10.3 Site Investigation Criteria

The following table lists the adopted site investigation criteria, based on the proposed land use scenario, in accordance with the relevant referenced sources

**Table 10-4 Adopted Site Investigation Criteria**

| Exposure Pathway | Land Use Setting[17] | Reference |
|---|---|---|
| Human health direct contact | HIL D | Table 1A(1) in NEPC (2013a)<br>Table B4 in Friebel, E & Nadebaum P (2011)<br>Table 2 in DoEE (2018) |
| Human health (asbestos) | Industrial/Commercial D | Table 7 in NEPC (2013a)[18] |
| Human health (aesthetics) | All | Characteristics and processes in<br>Section 3.6.2 and 3.6.3 in NEPC (1991a) |

### 10.3.1 Rationale for Criteria

The site investigation criteria outlined above is based on the proposed land use scenario and the identified human receptors. A SPR linkage is considered incomplete for ecological receptors based on the proposed sealed surface and minimal soil access for the site.

[17] Consideration will be given to soil type, soil texture, soil depth, groundwater depth and appropriate species protection levels.
[18] A depth of up to 10cm below ground level is adopted to define 'surface soil'.

# 11 Results

Intrusive works by test pitting and environmental sampling were undertaken by CS between 4th May and 7th May 2020. These works included:

> Excavation of 25 test pits (TP01 to TP25) a minimum 0.3m into inferred natural soils, using a five tonne tracked hydraulic excavator.

> Inspection and sampling four stockpiles SP1-SP4;

> Samples were collected in general accordance with SAQP outlined in Section 10.

> Soil samples were collected at each sampling point, immediately below the surface or where visual or olfactory evidence of contamination was observed.

> Test pits were backfilled with excavated soils and track rolled (except where suspect ACM material was identified, to prevent potential mobilisation of free asbestos fibres).

> Rinsate samples were only collected following decontamination of re-usable sampling equipment on the first two days of sampling, to provide assessment of the quality of the sampling procedures. As all sampling was conducted consistently using the same methodology and decontamination procedures, this is deemed sufficient for the purposes of the project.

> Duplicate and triplicate samples were collected by splitting the primary sample across three sample containers (without homogenising, to avoid loss of volatiles), to achieve the required density specified in the DQIs.

> Samples were screened using a PID, only where volatile contaminants were of concern. The PID was calibrated by the laboratory prior to field use, refer to **Appendix I**.

Sampling point locations were consistent with the sampling plan locations presented in **Figure 3A and 3B.**

## 11.1 Test Pit Soil Observations

Observations made of soils encountered during intrusive investigation works were recorded on logs. These logs are presented in **Appendix J.**

A summary of subsurface conditions is presented in Table 11-1**.**

**Table 11-1 Summary of Subsurface Conditions**

| Layer | Description | Depth (m) |
|---|---|---|
| Topsoil | Brown to dark brown gravelly SILT, gravelly SAND and silty CLAY (TP1-TP15, TP17, TP19, TP20, TP22-TP25) | 0 to 0.4 |
| Fill | Dark brown gravelly SAND at TP16, TP18 and TP21 | 0.1 to 0.8 |
| Natural | Residual brown to red CLAY, of medium plasticity;<br>Brown sandy CLAY, low plasticity; and<br>Grey silty CLAY of high plasticity. | 0.2 to 1.5 |

Groundwater was not encountered in the test pits.

Soils were noted as moist to wet, which is thought to be due to the light rainfall on the night of 4th May 2020.

Foreign Material, comprising of bricks, metal, plastic, timber and ceramics, was identified in TP20, TP21 and TP25 at 0 – 0.3m bgl.

Suspect asbestos containing material was identified in two fragments of slightly degraded fibro at TP21, 0.3m bgl.

No staining or olfactory evidence was observed in any of the test pits.

The results of the PID screening were indicative of background levels ranging from 0.2 to 4.2 ppm. The results of the PID screening are presented on the logs in **Appendix J.**

**Image 11.1.1 View of test pit at sampling point TP01**

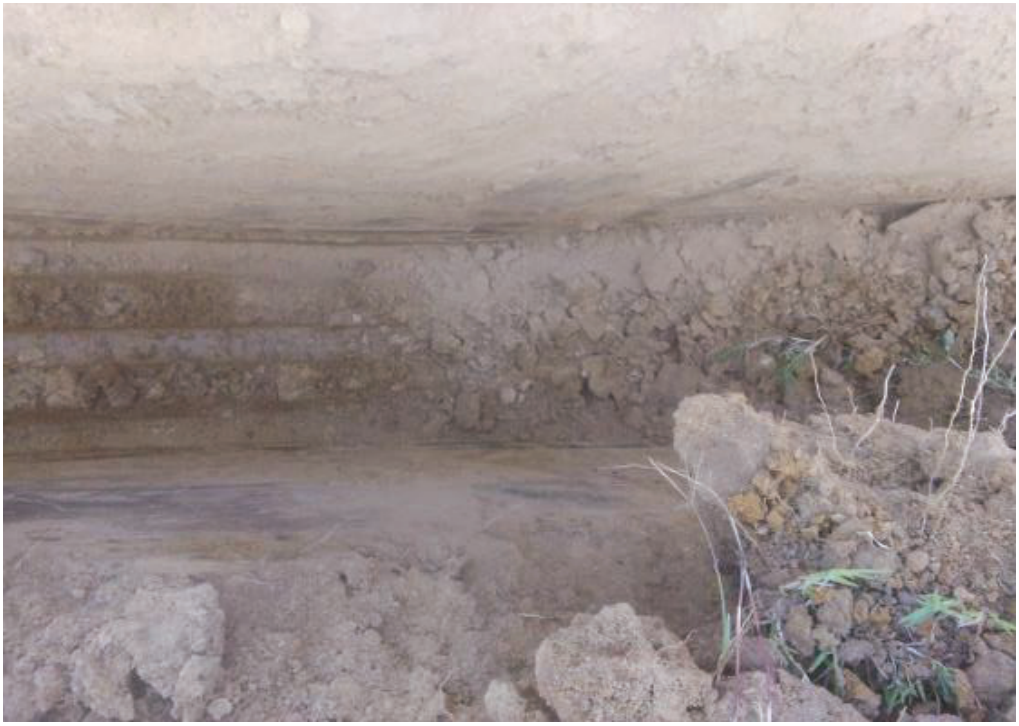


**Image 11.1.2. View of topsoil material 0-0.3m bgl at sampling point TP01**

**Image 11.1.3 View of ACM encountered at TP21 at 0.3m bgl**

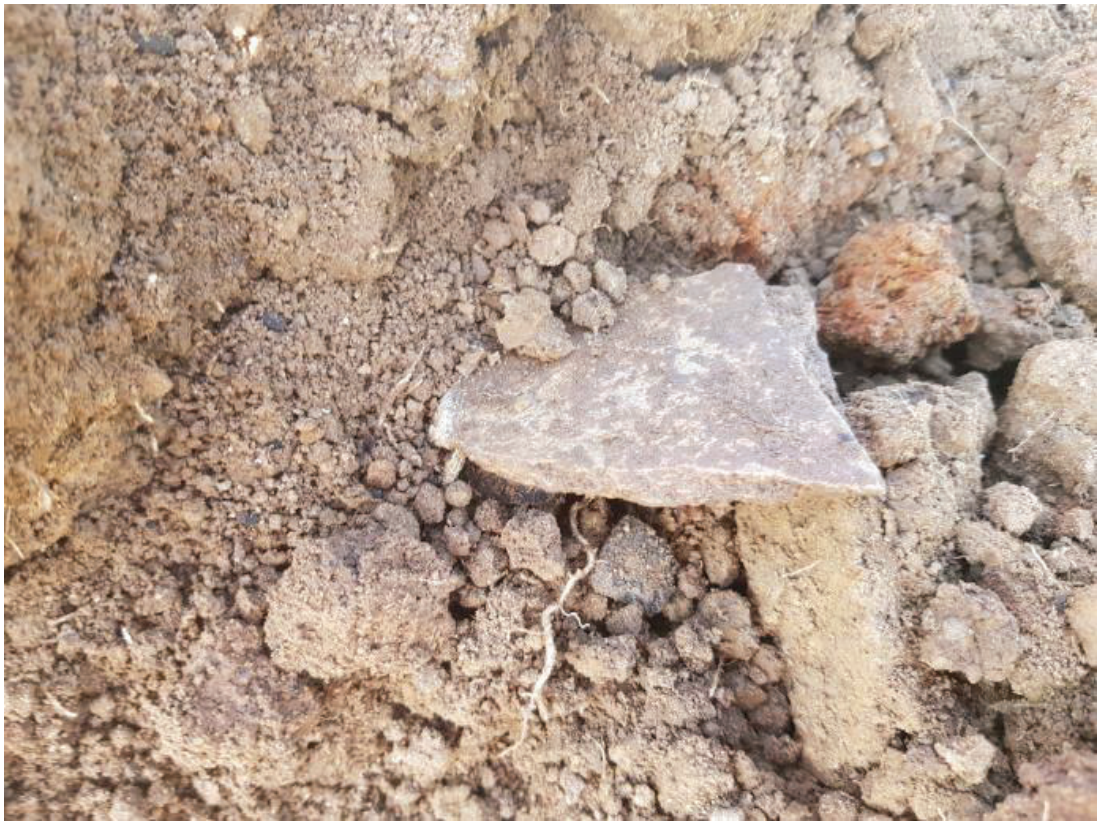


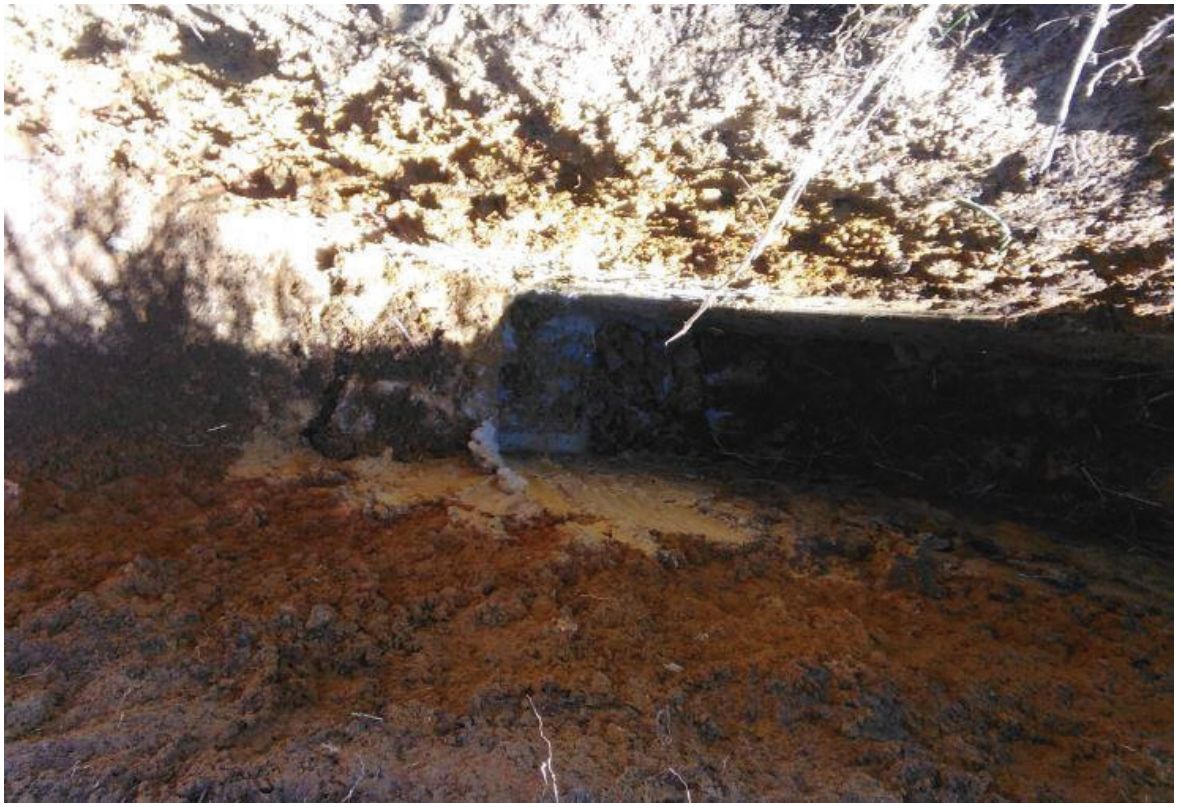
**Image 11.1.4 View of natural clay at TP21**

**Image 11.1.5 View of fill material 0-0.3m bgl at TP16**

**Image 11.1.6 View of completed test pit at TP16**

**Image 11.1.7 View of completed test pit at location TP25**

**Image 11.1.8 View of completed test pit at location TP08**



## 11.2 Stockpile Observations

The stockpiles SP1-SP4 were inspected and observed to comprise of the following (volumes are based on a visual estimate):

| Stockpile ID | Description | Volume ($m^3$) |
|---|---|---|
| SP1 | White to grey fine SAND with ceramic, bricks, glass and metal inclusions | 5 |
| SP2 - SP4 | Brown to grey sandy SILT with concrete, gravel, metal and ceramic inclusions | 5 per stockpile |

Stockpiles SP2-SP4 were visually consistent with the material in the adjacent gravel roadways.

No other visual or olfactory evidence of contamination was observed.

**Image 11.2.1 View of Stockpile SP1**

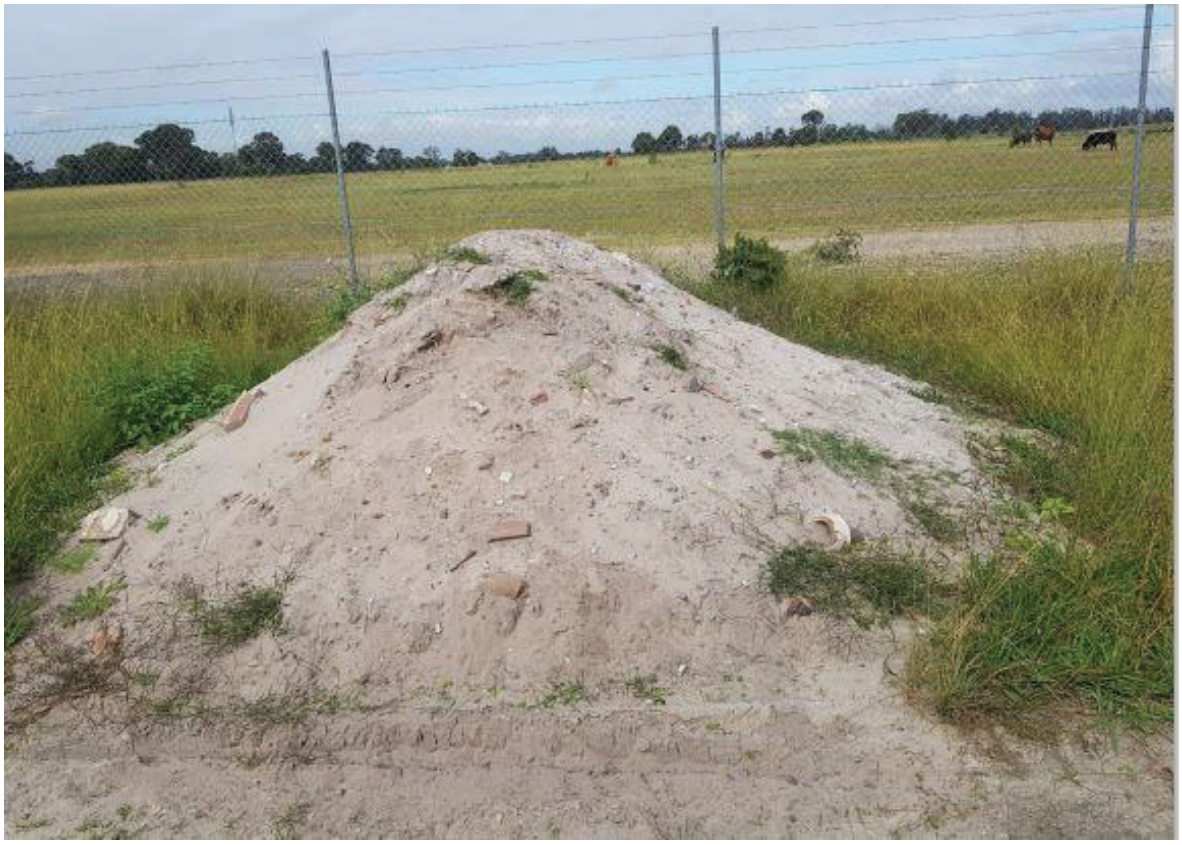


**Image 11.2.2 View of stockpile SP2**

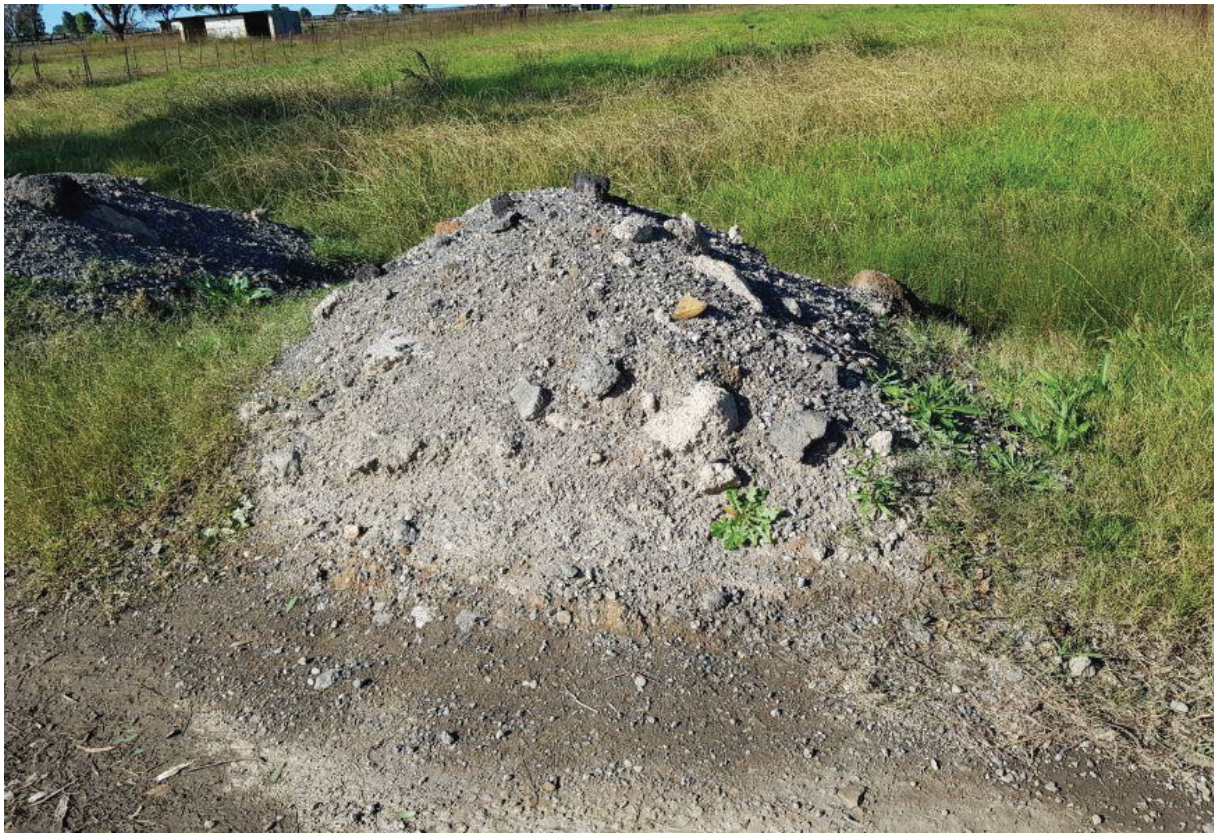


**Image 11.2.3 View of stockpile SP3**

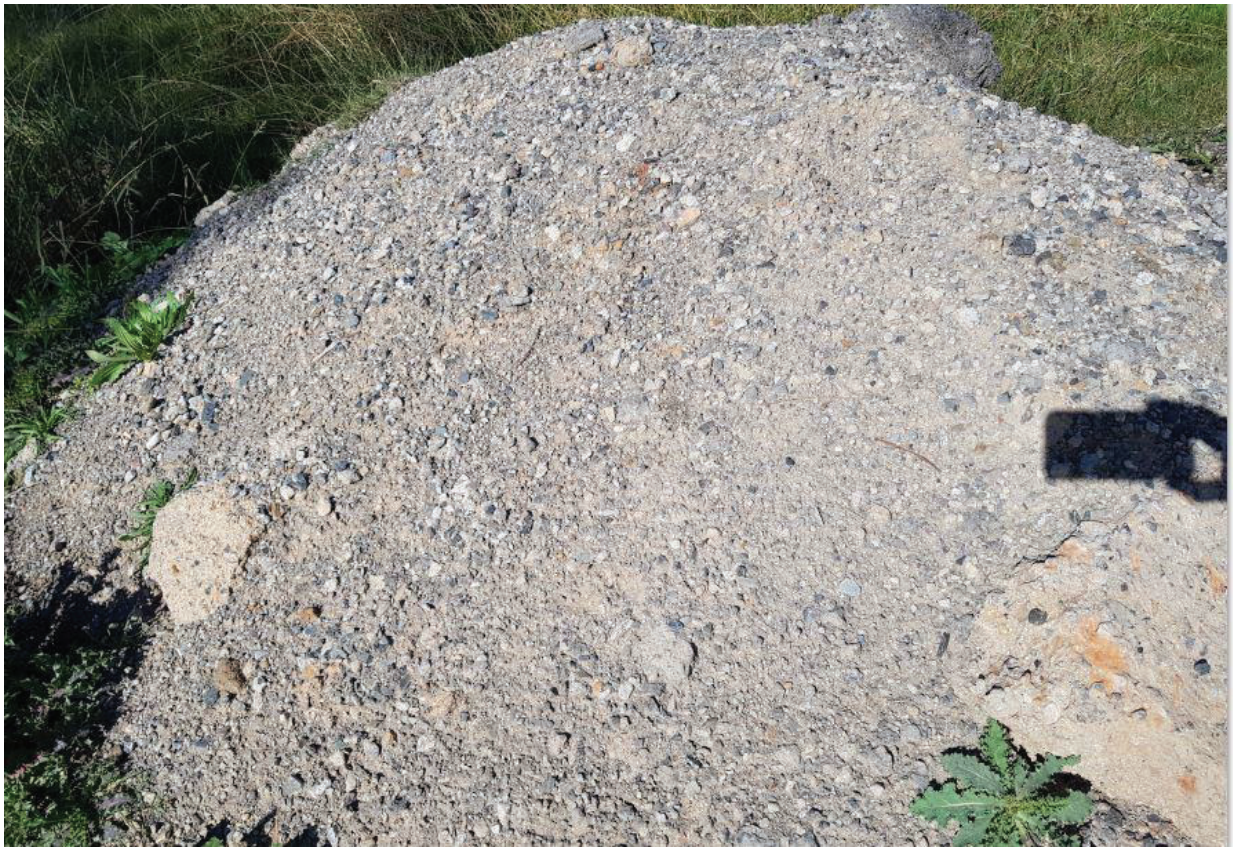
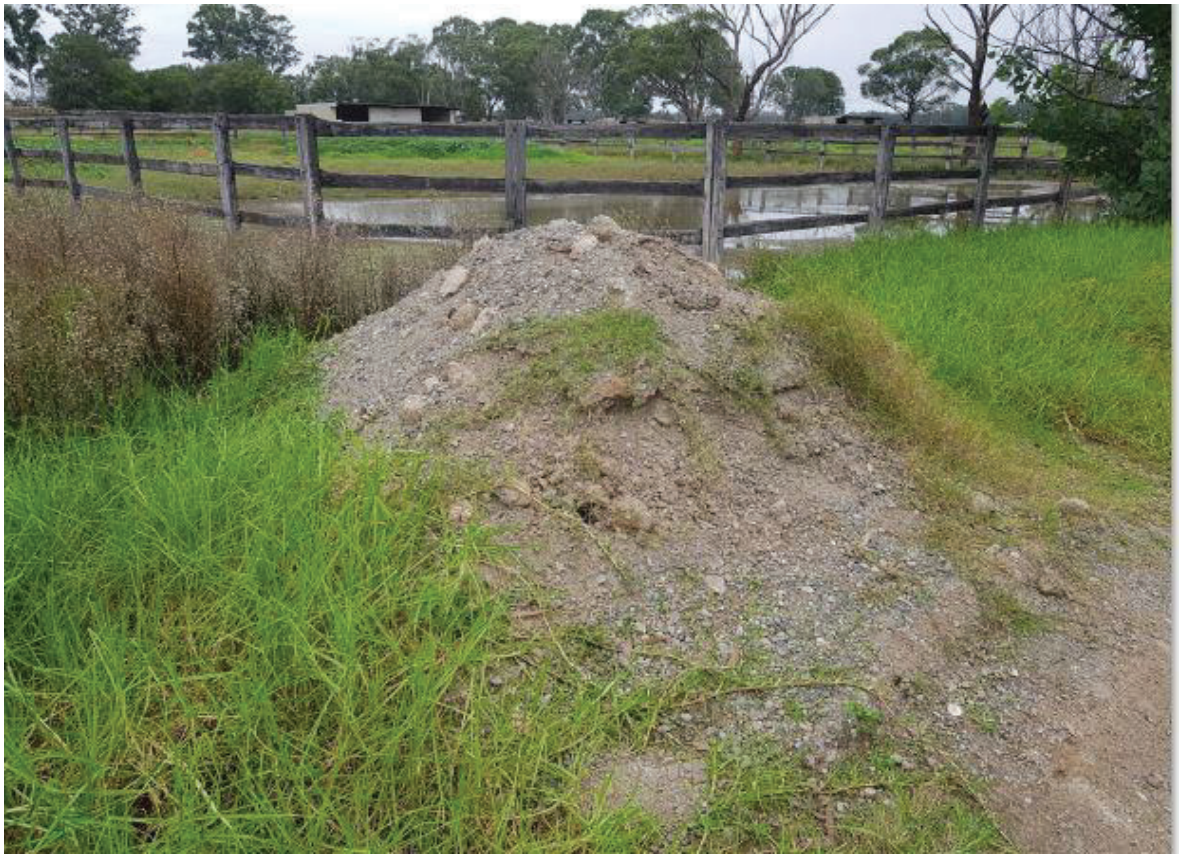


**Image 11.2.4 View of stockpile SP4**



## 11.3 Laboratory

The soil samples were transported to the analytical laboratory using chain of custody protocols. All samples were analysed, taking into consideration the laboratory analytical schedule presented in Section 10.2.3 and observations made in the field.

The relevant laboratory analytical results were tabulated and presented in the attached Table LR1 (test pits) and Table LR2 (stockpiles), **Appendix K.**

A copy of the sample receipts and certificates of analysis, is presented in **Appendix L**.

### 11.3.1 Test Pits

#### *11.3.1.1 Total Recoverable Hydrocarbons and Monocyclic Aromatic Hydrocarbons*

The results of the laboratory analysis reported no detections of TRH above the laboratory limit of reporting (LOR) in soil with the exception of one sample (TP16-0-0.2), which reported TRH in the F3 and F4 fraction. The detections were below the adopted investigation criteria.

The results of the laboratory analysis reported no detections of BTEX above the laboratory limit of reporting (LOR) for all samples analysed.

#### *11.3.1.2 Polycyclic Aromatic Hydrocarbons*

The results of the laboratory analysis reported no detections of PAH above the laboratory LOR.

#### *11.3.1.3 Pesticides*

The results of the laboratory analysis reported no detections of pesticides above the laboratory LOR.

#### *11.3.1.4 Heavy Metals*

The results of the laboratory analysis reported heavy metals in soil at concentrations below the adopted investigation criteria.

#### *11.3.1.5 Asbestos*

The results of the laboratory analysis reported no detections of asbestos in soil.

The solid fragment sample (TP21-ACM-0.3) reported a positive detection for the presence of asbestos.

### 11.3.2 Stockpiles

#### *11.3.2.1 Total Recoverable Hydrocarbons and Monocyclic Aromatic Hydrocarbons*

The results of the laboratory analysis reported no detections of TRH above LOR in soil with the exception of the following samples:

> SP2-1, SP2-2, SP2-3, SP3-1, SP3-2, SP3-3, SP4-1, SP4-2 and SP4-4 which reported TRH in the F3 and F4 fraction.

All detections were below the adopted health investigation criteria.

The results of the laboratory analysis reported no detections of BTEX above the laboratory limit of reporting (LOR) for all samples analysed.

#### *11.3.2.2 Polycyclic Aromatic Hydrocarbons*

The results of the laboratory analysis reported no detections of PAH above LOR, with the exception of one sample (SP4-1), which was at a concentration only slightly above the laboratory LOR and below the adopted investigation criteria.

#### *11.3.2.3 Pesticides*

The results of the laboratory analysis reported no detections of pesticides above the laboratory LOR.

#### *11.3.2.4 Heavy Metals*

The results of the laboratory analysis reported heavy metals in soil at concentrations below the adopted human health investigation criteria.

#### *11.3.2.5 Asbestos*

The results of the laboratory analysis reported no detections of asbestos.

# 12 Assessment of Data Quality Indicators

An assessment of performance against the data quality indicators (DQI), is presented in Table 12-1 to Table 12-5.

**Table 12-1 Completeness DQI**

| Field Considerations | Target | Actual | Comment |
|---|---|---|---|
| Critical locations sampled | 95% | 100% | Performance against DQI considered acceptable. |
| Critical samples collected | 95% | 100% | Performance against DQI considered acceptable. |
| SOPs appropriate | SOPs used | SOPs used | Performance against DQI considered acceptable. |
| Experienced sampler | Experienced CS staff | Nicholas Leong and Beau Dubois | Performance against DQI considered acceptable. |
| Documentation complete | Logs, calibration, COC | Documentation presented in relevant appendices | Documentation presented in relevant appendices. |
| **Laboratory Considerations** | **Target** | **Actual** | **Comment** |
| Critical samples analysed | 95% | 100% | Performance against DQI considered acceptable. |
| Analysis addresses COPC | 95% | 100% | Performance against DQI considered acceptable. |
| Methods and LORs | Refer Section 10.2.2.3 | Complied | Performance against DQI considered acceptable. |
| Sample documentation | SRA and COA supplied | Documentation presented in relevant appendices | Performance against DQI considered acceptable. |
| Holding times | Refer Section 10.2.2.3 | Complied | Performance against DQI considered acceptable. |

**Table 12-2 Comparability DQI**

| Field Considerations | Target | Actual | Comment |
|---|---|---|---|
| Same SOPs used | SOPs used | Complied | Performance against DQI considered acceptable. |
| Experienced sampler | Experienced CS staff | Nicholas Leong and Beau Dubois | Performance against DQI considered acceptable. |
| Climatic conditions | Sampling not affected by weather | Relevant samples stored in insulated containers with ice | Performance against DQI considered acceptable. |
| Same sample types | Same collection, preservation and handling methods | Complied | Performance against DQI considered acceptable. |
| **Laboratory Considerations** | **Target** | **Actual** | **Comment** |
| Comparable methods | Refer Section 10.2.2.3 | Complied | Performance against DQI considered acceptable. |
| Comparable LORs | Refer Section 10.2.2.3 | Complied | Performance against DQI considered acceptable. |
| Same laboratories | Primary samples to one lab | Samples sent to SGS Environmental | Performance against DQI considered acceptable. |
| Same units of measure | Refer Section 10.2.2.3 | Complied | Performance against DQI considered acceptable. |

**Table 12-3 Representativeness DQI**

| Field Considerations | Target | Actual | Comment |
|---|---|---|---|
| Appropriate media sample | Refer Section 10.2 | Complied | Performance against DQI considered acceptable. |
| Identified media sampled | Refer Section 10.2 | Complied | Performance against DQI considered acceptable. |
| **Laboratory Considerations** | **Target** | **Actual** | **Comment** |
| Samples analysed | Refer Section 10.2.3 | Complied | Performance against DQI considered acceptable. |

**Table 12-4 Precision DQI**

| Field Considerations | Target | Actual | Comment |
|---|---|---|---|
| SOP compliance | SOPs used | Complied | Performance against DQI considered acceptable. |
| Duplicate / triplicate RPD | Minimum 5% duplicates | 11% duplicates | Performance against DQI considered acceptable. |
| Duplicate / triplicate RPD | Minimum 5% triplicates | 5% triplicates | Performance against DQI considered acceptable. |
| Duplicate / triplicate RPD | No RPD limit where concentrations are <10 times LOR | Nil | Performance against DQI considered acceptable. |
| Duplicate / triplicate RPD | 50% RPD limit exceeded where concentrations are 10-20 times LOR | Nil | Performance against DQI considered acceptable. |
| Duplicate / triplicate RPD | 30% RPD limit exceeded where concentrations are >20 times LOR | 16 | Samples were not homogenised prior to splitting, as volatiles were identified as a COPC. Exceedances likely attributable to heterogeneity in each of the discrete soil samples. As a conservative measure, the samples reporting |

| Field Considerations | Target | Actual | Comment |
|---|---|---|---|
| | | | the higher detected concentration of relevant analytes should be used when assessing potential contamination risks on the site.<br>Performance against DQI considered acceptable. |
| **Laboratory Considerations** | **Target** | **Actual** | **Comment** |
| Laboratory duplicates | 95% pass | 95% | Three exceedances were reported to have exceeded the laboratory acceptance criterion, due to sample heterogeneity.<br>Performance against DQI considered acceptable. |

**Table 12-5 Accuracy (bias) DQI**

| Field Considerations | Target | Actual | Comment |
|---|---|---|---|
| Trip blanks | Analytes less than LOR | Analytes less than LOR | Performance against DQI considered acceptable. |
| Trip spikes | Recoveries between 60% and 140% | Recoveries between 87% and 102% | Performance against DQI considered acceptable. |
| Rinsate blanks | Analytes less than LOR | Rinsate sample (R-1) reported detections of Arsenic and Cadmium slightly above the laboratory LOR (Lab Ref: 717585) | Due to the increased sensitivity of detections in water samples these detections are considered unlikely to affect the quality of the data. Arsenic and cadmium concentrations in soils did not exceed the site criteria. Performance against DQI considered acceptable. |

| Laboratory Considerations | Target | Actual | Comment |
|---|---|---|---|
| Method blanks | 95% pass | 100% | Performance against DQI considered acceptable. |
| Matrix spikes | 95% pass | 100% | Performance against DQI considered acceptable. |
| Surrogate spikes | 95% pass | 100% | Performance against DQI considered acceptable. |
| Laboratory control samples | 95% pass | 95% | Performance against DQI considered acceptable. |

# 13 Discussion

## 13.1 Human Health – Direct Contact

The detected concentrations of the relevant COPC in the soil samples analysed, were less than the adopted human health direct contact investigation criteria.

Further assessment of direct contact human health exposure risks is considered not warranted.

## 13.2 Human Health – Vapour Intrusion / Inhalation

There were no detected concentrations of the relevant COPC in the soil samples analysed, which have the potential to pose a vapour intrusion risk to site receptors.

Further assessment of vapour intrusion / inhalation human health exposure risks is considered not warranted.

## 13.3 Human Health – Asbestos

### 13.3.1 Bonded Asbestos Containing Materials

Two fragments of bonded ACM greater than 7mm in size were observed during field screening of relevant bulk soil samples at location TP21 at 0.3 m bgl.

Asbestos was identified in one solid sample which was analysed for suspected ACM.

Further assessment of bonded ACM human health exposure risks is considered warranted at this location.

### 13.3.2 Asbestos Fines/Fibrous Asbestos (AF/FA)

There were no detections of AF/FA in the soil samples analysed. CS notes the soil samples were forwarded to the laboratory for analysis in accordance with AS 4964 (2004), which has a laboratory LOR of 0.01% w/w. Examination of a large sample size (500 ml) may improve the likelihood of detecting asbestos as AF/FA for assessment against the NEPM HSL criteria for AF/FA of 0.001% w/w.

CS notes the broken fibro walls of the old cottage which most likely contain asbestos. Potential AF/FA contamination of surrounding soils cannot be dismissed.

Further assessment of AF/FA human health exposure risks is considered warranted at location TP21 and the footprint of the old fibro cottage.

Furthermore, assessment of soils around other building footprints may also be required, if asbestos is subsequently identified in building materials.

## 13.4 Aesthetics

The following potential asbestos containing building materials were identified onsite which are currently considered an aesthetic risk:

> Fragments of fibrous cement sheeting were observed on the surface in the vicinity of sampling point TP16, observed to be located on a sealed asphalt surface.

> The walls of the old fibro cottage most likely contain bonded asbestos containing material;

> Various surface demolition waste was identified across the site, which may contain ACM.

Furthermore, due to the age of all buildings onsite, hazardous building materials, including asbestos, lead and zinc may be also present.

Further management of asbestos and other hazardous building materials related to aesthetic risks is considered warranted. This can be conducted during the development phase prior to demolition and earthworks.

The site walkover also revealed potential underground septic tanks at two locations and other septic tanks are considered likely onsite.

The above ground diesel tanks and IBC containing waste engine oil, are also considered to be an aesthetic risk which requires management, prior to earthworks.

The locations of these identified aesthetic risks are presented in **Figure 5A and 5B**.

## 13.5 Management Limits for Petroleum Hydrocarbons

The detected concentrations of the relevant COPC in the soil samples analysed, were less than the adopted management limits for petroleum hydrocarbon investigation criteria.

Further assessment of petroleum hydrocarbon related risks, in the context of formation of light non-aqueous phase liquids, fire and explosion hazards, or effects on buried infrastructure, is considered not warranted.

# 14 Revised Conceptual Site Model

Based on CS's assessment of desktop review information, fieldwork observations and laboratory analytical data, in the context of the proposed land use scenario, a revised conceptual site model for the site is presented in Table 14-1.

**Table 14-1 Revised Conceptual Site Model**

| ID | AEC Description | COPC | Exposure Pathway | Receptor | Perceived Risk |
|---|---|---|---|---|---|
| AEC01 | Imported Fill | Hydrocarbons, pesticides, metals, asbestos | Direct contact | Construction Workers, future residents, visitors | Low – unacceptable contamination risks not detected |
| | | | Inhalation (asbestos) | | High – ACM detected in location TP21. Asbestos fragments looked slightly degraded, soils may contain AF/FA. |
| AEC02 | Stained soils and incomplete combustion | Asbestos, PAH and metals | Direct contact | Construction Workers | Low – unacceptable contamination risks not detected |
| AEC03 | Green house and adjacent crops | Pesticides, asbestos, PAH and metals | Direct contact<br>Inhalation | Construction Workers | Low – unacceptable contamination risks not detected |
| AEC04 | Former Crops | Pesticides and metals | Direct contact | Construction Workers | Low – unacceptable contamination risks not detected |
| AEC05 | Previous motor vehicle storage | Hydrocarbons, metals | Direct contact<br>Inhalation | Construction Workers | Low – unacceptable contamination risks not detected |
| AEC06 | Soil stockpiles of unknown origin | Hydrocarbons, metals, PAH, pesticides, asbestos | Direct contact<br>Inhalation | Construction Workers | Low – unacceptable contamination risks not detected |
| AEC07 | Soils adjacent to above ground diesel tank | Hydrocarbons, PAH, asbestos and metals | Direct contact<br>Inhalation | Construction Workers | Low – unacceptable contamination risks not detected |
| AEC08 | ACM fragments stacked on surface | Asbestos | Inhalation | Construction Workers | Moderate – ACM stacked on surface observed in good condition |

| ID | AEC Description | COPC | Exposure Pathway | Receptor | Perceived Risk |
|---|---|---|---|---|---|
| AEC09 | Oil intermediate bulk container (IBC) | Hydrocarbons, PAH and metals | Direct contact<br>Inhalation | Construction Workers | Aesthetic risk only |
| AEC10 | Old fibro cottage walls broken | Asbestos and metals | Inhalation | Construction Workers | Moderate – ACM observed currently in good condition. |
| AEC11 | Household/Demolition surface waste | Asbestos and metals | Direct contact<br>Inhalation | Construction Workers | Aesthetic risk only |
| AEC12 | Two underground septic tanks | Coliforms, enterococci, E.coli, metals, OCP | Direct contact | Construction Workers | Aesthetic risk only |

## 14.1 Evaluation of SPR Linkages

> **AEC01:** Asbestos contamination was identified in topsoil, at sample location TP21. Inhalation of free fibres in soils during construction may present a risk to future construction workers. Therefore, a SPR linkage cannot be dismissed.

  Laboratory results indicate no detections of asbestos and chemical concentrations are below the adopted investigation criteria at all other AEC01 locations. This indicates a source of contamination is unlikely, hence, a SPR linkage is unlikely to exist.

> **AEC02-AEC07:** Laboratory results indicate no detections of asbestos and chemical concentrations are below the adopted investigation criteria. This indicates a source of contamination is unlikely, hence, a SPR linkage is unlikely to exist.

> **AEC08 and AEC10:** Visual observations during the site walkover have indicated the presence of ACM to be present in the old fibro cottage and broken fragments of fibro sheeting near TP16. CS considers this material to potentially pose a risk of inhalation of asbestos fibres to future construction workers if not managed correctly.

  CS also considers it likely that other buildings located onsite may contain hazardous building materials, including asbestos, lead and zinc. However, a hazardous buildings material survey is beyond the scope of this project.

> **AEC09, AEC11 and AEC12:** The IBC of waste oil, various locations of surface waste observed onsite, and potential underground septic tanks are currently considered aesthetic risks which require management during the proposed development.

## 14.2 Data Gaps

The following data gaps are noted:

> As stated above, a hazardous building material survey is beyond the scope of this investigation, and should be conducted prior to demolition;

> Building footprints should be investigated to assess contamination status, following their demolition;

> The locations of the test pits have been selected based historical desktop searches and visual observations from one site walkover. CS notes portions of the site are heavily overgrown with grass and

weeds and a visual assessment of surface soils could not be comprehensively undertaken. Topsoil stripping works in the building surrounds should be observed by the environmental consultant;

> Assessment of the locations of all underground septic tanks has not been undertaken. Removal of septic tanks should be observed and validated by the environmental consultant;

> Assessment of potential asbestos containing subsurface infrastructure (such as irrigation pipes) may be present and has not been investigated.

CS considers further assessment of soils can be conducted during the earthworks phase of development and inspections of buildings to be undertaken prior to demolition.

# 15 Conclusions and Recommendations

Based on CS's assessment of desktop review information, fieldwork observations and laboratory analytical data, in the context of the proposed land use scenario of industrial/commercial, CS makes the following conclusions:

> Bonded asbestos contamination was identified in fill, at sample location TP21. The potential for free asbestos fibres in soils at this location cannot be dismissed, which may present an unacceptable human health exposure risk;

> Bonded asbestos was identified on the surface near TP16 and the old fibro cottage, which may present an unacceptable human health exposure risk and unacceptable aesthetics risk;

> It is likely that other buildings located onsite may contain hazardous building materials, including asbestos, lead and zinc, which may present an unacceptable human health exposure risk and currently pose an aesthetics risk;

> Potential underground septic tanks are considered likely, which may pose an aesthetic risk;

> The above ground diesel tanks, surface household/demolition waste and IBC containing waste engine, may pose an aesthetic risk;

> Potential unexpected finds of underground asbestos containing infrastructure may pose an unacceptable human health exposure risk;

> The proposed development may require importation of material to raise the entire site to specific design levels and therefore an import protocol will be required to validate the importation of material.

> The site could be made suitable for the proposed land use scenario, subject to:

  - A hazardous building material survey of all buildings prior to demolition;
  - Validation sampling of soils around the footprints of buildings, following demolition;
  - Decommissioning of septic tanks and above ground tanks;
  - Inspection and removal of all household/demolition waste; and
  - Management and/or remediation of the bonded ACM and potential friable asbestos / asbestos fines in soil at TP21; and
  - Procedures being detailed for management and/or remediation of unexpected finds of asbestos infrastructure;
  - An import protocol be implemented to validate the importation of material.

Based on these conclusions, CS makes the following recommendations:

> Undertake a supplementary assessment of the identified asbestos risks, in order to delineate the lateral and vertical extent of the identified asbestos at TP21;

> A remedial action plan (RAP) should be prepared to include, but not limited to:

  - Remediation methodology;
  - an unexpected find protocol (UFP) for potential unidentified asbestos contamination or additional contamination found during earthworks;
  - supplementary validation of building footprints post-demolition;
  - validation inspections of footprints of locations which were identified as an aesthetic risk; and
  - Import protocol which will validate material to be imported and guide material tracking.

> A site validation report (SVR) should be prepared at the completion of all management / remedial works, confirming that the site has been made suitable for the proposed land use scenario.

# 16 References

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