Muscat Developments

Remedial Action Plan:
Proposed Depots
285 Finns Road, Menangle, NSW

P1806774JR14V04
September 2021

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All enquiries regarding this project are to be directed to the Project Manager.

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General Abbreviations

AASS	Actual acid sulfate soil
ABC	Ambient background concentrations
ACM	Asbestos containing material
AEC	Area of environmental concern
AF	Asbestos fines
AMP	Asbestos Management Plan
ANZECC	Australia and New Zealand Environment Conservation Council
ANZG	Australian and New Zealand Governments
ASC NEPM	National Environmental Protection (Assessment of Site Contamination) Measure (2013)
ASS	Acid sulfate soil
ASSMAC	Acid Sulfate Soils Management Advisory Committee
AST	Above ground storage tank
BGL	Below ground level
BH	Borehole
BTEXN	Benzene, toluene, ethylbenzene, xylene, naphthalene
CEMP	Construction Environmental Management Plan
COC	Chain of custody
COPC	Contaminants of potential concern
DA	Development application
DBT	Dibutyltin
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DNAPL	Dense non aqueous phase liquid
DP	Deposited Plan
DPI	NSW Department of Primary Industry
DPIW	NSW Department of Primary Industry – Water
DQI	Data quality indicators
DQO	Data quality objectives
DSI	Detailed Site Investigation
EAC	Ecological assessment criteria
EIL	Ecological investigation level
EMP	Environmental Management Plan
EPA	NSW Environmental Protection Authority
EQL	Estimated quantitation limit (Interchangeable with PQL and LOR)
ESA	Environmental Site Assessment
ESL	Ecological screening level
FA	Fibrous asbestos
GG	Ground gas
GIL	Groundwater investigation level
HIL	Health investigation level
HM	Heavy metals
HSL	Health screening level
IA	Investigation area
ISQG	Interim Sediment Quality Guideline
LGA	Local government area
LNAPL	Light non aqueous phase liquid
LOR	Limit of reporting (Interchangeable with EQL and PQL)
MA	Martens & Associates Pty Ltd
mAHD	Metres, Australian Height Datum
mbgl	Metres below ground level
MBT	Monobutyltin
MNA	Monitored natural attenuation
MPE	Multi phase extraction
NAPL	Non aqueous phase liquid
NATA	National Association of Testing Authorities
ND	No data
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
OCP	Organochloride pesticides
OEH	NSW Office of Environment and Heritage
OPP	Organophosphorus pesticides
PACM	Potential asbestos containing material
PAH	Polycyclic aromatic hydrocarbons
PASS	Potential acid sulfate soil
PCB	Polychlorinated biphenyl
PCEMP	Post Construction Environmental Management Plan
PESA	Preliminary Environmental Site Assessment
PFAS	Per- and polyfluoroalkyl substances
PID	Photoionisation detector
ppb	Parts per billion
ppm	Parts per million
PQL	Practical quantitative limit (Interchangeable with EQL and LOR)
PSI	Preliminary Site Investigation
QA/QC	Quality assurance / quality control
RAC	Remediation acceptance criteria
RAP	Remedial Action Plan
HHRA	Human Health Risk Assessment
RPD	Relative percentage difference
SAC	Site acceptance criteria
SAQP	Sampling and Analysis Quality Plan
SEPP	State Environmental Planning Policy
SIL	Soil investigation level
SOP	Standard operating procedure
SWL	Standing water level
SWMS	Safe Work Method Statement
TB	Trip blank
TBT	Tributyl tin
TCLP	Toxicity characteristics leaching procedure
TEQ	Toxic equivalency factor
TP	Test pit
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
TS	Trip spike
UCL	Upper confidence limit
UPSS	Underground petroleum storage system
UST	Underground storage tank
VHC	Volatile halogenated compounds
VOC	Volatile organic compounds
WHS	Work health and safety
WHSP	Work Health and Safety Plan

1 Introduction

1.1 Overview and Background

This remedial action plan (**RAP**) has been prepared by Martens and Associates Pty Ltd (**MA**) for Muscat Developments (the **Client**) to detail necessary remediation to make the site suitable for the intended land use the subject of development application 2019.688.1 (**DA**) to the Wollondilly Shire Council (**Council**) for construction of a depot at 285 Finns Road, Menangle (the **Site**).

The proposed depot development is understood to involve: construction of an office building and two new sheds; cut and fill in various locations; filling of two dams; and construction of hardstand and other site infrastructure. The proposed development is current the subject of a Class 1 appeal in the NSW Land and Environment Court - LEC proceedings number 2020/00178157 (the **Proceedings**).

In August 2020, MA prepared a Preliminary Site Investigation (**PSI**) report for the Site to inform the assessment of the development application by Council. A detailed review of the PSI is provided in Section 3.1. At the time of completing the PSI minor site filling works had commenced in the general vicinity of the two dams to be filled under the application. This fill material was supported by waste classification documentation, classifying the imported material as virgin excavated natural material (**VENM**) and excavated natural material (**ENM**). This documentation was reviewed as part of the PSI works.

The PSI concluded that, the combination of the proposed site development works' extensive hardstand areas and subject to the preparation and implementation of an Asbestos Management Plan (**AMP**) and an unexpected finds protocol (**UFP**), identified land contamination risks would be appropriately mitigated and managed during both the construction phase and operation phase of the proposed development.

On October 19, 2020 Council, the consent authority for the application, provided advice (**Council Advice**) via their legal representatives that the PSI provided together with proposed consent conditions:

> 'satisfactorily address the Council's outstanding contamination concerns'.

This advice is interpreted as a statement of satisfaction of Clause 7 of State Environment Planning Policy 55 (**SEPP 55**).

Subsequent to the issue of the Council Advice further fill material was imported to Site. Council advised that, due to this import of material, they were no longer satisfied regarding contamination. This advice was taken as a requirement under clause 7(3) to carry out and report on a detailed investigation of this 'new imported fill'. Subsequent to that advice a phased investigation of the site has been undertaken to identify and assess the significance of site contamination.

The site investigations works completed are summarised in the further DSI (**FDSI**) (MA, 2021c) report. That report documents all investigations undertaken on the site to assess the site contamination including those previously reported in the DSI (MA, 2021a) and SDSI (MA, 2021b) reports together with those investigation and assessment work completed since the SDSI. A summary of the FDSI is provided in Section 3.2.

The FDSI concluded that the Site was contaminated by both asbestos containing material (**ACM**) within fill material and hazardous ground gases (**GG**) as a result of the historical burial of waste material most likely in association with the past poultry farm uses. Site remediation was therefore required to make the Site suitable for the intended use.

This version of the RAP (V4) has been updated to address the completed site investigations works as described in the further DSI (**FDSI**) (MA, 2021c) and to describe the remedial works required to manage potential risk to future human receptors during both the construction and future use of the Site. Implementation of this RAP shall make the Site suitable for the proposed development purpose. By imposition of conditions requiring the implementation of the recommendations of this RAP, the consent authority may be satisfied that the Site shall be made suitable prior to the proposed use as required by SEPP 55 clause 7(3).

1.2 Site Auditor Appointment

NSW EPA accredited site auditor Mr Rod Harwood (the 'Auditor') from Harwood Environmental Consultants (**HEC**) has been engaged by the Client to prepare a non statutory site audit statement (**SAS**) and associated report (**SAR**) for the site.

It is proposed that conditions of consent be imposed on the development's approval to the effect that:

Condition 1:

> Prior to the issue of a Construction Certificate, a Section B site audit statement (SAS), completed by a NSW EPA accredited site auditor in accordance with the Contaminated Land Management Act 1997, is to be submitted to council and the EPA. The SAS is to state

that the site is able to be made suitable for the intended purpose of the approval.

Condition 2:

Prior to the issue of an Occupation Certificate, a Section A2 site audit statement (SAS), completed by a NSW EPA accredited site auditor in accordance with the Contaminated Land Management Act 1997, is to be submitted to council and the EPA. The SAS is to state that the site is suitable for the intended purpose of the approval.

1.3 Reference Guidelines

This RAP has been prepared in general accordance with the following:

- NSW Department of Urban Affairs and Planning and NSW Environment Protection Authority (1998) Managing Land Contamination – Planning Guidelines SEPP 55 – Remediation of Land.
- NEPC (1999, amended 2013) National Environmental Protection (Assessment of Site Contamination) Measure. Referred to as ASC NEPM (2013).
- NSW EPA (2017) 3rd Ed. Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme.
- NSW EPA (1995) Sampling Design Guidelines.
- NSW EPA (2020a) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.
- NSW EPA (2020b) Assessment and Management of Hazardous Ground Gases.
- NSW Work Health and Safety Regulation (2017).
- SafeWork NSW – Applicant Guide for Asbestos Licences and Notifications (2019).
- SafeWork NSW Code of Practice: How to Safely Remove Asbestos (2019).
- State Environmental Planning Policy 55 – Remediation of Land (SEPP 55).

1.4 Objectives and Scope of the RAP

The objectives for this RAP are:

- Setting remediation goals and criteria.
- Defining the extent of areas requiring remediation.
- Reviewing possible remediation options.
- Providing rationale for the preferred remedial option.
- Providing a remediation plan to implement and validate the preferred remediation option.
- Providing a site management plan for the remediation.
- Outlining contingency plans to protect the surrounding environment and community during remediation.
- Outlining regulatory compliance requirements.

2 Site Background Information

2.1 Location and Setting

Site information is summarised in Table 1. The Site and surrounds are shown in Attachment A.

Table 1: Site background information.

Item	Description / Detail
Site address	285 Finns Road, Menangle, NSW
Legal Identifier	part Lot 1 DP718840 (investigation area (IA) excludes residential dwelling and associated 'residential use' areas of the site)
Surveyed / Approximate area	Entire site: 4.385 ha (ChadwickCheng, 2021). Investigation Area: 4.032 ha (QGIS).
Local Government Area	Wollondilly Shire Council
Current zoning and land use	Zoned RU2 – Rural Landscape (NSW Planning Portal). The Site is currently approved for use as a poultry farm. The 'residential area' of the site has a single dwelling and associated residential uses (open space).
Proposed land use	Use as a depot.
Site description	The Site is currently approved for use as a poultry farm. There are four large sheds with associated access roads. A residential dwelling is located in the north eastern corner, this is located in the residential area not included in the DA, not considered in the FDSI and not addressed by this RAP. Three farm dams are located along the western boundary of the Site.
Surrounding land uses	Site is bordered by Finns Road to the northeast and rural properties to the north, south and west.
Topography	Gently sloping lands with a northern aspect of approximately 5%. Elevations range from approximately 117.7 mAHD in the Site's southern corner to approximately 99.5 mAHD in the Site's eastern corner – based on LIDAR data of the area.
Expected geology	The Wollongong – Port Hacking *1:100,000 Geological Sheet 9130* (1985) describes site geology as Bringelly Shale consisting of shale, carbonaceous claystone, laminate, coal in parts. The NSW Environment and Heritage eSPADE website identifies site soils characteristic of the Menangle soil landscape, Red/Brown Kurosols (Red/Brown Podzolic Soils) on upper foot slopes, Brown and Yellow Sodosols (Soloths, Solodic Soils, Yellow Podzolic Soils) on lower foot slopes and near drainage lines.
Surface hydrology	Site drainage is via overland flow discharging to the Finns Road road reserve and into an unnamed tributary of Navigation Creek, which flows into the Nepean River at Camden South.
Nearest surface water body	Navigation Creek (located approximately 700 m to the northeast).

2.2 Proposed Development

The proposed development is described in the development plans and statement of environmental effects. When considering site land contamination the following is considered significant:

1. The proposal shall involve the relocation of significant volumes of fill material present on site. Comparison of the ChadwickCheng survey of May 17, 2021 (40091/D1-MGA94-3d) with the 'existing contours' shown on design earthworks plans (MA PS03-C100) demonstrate the change in levels resulting from recent site filling.

   Comparison of design levels on plans to the survey show that significant amounts (of the order of 19,000 m^3) of the recently placed fill is to be relocated to achieve design site levels. Generally, this shall require excavation from the south east and southern areas of the site and placement of fill in the two dams at the site's south western corner. Areas from which recently placed fill is to be stripped are shown on Map 02 in Attachment A.

2. Should excess material result from the site earthworks that material shall require waste classification and offsite disposal to a site / facility licensed to receive it. Preliminary analysis of civil earthworks volumes conclude that of the order of 9,500 m3 of material shall required waste classification and offsite disposal.

3. Earthworks shall involve the excavation of placed fill from all areas of the site where the existing filled levels are higher than 300 - 500 mm (depending on nature of proposed capping) below the design levels. This is required to permit the construction of hardstand and landscaping layers over any imported fill.

4. Earthworks Cut & Fill Plan (MA PS03-C500) shows the earthworks required for the development against the prefilling surface. Imported fill alters this analysis, although this plan may be read for areas outside of recent filling.

5. Proposed Sheds A and B are to be constructed on area which have been, or are to be filled using the recently imported fill material.

6. Much of the site is to be covered with hardstand either as open air pavement (access driveways, circulation areas and parking), or by new shed foundation slabs. The remainder of the areas to be filled with recently imported material shall comprise batters required to form these hardstand and shed areas.

Proposed development Plans and Site Surveys have been provided in Attachment C.

3 Previous Site Investigations

Site contamination has been assessed in the following documents:

- Martens and Associates Pty Ltd (2020) *Preliminary Site Investigation: Proposed Depot and Transport Depot with Associated Buildings: 285 Finns Road, Menangle, NSW*. Ref. P1806774JR07V01.
- Martens and Associates Pty Ltd (2021a) *Detailed Site Investigation: Proposed Depot and Transport Depot with Associated Buildings: 285 Finns Road, Menangle, NSW*. Ref. P1806774JR18V01.
- Martens and Associates (2021b) Supplementary *Detailed Site Investigation: Proposed Depots and Transport Depot, 285 Finns Road, Menangle*. Ref. P1806774JR16V01.

The DSI and SDSI were previously prepared to document different 'phases' of the site investigations. The FDSI documents all Site contamination investigations and findings including those undertaken as a result of the Applicant's engagement of Mr Rod Harwood of Harwood Environmental Consultants (**HEC**) to undertake a non-statutory audit of the project. Summaries of PSI and FDSI are provided in following sections.

3.1 Preliminary Site Investigation

A PSI (MA, 2020) was completed for the Site which included a review of available historical records and aerial photographs, a review of available NSW EPA contaminated land registers and a detailed walkover of the Site and surrounding lands.

The desktop review found that the Site was cleared land/ paddock until 1969 and the poultry farm and residence were constructed between 1969 and 1990. The Site had remained a poultry farm and residential property until May 2018.

Available records and aerial images indicate that between 2017 and 2018 material was imported to the Site and placed in the two dams located in the southwestern portion of the Site. MA was provided with gate records documenting material importation which reported that between approximately 3,480 and 4,380 tons of material was brought to the Site during this time period. MA were also supplied with VENM and ENM classification documents. On the basis of the review of these it was concluded the imported material presented no contamination risks that would make the Site unsuitable for the intended purpose.

While no subsurface investigation into the material was undertaken during the PSI (nor were MA present during site filling), there was no readily available evidence observed during the site walkover (such as anthropogenic inclusions at the surface) which suggested the imported material either did not match the supplied VENM / ENM documentation or made the Site unsuitable for the purpose.

Other potential contamination sources as a result of past site uses and activities identified in the PSI are summarised as:

- Past shed construction, storage and maintenance could have introduced asbestos (possible construction material), pesticides (pest control) and heavy metals (paints, galvanised metals, pest control). Portions of the poultry shed walls are clad with potential asbestos containing material (**PACM**).

- The lower exterior walls along the perimeter of the two southern larger sheds contained PACM consisting of "super six" fibre cement sheets which extended into the subsurface. The PACM was broken or fractured in many locations and PACM had fallen to the ground surface in some locations. These fragments could be located in the adjacent soils.

- A former diesel AST may have introduced PAHs, heavy metals, BTEXN and TRH to the subsurface. However, staining was not observed on the ground surface.

- A stockpile of burned rubbish, paint cans, aerosol cans and glass bottles observed on the south east side of the dam located near the south west corner of the Site may have contaminated the subsurface with a variety of contaminants of potential concern (**COPC**).

- An approximately 2 m x 2 m x 0.3 m stockpile of broken "super six" PACM was observed in the grassed area near the south west boundary may have introduced PACM into the soil.

- A soil stockpile located approximately 25 m north west of the southernmost large shed with dimensions of approximately 3 m x 2 m x 1.5 m contained soil, brick, plastic, ceramics and PACM fragments.

- There is potential that a previously demolished large shed that was located between the two current southernmost sheds may have contained PACM in a similar configuration and condition to the two large sheds currently present on the south side of the Site. This PACM could potentially still be present in the subsurface.

- Former poultry farm use may have introduced heavy metals or OCP / OPP into the soil.

- Fill material previously and currently present along the southern boundary of the Site, on the north side of the southernmost shed and near the north west corner of the second southernmost large shed has the potential to add contamination including hydrocarbons, heavy metals, pesticides and asbestos.

- The dwelling construction and maintenance have the potential to have introduced contaminants in the form of asbestos (fibrous cement sheets as a construction material), pesticides (pest control) and heavy metals (paints, pest control, use of galvanised materials).

- Past earthworks associated with agricultural activities had the potential to have introduced localised site contamination.

The PSI noted that, based on the proposed development establishing widespread hardstand across much of the site area, there will be no direct pathway between future long term site receptors (i.e. site workers, visitors etc.) and underlying soils.

The PSI made the following recommendations to address potential contamination risks during the construction phase of the proposed development and to manage ACM impacted fill during future site operation as a depot:

1. An **AMP** be prepared to identify and manage asbestos in structures and any fragments resulting from building deterioration or stockpiling of asbestos containing building materials.

2. Prepare and maintain an asbestos register of all ACM to be retained on the Site (i.e. building products etc in existing structures).

3. Undertake asbestos removal works of all asbestos not associated with structures. Removal works shall include any stockpiled asbestos building products, picking of PACM fragments surrounding sheds and removal of any identified asbestos impacted soil / fill material on the Site. The AMP is to include all asbestos related controls required for asbestos removal works.

4. Preparation of an **UFP** for the proposed site earthworks. This protocol shall provide guidance for the management of any encountered PACM in soil material, oils stains or other signs of contamination should they be exposed during the proposed site earthworks.

The PSI concluded that, through the implementation of the above measures, the identified land contamination risks shall be appropriately and adequately mitigated and managed to ensure an acceptable land contamination outcome for the proposed development.

As a result of the PSI and additional recommended conditions of consent Council (the consent authority) were satisfied, as required by Clause 7 (1) of SEPP 55, that the Site was suitable, from a land contamination perspective, for the proposed development. This was evidenced by the Council Advice of October 2020.

3.2 Further Detailed Site Investigation

The FDSI (MA 2021c) comprised a multiphase investigation completed between March and August, 2021. The investigation works address the contamination status of imported fill material and contamination implications of former poultry farm uses including the burial of agricultural waste material in the south of the site and subsequent GG issues.

Initial phases of the works included test pits and investigation of recently imported fill material. Key findings of the imported fill assessment were:

- Bonded ACM fragments were identified and 11 tested by laboratory methods. All were confirmed to contain asbestos.
- 112 samples were tested for AF/FA, in total two had positive identification of AF/FA with one above the adopted site acceptance criteria (**SAC**) of 0.001% w/w.
- Soil samples (fill and natural material) were collected from 29 unique testing locations across the Site. Collected samples were analysed for a wide range of COPC including hydrocarbons (BTEXN, TRH and PAH), pesticides (OCP / OPP), PCBs and heavy metals.
- Initial investigations found all samples were found to be below adopted human health SAC for the proposed industrial land use.
- Two minor benzo(a)pyrene detections exceeded adopted ecological SAC for the proposed industrial land use, however these are not expected to pose a risk to any environmental receptors as material shall be placed beneath capping layers or removed from site.

A number of previously observed contamination sources, including asphalt, waste soil, PACM and burnt refuse stockpiles had been either removed from site prior to detailed site investigations or have been buried by recent filling works. Disposal locations of the materials was unknown at the time of reporting.

Review of historical aerial photography of the site identified former burial trenches in the southern portion of the site, between 2002 and 2017, during the site's operation as a poultry farm.

To investigate former burial trenches; other AECs identified in the PSI; and data gaps identified through Auditor consultation further soil, groundwater and GG investigations were designed and undertaken. Key findings of these work are:

- Further test pitting works identified putrescible material (including eggshells and bones) in former burial trench locations, consistent with waste being from the Site's former operation as a poultry farm.

- Minor elevated PAHs, TRH and formaldehyde in samples collected from the former burial trenches. All results were below SAC and not considered to pose a significant risk to the proposed development.

- One testing location identified elevated zinc concentrations exceeding the adopted SAC, likely attributed to the galvanised metal used in existing shed construction. This exceedance is not expected to pose a risk as no environmental receptors are expected in the proposed development area.

- Additional testing in Site AECs not previously assessed (i.e. site sheds, AST, historical road filling) found all results to be below the adopted SAC, and unlikely to pose a significant risk to future receptors.

- Groundwater was assessed through the installation and development of 10 groundwater wells within the IA.

- Elevated heavy metals were encountered during groundwater investigation works. Widespread elevated heavy metals was considered to be attributed to the site and wider areas long term rural land use, and the DSI concluded that these findings did not pose a significant risk to future site sensitive receptors. It was further concluded that heavy metal levels were not likely to be a significant risk to offsite groundwater receivers.

- Elevated formaldehyde and benzene exceeding SAC was noted in one groundwater sample collected from MW04, in the vicinity of former burial trenches. The FDSI concluded that groundwater encountered at MW04 is a shallow water bearing zone (WBZ) which has no hydraulic connection to a deeper, shale, WBZ encountered in other wells. The elevated contaminants identified at MW04 were not encountered at other installed wells confirming

that contamination is localised to the perched system where water has collected in former burial trenches, and is not impacting on the deeper groundwater system in the underlying shale.

- GG screening on all groundwater monitoring wells, as well as six dedicated GG wells was undertaken to determine if former burial trenches were creating hazardous GG at the site.

- The GG screening assessment identified the presence of elevated (above background) levels of methane and carbon dioxide as well as very depleted levels of oxygen in monitoring wells adjacent to former waste burial trenches. Additional GG wells installed further north from the former burial trench areas also identified elevated, however lower, concentrations of GG.

- In accordance with NSW EPA (2020), GG screening values (**GSV**) and characteristic situations (**CS**) at the site were calculated. CS at the site was found to range from 1 (very low risk) to 2 (low risk) based on concentration and flow (using the highest flow from any recording for CS calculations). Three wells (MW04, MW05 and MW08) contained GG concentrations >20 %v/v (with very low flow rates). In accordance with the guidelines these locations are reclassified as CS3 (moderate risk).

The FDSI concluded that recently placed fill material in the IA is impacted by asbestos and there are GG risks associated with former poultry farm waste burial trenches in the southern portion of the site. It was concluded that these areas require remediation and or management prior to the site being considered suitable for the proposed depot landuse purpose.

4 Remediation Areas

4.1 Updated Conceptual Site Model

The conceptual site model (**CSM**) for this RAP has been developed and refined in light of FDSI (2021c) investigation findings and is outlined in Table 4 and the following sections.

Table 2: Contamination sources and potential receptors.

AEC	Potential for Contamination	COPC
ACM impacted fill	ACM impacted fill material identified at the Site presents an unacceptable risk to human receptors.	Asbestos
Waste burial trenches	Former burial trenches containing agricultural waste are generating elevated concentrations of methane and carbon dioxide, which presents an unacceptable risk to the proposed development and future receptors.	Hazardous GG: methane and carbon dioxide

4.1.1 Potential Exposure Pathways

Primary potential exposure pathways of concern include:

- Inhalation of asbestos fibres from ACM within fill.
- Inhalation of GG.
- Ingress of GG to future development structures and associated explosion risk (methane).

4.1.2 Potential Receptors

In light of the proposed development, future receptors of interest include:

- Future site works involved in the construction of the proposed development.
- Future site users including site works and visitors.
- Future workers undertaking intrusive maintenance works for repair or installation of subsurface utilities.

4.1.3 CSM Discussion

The FDSI (MA, 2021c) confirmed the presence of asbestos (bonded in fragments of fibrous cement sheeting and at one of 112 locations, AF/FA over the adopted SAC) contamination in fill material (both at the surface and at depth) located in the southern half of the Site. Access to exposed soil in this area is, presently, readily available and a potential pathway between sensitive site receptors and identified ACM impacted fill is considered to be complete. Additionally, future earthworks associated with the proposed development, shall require the relocation of considerable volumes of ACM impacted fill and , without mitigation, a complete pathway between identified ACM and future site workers is likely to be completed.

GG (methane and carbon dioxide) have been detected in screening assessment works in wells located in the southern portion of the Site at unacceptable concentrations. GSV and CS were calculated for each monitoring well in accordance with the NSW EPA (2020) *Assessment and Management of Hazardous Ground Gases*, to determine a risk classification for each well location. CS ranged from 1 (very low risk) to 3 based on GG concentration and an adopted conservative flow rate (highest recorded value was used for calculations at all wells. CS3 is only determined at MW04, MW05 and MW08 as these wells have GG concentrations in excess of 20 %v/v.

4.2 Extent of Remediation Required

4.2.1 Fill Material

Investigations and mapping of the extent of fill impacted areas concludes approximately 16, 500 m^2 of the site has fill material likely to be impacted with ACM. The extent of filling was mapped based on aerial photograph interpretation with test pitting to confirm outer limits. Fill across the area shown on Map 02 (Attachment A) as 'Approximate Fill Extent' shall require remediation and management. Remediation works across this area shall vary and are further described in Section 6.4.

4.2.2 Burial Trenches

Elevated methane and carbon dioxide concentrations have been observed in monitoring well located in the southern portion of the Site. Based on the CSM, these gas concentrations are likely to be associated with the waste burial trenches identified to contain agricultural waste (chicken bones and eggshells).

Based on aerial photograph review and onsite investigations, burial trenches are believed to be limited to an area of approximately 1,000 m^2 in the south of the Site, as shown on Map 03 (Attachment A). The

trenches are believed to have been excavated and filled between 2010 and 2017 by a previous site owner, prior to the importation of fill material. From onsite test pit investigations, trenches containing agricultural waste material are expected to be approximately 0.5 – 1.0 m deep, and beneath approximately 2.0 – 2.5 m of overlying fill material.

Based on investigation findings, the lateral extents of the GG impacted area have been assessed and are shown on Map 03 (Attachment A).

5 Remediation Goals, Options and Recommendations

5.1 Remediation Objective and Goals

The objectives / goals of the proposed remediation works are to:

- Address the risk to human health associated with identified contamination at the Site, such that there is no unacceptable risk to human health in light of the proposed site purpose.
- Undertake remedial works in a safe, environmentally sustainable manner that causes minimal disruption to the surrounding sensitive receptors.
- Provide certainty to Council of the adequacy of the remediation plans to make the Site suitable for the purpose for which development consent is sought.

5.2 Assessment of Remedial Options

5.2.1 Assessment of Soil Remedial Options

Soil remediation options were considered with regards to ASC NEPM (2013) preferred hierarchy of options for site cleanup and / or management, namely:

- Cap and contain material in place with an appropriately designed barrier.
- Burial of material in a subsurface cell with appropriately designed capping.
- Removal of contaminated material to an approved facility, followed, where necessary, by replacement with clean material.
- Onsite treatment of soil so the contamination is destroyed or the associated risk is reduced to an acceptable level.
- Leaving imported fill material in place and deferring remediation of contaminated material.

Review of available soil remediation strategies and technologies is considered on the basis of:

- Effectiveness at achieving remediation goals.
- Suitability in light of the proposed development.
- Anticipated costs.
- Ongoing environmental and public health adequacy.

A review of remediation options considered possible at the Site for the remediation of identified ACM impacted fill and GG is presented in Table 3.

Table 3: Review of soil remediation options.

Remediation Options	Advantages	Disadvantages	Comments
Cap in place	o Eliminates offsite disposal costs o Suitable to manage risks associated with asbestos and GG.	o Human health risk is mitigated by capping, but contamination remains onsite. o A long term environmental management plan (**LTEMP**) required to manage the capping solution. o Places constraints on the use of land beneath which fill material is buried. o Will require additional construction requirements.	Capping of the fill material in place eliminates costs and other impacts (traffic, road wear and tear etc) associated with transport and offsite disposal of ACM impacted fill material. Burial of material on site requires ongoing management to ensure the constructed cap is maintained. Presence of entombed material and the extent of entombment requires documentation to ensure future users are aware of the Site constraint. Capping reduces the need for further earthworks therefore reducing risk of exposure to asbestos that may occur during offsite transport and disposal. GG protection measures will be required to manage hazardous GG.
Burial in cell	o Eliminates offsite disposal costs o Allows future use of land within the fill material footprint. o Suitable to manage risks associated with asbestos and GG.	o Human health risk is mitigated by capping, but contamination remains onsite. o A LTEMP required to manage the capping solution. o Places constraints on the use of land beneath which fill material is buried. o Require additional earthworks and over excavation to facilitate capping layer beneath design levels.	Burial of contaminated material in an underground containment cell offers similar advantages to capping material in place. This method is considered less practical as it would require considerable additional earthworks and site disturbance but would achieve no greater level of environmental or human health risk protection. The works would disturb a greater volume of ACM impacted soils than 'cap in place' therefore increasing potential risks to contractors and surrounding sensitive receptors during the construction phase without achieving a materially improve final site outcome. Similarly to capping in place, construction of GG collection systems beneath permanent hardstand and off gassing vents will be required to manage build up of hazardous GG.

Remediation Options	Advantages	Disadvantages	Comments
Offsite disposal	○ Removes long term site management requirements. ○ Will remove contamination source. ○ Suitable to manage risks associated with asbestos and GG (by removing GG source material).	○ Construction phase impacts (traffic, road wear and tear etc) works. ○ Cost of disposal of ACM impacted fill material. ○ Use of offsite landfill capacity.	This technique for managing onsite contamination removes identified contamination and associated risk to humans and environment. However, as material in the fill material has been assessed as asbestos waste, the cost of removal and disposal of the material is considered prohibitive. Offsite disposal would require the disturbance of large amounts of ACM impacted material which increases potential risk to contractors and surrounding sensitive receptors. Removal of burial trench material may be suitable to remove the source of GG generation. Offsite disposal would also result in a substantial truck movements for off site removal of material and corresponding movements for the delivery of new fill for the proposed site development.
Onsite remediation	○ Eliminates offsite disposal costs. ○ Removes long term management requirements.	○ ACM remediation would be by manual sorting and picking of fill. The clay character of the fill and the large volume of material make this a difficult process. ○ Considerable space is required for processing and ACM impacted material will be moved multiple time around the Site increasing construction phase impacts (noise etc) and risks (dust etc). ○ Waste material which is the source of GG may be remediated on site by excavation and 'landfarming' to achieve the aerobic decomposition of the waste material.	Onsite remediation of contaminated soil is considered feasible but is likely to be time consuming due to the clay nature of the fill. A portion of the fill material would not be able to be remediated on site (due to presence of AF/FA or due to repeated failures of validation for bonded ACM) and would require off site disposal or site capping. Onsite remediation is considered less preferable than the onsite burial of the ACM impacted material due to likely time and residual unremediated material issues. Onsite remediation of waste material may be possible. The process of onsite landfarming may generate odours and may require considerable time depending on the final character of the buried waste material.
Do nothing / Defer remediation	○ Eliminates all remediation costs and associated impacts.	○ Does not meet remediation objectives and site remains unsuitable for the intended purpose.	This option is unacceptable as it does not make the Site suitable for the purpose of the development application.

5.3 Preferred Soil Remediation Option

5.3.1 Fill Material

Considering soil remediation options presented in Table 3 and the proposed development, the preferred remediation option for identified ACM impacted fill material is to cap the material on site. As some ACM impacted fill material has been placed onsite in areas outside of proposed filling described in the development, and at levels in excess of those required to achieve a cap then proposed design levels, the excavation and replacement of some of the previously imported fill material shall be required. This remediation option is most consistent with the proposed development and the extensive hardstand areas proposed.

Whilst this remediation option shall place ongoing management obligations on the Site, it shall best mitigate environmental and public health risks. Options requiring the export of the material from Site are considered significantly less preferable due to the potential for impacts on other local road users and additional wear and tear on local roads as well as the need to import 'replacement' material for the purposes of the proposed development. Offsite disposal of all of the fill material shall also necessitate the disturbance of a far greater volume of ACM impacted fill with the associated increase is risk of exposure of site workers to ACM.

Suitable options for capping layer to separate the ACM impacted fill from end users have been developed to respond to each of the final surface uses / treatments proposed under the application as follows:

1. Structural concrete ground slabs for sheds.

2. Hardstand – this may be constructed as a rigid (i.e. concrete) or flexible sealed or unsealed 'pavement'. The hardstand is to comprise, as a minimum: (1) a high visibility marker layer (geotextile layer) over ACM impacted fill; and (2) pavement layers.

   Where a rigid concrete pavement is proposed the thickness is to be determined by the structural / pavement engineer's design.

   Where a flexible pavement is proposed it shall comprise a minimum 300 mm total thickness of pavement materials such as sandstone, road base and wearing course (e.g. chip seal / asphalt) materials. Development plans show an unsealed flexible pavement.

3. Landscape layer – this is to comprise, as a minimum, (1) a high visibility marker layer (geotextile layer) over ACM impacted fill; and (2) minimum of 500 mm of clean material for the establishment of site vegetation. Only shallow rooted vegetation is to be used in these areas.

The approximate extent of the proposed hardstand, structural slab and landscape capping layers are shown on Map 04 (Attachment A). In determining the mapped extent, it has been assumed that a 500 mm capping layer is required beneath the landscape and hardstand areas. Where a reduced capping layer is required (300 mm hardstand) the extent of the capping may extend to the south west. It shall however not exceed the DA approved earthworks extent as shown on Map 02.

5.3.2 Burial Trenches

Similar to ACM impacted fill, the preferred management / remediation options for GG arising for the waste burial trenches will be onsite management.

The proposed development in the remediation area is primarily open hardstand for vehicle parking and circulation. The GG guideline does not provide construction guidance for this type of development as it does not present a GG accumulation risk. The identified risk in this area is that the proposed filling and hardstand construction may result in the redirection of GG towards other sensitive receivers (neighbours, existing and proposed sheds and buried services). The proposed remediation works are therefore aimed to provide for the controlled venting of any generated GG and to prevent migration of GG to sheds or service conduits.

To manage GG risks associated with the hardstand use MA recommend the following be installed:

1. A GG cutoff trenches be constructed along the southern edge of the proposed site hardstand. The cutoff trench is to be extended to a depth of 2 m below the prefilling surface as shown on MA PS03-C100 by 'Existing Contours'. The trench is to be as shown in PS11-J100. Vent points are to be provided at intervals along the trench to permit the passive release of GG. Preliminary vent spacing of 50 m is shown on plans.

   This trench is provided to allow for the interception of any GG which may be directed south as a result of the hardstand capping. Its purpose is to prevent the off site migration of GG to the property to the south and to allow for the controlled venting of any accumulated GG.

2. A GG collection system is to be constructed within the retaining wall backfill along the southern side of Road 2 to the south of Existing Shed 4. This trench is to be extended to a depth 1 m below the 'Existing Contour' levels shown on MA PS03-C100. The trench is to be as shown in PS11-J100. Vent points are to be provided at intervals along the trench to permit the passive release of GG. Preliminary vent spacing of 50 m is shown on plans.

   This trench is provided to allow for the interception of any GG which may be directed north as a result of the hardstand capping. Its purpose is to prevent the uncontrolled venting of GG through the retaining wall and to stop the migration of GG towards Shed 4.

3. A ground gas barrier / venting system along the stormwater drainage lines running south and east from Shed B. These measures are provided to prevent the accumulation of gas in these services. Venting of the stormwater line to the south of Shed 4 may use the same vent structures as GG trench along the retaining wall described at (2) above. Similar service trench GG venting is to be provided for any other service trench across the hardstand area to the south of (or between) Shed 4 and Shed B.

Characterisation of the extent of GG contamination is described in the FDSI (MA 2021c). Elevated methane concentrations (i.e. >20% v/v) indicate that gas protection measures for a site with a CS value of 3, as outlined in NSW EPA (2020b), will be required for structures in the remediation area. Shed B is to be constructed on as yet not placed fill material. However, this structure is potentially 'at risk' should GG migration not occur as expected. Therefore, it is proposed that mitigation measures be provided for Shed B assuming CS3 based on the highest recorded GG levels in the investigation area.

In accordance with NSW EPA (2020), the structure will require 2 points of gas protection. MA recommend the following mitigation measures be included in the shed's detailed constructed to meet the minimum requirements:

1. Construction of a passive, under slab GG collection and venting system beneath the shed slab (1.5 points of gas protection).

2. Construction of a reinforced concrete ground bearing floor slab (0.5 points of gas protection).

An office proposed for the south west corner of the hardstand is to be constructed as a piered structure with an air gap between the hardstand

and the office. This construction detail shall provide adequate GG protection for all situations up to and including CS3.

The general location of these measures is shown on Map 04 (Attachment A) and PS11-J100, Attachment B.

5.4 Long Term Management

Long term site management will include the preparation of a **LTEMP**, which is to be approved by the appointed site Auditor and Council. The LTEMP is to detail:

- The presence and location of capped ACM impacted material and mapped burial trenches as described in the SDSI.
- Monitoring requirements for GG.
- Maintenance requirement for the constructed capping material and / or GG management infrastructure.
- Procedures for any future required works beneath the capping layer or GG protection measures (e.g. future services installation).

The LTEMP is to be legally enforceable, and is to be noted on the Section 10.7 certificate for the property.

6 Remediation Plan

The following sections outline the works required to remediate identified contamination such that the Site is made suitable for the proposed development purpose.

Unless otherwise identified, activities discussed below will be the responsibility of the contractor or its representative.

6.1 Stage 1 – Notifications and Site Preliminaries

Remediation works required by the RAP form part of the present application and therefore shall be approved subject to development consent conditions imposed on the DA.

The following notifications shall be required for any remediation of ACM:

- Notification to SafeWork NSW will be required to advise the presence of asbestos contamination.

6.2 Stage 2 – Appointment of Remediation Contractor / Environmental Consultant / Surveyor

For remediation works to be successfully completed, the appointment of a suitability qualified environmental consultant, a licensed asbestos removal contractor, and a suitably licensed earthworks contractor is required.

6.2.1 Licensed Asbestos Removal Contractor

All site remediation works are to be completed by a suitably licensed asbestos removal contractor (**LARC**). Due to the positive detection of AF/FA in soil samples, a 'Class A' LARC will be required to conduct remediation works involving asbestos impacted soils.

The LARC will be required to prepare an asbestos removal control plan (**ARCP**) which along with this RAP will require submission to SafeWork NSW.

6.2.2 *Environmental Consultant*

The environmental consultant should be engaged to:

- Supervise all remediation and validation works.
- Confirm the suitability of any capping material used in the remediation process.
- Monitor the placement of capping layer material.
- Document all stages of the placement of the capping material over the contaminated material.
- Perform validation inspections and testing of remediation areas.
- Prepare a validation report documenting remediation and validation reports, and confirming final site status.
- Undertake necessary reporting to inform the appointed site auditor to achieve the preparation of a Section B SAS prior to construction certificate and a Section A2 SAS prior to issue of occupation certificate.

6.2.2.1 *Surveyor*

The registered surveyor should be engaged to:

- Undertake a survey of the upper surface of the buried ACM impacted fill material after the placement of the geotextile marker layer.
- Undertake a survey of the upper surface of the capping layer.
- Undertake a survey of GG mitigation measures.

6.3 Stage 3 – Site Establishment

Prior to any remediation works, the Site shall be prepared for the works. This will include:

- Establishment of site offices, work sheds and amenities for site workers.
- Establishment of appropriate decontamination facilities for personnel, vehicles, and plant / equipment.
- Appropriate physical barriers and site signage are to be erected surrounding site areas requiring remediation.

- Installation of appropriate air monitoring and air quality control measures as required by the SafeWork approved plan.

- Establishment of site holding areas for contaminated material. Any site area outside of otherwise contaminated areas which are nominated for storage of contaminated material are to be lined with a high density polyethylene liner or placed on hardstand, and are to have appropriate environmental controls in place including storm water diversion, erosion and sedimentation controls and dust suppression.

The appointed LARC (as the principal contractor) will be responsible for managing the induction process for all site personnel. The induction should include identification of all site asbestos and the relevant site controls in place to manage associated risks during remediation works.

6.4 Stage 4 – ACM Remediation Work

The general sequence for the proposed remediation program shall be:

1. Relocation of fill material to levels and locations which allow for the formation of the required capping layers beneath the proposed site design levels. These works shall regrade the site to a 'precap' surface in all areas where ACM impacted fill is to be retained and capped. This surface is defined as the surface sufficiently lowered from the design site levels as shown on MA PS03 - C100 to allow for the construction of the capping layer.

   In areas where current level of fill (as shown on the ChadwickCheng survey) exceeds the required levels for the precap surface fill material shall be excavated and used elsewhere on site to achieve the precap surface levels.

2. Where fill material has been placed on Site in areas where the DA does not seek consent for filling this material is to be relocated to locations where filling is included in the development application.

   Proposed cap extent is shown on Map 05 with cap type shown on Map 05 (Attachment A), this shows areas where, after initial earthworks, ACM impacted fill shall remain on Site for capping.

3. Where excess ACM impacted fill material remains after the formation of the precap surface that material is to be waste classified and removed from site to an appropriately licensed / approved location subject to the waste classification.

4. The precap surface of the remediation area is to undergo an emu pick by the remediation contractor to remove all surface ACM. A surface clearance certificate is to be prepared confirming the

surface of the remediation area to be free of ACM.

5. A high visibility marker layer (such as a geotextile fabric) is to be placed over the fill material prior to the establishment of the capping layer (hardstand, building slab or landscaping material).

6. A survey by a registered surveyor is to be completed of the top surface of the marker layer, prior to the commencement of capping material placement. Survey to be to mAHD and of sufficient detail to allow full characterisation of the surface adequate for the locating of the buried material and assessment of the thickness of the placed capping layer.

7. Establishment of capping layers across the entire remediation area.

8. Following placement of the capping layer, a site survey is to be completed to confirm the thickness of the capping layer. Survey is to be to mAHD and of sufficient detail to allow full characterisation of the surface adequate for the assessment of the thickness of the placed capping layer.

6.5 Stage 5 – Ground Gas Management

6.5.1 Ground Gas Mitigation Measures

Works associated with the installation of the gas protection system will be subject to the requirements of the final development layout and to detailed design and site auditor review and approval prior to the issues of Section B SAS (prior to construction certificate).

As noted in Section 5.3.2 suitable protection measures would include:

1. Installation of a GG cut off trench along the southern edge of the hardstand area to allow for the controlled venting of GG and prevent off site migration. Where buried waste material is identified to the south of this structure that buried material shall be excavated, waste classified and removed from site as required.

2. Installation of a GG cut off trench along the retaining wall immediately south of Shed 4 to prevent the uncontrol GG off gassing at the retaining wall and to prevent migration of GG to Shed 4.

3. Installation of GG venting systems within drainage and other service trenches to prevent GG accumulation and potential migration to site sheds.

4. Construction of a passive, under slab GG collection and venting system beneath proposed new on ground buildings.

5. Survey, by registered surveyor, of the extent of all constructed gas management infrastructure.

Extent and general arrangement of required GG management infrastructure are shown on PS11-J100 in Attachment B.

6.6 Stage 6 – Site Validation

Prior to the Site being certified as suitable for the proposed land use purpose, a validation report documenting the completed remediation works must be prepared by the appointed site environmental consultant. It is recommended that the Site validation report be required to be issue to the appointed site auditor and a Section A2 SAS be provided to the applicant, Council and the EPA prior to issue of the first Site occupation certificate. This ensures that, prior to the commencement of the purpose, the Site shall be made suitable for that purpose in accordance with clause 7(1)(c) of SEPP 55.

The following sections outline Site validation requirements.

6.6.1 Data Quality Objectives

The data quality objective (**DQO**) process is required to define the type, quantity and quality of data needed to support decisions relating to the environmental condition of the Site. Table 4 outlines the process used to develop the DQO for the Site post remediation and were developed with reference to NSW EPA (2017) and ASC NEPM (2013).

Table 4: Data quality objectives for the assessment of soil.

Step 1 **Stating the Problem**	Previous site investigations have identified ACM in fill material which present a risk to future site receptors. Elevated GG (methane and carbon dioxide) have also been identified during investigation works targeting former agricultural waste burial trenches in the southern portion of the Site. Remediation of ACM impacted material and management of hazardous gases is required before the Site can be made suitable for intended land use purpose.
Step 2 **Identifying the Decision(s)**	To assess the suitability of the Site for future land use, decisions are to be made based on the remediation removing the identified risk to future site users. o Has the completed remediation works adequately mitigated the identified risk to future site users? o Is the proposed capping material appropriate for use in managing identified risk to sensitive receptors? o Is long term management of the Site required?
Step 3 **Identification of Inputs to the Decision**	The inputs to the validation of the Site will include: o Existing assessment data. o Observations and records of remediation activities.

	o Survey of top of ACM material and top of capping layer where placed. o Validation gas monitoring results.
Step 4 **Study Boundary Definitions**	Study boundaries are as follows: o Lateral – Lateral boundary of the assessment is defined by the remediation area extents or the final extent of buried ACM material and / or burial trenches. o Vertical – Vertical boundary will be governed by the maximum depth of placed contaminated material (expected to be approximately 3.7 m BGL). o Temporal – Date of site inspections, remediation and validation works.
Step 5 **Development of Decision Rules**	The decision rules for this remediation area are as follows: o If the fill material surface is visually free of ACM, and the fill material is covered by a marker layer and capping layer in accordance with this RAP, then the fill material area can be validated as adequately remediated. o If hazardous GG are no longer being generated at an unacceptable level, or gases have been appropriately collected and released in a safe manner, the Site may be validated as adequately remediated. o If any material nominated for offsite disposal, it shall be classified in accordance with NSW EPA (2014) Waste Classification Guidelines. o Material tracking is to be appropriately documented and waste disposal records showing disposal to appropriately licenced landfill shall be presented in the validation report.
Step 6 **Specification of Limits on Decision Errors**	Errors in survey data are to be specified by the registered surveyor preparing the survey and are to be considered in the assessment of the depth of the placed capping layers. For interpretation of and laboratory data, guidance found in ASC NEPM (2013) Schedule B2 regarding 95% upper confidence limit (**UCL**) may be applied. Schedule B2 states that the 95% UCL of the arithmetic mean provides a 95% confidence level that the true population mean will be less than or equal to this value. Therefore, a decision can be made based on a probability that 95% of the data collected will satisfy the site acceptance criteria. A limit on decision error will be 5% that a conclusive statement may be incorrect. In applying the statistical analysis of the data: o No individual sample results have a concentration that exceeds 250% of the SAC. o The standard deviation of the sampled population should not exceed 50% of the SAC.
Step 7 **Optimisation of Sampling Design**	Validation based on the remediation option, to ensure that all the necessary data is collected to confirm site suitability the proposed land use.

6.6.2 *Fill Relocation Validation*

Areas of the site where ACM impacted fill has been placed which are outside of the proposed capping area (see Map 02 in Attachment A) will require relocation either on site beneath future capping or offsite. These areas are to be validated after relocation of ACM impacted fill material. Areas are to be validated by visual inspection confirming that all previously placed fill material has been removed and no remaining ACM material is present.

Comparison of stripped surface levels against 'existing surface levels' as shown in project plan PS03 – C100 may be used as a guide for the required level for stripping of recently place ACM impacted fill material. Final validation of the ACM impacted fill material's removal is to be achieved through shallow test pitting to a depth of not less than 500 mm. Test pits are to be completed at a density determined by Table A of NSW EPA (1995) guidelines to validate that all recently placed fill material has been relocated.

For the purposes of this validation a visual presence absence clean up criteria is to be applied. Where recent ACM impacted fill material remains further remedial work (fill relocation) is to be undertaken.

6.6.3 ACM Capping Layer Validation

6.6.3.1 Hardstand / Structural Slab Capping Layer

Remediation areas where hardstand or structural slab is proposed as part of the development are outlined in Map 04 in Attachment A. The hardstand / slab in these areas is to be constructed in accordance with the relevant engineering design requirements. Building slab and any rigid hardstand (i.e. concrete) are to be designed by structural / pavement engineer. Flexible pavement capping layers are to be designed by geotechnical / pavement engineer and to be constructed with a minimum total thickness over buried ACM impacted material of 300 mm.

Capping layer verification is to be provided by the environmental consultant once an as built survey of the marker layer and the capping layer has been prepared by a register surveyor and the environmental consultant is satisfied that it demonstrates a capping layer in accordance with this RAP.

Copies of the surveys and a comparison of the two surfaces is to be included in the validation report and long term management plan.

6.6.3.2 Soil Capping Layer

All non hardstand areas within the remediation area outlined in Map 04 in Attachment A are to be capped with a landscaping layer. The construction of the non hardstand capping layer is to be supervised by the appointed environmental consultant. The capping layer is to consist of VENM, ENM or other waste exempt (for the purposes of landscaping) material and be a minimum of 0.5 m thick.

The non hardstand capping layer is to be visually confirmed by the environmental consultant along with the thickness confirmed through pre and post survey data.

6.6.3.3 *Validation Test Failure*

Where placed capping thickness is less than the specified minimum thickness additional capping material is to be placed and the surface resurveyed. This process is to continue until a cap of compliant with the relevant minimum thickness and the approved design levels is validated.

6.6.4 *Ground Gas Protection System Validation*

Validation requirements for the GG protection system will include the following:

- Inspections at relevant hold points (to be confirmed at detailed design) but to include: (1) excavation of cut off trench; (2) placement of gas collection infrastructure; and (3) completion of venting system.
- Review of data collected during detailed design phase and during construction phase inspections.
- Surface methane monitoring to be completed following passive sub slab ventilation system. As outlined in NSW EPA (2020b) Ground Gas Guidelines, steady state methane concentration over 100% of the ventilation layer <1% v/v at a wind speed of 0.3 m/s to be considered a 'very good performance'.

6.6.5 *Imported Fill Protocol*

Where any fill is imported to the Site during remediation or for further earthworks, the fill is to be documented and verified as VENM, ENM or other waste exempt material suitable for the intended purpose. Waste classification documentation is to be provided and reviewed by the appointed environmental consultant prior to material importation.

Prior to import, the fill material is to be inspected at the source and sampled at a rate of 1 sample per 100 m^3 of material. Material is to be tested for heavy metals, BTEXN, TRH, PAH, OC and OP pesticides, PCBs and asbestos. Where the material is classified as ENM, it is also to be tested for pH, EC and foreign materials.

All imported material is to be tracked and inspected by the environmental consultant during any importation works to verify it as being consistent with the provided waste classification certificates.

6.6.6 *Validation Reporting*

A site validation report is to be prepared by the environmental consultant at the completion of remediation works. This report shall document the remediation and validation sequence, detail the results of the

assessment, provide waste classification and material tracking data for any material taken from the Site (if required) and document any imported material (and testing or supporting documentation).

The document shall include a Site survey showing boundaries and extent of buried ACM and as built details of gas protection measures. It shall identify residual risks posed by remaining contaminants, and provide comment on whether remediation has been successful and conclusions regarding the suitability of the Site for the proposed depot land use purpose.

7 Additional Site Characterisation

7.1 Overview

To better characterise site soils, groundwater and ground gas at the site, additional investigations are recommended. Additional investigations are not intended to change the adopted remedial strategy, and are to be undertaken to better characterise identified contamination risks.

Following completion of additional characterisation works, and subject to the instruction and advice of the site auditor, an addendum to this RAP may be prepared to detail any amended to the remediation solution if it is considered sufficiently significant. However, remedial strategies outlined in this RAP are considered suitably conservative and generally appropriate to manage all site contamination risks, and to make site suitable for the intended landuse purpose.

7.2 Additional Soil Characterisation

Per and poly fluoroalkyl substances (PFAS) in groundwater was assessed as part of FDSI (MA, 2021) investigations. As part of the assessment, PFAS above laboratory detection levels were detected in two groundwater monitoring wells, however results were below adopted SAC, and not considered to pose a risk or require management and / or remediation.

While no management or remediation of PFAS is recommended at this stage, it is recommended that, to better understand potential sources of PFAS detections in groundwater, additional near surface soil samples be collected from inside former poultry sheds. The following additional works are recommended:

1. Collection of a minimum of one near surface soil sample from each existing shed at the site which was formerly used as a poultry shed.

2. Analysis of the collected sample for PFAS.

7.3 Additional Ground Gas Characterisation

To inform the detailed design of the GG measures further characterisation of GG should be undertaken in consultation with the site auditor as follows:

1. A GG specific sampling analytical and quality plan (SAQP) be prepared, which shall detail further monitoring to inform the detailed design and is likely to include additional monitoring events to determine changes in soil gas conditions over time.

2. Document findings of the SAQP guided investigation works in a GG report which analyses GG monitoring findings, reviews soil gas trends and completed further GG risk assessment.

It is recommended that, prior to approval of final GG mitigation measure designs, pilot trials of the proposed GG mitigation measures be undertaken to ensure the suitability of the proposed design to manage site GG risks.

7.4 Additional Groundwater Characterisation

To better characterise site groundwater conditions and migration risks from the site, additional groundwater monitoring is recommended. Further groundwater monitoring should include:

1. Installation of an additional groundwater monitoring well adjacent to the northern site boundary.

2. Completion of an additional groundwater monitoring event, including onsite screening of groundwater quality parameters and collection of groundwater samples from each site monitoring well.

3. Analysis of collected groundwater samples for heavy metals, BTEXN, TRH, PAH, nutrients (ammonia, nitrates, nitrites and phosphorus) and PFAS.

4. Completion of (falling or rising head) slug tests at each monitoring location to assess WBZ permeability.

8 Site Management Plan for Remediation

8.1 Overview

A site specific asbestos removal control plan (**ARCP**) and worker health and safety plan (**WHSP**) are to be prepared by the appointed Contractor prior to the commencement of site works. The following sections are intended as a guide to the information that to be included in these plans.

8.2 Asbestos Removal Control Plan

The ARCP should be developed in consideration of site specific risks and proposed construction works. At a minimum, it should consider the following:

- The location, type and extent of asbestos contamination at the Site.
- Preparation of an asbestos register.
- Site specific asbestos risks and control measures.
- Procedures for the excavation, stockpiling, transport and handling of asbestos containing materials.
- Asbestos monitoring requirements (if any).
- Roles, responsibilities and training requirements.
- Emergency response plan.

8.3 Worker Health and Safety Plan

Based on the Site condition and proposed remediation method, primary environmental hazards requiring management during remedial works may include:

- Soil management.
- Noise and odour controls.
- Air monitoring / dust control.
- GG monitoring.
- Decontamination.
- Erosion and sediment control measures.

Additional onsite management issues that should be included in the WHSP include:

- Site access and security.
- Signage and contact Information.
- Traffic control.
- Hours of operation.
- Imported material.

Suggested requirements for these management points are discussed in the following subsections.

8.3.1 Soil Management

The following should be addressed regarding soil and stockpile management in accordance with Landcom (2004) *Managing Urban Stormwater: Soils and Construction*:

All stockpiles containing soil or material identified as contaminated shall be stored in clearly marked areas with appropriate signage.

Appropriate environmental controls are to be implemented at the site, including storm water diversion, erosion and sedimentation controls and dust suppression.

8.3.2 Noise Control

To mitigate noise impacts which may arise as a result of remedial works, the contractor shall undertake works in accordance with state and local noise regulations. The contractor's machinery, including machinery hired by the contractor, should be in good working order so that abnormal machine noise is avoided.

All works are to be undertaken with the designated working hours in Section 8.3.12.

8.3.3 Odour Control

Based on the identified site contaminants and site location relative to surrounding receptors, odour is not considered to be a significant environmental concern. Should odours be encountered during excavation works, contingency measures including the covering of temporary stockpiles should be implemented.

8.3.4 Air Monitoring

Airborne asbestos fibre monitoring will be undertaken during any excavation, movement or loading out of asbestos impacted soils using static or positional sampling locations to measure the level of airborne asbestos fibres adjacent to the relevant work area.

Air testing will be completed in accordance with *Guidance note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres. 2nd Edition [(NOHSC:3003 (2005)*].

Daily air monitoring reports will be provided to the LARC. The action levels of asbestos air monitoring are outlined below:

- <0.01 fibres per millilitre of air – Continue with control measures.
- Between 0.01 – 0.02 fibres per millilitre of air – Review site control measures and introduce more stringent controls. LARP to advise on improved site controls.
- >0.02 fibres per millilitre of air – Stop works and notify SafeWork NSW. Identify the cause of the elevated concentrations and update site protocols. Changed to site protection measure must be approved by SafeWork prior to recommencing works.

8.3.5 Methane Monitoring

Personal and ambient methane monitoring will be undertaken during all future excavation works where a GG risk may be present (i.e. those prior to capping or future works which interfere with capping). Methane monitoring controls are to be documented in the site CEMP and a dedicated WHS plan for future works, but should include, at a minimum:

1. All workers conducting excavation or hot works are to be equipped with a personal methane LEL meter and PID with appropriate monitoring alarms.
2. All deep (> 1 m) excavations are to be fitted with a methane LEL monitor with appropriate monitoring alarms.
3. Where LEL meter detects methane >4 %v/v, all works are to be ceased immediately and workers to move upwind of the area. The area is to be vented and works not commenced until gas levels have decreased.

8.3.6 *Air Quality / Dust Control*

Dust control procedures are to include:

- Covering of all soil loads entering or exiting the Site.
- Covering of stockpiles on Site as required to mitigate dust generation.
- Use of water sprays across stockpiles and disturbed areas.
- Use of shade cloth along Site boundary fencing where landscape screening is inadequate.
- Ceasing of works if environmental conditions result in visible dust being generated from the Site.

8.3.7 *Erosion and Sediment Control Measures*

Erosion and sediment control measures will be required at the Site in accordance with Landcom (2004). Measures are to be:

- Suitable for the proposed remediation works;
- Assessed, maintained and where necessary repaired throughout the duration of works;
- Appropriate for mitigating topsoil erosion, containing sediment within the Site after works have been completed; and
- Maintained onsite until all surface soils have been stabilised at the premises.

8.3.8 *Site Access and Security*

Prior to works commencing, barricades shall be erected to control access to the designated work area, along the proposed remediation area boundary. Site security and access controls must remain in place during all onsite construction works.

8.3.9 *Signage and Fencing*

The work zone should be secure and signed appropriately as an 'Asbestos Work Zone' (for all areas where ACM impacted material is identified). This includes establishment of a physical barrier and exclusion zone around the work area. These measures must be maintained throughout the duration of the works until an asbestos clearance certificate is issued.

Security fencing and appropriate signage around all open excavations must be installed and maintained by the contractor.

8.3.10 Site Contact

A sign displaying the contact details of the contractor (including the onsite foreman or manager) shall be displayed for the duration of onsite works.

8.3.11 Decontamination

An appropriate 'wet' decontamination area must be set up at the entrance of the Asbestos Work Zone. All site personnel must make their way through the decontamination area prior to leaving the work area.

All tools and equipment used during remediation works must be decontaminated before they are removed from the work area. Tools and equipment which cannot be decontaminated must be dedicated to asbestos remediation works and double bagged in asbestos waste bags before being removed from the work area. Non-disposable personal protective equipment (**PPE**) such as respirators must be inspected and wet wiped prior to removal from the work area.

A plant decontamination areas is also to be established to allow for the decontamination of plan prior to existing a nominated asbestos work area.

Full site decontamination requirements are to be confirmed with the appointed LARC prior to the commencement of remediation works.

8.3.12 Hours of Operation

Onsite works are generally only permitted during the following hours, these may be varied by development consent conditions:

- Monday – Friday: 7:00 am – 6:00 pm.
- Saturday: 8:00 am – 1:00 pm.
- Sunday and public holidays: No work permitted.

8.4 Worker Health and Safety Plan (WHSP)

Worker health and safety of all onsite workers or visitors is the responsibility of the contractor. The purpose of a WHSP is to provide relevant health and safety information for all personnel working on or visiting the Site.

The WHSP should include (but not necessarily be limited to):

- WHS legislative requirements.
- Hazardous materials identification (including fuel and chemical management).
- Induction requirements. All onsite personnel and visitors must be suitably inducted prior to entering the Site.
- Location of worker facilities.
- Designation, delineation and control of access to various work zones.
- Community notification.
- Roles and responsibilities.
- Training and competency.
- Hazard identification and risk assessment.
- Control measures including PPE.
- Incident and emergency response.
- Safe work method statement(s).
- Toolbox meetings.
- Audits and inspections.

8.4.1 WHS Legislation and Standards

All onsite works should comply with the WHS act, regulations, codes of practice, and with relevant Australian Standards. As a minimum all work must comply with:

- Workplace Health and Safety Act (2011).
- Workplace Health and Safety Regulation (2017).
- AS 1940 (2017) – The Storage and Handling of Flammable and Combustible Liquids.
- AS 2436 (2010 R2016) – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.

- Managing the Work Environment and Facilities Code of Practice (December 2018).
- Managing Noise and Preventing Hearing Loss at Work Code of Practice (October 2018).
- Hazardous Manual Tasks Code of Practice (October 2018).
- Work Health and Safety Consultation, Co-operation and Co-ordination Code of Practice (May 2018).
- SafeWork NSW Code of Practice: How to Safely Remove Asbestos (2019).

8.4.2 Hazard Assessment

A WHS hazards assessment is to be completed by the contractor and incorporated into the WHSP. Key hazards include:

- Asbestos exposure.
- GG exposure.
- Onsite chemical hazards (storage of fuels, contaminated soils).
- Heat exposure for workers.
- Noise.
- Dust.
- Operation of heavy equipment.

8.4.3 Site Inductions

Prior to starting works, site workers and subcontractors involved in the project shall attend a site specific safety induction.

Documented evidence of the safety induction must be available onsite. The contractor must supply site workers and subcontractors with appropriate PPE as outlined in Section 8.4.4.

8.4.4 Personal Protective Equipment

Table 5 below lists the PPE required to prevent exposure to contaminants, in designated remediation areas.

Table 5: Personal protective equipment

Type	Description	When Required
Head protection	Hard hat	All site activities with heavy plant and equipment and any overhead works
Eye protection	Safety glasses	All site activities
Hand protection	Disposable nitrile gloves	All site activities with potentially corrosive or contaminated materials
	Cut resistant gloves	Manual handling activities
Body protection	High visibility clothing	All site activities
	Type 5 & 6 disposable overalls	All remedial activities involving movement of ACM impacted fill
	Sunhat, sunscreen	All site activities
Foot protection	Steel toed boots	All site activities
Hearing protection	Ear plugs or ear muffs	Site activities likely to generate potentially harmful noise levels
Respiratory protection	Minimum half face respirators with P2 filters	All remedial activities involving movement of ACM impacted fill

Site personnel should be aware that personal protective equipment required to be worn may limit manual dexterity, hearing, visibility and may increase the difficulty of performing tasks. PPE places an additional strain on the user when performing work that requires physical activity.

Eating, drinking, chewing gum or tobacco, smoking or any practice that involves hand to mouth transfer increases the probability of ingestion of foreign matter into the body. Hands must be thoroughly washed before eating, drinking or smoking. Clothing which becomes dirty from onsite work should be washed separately from other clothing.

9 Environmental Regulatory Requirements

9.1 Waste Disposal Requirements

All waste soil excess to site requirements must be classified in accordance with EPA (2014) waste classification guidelines prior to offsite disposal to a suitably licenced waste receiving facility. The volume of material classified is to be included in the waste classification documentation. Adequate detail is to be included in the documentation to clearly identify the material on site and to all for tracking of the material from classification to disposal.

Waste classification documentation must be kept for validation of the remediation works.

9.2 Asbestos Licences

Notification to SafeWork NSW is required prior to the commencement of remediation works. Removal of asbestos shall be undertaken in accordance with relevant work health and safety regulation including but not limited to:

- SafeWork NSW – Applicant Guide for Asbestos Licences and Notifications (2019).
- SafeWork NSW Code of Practice: How to Safely Remove Asbestos (2019).

10 Construction Phase Management Requirements

Following validation of remediation, it is considered possible that proposed development works may compromise the integrity of the constructed capping layer (i.e. for the installation of underground services and / or pile footings).

Where works are to be conducted which will compromise the capping layer (for example where construction at depth is required and shall result in the disturbance of any ACM impacted material), at a minimum, the works are to be completed in accordance with an asbestos control plan, and undertaken by an appropriately qualified asbestos contractor.

The asbestos control plan should include, at a minimum:

- Details of the likely volume of material to be disturbed.
- Requirement for any excavated ACM impacted spoil from beneath the cap layer to be appropriately waste classified in accordance with NSW EPA (2014) Waste Classification Guidelines.
- Measures for the temporary storage of classified waste on site prior to disposal. Measures to consider control of exposure risks as well as management of risks associated with erosion or loss of spoil to the environment.
- Where the cap is to be disturbed by works, reinstatement of the cap is required to achieve a minimum cap performance as outlined in Section 5.3.1 of this report.
- Once repaired / replaced, the cap is to be validated by an appropriately qualified environmental consultant. Validation requirements are provided in Section 6.6.3 of this report.
- A registered surveyor is to record the extent of any disturbance of the cap and site records for the capping system are to be updated to reflect the completed works.
- Where disturbance of ACM impacted material is to the south of Shed 4 and is for the purposes of service installation appropriate measures are to be designed to respond to the GG conditions (as well as ACM) as they are at the time of the works.

GG monitoring shall be necessary during any excavations undertaken in the area south of, or between, Shed 4 and Shed B.

Following completion of the construction phase, ongoing cap maintenance requirements are to be documented within the LTEMP (Section 11). Ongoing GG monitoring requirements shall be developed in consultation with the site auditor.

11 Long Term Environmental Management Plan

A LTEMP will be required as part of the long term approach to the management of site contamination. As a minimum, the LTEMP must:

- Provide a plan clearly identifying the location and extent of encapsulated ACM impacted material.
- Provide protocols and procedures to ensure the integrity of the ACM capping layer.
- Provide monitoring framework to ensure GG do not present an ongoing risk to receptors.
- Identify WHS requirements to current and future site users or workers.
- Provide recommendations and control measures for any future site works which have the potential to impact the capping layer or be impacted by Site GG.
- Detail how the LTEMP will be legally enforced (note on 10.7 planning certificate recommended).
- Be approved by the Section A2 SAS and shall be varied only with the approval of Council or be the subject of a subsequent Section A2 SAS.

12 Remediation Contacts

Names and phone numbers of appropriate personnel for contact during the remediation will be provided prior to commencement of remediation work.

13 Contingency Plan for Remediation and Redevelopment

13.1 Overview

It is considered possible that unexpected situations may occur during remediation and site redevelopment works including the possibility to uncover unidentified contamination. A site contingency plan for managing unexpected situations should be prepared by the Contractor. Unexpected situations that may arise include:

1. Uncovering types of contamination that are not presently identified.
2. Generation of unacceptable levels of dust.
3. Generation of unacceptable asbestos fibres.
4. Generation of an unacceptable level of noise.
5. Excessive rainfall, and collection of excessive water in excavations.

The following sections outline contingency procedures for the events listed above.

13.2 Unexpected Finds

All site personnel are to be aware of their responsibilities under the unexpected finds protocol and are to report any potential signs of contamination (e.g., observed PACM outside of known areas of occurrence, petroleum and / or oil spills, chemical odours or staining) to the site manager immediately.

In the event of uncovering unexpected finds during remedial works, the following steps are to be undertaken by the contractor:

- Cease all work in the area and notify site foreman / manager and environmental consultant.
- Notify any relevant authorities (e.g., fire brigade) if an emergency response is required.
- Construct temporary barricading to prevent worker / public access to any unexpected and / or unknown substances.
- Install appropriate stormwater diversion and sediment controls as required.

- Notify relevant authorities that the contractor / Site owner is legally required to notify (e.g., NSW EPA and / or Council).

- Site foreman / manager is to arrange site inspection by the environmental consultant to assess the unexpected find and determine if any further investigation, management or remedial action is required in the area.

The environmental consultant is to prepare an assessment and, if required, validation of each unexpected find to the contractor prior to the recommencing of works ceased as a result of the unexpected find.

All unexpected finds are to be documented in the site Validation Report prepared by the environmental consultant at the end of remediation works.

13.3 Unacceptable Level of Dust

Contingency measures must be prepared to control unacceptable dust levels. Excessive dust may be identified by workers, dust monitoring equipment or community complaints. Actions to control excessive dust can include:

- Increased use of water sprays.

- Covering soil stockpiles.

- Changing work protocols (e.g., avoiding work on windy days).

13.4 Unacceptable Level of Noise

Contingency measures must be prepared to control unacceptable noise levels. Excessive noise may be identified by workers, noise monitoring equipment or community complaints. Actions to control excessive noise can include:

- Identification and isolation of the source of noise.

- Modification of the action of the source to reduce the noise.

- Erection of temporary noise barriers.

13.5 Excessive Rainfall

Contingency measures must be prepared to control the effects of excessive rainfall. Actions to control the effects of excessive rainfall can include:

- Construction of sediment and surface water controls.
- Diversion of surface water away from excavations, soil stockpiles and active work areas.
- Appropriate stockpile covers.

14 Conclusion

This RAP has outlined the remediation and validation requirements to address identified ACM impacted fill material and hazardous GG identified at 285 Finns Road, Menangle, NSW.

From a review of previous investigation findings and the proposed development objectives, encapsulation of contaminated material beneath an appropriately designed capping layer (ACM impacted fill) along with appropriately designed and installed GG protection measures, and development of a LTEMP, are considered the most appropriate remediation techniques to address identified site contamination.

Management of potential GG impacts is achieved through the controlled venting of GG through cut off trenches, service trench GG collection and venting systems. While the risk to proposed Shed B is considered low, a passive gas collection and venting system together with a concrete raft slab are proposed for the prevention of GG ingress to this structure. The proposed site office (south western corner of hardstand) is to be constructer with an air gap to the underlying hardstand.

This RAP provides remediation and validation methodology to manage risk posed by contamination (ACM and GG) and render the Site suitable for the proposed development.

Following successful remediation and validation, the Site shall be made suitable for the proposed development. Implementation and validation of this RAP under the supervision of a NSW EPA Accredited auditor should be made a condition of development consent to give Council the required certainty that the remediation shall be completed prior to the proposed use. Conditions that a Section B SAS be issued prior to issue of the first construction certificate and that a Section A2 SAS be prepared and submitted to Council prior to the grant of the first occupation certificate provides the consent authority with certainty in accordance with clause 7(1)(c) of SEPP 55.

15 References

ChadwickCheng survey 40091/D1-MGA94-3D dated 17.05.2021.

Landcom (2004) *4th Ed. Managing Urban Stormwater: Soils and Construction.*

Martens and Associates Pty Ltd (2020) Preliminary Site Investigation: Proposed Depot and Transport Depot with Associated Buildings: 285 Finns Road, Menangle, NSW. Ref. P1806774JR07V01.

Martens and Associates (2021a) Detailed Site Investigation: Proposed Depots & Transport Depot 285 Finns Road, Menangle, NSW. Ref. P1806774JR13V01.

Martens and Associates (2021b) Supplementary *Detailed Site Investigation: Proposed Depots and Transport Depot, 285 Finns Road, Menangle.* Ref. P1806774JR16V01.

Martens and Associates (2021c) Further *Detailed Site Investigation: Proposed Depots, 285 Finns Road, Menangle.* Ref. P1806774JR18V01.

NEPC (1999, amended 2013) *National Environmental Protection (Assessment of Site Contamination) Measure*. Referred to as NEPM (1999, amended 2013).

NOHSC (2005) *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres. 2nd Edition* [NOHSC:3003 (2005)].

NSW Department of Environment & Heritage eSPADE, NSW soil and land information (www.environment.nsw.gov.au).

NSW Department of Mineral Resources (1983) *Sydney 1:100,000 Geological Sheet 9130.*

NSW Department of Urban Affairs and Planning and NSW Environment Protection Authority (1998) Managing Land Contamination - Planning Guidelines SEPP 55 - Remediation of Land.

NSW EPA (1995) *Contaminated Sites: Sampling Design Guidelines.*

NSW EPA (2009) *Interim Construction Noise Guideline.*

NSW EPA (2017) *3rd Ed. Contaminated Sites: Guidelines for the NSW Site Auditor Scheme.*

NSW EPA (2014) *Waste Classification Guidelines Part 1: Classifying Waste.*

NSW EPA (2020) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.*

NSW Government (2020) What regulations apply to noisy construction? *https://www.environment.nsw.gov.au/questions/regulations-for-noisy-construction*

SafeWork NSW (2019) Code of Practice: How to Safely Remove Asbestos.

Standards Australia (2004) Australian Standard AS 4964 – *Method for the qualitative identification of asbestos in bulk samples.*

State Environmental Planning Policy No. 55 (1998) – *Remediation of Contaminated Land.*

16 Attachment A – Mapset

Legend

Investigation Area

N

0 10 20 30 40 50 m

1:1500 @ A3

Map Title / Figure:

Overview Plan

martens

Environment | Water | Geotechnics | Civil | Projects

Map 01	Map
285 Finns Road, Menangle, NSW.	Site
Planning & Engineering Services: 285 Finns Road, Menangle	Project
Remedial Action Plan	Sub-Project
Muscat Developments	Client
23/08/2021	Date

Project No: P1806774 Map Set: MS06-R02 EPSG: 28356

Legend

- Investigation Area
- Proposed Cap Extent
- Fill Material to be Relocated Under Cap
- Approximate Fill Extent

N

0 10 20 30 40 50 m

1:1500 @ A3

Map Title / Figure:

Approximate Extent of Fill

martens
Environment | Water | Geotechnics | Civil | Projects

Map 02	Map
285 Finns Road, Menangle, NSW.	Site
Planning & Engineering Services: 285 Finns Road, Menangle	Project
Remedial Action Plan	Sub-Project
Muscat Developments	Client
23/08/2021	Date

Project No: P1806774 Map Set: MS06-R02 EPSG: 28356

Legend

- Investigation Area
- Former Pits and Trenches
- GG Impacted Fill Area

N

0 10 20 30 40 50 m

1:1500 @ A3

Map Title / Figure:

Former Burial Trenches and Impacted Area

martens
Environment | Water | Geotechnics | Civil | Projects

Map 03	Map
285 Finns Road, Menangle, NSW.	Site
Planning & Engineering Services: 285 Finns Road, Menangle	Project
Remedial Action Plan	Sub-Project
Muscat Developments	Client
23/08/2021	Date

Project No: P1806774 Map Set: MS06-R02 EPSG: 28356

N

0 10 20 30 40 50 m

1:1500 @ A3

Project No: P1806774 Map Set: MS06-R02 EPSG: 28356

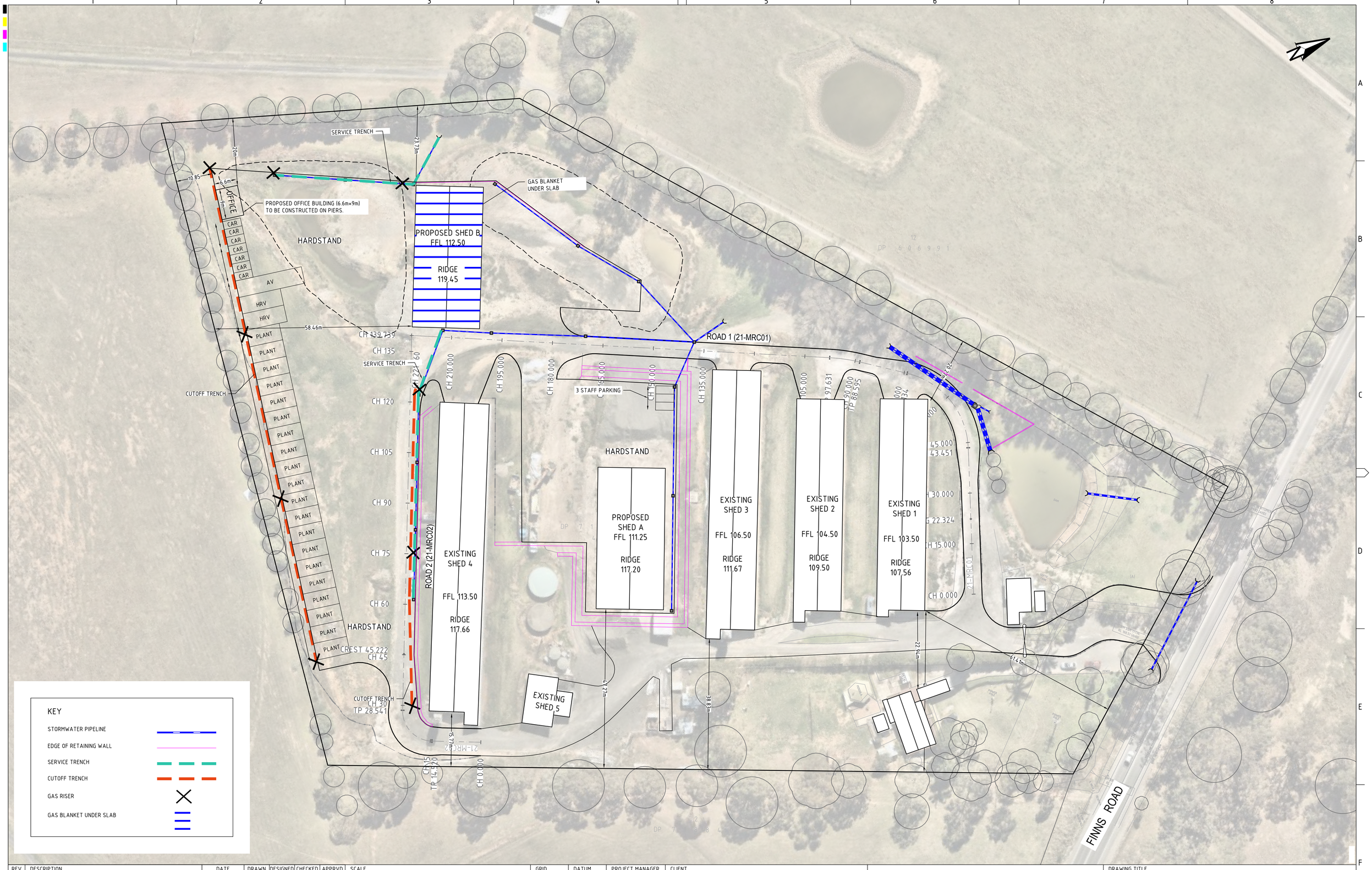
Map Title / Figure:

Proposed Capped Areas

Map 04	Map
285 Finns Road, Menangle, NSW.	Site
Planning & Engineering Services: 285 Finns Road, Menangle	Project
Remedial Action Plan	Sub-Project
Muscat Developments	Client
23/08/2021	Date

martens
Environment | Water | Geotechnics | Civil | Projects

17 Attachment B – Planset



KEY

- STORMWATER PIPELINE
- EDGE OF RETAINING WALL
- SERVICE TRENCH
- CUTOFF TRENCH
- GAS RISER
- GAS BLANKET UNDER SLAB

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENTS	27/08/2021	NN	RM	BM	BM
A	INITIAL RELEASE	24/08/2021	NN	RM	BM	BM

SCALE
0 5 10 15 20 25 30 35 40 45 50 METRES
A1 (A3) 1:500 (1:1,000)

GRID | DATUM | PROJECT MANAGER: MS

CLIENT: MUSCAT DEVELOPMENTS

PROJECT NAME/PLANSET TITLE: REMEDIAL ACTION PLAN

285 FINNS ROAD, MENANGLE, NSW

martens & Associates Pty Ltd
Consulting Engineers
Environment
Water
Geotechnical
Civil
Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

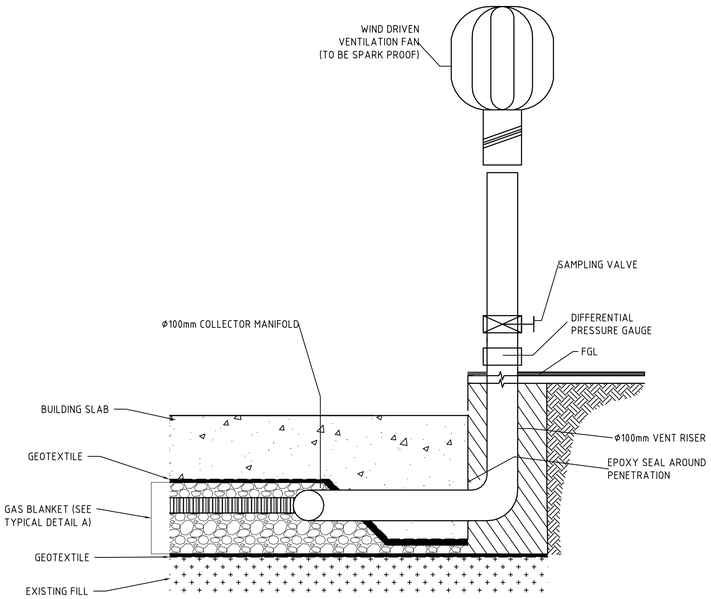
DRAWING TITLE: PROPOSED GROUND GAS MITIGATION

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1806774	PS11	R02	PS11-J100	B

DRAWING ID: P1806774-PS11-R02-J100

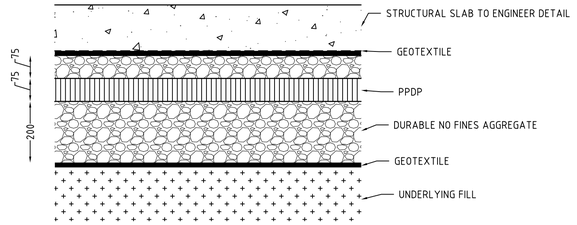
PRINTED: ---- USER: NNKZ4D

A1 / A3 LANDSCAPE (A1LC_v02.0.01)



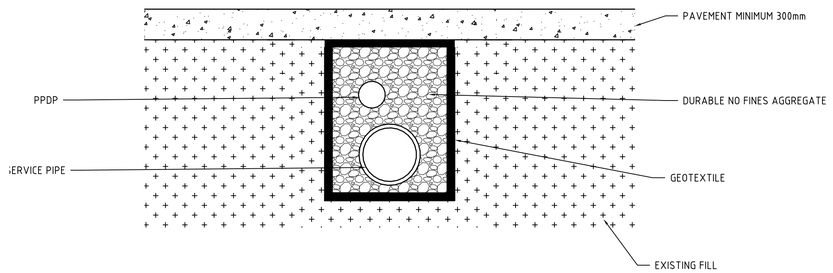
TYPICAL DETAIL B - INDICATIVE BUILDING GAS RISER SECTION

NOT TO SCALE



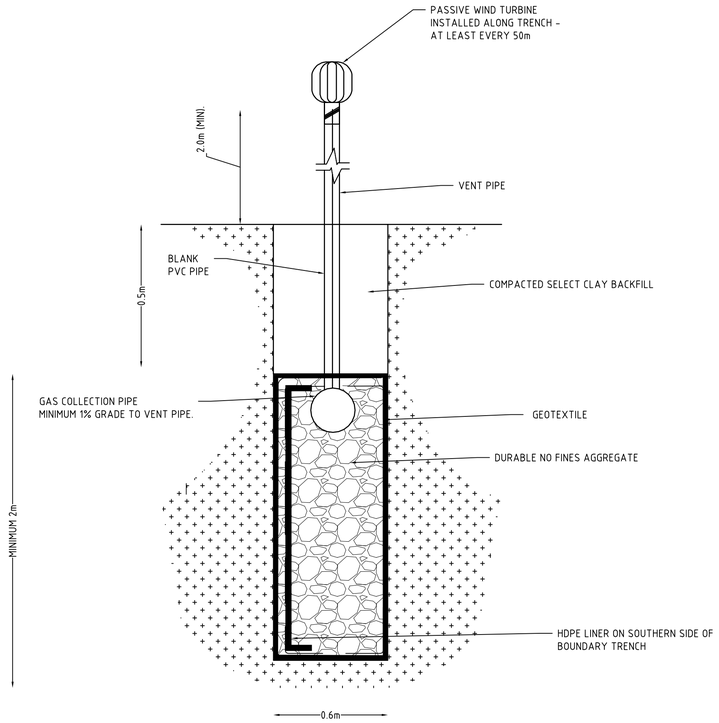
TYPICAL DETAIL A - GAS BLANKET UNDER SLAB

NOT TO SCALE



TYPICAL DETAIL C - PIPE TRENCHES

NOT TO SCALE



TYPICAL DETAIL D: LFG TRENCH/CUTOFF WALL

NOT TO SCALE

NOTE:
PPDP - 100mm (MINIMUM) PERFORATED PLASTIC DRAINAGE PIPE

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	**MINOR AMENDMENTS**	**27/08/2021**	**NN**	**RM**	**BM**	**BM**
A	INITIAL RELEASE	24/08/2021	NN	RM	BM	BM

SCALE

GRID | DATUM | PROJECT MANAGER: MS

CLIENT: MUSCAT DEVELOPMENTS

PROJECT NAME/PLANSET TITLE: REMEDIAL ACTION PLAN

285 FINNS ROAD, MENANGLE, NSW

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Consulting Engineers
Environment
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Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE: TYPICAL GROUND GAS MITIGATION SECTIONS AND DETAILS

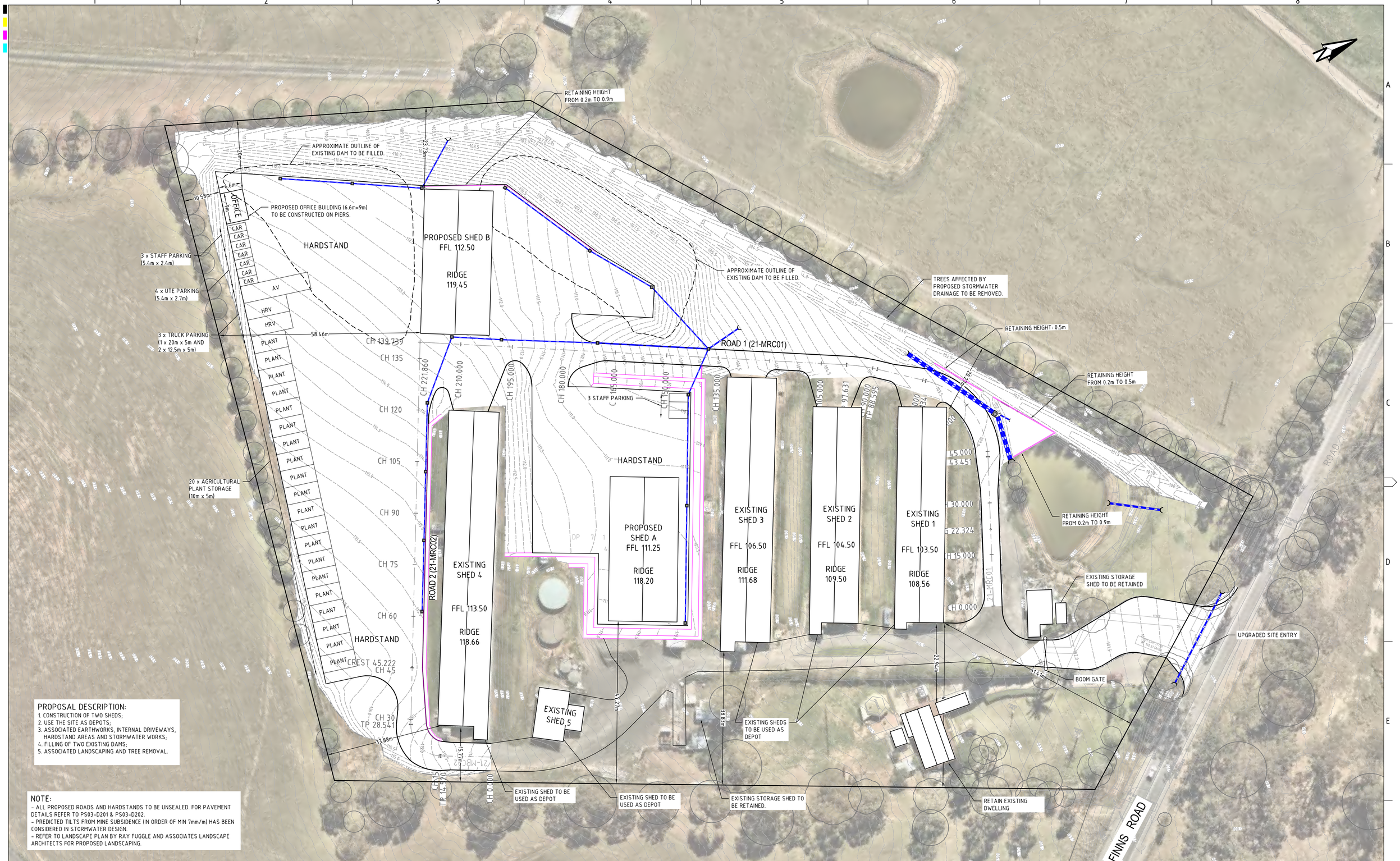
PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1806774	PS11	R02	PS11-J200	B

DRAWING ID: P1806774-PS11-R02-J200

PRINTED: --- - USER: NNAZAD

A1 / A3 LANDSCAPE (A1LC_v02.0.01)

18 Attachment C – Proposed Development Plans and Site Surveys



PROPOSAL DESCRIPTION:

1. CONSTRUCTION OF TWO SHEDS;
2. USE THE SITE AS DEPOTS;
3. ASSOCIATED EARTHWORKS, INTERNAL DRIVEWAYS, HARDSTAND AREAS AND STORMWATER WORKS;
4. FILLING OF TWO EXISTING DAMS;
5. ASSOCIATED LANDSCAPING AND TREE REMOVAL.

NOTE:

- ALL PROPOSED ROADS AND HARDSTANDS TO BE UNSEALED. FOR PAVEMENT DETAILS REFER TO PS03-D201 & PS03-D202.
- PREDICTED TILTS FROM MINE SUBSIDENCE (IN ORDER OF MIN 7mm/m) HAS BEEN CONSIDERED IN STORMWATER DESIGN.
- REFER TO LANDSCAPE PLAN BY RAY FUGGLE AND ASSOCIATES LANDSCAPE ARCHITECTS FOR PROPOSED LANDSCAPING.

DEVELOPMENT APPLICATION - NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
N	**ADDITIONAL INFORMATION PROVIDED**	**14/04/2021**	**JS**	**MS**	**MS**	**MS**
M	FURTHER AMENDMENTS	16/03/2021	JS	MS	DD	MS
L	FURTHER AMENDMENTS	11/03/2021	CG	MS	DD	MS
K	FURTHER AMENDMENTS	18/01/2021	CG/RK	CG	DD	MS
J	FURTHER AMENDMENTS	17/11/2020	RK/GM	AW/SS	SA/AN	MS
I	ADDITIONAL INFORMATION BASED ON RFI	30/01/2020	GM	MS	MS	MS
H	MINOR AMENDMENT	28/11/2019	GM	CS	SA	MS
G	DA LODGEMENT	18/09/2019	GM	LZ/AVG	SA	MS

SCALE
0 5 10 15 20 25 30 35 40 45 50 METRES
A1 (A3) 1:500 (1:1,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	MS

CLIENT
MUSCAT DEVELOPMENTS

PROJECT NAME/PLANSET TITLE
PROPOSED DEPOTS
ROAD AND DRAINAGE DESIGN
285 FINNS ROAD, MENANGLE, NSW 2568
LOT 1 DP 718840

martens & Associates Pty Ltd
Consulting Engineers
Environment
Water
Geotechnical
Civil
Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE
DEVELOPMENT OVERVIEW & NOTIFICATION PLAN

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1806774	PS03	R15	PS03-A050	N

NOTE:

THIS PLAN IS PREPARED FOR DETAIL AND LEVEL PURPOSES ONLY. THE BOUNDARIES HAVE BEEN COMPILED FROM DP 718840 OBTAINED FROM LAND REGISTRY SERVICES (LRS).

ANY STRUCTURES RELATED TO PHYSICAL FEATURES (BUILDINGS, TREES, ETC.) MUST BE CONFIRMED PRIOR TO FINAL DESIGN.

ALL SERVICES MUST BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

IF ANY CONSTRUCTION IS PLANNED IT WOULD BE ADVISABLE TO CARRY OUT FURTHER SURVEY WORK TO DETERMINE THE BOUNDARY DIMENSIONS.

ORIGIN OF LEVELS SSM 17736, RL 100.51 (AHD)

DISCLAIMER OF LIABILITIES TO ANY THIRD PARTIES : THIS PLAN IS MADE SOLELY FOR THE USE AND BENEFIT OF THE CLIENT NAMED ABOVE AND NO LIABILITY OR RESPONSIBILITY WHATSOEVER IS ACCEPTED TO ANY THIRD PARTY WHO MAY RELY ON THIS PLAN WHOLLY OR IN PART. ANY THIRD PARTIES ACTING OR RELYING OF THIS PLAN WHETHER WHOLLY OR IN PART ARE IN BREACH OF OUR COPYRIGHT AND DO SO AT THEIR OWN RISK.

(A) EASEMENT FOR TRANSMISSION LINE 30.48 WIDE (VIDE F174253) (DP718840)

LEGEND:

- GRAVEL
- BITUMEN
- PAVED AREA
- CONCRETE
- BUILDING & METAL SHED
- PIPE
- IL INVERT LEVEL

NO INVESTIGATION OF UNDERGROUND SERVICES HAS BEEN MADE. ALL RELEVANT AUTHORITIES SHOULD BE NOTIFIED PRIOR TO ANY EXCAVATION ON OR NEAR THE SITE

DEVELOPERS & EXCAVATORS MAY BE HELD FINANCIALLY RESPONSIBLE BY THE ASSET OWNER SHOULD THEY DAMAGE UNDERGROUND NETWORKS.

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SIMON P CHENG
Registered Surveyor
Registered Surveyor ID: 806

1) 17.05.2021 ADDITIONAL DETAILS

chadwickcheng consulting surveyors suite 317 / 5 celebration drive bella vista nsw 2153 po box 7979 norwest nsw 2153 p: 88832622 f: 88832633 e: admin@cca.net.au	PLAN SHOWING PARTIAL DETAIL & LEVELS OVER PART OF LOT 1 IN DP718840 AT No 285 FINNS ROAD, MENANGLE	SHEET 1 OF 1 SHEETS
	DATUM: AHD	RATIO: 1 : 300 (A0)
	DATE: 30.10.2020	PRINCIPAL: MUSCAT DEVELPMENTS
		REFERENCE 40091 / D1--MGA94-3d

LEVEL SPREADER DETAILS

NOT TO SCALE

NOTE:
- FOR RETAINING WALL DETAILS, REFER TO PS03-C600.

KEY

- EXISTING CONTOURS
- PROPOSED CONTOURS
- EARTHWORKS HINGE
- INTERFACE
- RETAINING WALL
- LIMIT OF WORKS
- SITE BOUNDARY

DEVELOPMENT APPLICATION - NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
J	**FURTHER AMENDMENTS**	**16/03/2021**	**JS**	**MS**	**DD**	**MS**
I	FURTHER AMENDMENTS	18/01/2021	CG/RK	CG	DD	MS
H	FURTHER AMENDMENTS	17/11/2020	RK/GM	AW/SS	SA/AN	MS
G	MINOR AMENDMENT	28/11/2019	GM	CS	SA	MS
F	DA LODGEMENT	18/09/2019	GM	LZ/AVG	SA	MS
E	FOR PRE-DA MEETING	26/08/2019	LL	LZ/AVG	SA	MS
D	ADDRESS MINE SUBSIDENSE COMMENTS	13/05/2019	PB	PB	SA	MS
C	MINOR AMENDMENTS	09/04/2019	PB	PB	SA	MS

SCALE
0 5 10 15 20 25 30 35 40 45 50 METRES
A1 (A3) 1:500 (1:1,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	MS

CLIENT
MUSCAT DEVELOPMENTS

PROJECT NAME/PLANSET TITLE
PROPOSED DEPOTS
ROAD AND DRAINAGE DESIGN
285 FINNS ROAD, MENANGLE, NSW 2568
LOT 1 DP 718840

martens & Associates Pty Ltd
Consulting Engineers
Environment
Water
Geotechnical
Civil
Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE
EARTHWORKS GRADING PLAN

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1806774	PS03	R14	PS03-C100	J

DRAWING ID: P1806774-PS03-R14-C100

PRINTED: ---- USER: JSUAREZ
A1 / A3 LANDSCAPE (A1LC_v02.0.01)

EARTHWORKS SUMMARY

	CUT	FILL
EARTHWORKS VOLUME (m^3)	3178	32452
EARTHWORKS BALANCE (m^3)	-	29274

LESS THAN	-3.000		m
-3.000	to	-2.250	m
-2.250	to	-1.500	m
-1.500	to	-0.750	m
-0.750	to	-0.150	m
-0.150	to	0.150	m
0.150	to	0.750	m
0.750	to	1.500	m
1.500	to	2.250	m
2.250	to	3.000	m
GREATER THAN	3.000		m

DEVELOPMENT APPLICATION - NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
J	**FURTHER AMENDMENTS**	**16/03/2021**	**JS**	**MS**	**DD**	**MS**
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SCALE
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A1 (A3) 1:500 (1:1,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	MS

CLIENT
MUSCAT DEVELOPMENTS

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DRAWING TITLE
EARTHWORKS CUT & FILL PLAN

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1806774	PS03	R14	PS03-C500	J

PRINTED ---- VIGEN JSUAREZ
A1 / A3 LANDSCAPE (A1LC_v02.9.01)
DRAWING ID: P1806774-PS03-R14-C500