Appendix H:

Geotechnical Desktop Study

Geotechnical Desk Study

Camperdown Battery Energy Storage System (BESS)

Camperdown BESS Pty Ltd

29 Ringara Street, Manly West Qld 4179

Prepared by:

SLR Consulting Australia

SLR Project No.: 620.041535.00021

6 February 2025

Revision: 1.1

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	31 January 2025	Amanda Lane	Nick Barker	Nick Barker
1.1	06 February 2025	Amanda Lane	Nick Barker	Nick Barker

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Camperdown BESS Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Table of Contents

Tables

Figures

Appendices

1.0 Introduction

1.1 Background

SLR Consulting Australia Pty Ltd (SLR) was engaged by Camperdown BESS Pty Ltd (Camperdown BESS) to undertake a geotechnical desk study for the proposed Battery Energy Storage System (BESS) development located at Wire Lane, Camperdown, Victoria (the 'site'). The site is identified as Lot 2 of LP34716 and Lot 2 of PS817143.

SLR understands that the site is in the process of development approval and review for the planned installation of a BESS with an appropriate capacity of 75-megawatt (MW) at the point of connection. The areas of investigation and assessment discussed within this report, include:

- Study Area (the site) - (Lot 2 of LP34716 and Lot 2 of PS817143) - 48.8 hectares (ha).
- Project Footprint (the current proposed location of the BESS) - 1.9 ha.

This work was undertaken in accordance with the scope and limitations in SLR's Offer of Services dated 8 November 2024 (SLR Ref 620.041378.00001).

1.2 Methodology

This desktop geotechnical assessment examines the geology and geomorphology at the site and the wider local area using select available data to understand potential ground conditions and to gain an appreciation of likely geotechnical constraints that may impact project delivery.

This Desktop Geotechnical Assessment has included the examination of select publicly available data such as:

- Geological maps
- Hydrogeological maps
- Satellite Imagery
- Topographical contour maps; and
- Published geotechnical reports and papers.

Where possible, publicly available data has been used in the preparation of figures.

A gap analysis has been undertaken and is presented in Appendix D. The gap analysis provides commentary on the extent and suitability of the data sources.

A site walkover to inform a visual inspection of the site and surrounding features did not form part of the scope for this desktop geotechnical assessment.

1.3 Aim and objective

The overall preliminary works for the proposed Camperdown BESS development program involves various studies to assess the potential elevated risk items identified as part of the pre-development due diligence. This geotechnical desk study forms one of the assessments being completed for this project. Findings from all the assessments will be used in determining the suitability of the site for the proposed BESS development. The various assessments will also determine the requirements for further assessments, where relevant.

The objective of this desk study is to review the relevant geotechnical information that is available and assess conditions at the site which may pose a geotechnical risk and/or place constraints on the future development within the project footprint. The following has been considered:

- Review of site location and proposed site layout.
- Review of select geological mapping.
- Review of select publicly available information in the vicinity of the site.
- Review of select available previous geotechnical investigation reports deemed relevant to the site.
- Summarise geotechnical risks and hazards to the proposed development.
- Preliminary geotechnical design recommendations.
- Present recommendations for further work to reduce geotechnical uncertainty, including geotechnical site investigation.

1.4 Sources of information

The following select sources of information have been examined as part of this assessment:

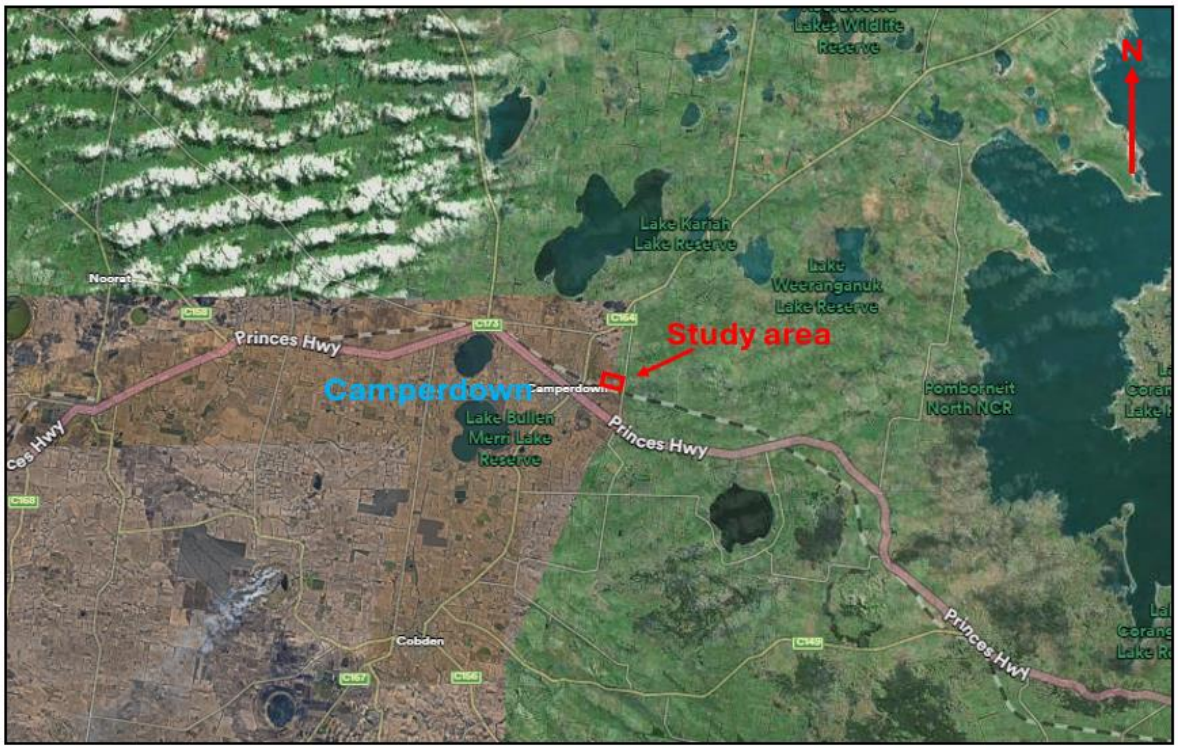
- Lot Search report, ref LS067521 EP, 25th November 2024.
- GeoVic, (www.gsv.vic.gov.au, accessed on 15th January 2025).
- Department of Defence UXO mapping (www.defence.gov.au, accessed on 21st January 2025).
- Visualising Victoria's Groundwater (www.vvg.org.au, accessed on 16th January 2025).
- Department of Environment, Land, Water and Planning (Victoria), www.deeca.vic.gov.au, accessed on 21st January 2025).
- Geosciences Australia, (www.ga.gov.au, accessed on 16th January 2025).
- Nearmap aerial photography (2018 to 2025), (www.nearmap.com, accessed on 15th January 2025).
- Openinframap utilities plan (www.openinframap.com, access on 16th January 2025).
- Australian Soil Resource Information System, Acid Sulphate Soils mapping, (www.data.csiro.au, accessed on 28th January 2025).

2.0 Site setting

2.1 Site description

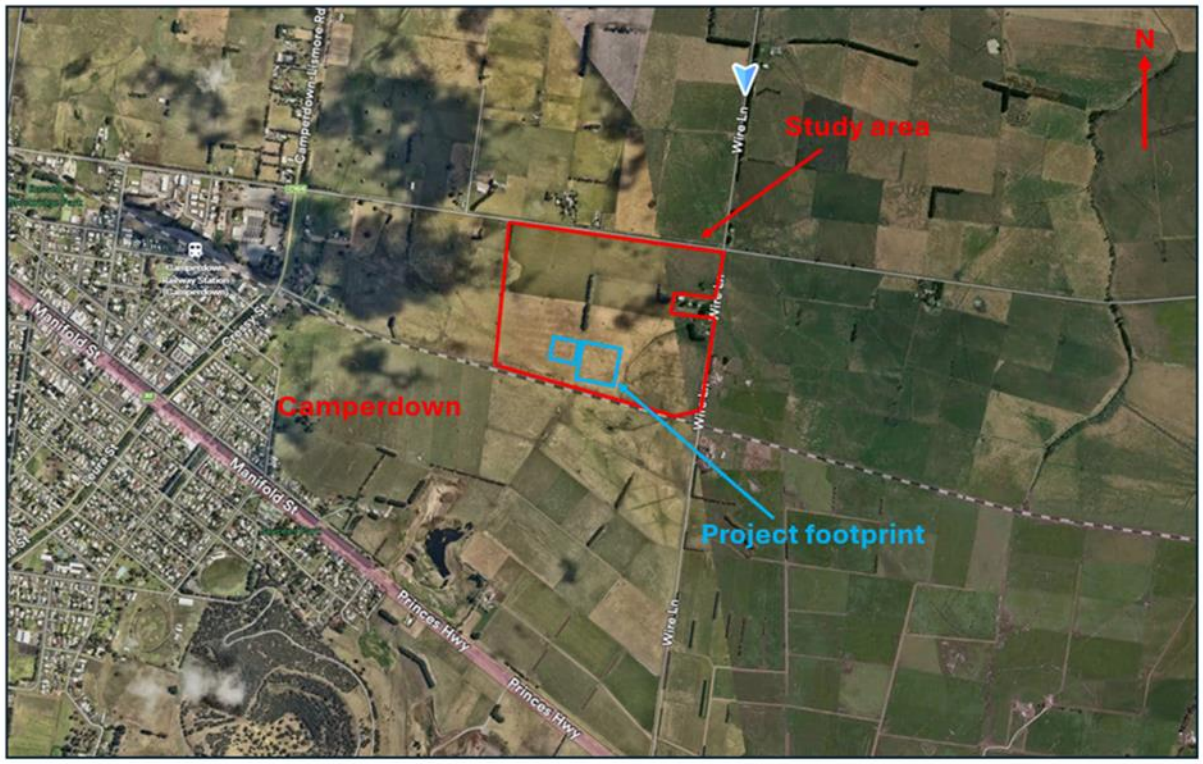
The site is located on Lot 2 of LP34716 and Lot 2 of PS817143, Wire Lane in Camperdown, VIC 3260, as presented on the site location plan and surrounding features plan in Appendix A. A recent aerial image indicates the site is likely to be consist of open grassland with few visible features, as presented in Figure 1 and Figure 2.

Figure 1 Aerial site location plan



Source: Nearmap, date of image 10th January 2025

Figure 2 Site aerial



Source: Nearmap, date of image 10th January 2025

The site is bounded by the following features:

- To the north: agricultural/pastoral lots.
- To the east: Wire Lane, then agricultural/pastoral lots.
- To the south: Dennington rail line, then agricultural/pastoral lots, with two quarries within 1.5 km of the site.
- To the west: agriculture/pastoral lots, with Camperdown to the west and southwest.

2.2 Proposed development

2.2.1 Structural layout

With reference to the proposed development layout plans provided by the Client, the BESS area is likely to comprise the following:

- Battery storage
- Switch room
- Control room
- Auxillary services
- Storage room
- Substation
- Associated access tracks, laydown areas and car parking
- Earthworks and site drainage infrastructure

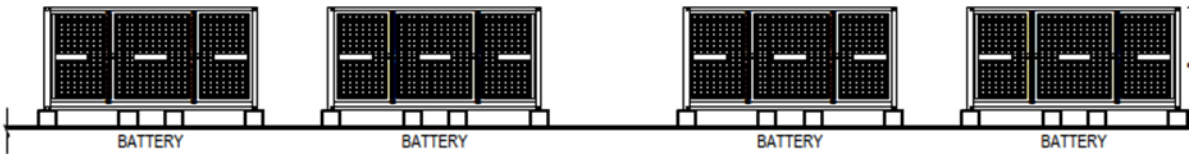
The proposed site layout plan is presented in Appendix B, with an extract from the plan presented in Figure 3.

Figure 3 Proposed BESS development layout

Source: Quintasenergy, drawing ref. BESS-LAYOUT-CAMPERDOWN-PRELIM-SMA-BYD, Rev O, 20th November 2024

Typical BESS battery arrangements are likely to comprise the following:

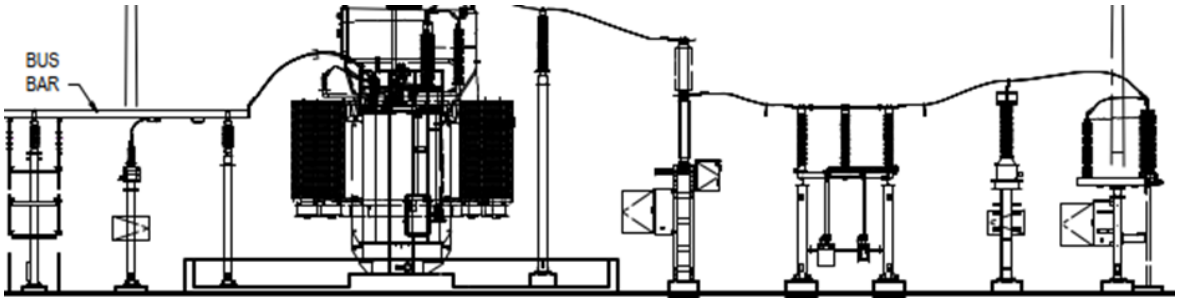
- Batteries stored within shipping containers supported on ‘sleeper-style’ footings. An example of this is presented below.



With reference to the proposed layout plan, there are a maximum of 48 no. LI-ION BESS units and 24 no. SMA MVPS 4600-S2 units expected to be installed at the site.

- Switch room building that is typically supported on a framework-style structure:

- Substation that is supported on a concrete slab.



- Associated small support buildings, pavements and access roads.

In SLR's experience of working on BESS sites, the sites tend to be prepared to a reduced level that is dictated by the fall required for stormwater management. The most rigid structure tends to be the concrete pad on which the substation is supported.

2.2.2 Proposed earthworks

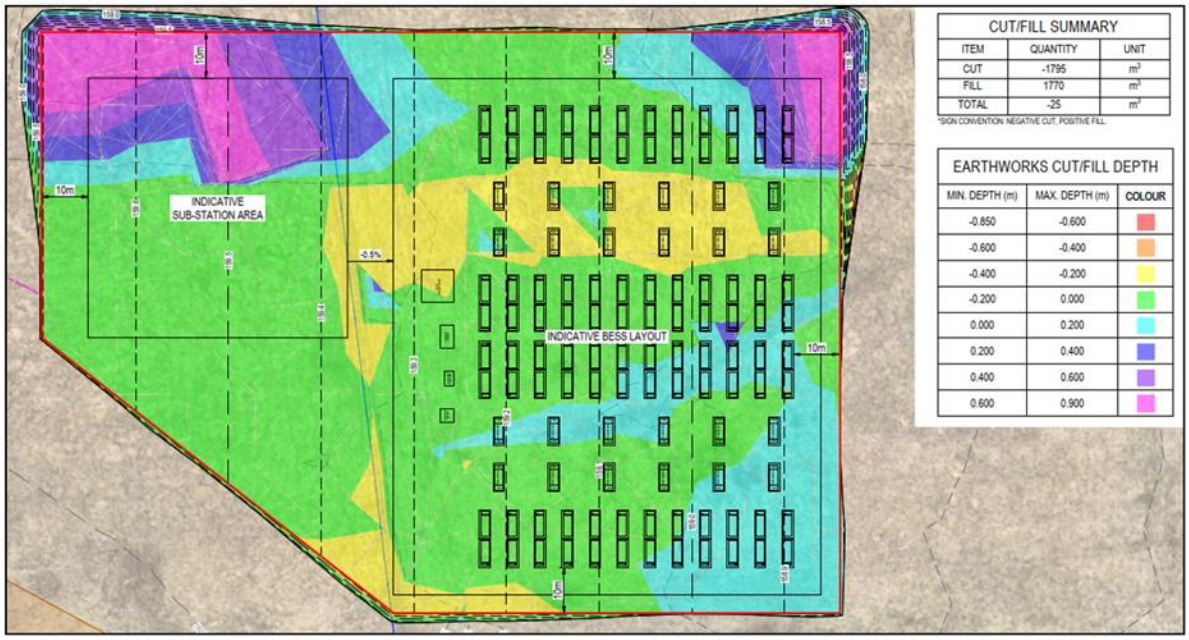
Minor earthworks are expected to prepare the project footprint area for construction. With reference to SLR drawing 620.041535-CI-1010, 'Cut and Fill Preliminary Earthworks Layout Plan', presented in Appendix C, cut and fill of up to +/-1 m is expected across the project footprint area. An extract of the plan is presented in Figure 4.

Preliminary earthworks volumes comprise the following:

- Cut of 1795 m^3
- Fill of 1770 m^3

This leaves a material surplus of 25 m^3.

Figure 4 Extract from cut and fill preliminary earthworks plan



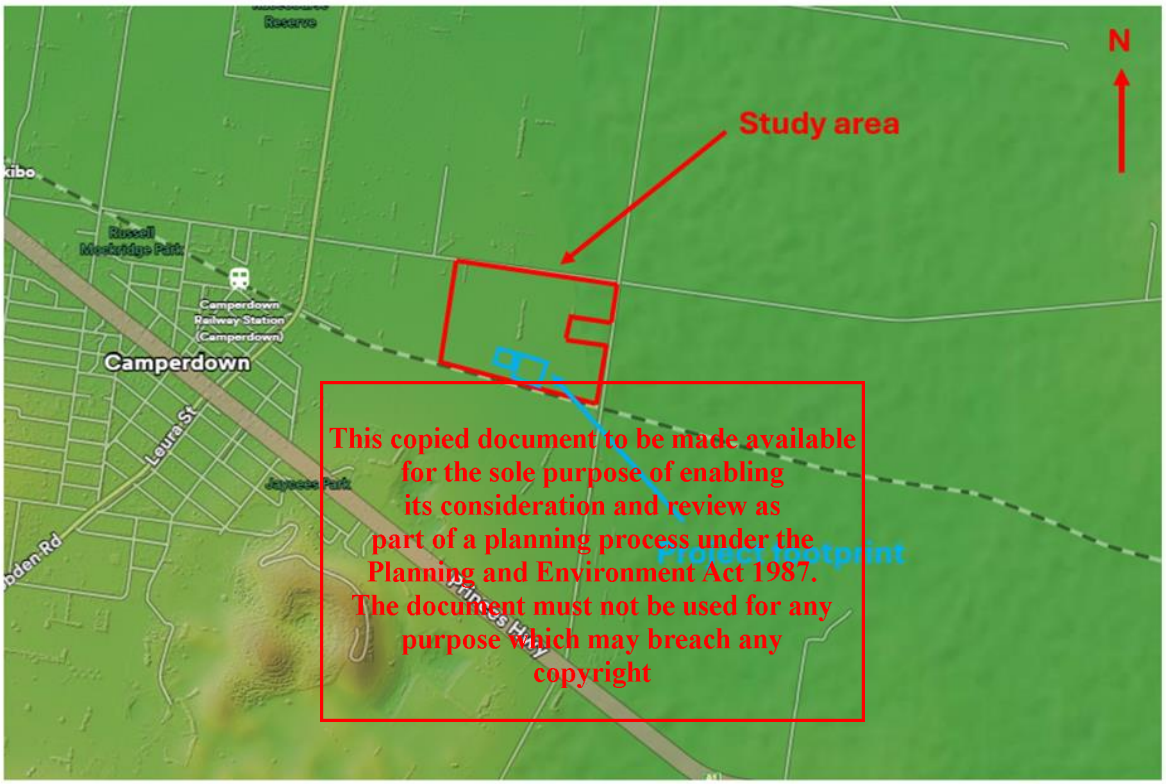
Source: SLR drawing, ref. 620.041535-CI-1010, rev A, 9th December 2024

3.0 Desktop assessment

3.1 Topography

The topography of the site is relatively level at RL 160 m AHD (+/- 1 m), dipping gently towards the northern boundary. An image presenting the terrain of the study area and local surrounds is presented in Figure 5.

Figure 5 Topography of the local area



Source: Nearmap, web-based, LiDAR layer, accessed on 15th January 2025

3.2 Regional geology

The surface geology for the area, identified using the database accessible through the Geo Vic website (accessed on 15th January 2025), indicates the site to be underlain by the following:

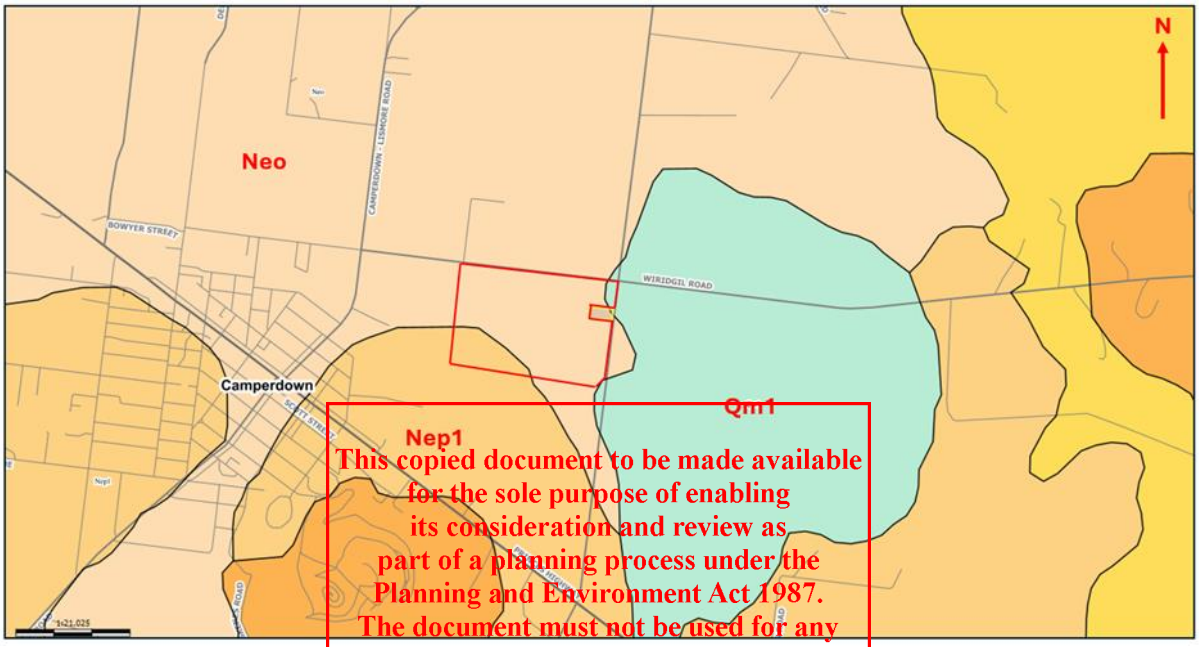
- Newer Volcanic Group (Neo) of the Miocene and Holocene epochs. This stratum is expected to be present beneath the majority of the site.
- Within the northeastern tip of the site boundary, swamp and lake deposits (Qm1) of the Pleistocene to Holocene epoch are expected to be present. According to the geological mapping, these deposits may be encountered within the eastern extent of the site area.
- Within the southwestern corner of the site, the Newer Volcanic Group (Nep1) of the Miocene to Holocene epochs is expected to be encountered. According to the geological mapping, this stratum may be encountered within the southwestern area of the site.

The layers that were accessible for the site and the local area were as follows:

- Shear displacement structure 50K and 250K layer
- Geological unit and unit contact 50K and 250K layer

An extract from the geological mapping layer (50K) for the local area of Camperdown is presented in Figure 6.

Figure 6 Regional geology



Source: Geo Vic, geological unit and geological unit contact layers (50K), accessed on 15th January 2025

In accordance with the findings from the geological mapping for the area, a summarised description of the materials expected to be encountered across the site is presented in Table 1.

Table 1 Summary of geological units

Symbol	Name	Description
Neo	Newer Volcanic Group – basalt flows	Olivine tholeiite, quartz tholeiite, basanite, basaltic icelandite, hawaiite, mugearite, minor scoria and ash, fluvial sediments; includes sheet floes and intercalated gravel, sand and clay.
Nep1	Newer Volcanic Group – tuff rings	Tuff rings: pyroclastic base surge and fall deposits consisting of ash, lapilli, scoria, volcanic bombs and calcareous lithic fragments, well-bedded, well sorted, moderately consolidated.
Qm1	Swamp and lake deposits	Grey to black carbonaceous silt, clay and occasional peat, generally unconsolidated; rare dolomite.

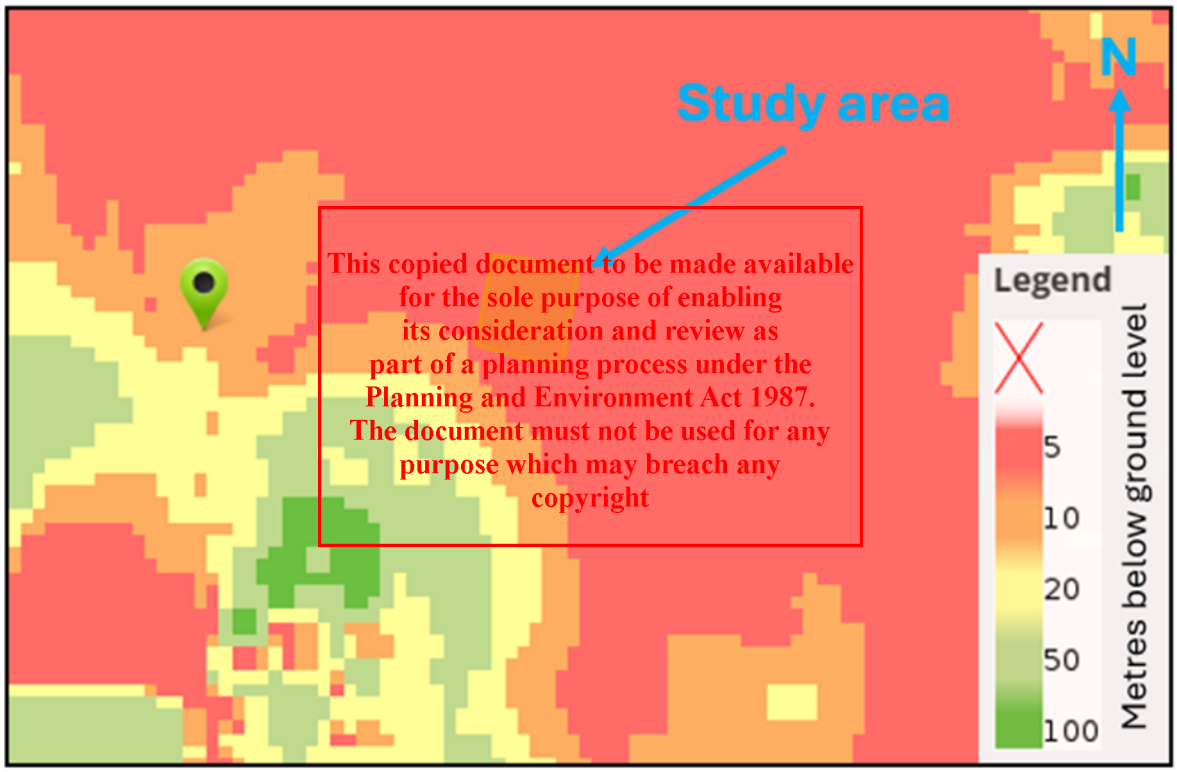
The geological mapping indicates that there are no geological faults, faulted contacts, marker beds, dykes, veins, shear zones or other complex geological structures present within the near surface geology.

3.3 Hydrology and hydrogeology

The data provided in the Lotsearch report and the Department of Environment, Land, Water and Planning (DELWP, State Government Victoria) website, accessed on 21st January 2025, presents boreholes that were primarily drilled for farming or domestic water supply purposes. There is limited to no information presented regarding groundwater levels within the boreholes that were carried out within close proximity to the site (Lot Search and GeoVic). The Hydrogeology map of Australia (Geosciences Australia, web-based, accessed on 16th January 2025) suggests that a highly productive aquifer is present within the Camperdown area.

The data obtained from the Lotsearch report and DELWP indicates that the groundwater level is generally less than 5 m bgl, see Figure 7.

Figure 7 Depth to water table



Source: DELWP, web-based, accessed on 21st January 2025

Within the borehole information obtained from DELWP's information database, construction details of the groundwater wells are presented. From observing where the screened/slotted sections of the wells are recorded, it is likely that these sections correspond to the most productive water-bearing layers, for example, granular soils. The range of slotted/screened sections recorded is from 1 m bgl (minimum top level) to 51 m bgl (maximum base level). Note that reduced levels are not presented with the data.

A review of aerial imagery (Nearmap) was undertaken to identify drainage features such as incised or eroded channels throughout the site that may provide insights into the site hydrology.

Following an examination of Nearmap images from March 2018 to January 2025, and from the aerial images presented in the Lotsearch report from 1947 to 2023, there appears that no drainage features are visible on the site. However, it should be noted that this does not preclude the absence of site hydrology.

3.4 Historical/current land use

With reference to the data provided in the Lotsearch report, the site is currently privately owned with the land being used for agricultural purposes (classified as an FZ1 farming zone) where it is utilised as grassland. It is understood that the site has been used for agricultural purposes since the 1940's. Historical mapping from 1947 to 2023 (Lotsearch report) appears to confirm that this is the case.

3.5 Mining

According to Victoria State Government records for historical and current mining activities, accessed through GeoVic on 15th January 2025, there are no historical or current mining activities comprising the presence of mine shafts or activity, recorded at or within close proximity (< 1km) to the site. This information was obtained by utilising the following mapping layers:

- Historical mining activities
- Mines and mineral occurrences*

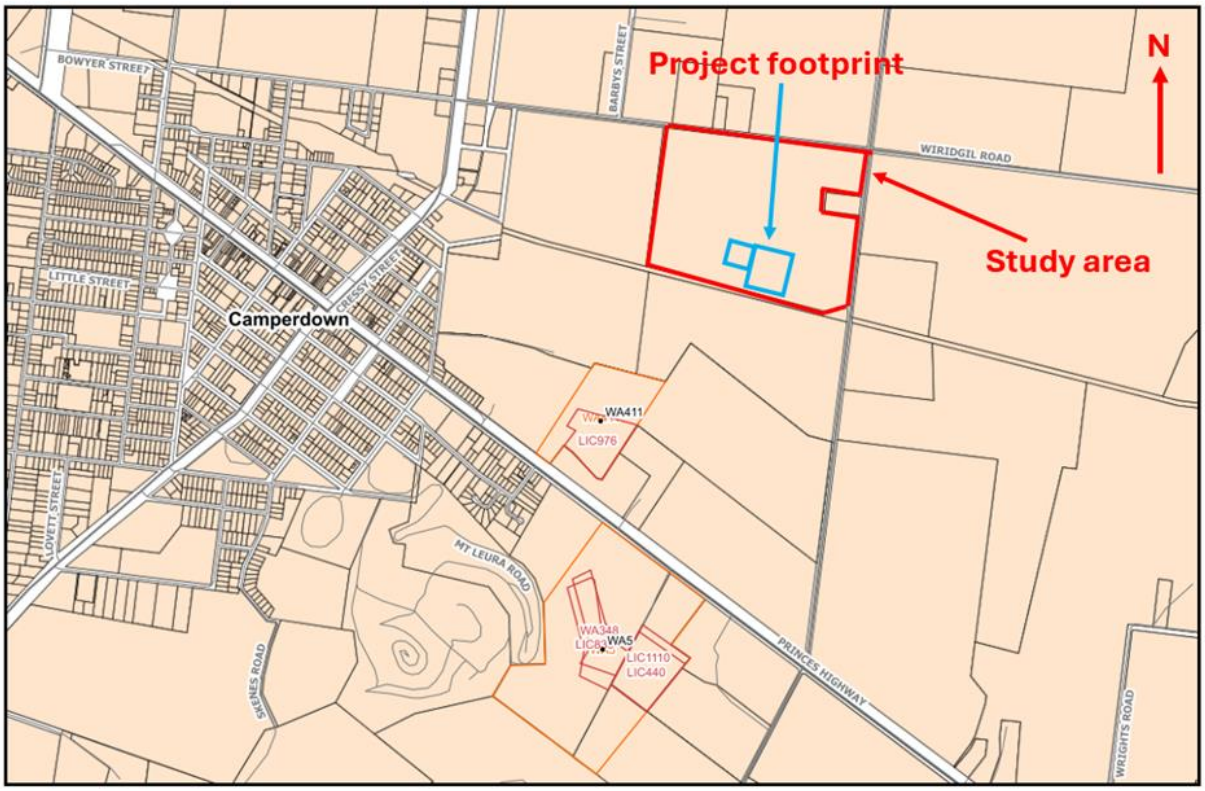
*Note that mining licences are active at the quarries presented in section 3.6. However, it is expected that these licences are related to quarrying activities.

3.6 Quarrying

There are two quarries that are located to the south of the site. The location of the quarries is presented on the site location plan in Appendix A. The GeoVic website (accessed on 15th January 2025) identifies two areas where extractive industry licences are current (highlighted orange) or have expired (highlighted red) within the local area, as presented in Figure 8. The current licences (WA411 and WA5) correspond to the areas where quarrying activities are currently being undertaken. The layers that were used on the GeoVic website to obtain this information are as follows:

- Expired extractive industry tenements
- Current extractive industry work authorities

Figure 8 Location of current extractive licences



Source: GeoVic, web-based, accessed on 15 January 2025

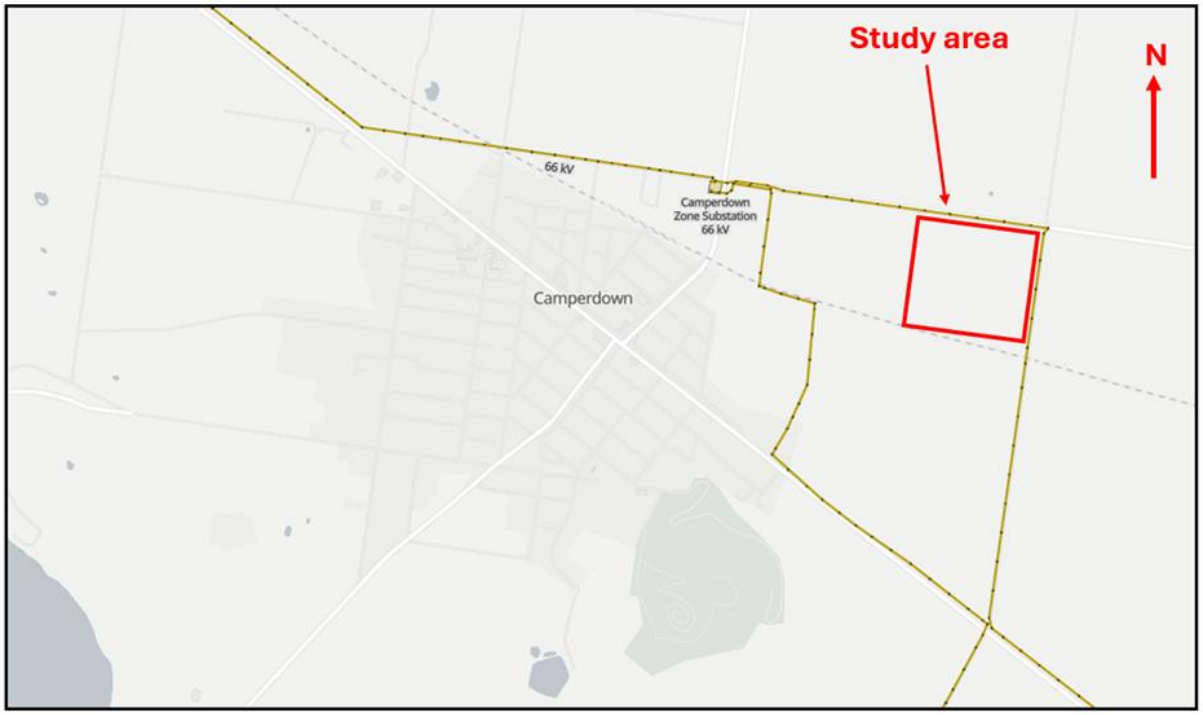
The Gent quarry (WA411) is located approximately 600 m to the southwest of the site and the WA Molan and Sons quarry (WA5) is located approximately 1.3 km of the site. Based on an internet search, it is understood that their operations are primarily based on extracting 'bluestone' from the ground.

'Bluestone' is a cultural or commercial name for a variety of natural dimension or building stone varieties and is therefore not a geological term for a particular rock type. In Victoria, bluestone commonly refers to Basalt.

3.7 Services and utilities

An electric substation is located approximately 0.6 km to the west of the site. With reference to the Open Infrastructure Map (openinframap.com, accessed on 16th January 2025), the 66 kV cables leading from the substation are located within the roadways and not beneath the site, as presented in Figure 9.

Figure 9 Location of services



Source: openinframap.com, web-based, accessed 16th January 2025

It is highly likely that other services and utilities are present beneath or within close proximity to the site. This risk needs to be considered as part of the methodology and risk assessments for any work undertaken on site, including site investigation.

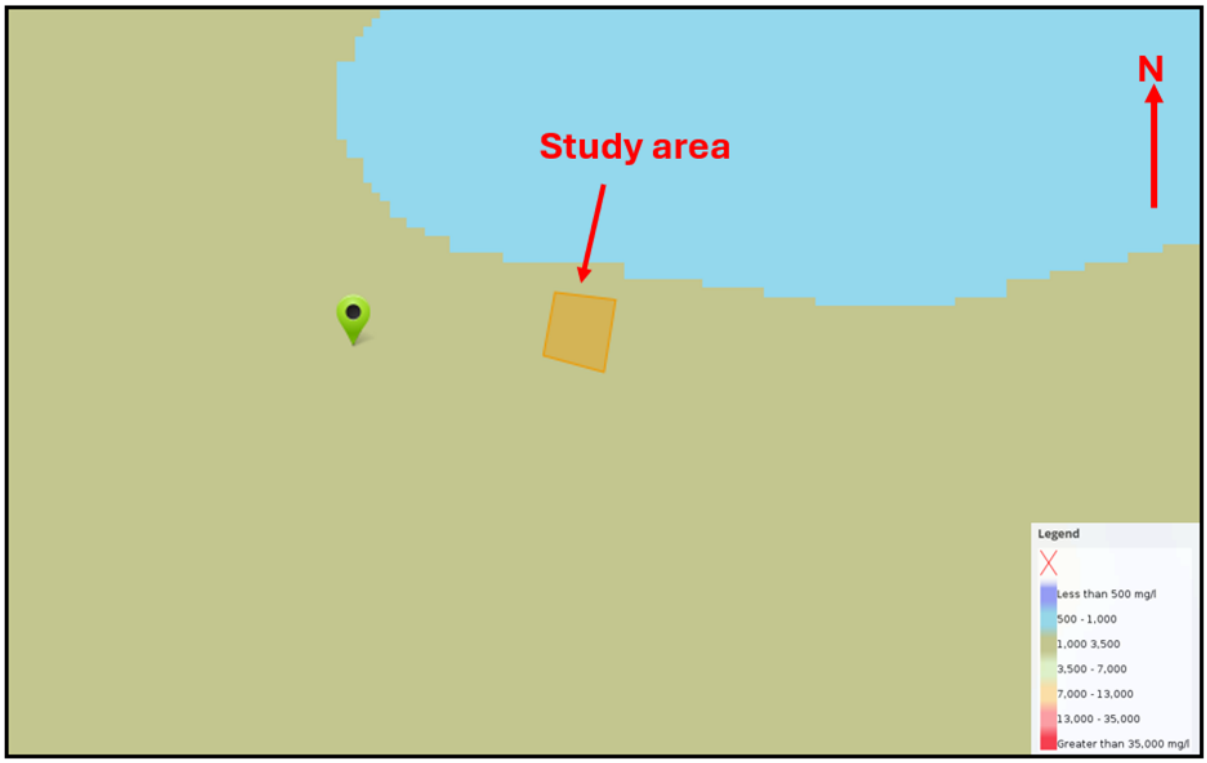
3.8 Acid Sulphate Soil (ASS) generation potential

The Australian Soil Resource Information System website compiles data from across Australia to produce a map which indicates the probability of Acid Sulfate Soils (ASS) and also the confidence in the data set. The search states indicates that there is a low probability (Class B) of ASS occurring on the site. However, the probability ranges from 6 % to 70 %, indicating low confidence in the dataset.

3.9 Salinity

Visualising Victoria's Groundwater database, accessed on 16th January 2025, suggests that the site is within an area where groundwater salinity is 1000 mg/l to 3500 mg/l, as presented in Figure 10.

Figure 10 Groundwater salinity



Source: Visualising Victoria's Groundwater, web-based, accessed on 16th January 2025

3.10 Erosion

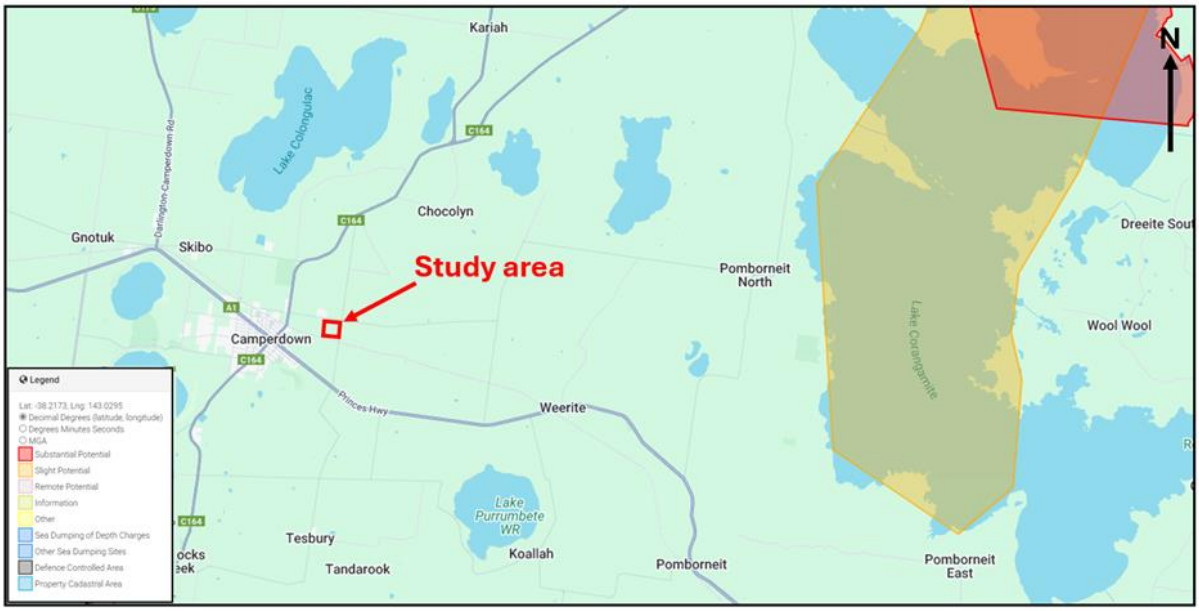
It is considered that the soils expected to be encountered within the study area may be highly dispersive dependent on their grading and composition.

Owing to the earthworks that are proposed for the project footprint area, soil dispersiveness should be investigated. This is typically done as part of an investigation via comprehensive laboratory testing of select samples (Emerson Class testing, AS 1289 3.4.1).

3.11 Unexploded Ordnance

The Department of Defence mapping, unexploded ordnance (UXO) mapping layer, (web-based, accessed on 21st January 2025) for the local area suggests that there is no risk from within the study area. The Lake Corangamite area, approximately 15 km to the east, is the closest area to the site where UXO risk is highlighted, see Figure 11.

Figure 11 UXO map



Source: Department of Defence, web-based, accessed on 21st January 2025

3.12 Local geology review

With reference to the findings presented in the Lotsearch report which has complied data from a number of sources, there are boreholes that have been previously drilled within a 2 km radius of the study area. Note that there are no historical boreholes identified within the site boundary.

However, the geology expected within the study area boundary, is widespread and anecdotally consistent throughout the local area and therefore the information contained from the borehole records may be considered relevant to the conditions expected at the site.

A summary of the borehole data available within the same ground conditions expected at the site, is presented in Table 2, with a figure identifying the location of the select boreholes presented in Figure 12.

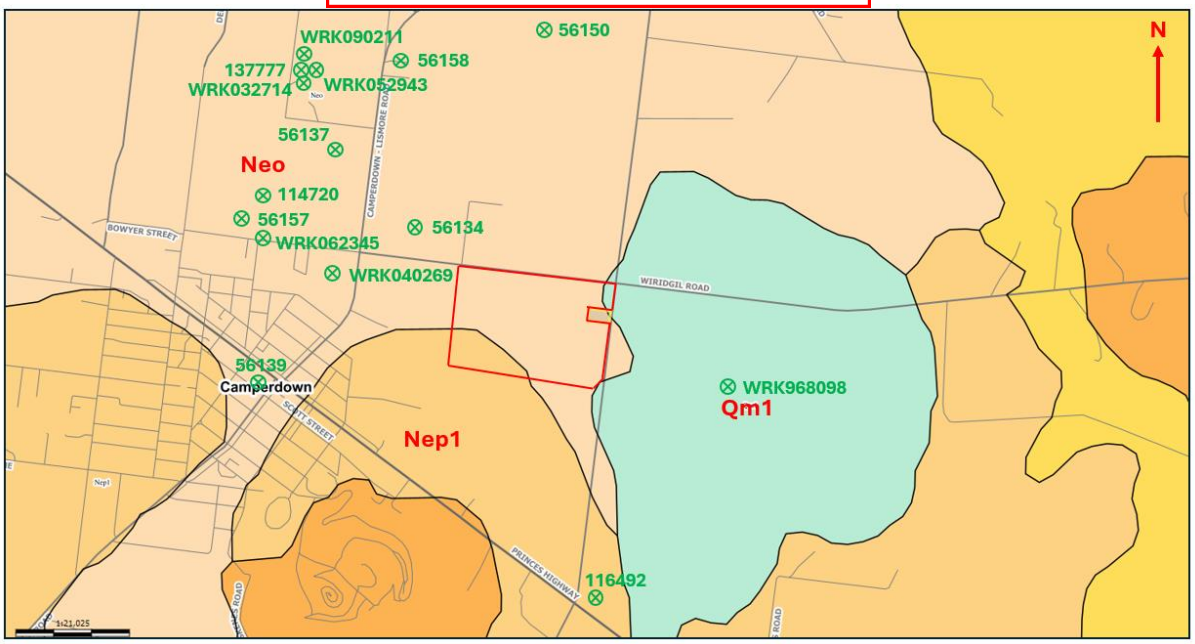
Table 2 Summary of the ground conditions encountered

BH Ref.	Drillers log description		Termination depth (mbgl)
	Soil Mbgl (material)	Rock Mbgl (material)	
56134	0.00 to 5.80 (clay) 20.10 to TD (clay)	5.80 to 18.90 (stone) 18.90 to 21.10 (scoria)	21.30
WRK040269	0.00 to 6.00 (rubble and boulders) 6.00 to 10.00 (black clay) 23.40 to 26.50 (grey clay) 48.00 to TD (gravel)	10.00 to 19.50 (soft sandstone) 19.50 to 23.40 (basalt) 26.50 to 48.00 (basalt)	50.90
56157	0.00 to 1.00 (topsoil and clay) 6.00 to 6.50 (gravel) 6.50 to 11.00 (black mud)	1.00 to 6.00 (basalt) 11.00 to TD (rock and gravel layers)	17.00
114720	19.00 to TD (blue clay)	0.00 to 19.00 (basalt)	20.00

BH Ref.	Drillers log description		Termination depth (mbgl)
	Soil Mbgl (material)	Rock Mbgl (material)	
56137	(0.00 to 12.00 – no details available)	12.00 to 14.00 (rock)	19.00
	14.00 to TD (clay and rock)		
137777	0.00 to 4.00 (clay) 8.00 to 9.00 (clay)	4.00 to 8.00 (stone) 9.00 to TD (stone)	15.00
WRK032714	0.00 to 4.00 (clay) 8.00 to 9.00 (clay)	4.00 to 8.00 (stone) 9.00 to TD (stone)	15.00
WRK052943	0.00 to 1.20 (soil) 12.50 to TD (clay)	1.20 to 12.50 (basalt)	32.00
WRK090211	0.00 to 2.00 (soil)	2.00 to TD (basalt)	32.00
56158	0.00 to 9.00 (clay)	9.00 to TD (scoria)	15.00
56150	0.00 to 5.00 (clay) 21.50 to TD (gravel)	5.00 to 21.50 (basalt)	23.50
116492	0.00 to 4.00 (clay)	4.00 to TD (sandstone)	17.10
WRK968098*	0.00 to 1.00 (topsoil)	1.00 to 25.90 (basalt) 25.90 to TD (basalt and AQ?)	39.00

Notes:
Mbgl = metres below ground level at the time of the investigation
NE = not encountered
AQ? = no description is provided as to what AQ is.
WRK968098* = this BH was located within, according to the 50k geological mapping layer (GeoVic), the swamp and lake deposits (Qm1).

Figure 12 Select historical borehole locations



Source: GeoVic, accessed on 15th January 2025

Note that, although historical boreholes were identified in the Lotsearch report as being drilled within the swamp and lake deposits (Qm1) located to the east of the site, only one borehole record was available for review.

The material descriptions available are very basic and provide no further description than what is provided in Table 2. However, what it does highlight is the variability in the depth and thickness at which the various material types that were encountered. This variability is considered typical for these types of ground conditions.

From an information search, preliminary comments can be made regarding the soil that was encountered in the historical boreholes that are expected to be present from surface level at the site. 'Clay' is recorded as having been encountered in the majority of the historical boreholes, refer to Table 2. The origin of the clay is currently unknown. It is possible that it is residual soil from the Basalt which tends to be encountered as a reddish brown clay.

However, reference is made in the historical logs (56157 and WRK040269) to 'grey clay' and 'black clay'. Local knowledge of the Camperdown area would tend to suggest that this clay, particularly with reference to its colour, is generally associated with organic clay and may be an indicator of buried swamp deposits.

From the rock types identified in the historical boreholes, volcanic rock is the main rock type and is expected to form most of the residual soils and bedrock at the site.

- 'Basalt' is a volcanic rock that weathers to reddish brown clay.
- 'Scoria' is a pyroclastic, dark coloured volcanic rock. It has a low density and is a high strength rock with high internal angles of friction.
- 'Sandstone' was described as being present in BH WRK040269 and BH 116492. Based upon the geological setting, the occurrence of sandstone between layers of basalt is unlikely to occur. It may be the case that layers of Tuff (volcanic ash) may have been misdescribed. The description of this rock type could be confirmed with petrographic analysis.
- 'Stone' is most likely referring to Bluestone. Bluestone is a common layperson's description for basalt rock.

4.0 Geological and geotechnical risk assessment

4.1 Geological and geotechnical hazards

From the data review, presented in Section 3.0 of this report, it is possible to summarise the geological and geotechnical hazards and associated likelihood of the risks to the proposed development at the site, as presented in Table 3.

Table 3 Geological and geotechnical hazards and risk likelihood

Hazard	Comment	Risk	
		Unlikely	Plausible
Geological/geotechnical hazards			
Soft ground/compressible soils	From the information derived from the historical borehole logs and local knowledge, the site is potentially underlain by soft, compressible organic clay. The geology map suggests that swamp and lake deposits (Qm1) are present within the southeast and northeastern corners of the site. However, the actual extent of its presence across the site has not been assessed.	☐	☒
Variable soils	The depth and thickness of the soil types encountered in the historical borehole records obtained within the local area is highly variable.	☐	☒
Difficult excavation	Excavation would be expected to be relatively easy in the shallow soils, but as density and consistency increase slower progress would be expected particularly if weathered rock should be encountered. Shallow rock and floaters are a significant risk on this site and could certainly become a challenge, slowing down the progress of excavation.	☐	☒
Groundwater	Limited groundwater data exists.	☐	☒
Shallow rock	It is possible that shallow rock could be encountered during construction at the site. Although, it is not considered necessary that bedrock needs to be proven for the proposed development, it could slow down the progress of excavation for foundations, trenches and access tracks/roads, if encountered.	☐	☒
Karstic landscape	The geology recorded on site is not susceptible to Karstic processes.	☒	☐
Reactive soils	It is expected that the soils on site will be highly reactive.	☐	☒
Naturally occurring asbestos	The geology recorded on site is not considered to include asbestos.	☒	☐

Hazard	Comment	Risk	
		Unlikely	Plausible
Acid sulphate soils	The geology recorded on site is noted to be of a low risk of acid sulphate generation. Whilst unlikely to pose a risk good practice would require further proof via laboratory testing.	☒	☐
Saline soils	It is considered that saline soils are not present on the site.	☒	☐
General Slope Stability	There are changes in elevation across the site, but these are gradual and form a relatively flat environment.	☒	☐
Landslides	The geomorphology and geology of the site does not lend itself to the formation of relief or conditions that may pose a high risk of land sliding.	☒	☐
Erosion	It is considered that the soils present on site can be highly dispersive dependant on their grading. Should significant earthworks or soil movements be required then soils dispersiveness should be investigated.	☐	☒
Services	There is a power source identified close to the boundary of the site. It is expected that additional services and utilities could be present at or within close proximity to the site. Identification and planning around these and service location should be undertaken prior to intrusive works.	☐	☒
Uncontrolled/Engineered fill	Given the historical and current land use for the site, the risk of made ground and uncontrolled fill is low for most of the site but it is likely to be present somewhere.	☐	☒
Voids	There is no evidence or licensing that would suggest mining or quarrying has taken place on site.	☒	☐
Mining		☒	☐
Below ground structures	Given the historical land use for the site, the risk of below ground structures is low.	☒	☐
UXO	The UXO mapping shows that there is a very low anticipated risk of UXO on site.	☒	☐

4.1.1 Soft/compressible ground

From the historical borehole data, it is known that ‘clay’ was commonly encountered throughout the local area. However, no description is assigned to this material, so its strength, composition and potential source of origin are unknown.

With swamp and lake deposits highlighted as being present along the eastern boundary of the site, it is possible that ‘grey clay’ and ‘black clay’ could be present within the site boundary. It would be expected that these materials are organic (potentially peat) which are highly compressible and very soft too soft in strength. If not managed correctly, once loaded, such soils, are at a high risk of differential settlement.

This risk can be reduced by carrying out an intrusive ground investigation to assess whether these soils are present beneath the proposed footprint of the BESS structures.

4.1.2 Variable ground conditions

From the historical borehole data that has been reviewed, it is likely that the ground conditions, in terms of the depth, thickness and material composition of the varying strata across the local area in Camperdown are variable.

Should this variation exist across the site, differential settlement across the BESS structures could become a risk and will need to be considered when designing the foundations.

This risk can be reduced by carrying out an intrusive ground investigation to assess the ground conditions that are present beneath the proposed footprint of the BESS structures.

4.1.3 Difficult excavation

The ground conditions beneath the proposed location of the BESS structures are currently unknown. Should high density/high strength soils and weathered rock be encountered at depths that are within those anticipated for either foundations or buried services, this could make excavation challenging. Conversely, the presence of soft strength/loose density soil could lead to collapse of the excavation side walls.

This risk can be reduced by carrying out an intrusive ground investigation to assess the ground conditions that are present beneath the proposed footprint of the BESS structures.

4.1.4 Groundwater

Limited groundwater data exists for the site. From the information available, it is expected that it is approximately 5 m bgl. Groundwater that is much shallower than this, could pose a risk during excavation and would require management i.e. pumping, to remove it during construction.

Following rain events, perched water may accumulate on cohesive surfaces. Should this occur, it will require careful management, for example, drainage or a granular blinding layer, during the construction works to ensure that areas can remain trafficable

This risk can be reduced by carrying out an intrusive ground investigation and recording any groundwater observations that may present.

4.1.5 Shallow rock

The depth to rock is unknown at the site. It was encountered at variable depths within the historical boreholes that have been reviewed for the local area. It is not necessary to understand where bedrock is beneath the site for the BESS development. However, should rock be encountered at a depth where foundations or buried services are likely to be located, although favourable for supporting building structures, could pose a challenge for excavatability.

This risk can be reduced by carrying out an intrusive ground investigation to assess the ground conditions that are present beneath the proposed footprint of the BESS structures.

4.1.6 Dispersive soils

Until quantified, it is considered that the clay soils which are expected to be present could be highly dispersive dependent on their grading and composition. Owing to the earthworks that are expected to take place on the site, soil dispersiveness should be investigated.

This risk can be reduced by taking samples for dispersion testing (Emerson Class) in the laboratory. These samples can be obtained during intrusive ground investigation.

4.1.7 Reactive soils

The actual reactivity of the clay soils that are expected to be present on the site are unknown. However, from local experience of these soils, Basaltic clays (Neo) and swamp and lake deposits (Qm1) can be highly to extremely reactive with significant shrinking and swelling within the clay matrix to be expected which will impact the foundation design adopted to support the load of the BESS structures.

This risk can be reduced by taking samples for shrink swell testing in the laboratory. These samples can be obtained during an intrusive ground investigation.

4.1.8 Acid Sulphate Soils

Although it is expected that the risk of ASS's being present on the site is low, there is low confidence in the range presented in the data set. It is considered that the geological conditions present have a low risk of containing the geochemical properties required to generate acid sulphate.

It is best practice to confirm this during intrusive investigations.

4.1.9 Services

It is likely that there are services and utilities, present at or within close proximity to the site, that are currently unknown. The risk of this needs to be considered as part of the methodology and risk assessments for any work undertaken on site.

4.1.10 Uncontrolled fill

Although the site has historically been used for agricultural purposes, it is possible that uncontrolled fill could exist. Its presence could pose a risk to the foundation design as it is not generally accepted as a suitable founding stratum.

This risk can be reduced by carrying out an intrusive ground investigation to assess the ground conditions that are present beneath the proposed footprint of the BESS structures.

5.0 Geotechnical advice and recommendations

5.1 Geotechnical advice for concept designs

5.1.1 Foundations

From review of the desktop data presented in Section 3.0 and from assessing the associated geotechnical risks and hazards, presented in Section 4.0, it can be summarised that the site is potentially geotechnically complex. Note there is currently no geotechnical data that is specific to the site. However, based on the historical borehole logs, refer section 3.12, that are available for local area, it can be assessed that the current geotechnical risks associated with the site are as follows:

- Potential for shallow high strength rock (Basalt/Scoria) resistant to excavation
- Potential for highly reactive clays that will require deepened and stiffened foundations
- Potential for soft/compressible soils that will require ground improvement

Depending on the actual ground conditions, it is possible that a shallow foundation may be appropriate to support the load of some of the structures. High strength soil and/or weathered rock may be present that will be able to support the loads within tolerable (total and differential) settlement limits. However, these shallow foundations must consider the potential reactivity of any clays present.

The concrete slab that supports the substation is expected to be the most movement sensitive structure at the BESS. Should this slab, or any other rigid support systems span ground conditions of varying material composition and strength/density, both laterally and with depth, appropriate structural design to accommodate movement will need to be considered.

In addition, should the findings from the reactivity testing indicate that the soils are highly reactive, this again must be accounted for in the slab design. Highly reactive soils imply high ground surface movements resulting from the potential of the soil to shrink and swell upon drying and wetting. Certain types of slabs, for example, waffle slabs, are generally not considered appropriate in such highly reactive conditions.

To confirm an appropriate foundation system for the various BESS structures, it is strongly recommended that a site investigation is carried out. The findings from the site investigation will assist in informing the geotechnical design of the foundations.

5.1.2 Earthworks

It is currently anticipated that cut and fill would be required to create suitable building platforms for the proposed structures, ref. drawing 620.041535-CI-1010, ‘Cut and Fill Preliminary Earthworks Layout Plan’, presented in Appendix C. All earthworks procedures should be carried out in a responsible manner in accordance with AS.3798-2007 “Guidelines on Earthworks for Commercial and Residential Developments”.

The level of subgrade preparation required should be determined based on findings from the recommended intrusive investigation works and subsequent laboratory testing.

5.1.2.1 General site preparation

In order to prepare the site, the following procedures are suggested to be undertaken prior to any proposed construction:

- Strip all existing filling and/ or deleterious materials and remove to stockpile for retention or off-site disposal.

- At design levels, roll the exposed surface with minimum six passes of a minimum ≥12 tonne smooth roller, followed by a further proof roll pass in the presence of a geotechnical engineer or testing authority to detect additional soft or compressible zones. Where encountered, localised soft or compressible zones may require additional over-excavation to invert of soft zone and replacement with competent soils compacted in accordance with earthworks specification.

5.1.2.2 Compaction procedures

In general, all filling works should be carried out with full-time onsite supervision from a Geotechnical Inspection Testing Authority (GITA) to Level 1 requirements (in accordance with developed earthworks specifications and AS 3798-2007 'Guidelines on Earthworks for Commercial and Residential Developments') so that the fill formation is adequately and uniformly compacted, with appropriate testing carried out in accordance with AS 1289.

5.1.2.3 Excavatability

Based on the geology and records to date it is considered that excavation will be readily undertaken using conventional earthmoving equipment such as large capacity dozers and excavators.

However, should shallow rock or shallow groundwater be encountered this may make excavation more difficult. In this case a suitably experienced earthworks contractor should be sought for advice with regard to excavation machinery required, for example rock breakers.

5.1.2.4 Trafficability, site drainage and weather

Problems may arise when the upper level soil is disturbed and exposed to rainfall or runoff which may result in weakening of the soil. An important aspect of maintaining trafficability is seepage/drainage control, particularly within the areas of the site where there are greater thicknesses of soil. The site will quickly become untrafficable if appropriate seepage and drainage control measures, along with construction practices appropriate for the site conditions, are not maintained. It should be ensured that runoff is diverted away from the construction area to prevent ponding of water.

Cohesive soils can be susceptible to severe loss of strength with an increase in moisture content that can occur during wetter times of the year or after heavy rainfall. Significant material improvement may be required if heavy rainfall and water are allowed to enter excavations.

While it would be preferable for construction to be programmed for the drier months, given the possibility of wet weather during construction, we recommend the following:

- Place surface water runoff collection and diversion systems around the excavation to divert surface water away from the trenches/pits.
- If wet weather is anticipated, or seepage water is accumulating in the base of the excavation, excavate a downslope collection sump to pump water out to minimise ponding and saturation.
- Replace unsuitably wet materials with a suitable fill such as sand or gravel to enable construction to proceed. Note that the suitability of any proposed fill for this purpose will require laboratory testing and/or sufficient proven performance in practice.

The contractor should fully inform themselves of the ground conditions on site prior to the commencement of earthworks. The requirement should be explicit in any earthwork's specifications or contract. Please note that should highly reactive clays be present within the project footprint area; additional measures may need to be taken during the earthworks to

reduce the effects of shrink swell on the soil. In addition, special consideration needs to be given if the clay is to be used as fill as it can result in excessive ground surface movements if not adequately treated and compacted under controlled conditions.

6.0 Recommendations for geotechnical site investigation

A geotechnical site investigation should be undertaken to finalise any risks associated with the findings presented in Section 4.0.

6.1 Intrusive geotechnical investigation

Based on the information reviewed the following outstanding risks should be investigated via an appropriate intrusive investigation:

- Confirm the site-specific ground conditions across the site including thickness and/or depth of soil and depth to top of rock across the project footprint.
- Assess material type, composition, strength/density, depth and thickness and material variability with depth and laterally across the site.
- Undertake suitable levels of laboratory testing to confirm the conclusions to date and provide information regards earthworks reuse and construction.
- It would be prudent to cover the below recommended items during the detailed investigation.
- Boreholes or Test Pitting (as deemed appropriate) across the footprint of the proposed structures (at a frequency determined suitable to control risk):
  - Shallow investigation, testing pits to 2.50 m bgl (or refusal) and boreholes with SPT testing at 1.0 m centres to 5.00 m bgl (or refusal).
  - Collection of bulk, disturbed, undisturbed and chemical testing samples.
- Test Pitting/DCP testing for proposed access tracks and areas of pavement hardstand.

6.2 Geotechnical laboratory testing

It is recommended that a comprehensive laboratory testing program is undertaken to confirm the material properties and geotechnical parameters of the soils encountered during the intrusive geotechnical investigation. A summary of the proposed geotechnical testing that could be carried out that is appropriate to the ground conditions expected within the study area is presented in Table 4.

Table 4 Proposed laboratory testing and rationale

Test Method	Standard	Rationale
Soil - Characterisation		
Moisture Content	AS 1289.2.1.1	Determine moisture content of recovered material to assess in-situ conditions and likely behaviour characteristics.
Particle Size Distribution	AS 1289.3.6.1	Characterise material and assess suitability for material re-use in construction.
Atterberg Limits	AS 1289 3.3.1	Assess the liquid and plastic limit of cohesive soils (clays and silts) and assess suitability for reuse and likely behaviour characteristics with moisture changes.
Linear Shrinkage	AS 1289 3.4.1	Using Atterberg Limit findings, further assess the material behaviour with moisture change, i.e. its shrinkage.

Test Method	Standard	Rationale
Shrink Swell Index	AS 1289.7.1.1	Assess shrink swell properties of soil. Used as input for lot classification.
Emerson Class	AS 1289 3.4.1	Assess the materials propensity to disperse into a liquid.
Proctor (Standard)	AS 1289.5.1.1	Determine the relationship between the materials moisture content and its density with compaction. Assess the compaction effort required and moisture content for materials in construction.
Salinity Suite	ALS suite	Electric conductivity used to assess salinity of soil.
Aggressivity Suite	ALS Suite	Aggressivity suite on soil to evaluate concrete cover and steel corrosion resistance for structures founded below surface.
Soil - Strength		
California Bearing Ratio	AS 1289.6.1	Assess California bearing ratio of subgrade materials.

6.3 Geotechnical design report

From the findings of the intrusive geotechnical site investigation and the geotechnical laboratory testing, an interpretative report can be prepared to present the field data and geotechnical design recommendations for the proposed BESS development.

7.0 Summary and conclusions

Considering the review of the available information that forms the basis of this desk study, it is apparent that the site is potentially geologically complex. The ground and groundwater conditions at the site are currently unknown. However, data from the local area suggests that they are highly variable in terms of material composition, strength/density and thickness and depth.

The risks associated the potential geotechnical conditions within the study area, including the project footprint, are currently unquantifiable. Once a site investigation has been completed, the geotechnical risks can be better quantified so that an appropriate geotechnical assessment can be progressed to inform a suitable design for the structures and to confirm an appropriate location for the BESS infrastructure.

Appendix A Site location plan

Geotechnical Desk Study

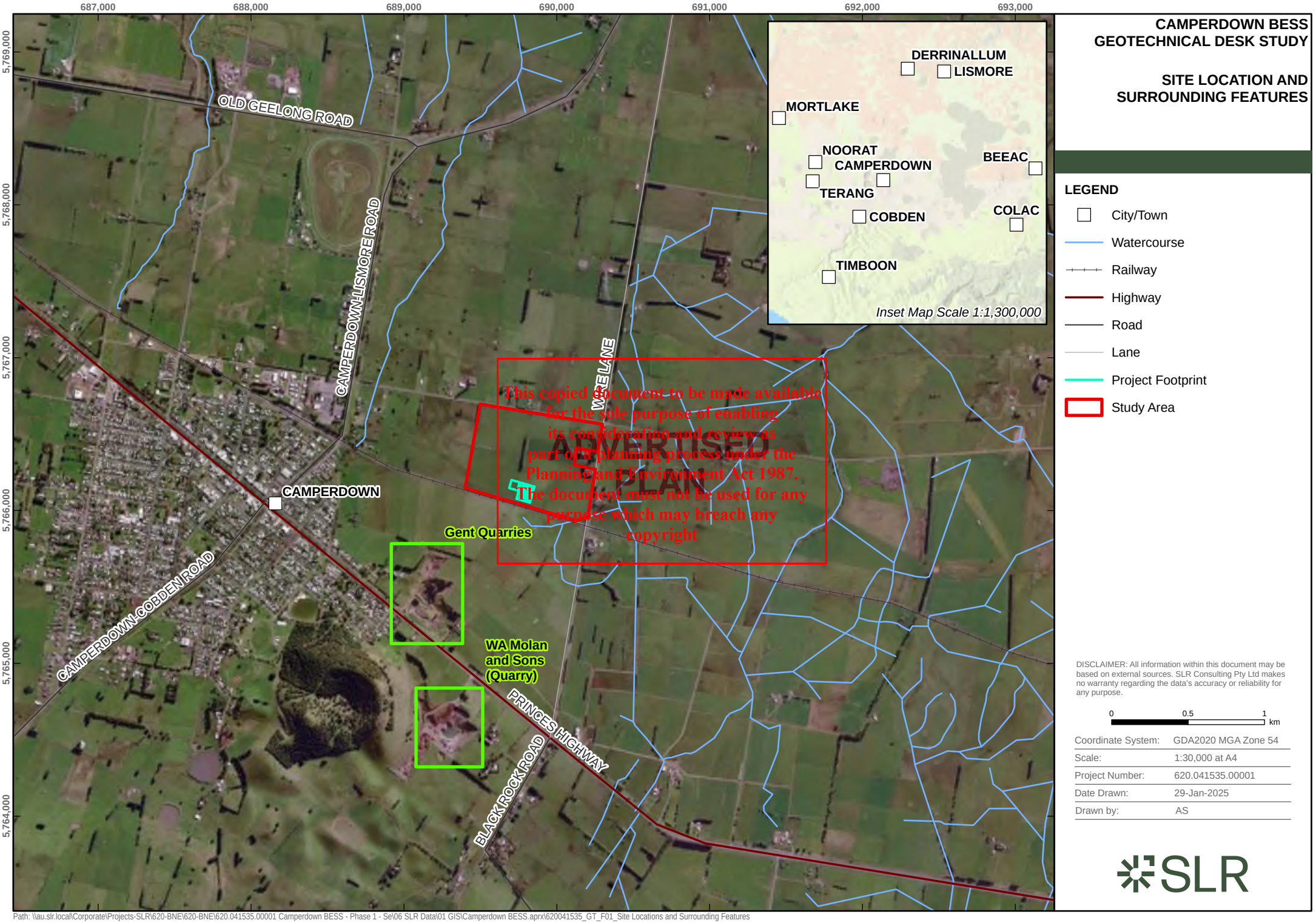
Camperdown Battery Energy Storage System (BESS)

Camperdown BESS Pty Ltd

SLR Project No.: 620.041535.00021

6 February 2025

SLR



CAMPERDOWN BESS GEOTECHNICAL DESK STUDY

SITE LOCATION AND SURROUNDING FEATURES

LEGEND

- City/Town
- Watercourse
- Railway
- Highway
- Road
- Lane
- Project Footprint
- Study Area

0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 54
Scale:	1:30,000 at A4
Project Number:	620.041535.00001
Date Drawn:	29-Jan-2025
Drawn by:	AS

SLR

Appendix B Proposed BESS development plan

Geotechnical Desk Study

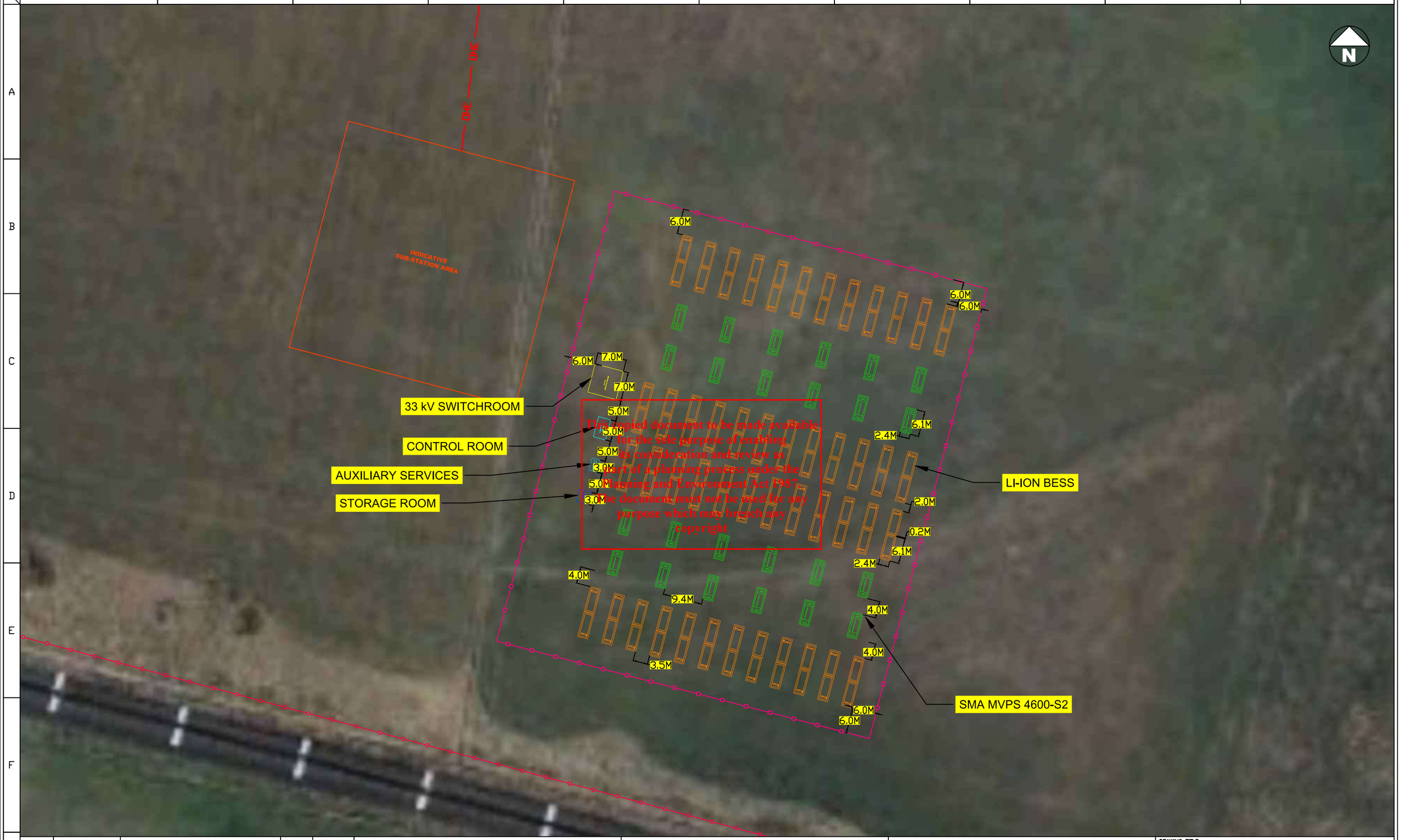
Camperdown Battery Energy Storage System (BESS)

Camperdown BESS Pty Ltd

SLR Project No.: 620.041535.00021

6 February 2025

SLR



REVISION	DATE	DESCRIPTION	DRAWN BY	APPROVED BY
0	20/11/2024	PRELIMINARY DESIGN	C.B	

Quintasenergy
MANAGING POWER
LEVEL 10/120 EDWARD STREET, BRISBANE, QLD–4000
Ph no.: +61 7 3103 0393
www.quintasenergy.com

CAMPERDOWN

ARES

ADVERTISED PLAN

DRAWING TITLE:
BESS-LAYOUT-CAMPERDOWN-PRELIM-SMA-BYD

DWG NO.:		SYSTEM CAPACITY (MWac):	75
JOB NO.:	–	BESS (MWh):	300
DNSP:	–	PV CAPACITY (MWp):	–
NMI:	–	SCALE:	1:500
ISSUE: 1		SHEET: 3	

NOT FOR CONSTRUCTION

Appendix C SLR earthworks plan

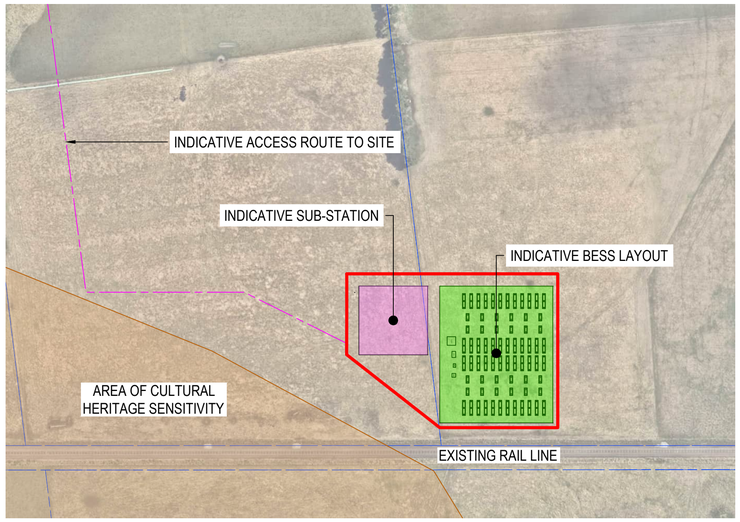
Geotechnical Desk Study

Camperdown Battery Energy Storage System (BESS)

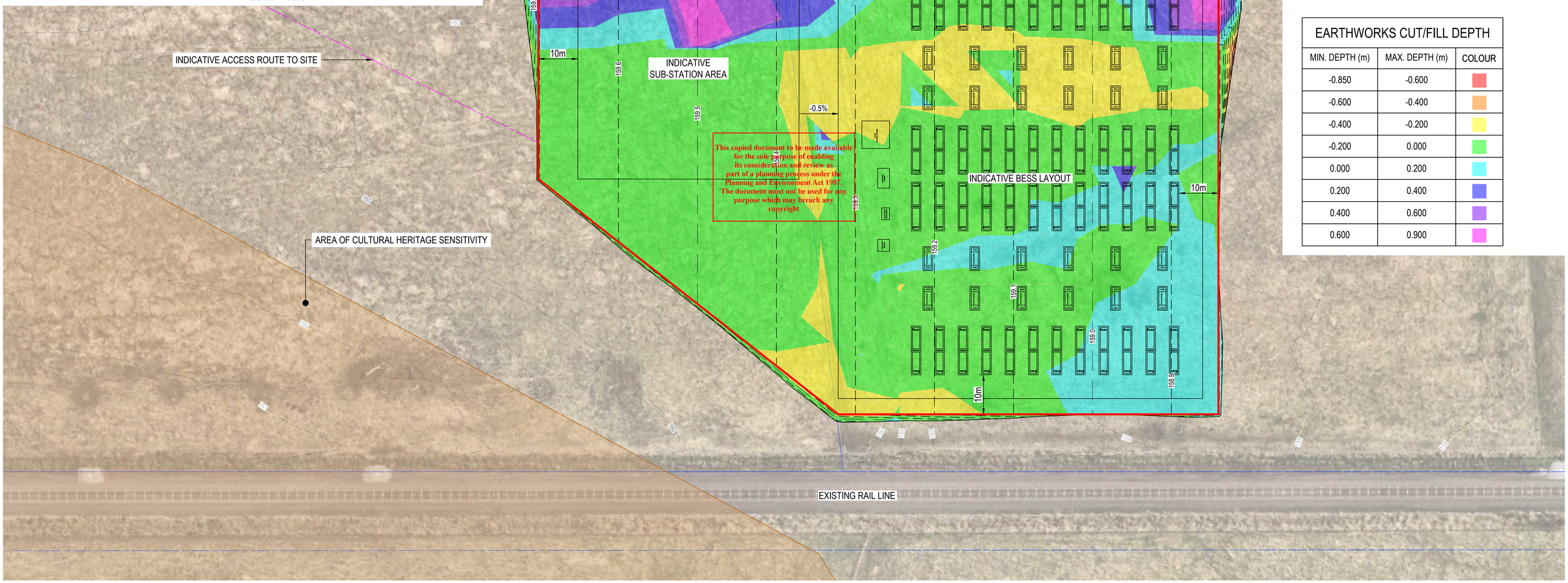
Camperdown BESS Pty Ltd

SLR Project No.: 620.041535.00021

6 February 2025



LOCALITY PLAN
SCALE 1: 2500



EARTHWORKS LAYOUT PLAN
SCALE 1: 500

NOTES:

1. EXISTING CONTOURS INTERVAL 0.5m, MGA 2020 COORDINATES.
2. SIDE BATTER SLOPES ARE 1V:6H
3. SITE SURVEY AND LiDAR COMBINED FOR EXISTING GROUND CONTOURS. AT DETAIL DESIGN A FULL SURVEY OF THE SITE EXTENTS SHOULD BE UNDERTAKEN TO CONFIRM EXISTING GROUND LEVELS.

LEGEND:

- CADASTRAL BOUNDARY
- 134.0 EXISTING GROUND CONTOURS
- 135.0 PROPOSED GROUND CONTOURS
- INDICATIVE INFRASTRUCTURE LIMITS (1.9ha)
- INDICATIVE ACCESS ROUTE TO SITE
- AREAS OF CULTURAL HERITAGE SENSITIVITY

CUT/FILL SUMMARY		
ITEM	QUANTITY	UNIT
CUT	-1795	m^3
FILL	1770	m^3
TOTAL	-25	m^3

*SIGN CONVENTION: NEGATIVE CUT, POSITIVE FILL.

EARTHWORKS CUT/FILL DEPTH		
MIN. DEPTH (m)	MAX. DEPTH (m)	COLOUR
-0.850	-0.600	
-0.600	-0.400	
-0.400	-0.200	
-0.200	0.000	
0.000	0.200	
0.200	0.400	
0.400	0.600	
0.600	0.900	

REVISIONS				
A	09/12/2024	FOR REVIEW	RMC	
	DATE	DESCRIPTION	APPROVED	

PLOT DATE 09-Dec-2024 2:56:13 PM

BEFORE YOU DIG www.byda.com.au

SCALE 1:2500 (0.0 25 50 75 100 METRES)
SCALE 1:500 (0.0 5.0 10 15 20 METRES)

DRAWN:	RMC	DATE: 09/12/2024
DESIGN:	RMC	DATE: 09/12/2024
DWG. CHECK:	RS	DATE: 09/12/2024
DES. CHECK:	RS	DATE: 09/12/2024
RESPONSIBLE PRINCIPAL SIGNATURE:		DATE:

RPEQ :

SLR
LEVEL 16, 175 EAGLE STREET
BRISBANE
QUEENSLAND, 4000
AUSTRALIA
T: +61 (0)7 3858 4800
www.slrconsulting.com

CLIENT: CAMPERDOWN BESS PTY LTD

PROJECT: CAMPERDOWN BATTERY ENERGY STORAGE SYSTEM (BESS) PHASE 1
LOTS 2/LP34716, 2/PS817143 WIRE LN, CAMPERDOWN

DRAWING TITLE: CUT & FILL PRELIMINARY EARTHWORKS LAYOUT PLAN

SIZE: A1

STATUS: NOT FOR CONSTRUCTION

SCALE: AS SHOWN

DATUM: GDA 2020 Z54

DRAWING NUMBER: 620.041535-CI-1010

REVISION: A

\\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.041535.00001 Camperdown BESS - Phase 1 - Sel\06 SLR Data\06 CAD\620.041535-CI-1010.dwg

Appendix D Gaps analysis

Geotechnical Desk Study

Camperdown Battery Energy Storage System (BESS)

Camperdown BESS Pty Ltd

SLR Project No.: 620.041535.00021

6 February 2025

SLR

Table B-1 Gap Analysis

Category	Data available	Source	Suitability	Residual Data Gap Risk
Topography	Yes	*Lotsearch, Nearmap and GeoVic*	Suitable quality of data to allow for assessment however greater detail can be gleaned from higher resolution of data.	Low
Hydrology and Hydrogeology	Yes	*Lotsearch, GeoVic, Visualising Victoria's Groundwater and DELWP*	Limited availability of data and insufficient coverage, whilst it is unlikely for groundwater levels to have changed substantially it would be prudent to confirm data and bear in mind seasonal changes and fluctuations.	Medium
Geology	Yes	*Lotsearch, GeoVic and Geosciences Australia*	Suitable quality of data to allow for indication of geological conditions, correlated with investigation boreholes. However, the number of locations for the size of the site is not sufficient.	Medium
Historical Mapping	Yes	*Lotsearch and Nearmap*	Maps available for a limited number of years, more would be preferable covering a greater range of time. However not considered to have great impact on the assessment.	Low
Reports and records	No	*(none available)*	No geotechnical reports and records available for the site.	High
Mining and Raw Materials	Yes	*Lotsearch and GeoVic*	No records of mining or raw mineral licenses / permits within the site boundary	Low
Acid Sulfate Soil	Yes	*Acid Sulphate Soil (ASS) Risk Map, Lotsearch*	Suitable quality of data to allow for assessment.	Low
Services and Utilities	Yes	*Open Infrastructure Map Website*	Suitable quality of data to allow for assessment.	Medium
UXO	Yes	*Government of Australia (department of defence) UXO risk map*	Suitable quality of data to allow for assessment.	Low

Making Sustainability Happen