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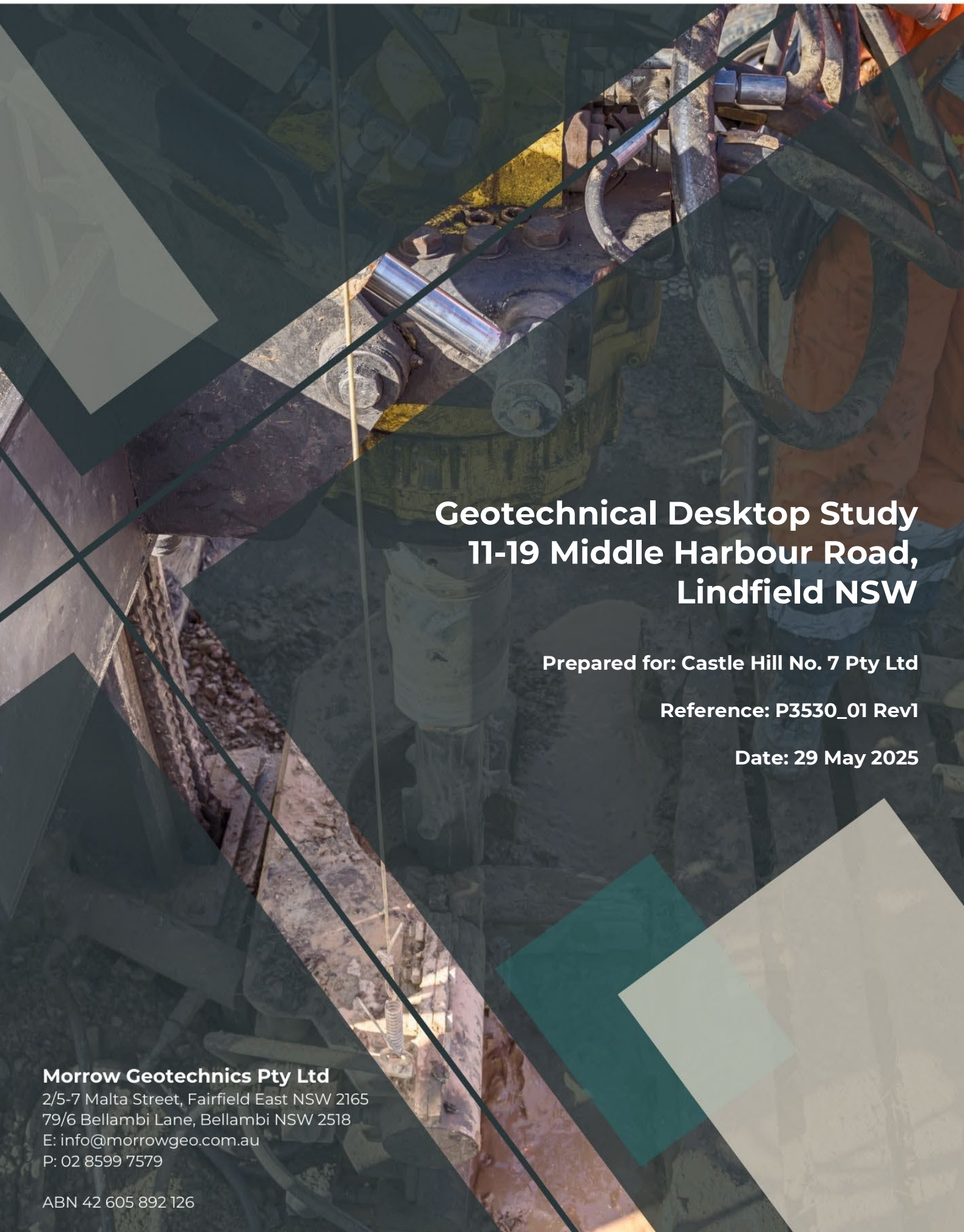

Geotechnical Desktop Study 11-19 Middle Harbour Road, Lindfield NSW

Prepared for: Castle Hill No. 7 Pty Ltd

Reference: P3530_01 Rev1

Date: 29 May 2025

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	Full Name & Title	Signature
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PROJECT DETAILS	
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Address of subject land	11-19 Middle Harbour Road, Lindfield NSW
Legal Description	
APPLICANT DETAILS	
Applicant name	**Castle Hill No. 7 Pty Ltd**
Applicant address	Level 40, 2 Chifley Square Sydney NSW 2000
REPORT DETAILS	
Name of report this declaration relates	Geotechnical Desktop Study for 11-19 Middle Harbour Road, Lindfield NSW
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Company name (inc. ABN / ACN)	Morrow Geotechnics Pty Ltd
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DECLARATION BY CONSULTANT	
Name	Alan Morrow
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Declaration

The undersigned declares that the Geotechnical Investigation Report:

- has been prepared in accordance with the following policy, guidelines, or legislative requirements:
- SEARS Environmental Assessment Requirements (Item 12)
- contains all available information relevant to the environmental assessment of the development, activity or infrastructure to which the Geotechnical Report relates;
- does not contain information that is false or misleading;
- identifies and addresses the relevant Planning Secretary's environmental assessment requirements (SEARs) for the project;
- identifies and addresses the relevant statutory requirements for the project, including any relevant matters for consideration in environmental planning instruments to which the Geotechnical Report relates;
- contains a consolidated summary of the proposed or necessary mitigation measures

Signature  **29/05/2025**

1. Project Background

Morrow Geotechnics Pty Ltd has undertaken a Geotechnical Desktop Study (GDS) for the proposed development at 11-19 Middle Harbour Road, Lindfield NSW (the site). This GDS report has been prepared to provide preliminary advice and recommendations for early development of designs for the proposed development. This report has been prepared to provide geotechnical advice and recommendations related to the proposed development.

SEARS Compliance Requirements are presented below:

Item	SEARS Requirement	Relevant Section of Report
12	**Ground and Groundwater Conditions** • Assess potential impacts on soil resources and related infrastructure and riparian lands on and near the site and including soil erosion. • Where required provide a concept Groundwater Impact Assessment in accordance with relevant Groundwater Guidelines. If the proposed development is on land identified as having high salinity or acid sulfate soil potential in an EPI provide a Salinity Management Plan or Acid Sulfate Soil Management Plan that includes appropriate management measures and strategies.	The site is not in an area of riparian lands and further assessment is not required. Concept Groundwater Impact Assessment provided in Sections 2.3, 2.4 & 4.5 of this report. The site is not in a mapped acid sulfate soil area and further assessment is not required. The site is not in a mapped area of high salinity potential and further assessment is not required.

1.1 Proposed Development

We understand that the proposed development will involve the demolition of existing structures and the construction of a multi storey residential development with basement parking.

1.2 Scope of Work

The purpose of this report is to present the findings from a desktop study, to provide information for the design of the proposed development. The following scope of work was carried out for the preparation of this report:

- Review of publicly available geotechnical information;
- Evaluate the ground conditions on the site;
- Create a preliminary geotechnical model;
- Evaluate general risks and opportunities for the proposed structures; and
- Recommend future geotechnical works that may be beneficial for the project.

1.3 Investigation Constraints

The GDS is limited by the preliminary intent of the study and the fact that no intrusive investigations have been undertaken at this stage. The discussions and advice presented in this report are intended for the development of preliminary shoring and excavation plans for the development. Further geotechnical investigations should be carried out after once site access is available to confirm both the geotechnical and groundwater model and the preliminary design parameters provided in this report.

2. Desktop Study

2.1 Site Description and Identification

The site Identification details, and associated information are presented **Table 1**.

Table 1 Summary of Site Information

Information	Detail
Local Government Authority	Ku-ring-gai Council Local Government Area
Site Description	The site comprises three lots and is rectangular in shape. See **Figure 1.** At the time of the study the site is occupied by four brick and rendered brick residential properties with one to two storeys and swimming pools, the site contains trees of approximately 5m to 15m in height
Current Zoning	R2 – Low Density Residential, Ku-ring-gai Local Environmental Plan 2015. See **Figure 2**
Site Area	Approximately 5217m^2 (from NSW Spatial Explorer, https://portal.spatial.nsw.gov.au/explorer)

Figure 1 Site Plan (source: https://portal.spatial.nsw.gov.au/explorer; 16 May 2025)

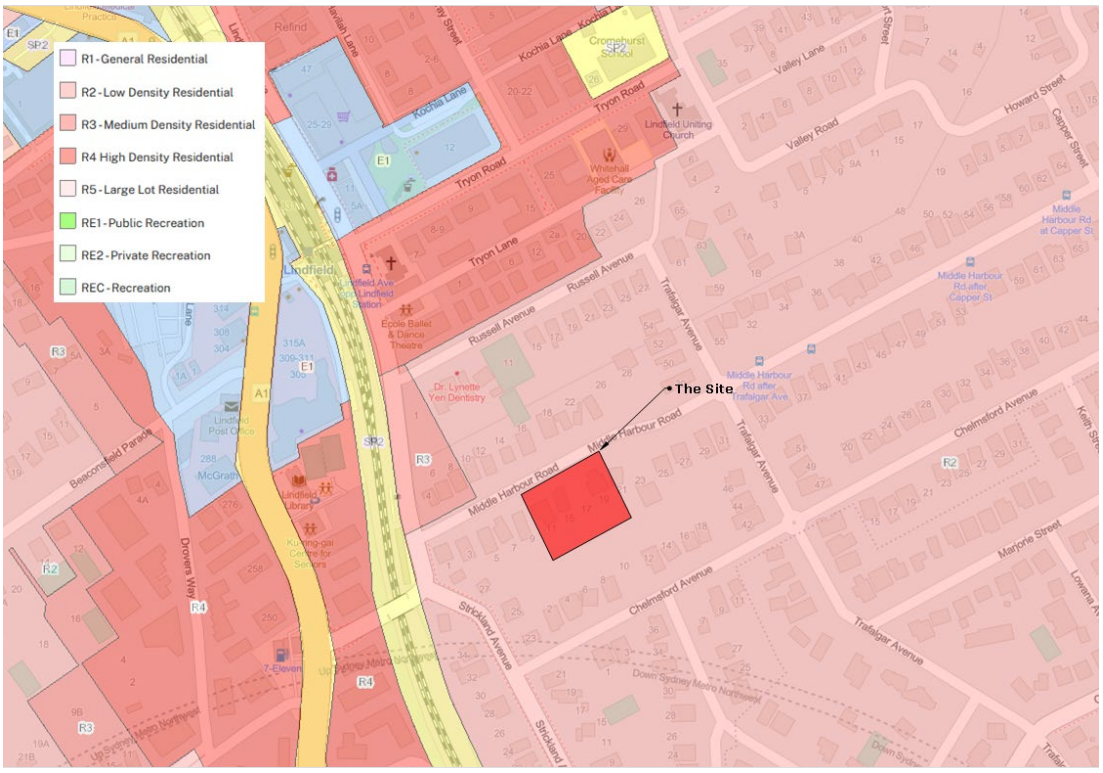

Figure 2 Current Zoning (source: geo.seed.nsw.gov.au; accessed 16 May 2025)

2.2 Local Land Use

The site is situated within a low-density residential and commercial area. The current used on the surrounding land is as described in **Table 2**. Observations presented in **Table 2** are based on walkover inspection publicly accessible areas surrounding the site. No access has been provided to neighbouring properties at the time of this study.

Table 2 Summary of Local Land Use

Direction Relative to Site	Land Use Description
North	Middle Harbour Road.
East	Occupied by a brick residential house with a swimming pool.
South	Four brick and rendered brick residential properties of one to two storeys with swimming pools.
West	Occupied by a rendered residential house.

2.3 Regional Setting

The site topography, geological and hydrogeological information for the locality is summarised in **Table 3**.

Table 3 Topographic, Geological and Hydrogeological Information

Attribute	Description
Topography	The regional geology grades downwards to the North East at approximately 15°-20° along Middle Harbour Road.
Soil Landscapes	The Soil Conservation Service of NSW Sydney 1:100,000 Soil Landscapes Series Sheet 9029-9030 (2nd Edition) indicates that the erosional landscape at the site likely comprises Glenorie Landscape. Generally, comprises gently undulating to rolling low hills on Wianamatta Group shales with inclined slopes of typically 5-20%. Soils of Glenorie landscape generally comprises shallow to moderately deep (<1000cm) red and brown podzolic soil in the upper slopes. These soils are noted moderately reactive.
Regional Geology	Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map Sydney 1:100,000 (Geological Series Sheet 9130) indicates that the site is underlain by (Rwa) Ashfield Shale of the Wianamatta Group, which is typically comprised of black to dark-grey shale and laminate. See **Figure 4**
Acid Sulfate Soils (ASS)	In accordance with the Ku-ring-gai Council Local Government Area Environmental Plan 2015 Acid Sulfate Soils Map, identifies the proposed development site as being within an area affected by acid sulfate soils (ASS) and classified as Class 5. See **Figure 5** below.
Structural Geology	Department of Mineral Resources Geological Map Sydney 1:100,000 (Geological Series Sheet 9130) indicates that the site is not on the alignment of mapped Dykes, Fault Zones or Joint Swarms.
Groundwater	An online search was conducted using the NSW Office of Water (NOW) real-time database, which records relevant information pertaining to all licensed water bores for the state of New South Wales indicates there are no groundwater bores within 500m from the site. From previous jobs within similar soil and rock landscapes within the local area our experience is that seepage water may be expected within open excavations from the soil rock interface.

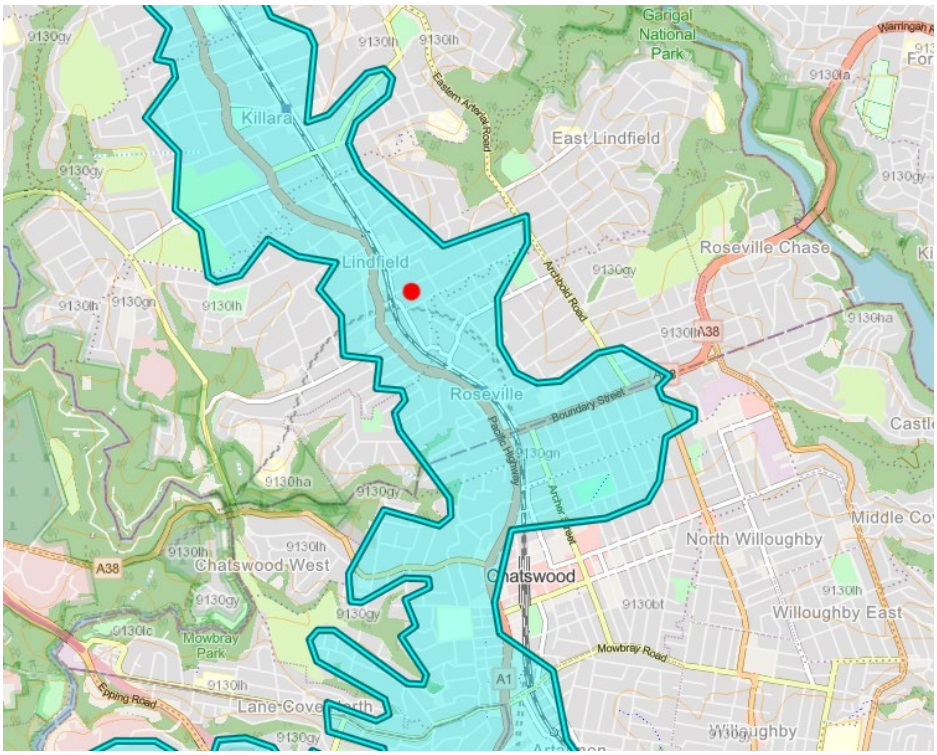

Figure 3 Glenorie Soil Landscape (source: geo.seed.nsw.gov.au; accessed 16 May 2025)

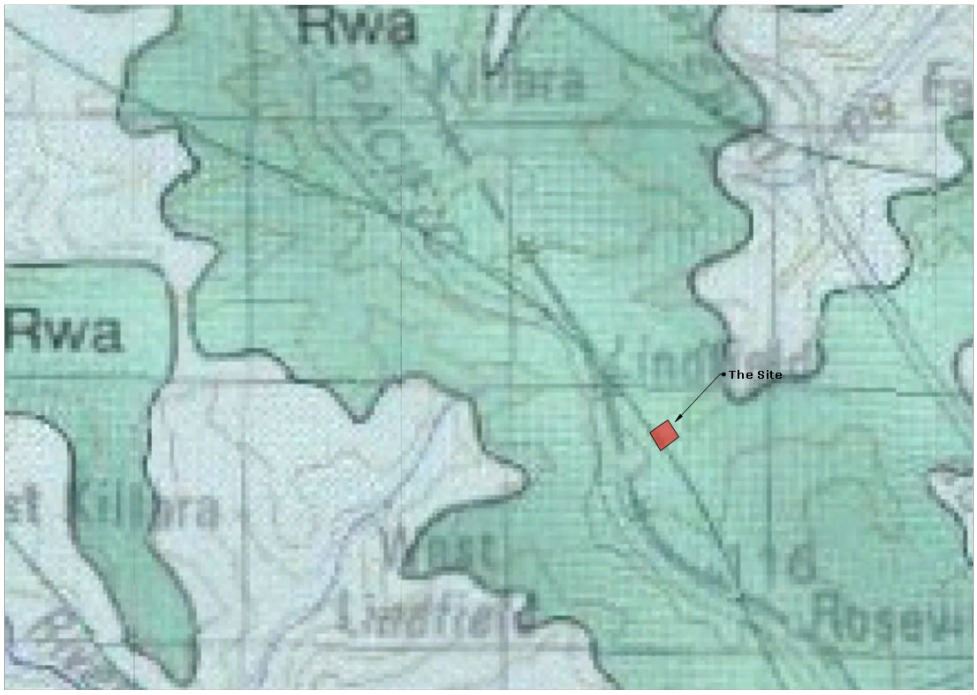

Figure 4 Regional geology for the Site - Department of Mineral Resources Geological Map Sydney 1:100,000 (Geological Series Sheet 9130)

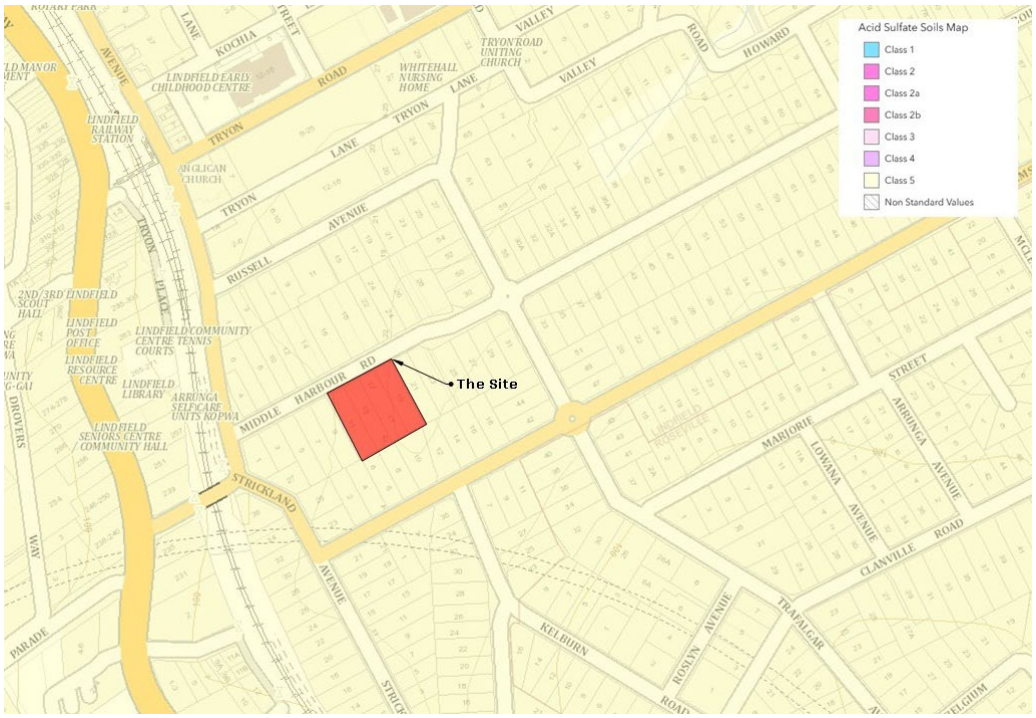

Figure 5 An excerpt from ASS Map (source: planningportal.nsw.gov.au; accessed 16 May 2025)

2.4 Publicly Available Information

Morrow searched for available geotechnical information in the area to understand the local geology of the site. No geotechnical investigation reports were found for nearby through a search on MinView – Geological Survey of NSW (minview.geoscience.nsw.gov.au), however Morrow Geotechnics has previously conducted geotechnical works within the surrounding area. The details are listed below in **Table 4**.

Table 4 Previous Geotechnical Investigations

Project	Author	Year
Trafalgar Avenue & Valley Road, Lindfield NSW,	Morrow Geotechnics Pty Ltd	2025
Pacific Highway, Lindfield NSW	Morrow Geotechnics Pty Ltd	2023
Woodside Avenue, Lindfield NSW	Morrow Geotechnics Pty Ltd	2021
Tryon Road, Lindfield	EI Australia Pty Ltd	2020

2.4.1 Trafalgar Avenue & Valley Road, Lindfield 2025

A geotechnical investigation was carried out by the Morrow Geotechnics in March 2025 at Trafalgar Avenue & Valley Road, Lindfield NSW, involving the drilling of five boreholes between 18.0 & 35.7 mBGL (metres below ground level). The subsurface material encountered during the investigation was summarised below.

- **Fill:** Silty sandy FILL and TOPSOIL, very loose to loose density, moist, fine to coarse grained, thickness ranging from 0.0 and 0.35 mBGL.
- **Residual Soils:** Sandy silty CLAY, medium to high plasticity, stiff to very stiff, fine grained, moist, extending to depths of 0.25 and 2.0 mBGL.
- **Very Low to Low Strength Sandstone:** Extremely to moderately weathered Sandstone, very low to low strength, fine grained, encountered at depths of 0.5 and 6.4 mBGL.
- **Medium to High Strength Sandstone:** Freshly weathered Sandstone, medium to high strength, fine grained, encountered at depths of 6.4 and 35.7 mBGL.

Standpipe piezometers were installed within BH1, BH2, and BH5 as part of the geotechnical investigation and recorded ground water depths were between 2.28 & 8.80 mBGL (81.27 & 82.52 mAHD)

2.4.2 Pacific Highway, Lindfield 2023

Foundation pile inspections were carried out between May and July 2023 to assess pile and socket conditions for detailed footing excavations at bulk excavation level (BEL). Material within the inspected piles comprised of moderately to slightly weathered interbedded shale and sandstone. The observed rock was medium to high strength with an adequate allowable bearing capacity of 3000 kPa.

2.4.3 Woodside Avenue, Lindfield 2021

A geotechnical investigation was carried out by the Morrow Geotechnics in 2021 at Woodside Avenue Lindfield, involving the drilling of two boreholes between 1.5 & 2.0 mBGL. The subsurface material encountered during the investigation was summarised below.

- **Fill:** Silty sandy FILL and TOPSOIL, very loose to loose density, moist, fine to coarse grained, thickness ranging from 0.0 and 0.35 m BGL.
- **Residual Soils:** Sandy silty CLAY, medium to high plasticity, stiff to very stiff, fine grained, moist, extending to depths of 0.25 and 2.0 m BGL.
- **Sandstone Bedrock:** Weathered Sandstone, fine to medium grained, extremely to moderately weathered, very low to medium strength, with trace silty clasts, encountered at depths between 1.5 and 2.5 m BGL.

Minor seepage was observed during drilling in BH1 near the soil/rock interface at approximately 1.8 mBGL, inflows may also occur within highly weathered sandstone layers.

2.4.4 Tryon Road, Lindfield 2020

A geotechnical investigation was conducted by EI Australia (EI) or the proposed development at Tryon Road, Lindfield for the construction of a 3 level basement car park. The subsurface material encountered during the investigation was summarised below.

- **Fill:** Gravelly sandy FILL and silty clay FILL, medium to coarse grained sand, fine grained clay, medium plasticity with construction waste, ranging from 0.0 m and 0.6 mBGL.
- **Residual Soils:** Silty CLAY, low to medium plasticity, stiff to hard, fine grained, grading into extremely weathered shale, extending to depths of 0.1 and 7.8 mBGL.
- **Very Low to Low Strength Interbedded Shale and Sandstone:** Distinctly weathered interbedded sandstone and shale, very low to low strength, fine to medium grained, with extremely weathered bands, encountered at depths between 3.0 and 15.6 mBGL.

- **Medium Strength Interbedded Shale and Sandstone:** Distinctly to slightly weathered interbedded sandstone and shale, medium strength, fine to medium grained, trace low strength zones, encountered at depths between 3.0 and 15.6 mBGL.
- **High Strength Interbedded Shale and Sandstone:** Slightly to fresh weathered interbedded sandstone and shale, high strength, fine to medium grained, trace low and medium strength zones, encountered at depths between 12.2 and 18.1 mBGL.

3. Expected Stratigraphy

Using the subsurface information from previous geotechnical investigations, published data and archived information, our proposed geotechnical units for the site have been developed to characterise the soil and rock strata and are presented in **Table 5** below.

Table 5 Summary of Inferred Subsurface Conditions

Unit	Material	Generalised Description
1	**Fill**	Generally mixed soils, likely to be uncontrolled and poorly compacted.
2	**Residual Soil**	CLAY/ Sand, stiff grading to hard, medium plasticity.
3	**Extremely Low Strength Shale**	Extremely weathered SHALE, extremely low to very low strength, fine grained.
4	**Extremely Low Strength Sandstone**	Extremely weathered SANDSTONE, extremely low to very low strength, fine grained.
5	**Low Strength Shale**	Highly weathered SHALE, low strength, fine grained.
6	**Low Strength Sandstone**	Highly weathered SANDSTONE, low strength, fine grained.
7	**Medium to High Strength Shale**	Moderately weathered to fresh SHALE, medium to high strength, fine grained.
8	**Medium to High Strength Sandstone**	Moderately weathered to fresh SANDSTONE, medium to high strength, fine grained.

Detailed descriptions of the material likely to be encountered along with the depth of each stratigraphic unit can only be provided following an intrusive geotechnical investigation comprising cored boreholes.

4. Geotechnical Recommendations

4.1 Site Preparation

It is anticipated that the existing residential structures will be demolished. Excavation works will be conducted into the underlying soil layers and weathered bedrock within the proposed site and basement footprint.

Any deleterious/surplus material such as timber, concrete, rubble, and any other unsuitable materials shall be identified and disposed off-site. Any alluvial soils and residual soils within the bulk earthworks area can be stripped and stockpiled for later reuse/blending in accordance with a direction by a qualified geotechnical engineer. Reuse of the site-won materials should be contamination-free and should comply with Australia Standard AS3798-2007 Earthworks.

4.2 Dilapidation Survey

Extreme caution will be required during the demolition of existing structures, including concrete floor slabs, due to the close proximity of neighbouring buildings. To prevent potential damage or destabilisation of these structures, careful assessment and monitoring will be necessary throughout construction activities.

Due to proximity of the site to road reserves, underground utilities, and existing neighbouring structures, it is recommended that comprehensive dilapidation reports be prepared for surrounding structures within the zone of influence before demolition and excavation commence. Property owners should review and confirm the accuracy of these reports as a fair representation of existing conditions. These assessments should be carefully reviewed to ensure that appropriate demolition and excavation methods are nominated. Furthermore, this will help evaluate their condition before and after excavation and construction activities.

4.3 Excavation and Vibration

Excavation will likely involve excavation through soil and may extend into bedrock. Conventional earthmoving equipment, such as hydraulic excavators, can be used for soil and extremely weathered to highly weathered bedrock with very low to low strength. For stronger bedrock, heavy excavators equipped with toothed buckets may be necessary. If excavation into medium or higher-strength bedrock is required, hydraulic hammers attached to heavy excavators may be needed. All excavation work should comply with Safe Work Australia's *Excavation Work, Code of Practice* (2020).

The excavation is situated at adjacent structures and road reserves. Therefore, excavation support measures will be considered. This may involve the use of a shoring wall system or other suitable temporary retaining systems to provide the necessary stability and support during the excavation process. These methods will ensure the safety and integrity of the excavation works.

Site preparation and excavation activities may generate noise and vibration, potentially impacting neighbouring properties, infrastructure, and road reserves. This could result in structural damage to nearby buildings and disturbances to the public.

To mitigate these risks, it is recommended that a qualified consultant be engaged to assess site conditions and develop a Noise and Vibration Management Plan (NVMP) before construction begins. The NVMP should be implemented and regularly updated, with ongoing monitoring

conducted throughout the construction phase to ensure compliance and minimize adverse effects.

4.4 Acid Sulphate Soil

According to the Ku-ring-gai Council Local Environmental Plan 2015, the Acid Sulfate Soils Map in **Figure 5** in **Section 2.3** identifies the proposed development site as being within an area classified as Class 5. For sites in this category, development consent is required if works are carried out within 500 metres of Class 1, 2, 3, or 4 land and are likely to lower the water table below 1 metre AHD.

Actions Following Step 1

- If the activities are being carried out in an area that the ASS Planning Maps have defined as having an environmental hazard, and if these activities are expected to disrupt the soils in that area, then move on to Step 3. Step 2 can assist in verifying the presence of ASS in the mapped area and pinpointing the areas with the greatest risk.
- If the site is near an area mapped as having potential acid sulfate soils, proceed to Step 2 to assess whether such soils are likely to be present based on site characteristics and geomorphic factors.
- If the site is neither within nor adjacent to a mapped ASS area, no further assessment is required.

Step 2

To evaluate the likelihood of acid sulfate soils on-site, a desktop assessment was conducted, considering the topographic and geomorphic features outlined in **Section 2.3**. The criteria listed in **Table 6**, based on Section 2.2 of the Acid Sulfate Soils Assessment Guidelines (Acid Sulfate Soils Management Advisory Committee, 1998), were applied to determine the probability of acid sulfate soils occurring at the site

Table 6 Summary of the topographic and geomorphic features of the site

Assessment Criteria	Yes/No	Comments
Sediments of recent geological age (Holocene)	No	Quaternary Deposits, Triassic age
Soil horizons less than 5 m AHD	No	All works above 5m AHD
Marine or estuarine sediments and tidal lakes	No	See Section 2.3
In coastal wetlands or back swamp areas; waterlogged or scalded areas; interdune swales or coastal sand dunes	No	See Section 2.3
In area where the dominant vegetation is mangroves, reeds, rushes and other swamp-tolerant or marine vegetation such as	No	See Section 2.3

Assessment Criteria	Yes/No	Comments
swamp mahogany (Eucalyptus robusta), paperbark (Melaleuca quinquenervia) and swamp oak (Casuarina glauca)		
In areas identified in geological descriptions or in maps as bearing sulfide minerals, coal deposits or former marine shales/sediments	No	See Section 2.3
Deep older estuarine sediments >10 metres below ground surface, Holocene or Pleistocene age	No	See Section 2.3

Action Following Step 2

- If the proposed activities are likely to disturb areas that meet any of the identified criteria or are mapped as having a potential presence of acid sulfate soils, it is advisable to proceed to Step 3. This step involves assessing soil and water indicators to confirm the likelihood of acid sulfate soils.
- If the activities are planned in areas that do not meet the specified geomorphic or site criteria and are not within Class 1-4 zones on the planning maps, it can be reasonably concluded that acid sulfate soils are unlikely to be present. Soils that are geologically older or not derived from sedimentary deposits can generally be excluded from further assessment unless significant or deep disturbances are proposed.

Given that acid sulfate soils are typically found in saturated estuarine environments and low-lying areas near sea level, the likelihood of their presence at the proposed development site is minimal. Further investigation into acid sulfate soils should be carried out during geotechnical investigations to confirm this assessment.

4.5 Concept Groundwater Assessment

Based on the publicly available groundwater data, experience within local geology and ground water monitoring, the proposed excavation may intersect the groundwater table. It is possible to conclude that the hydrogeological conditions at the site are typical of a generally low to moderate permeability rock mass. Minor seepage to open excavations may occur at the soil/rock boundary in response to surface water infiltration following rainfall events.

On the basis of long-term groundwater carried out on sites within the immediate project area, it may be anticipated that a drained basement is possible. Drained basement design should be demonstrated by groundwater studies and seepage modelling to WaterNSW *Minimum Requirements*.

The geological profile at the site comprises residual soil over shale and sandstone bedrock. The soils encountered are derived from weathering of the bedrock. Alluvial soils are not expected during the investigation. Acid Sulfate Soils are generally linked with alluvial and marine sediments of the Holocene era (<10,000 years ago). The soils encountered on site comprise residual soils derived from the Wianamatta Group which ages to the Middle Triassic era (between 247.2 and 237 million years ago). The soils encountered at the site are not consistent in age or

origin to produce Acid Sulfate Soils. An Acid Sulfate Soils Management Plan is not required for the site under ASSMAC Guidelines.

Additionally, groundwater aggressivity towards steel and concrete should be evaluated in accordance with AS 2159:2009, which provides guidelines on the susceptibility of foundation materials to soil and groundwater conditions.

4.6 Foundations

We recommend that proposed buildings are supported by large pad footings or bored piles founding on suitable Hawkesbury Sandstone or Ashfield Shale. To transfer column or building loads to more competent strata at depth and to limit the possibility of adverse foundation settlements or excavation movement, a piled foundation system may be considered. This will depend on specific load cases and specific load bearing locations, which can be optimised once intrusive investigations are undertaken.

For preliminary design purposes, the 'Foundations on Sandstone and Shale in the Sydney Region' by Pells, Mostyn and Walker (1998), provides a suitable basis for design. Foundation design parameters from Pells et.al. have been provided in **Table 6**.

Table 7 Typical Foundation Parameters for Foundations In Sandstone

Material	Ultimate End Bearing (kPa)	Allowable End Bearing (kPa) [1]	Ultimate Shaft Adhesions (kPa) [2]
Extremely Low to Low Strength Shale	2100	700	100
Extremely Low Strength Sandstone	3000	1000	150
Low Strength Sandstone	6000	2000	200
Medium Strength Shale	7500	2500	250
High Strength Shale	10500	3500	400
Medium to High Strength Sandstone	15000	3500-6000	800

Notes:
[1] End bearing pressure to cause settlement of <1% of minimum footing dimensions
[2] Clean socket of roughness category R2 or better.

5. Conclusion

The Desktop Study indicates that the site is suitable for development. While uncertainties remain regarding groundwater depth and subsurface soil parameters, these are typical of preliminary assessments and can be resolved through a targeted geotechnical investigation. Conducting this investigation will allow for refinement of the ground model, reduction of geotechnical risk, and provision of reliable data to inform safe and efficient design and construction practices.

An initial groundwater assessment has been undertaken to determine that the proposed development may be carried out without detrimental impact to the regional groundwater regime.

6. Recommendations

A comprehensive geotechnical investigation is essential before advancing with the design and construction process. To ensure that the proposed development is built on a stable foundation, a detailed investigation should be carried out within the designated footprint of the development area.

The Intrusive investigation can be used to assess the nature and sequence of the subsurface strata, including physical and mechanical properties for use in specifying geotechnical design parameters. The investigation must consist of at least five boreholes extending to a minimum depth of 5 m below the proposed excavation level.

Furthermore, geotechnical inspections and verifications may be necessary during construction to confirm that design requirements and assumptions are met. These assessments can include verifying foundation materials, assessing soil/rock bearing capacity for shallow footings, and inspecting bored piles.

7. REFERENCES

AS1726:1993, Geotechnical Site Investigations, Standards Australia.

AS2159:2009, *Piling – Design and Installation*, Standards Australia.

AS2870:2011, *Residential Slabs and Footings*, Standards Australia.

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APPENDIX A
IMPORTANT INFORMATION

This Document has been provided by Morrow Geotechnics Pty Ltd subject to the following limitations:

This Document has been prepared for the particular purpose outlined in Morrow Geotechnics' proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.

The scope and the period of Morrow Geotechnics' Services are as described in Morrow Geotechnics' proposal, and are subject to restrictions and limitations. Morrow Geotechnics did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. The scope of services may have been limited by such factors as time, budget, site access or other site conditions. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Morrow Geotechnics in regards to it. Any advice given within this document is limited to geotechnical considerations only. Other constraints particular to the project, including but not limited to architectural, environment, heritage and planning matters may apply and should be assessed independently of this advice.

Conditions may exist which were undetectable given the limited nature of the enquiry Morrow Geotechnics was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required. No geotechnical investigation can provide a full understanding of all possible subsurface details and anomalies at a site.

In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Morrow Geotechnics' opinions are based upon information that existed at the time of the production of the Document. It is understood that the Services provided allowed Morrow Geotechnics to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

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Where ground conditions encountered at the site differ significantly from those anticipated in the report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the report that Morrow Geotechnics be notified of any variations and be provided with an opportunity to review the recommendations of this report.

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