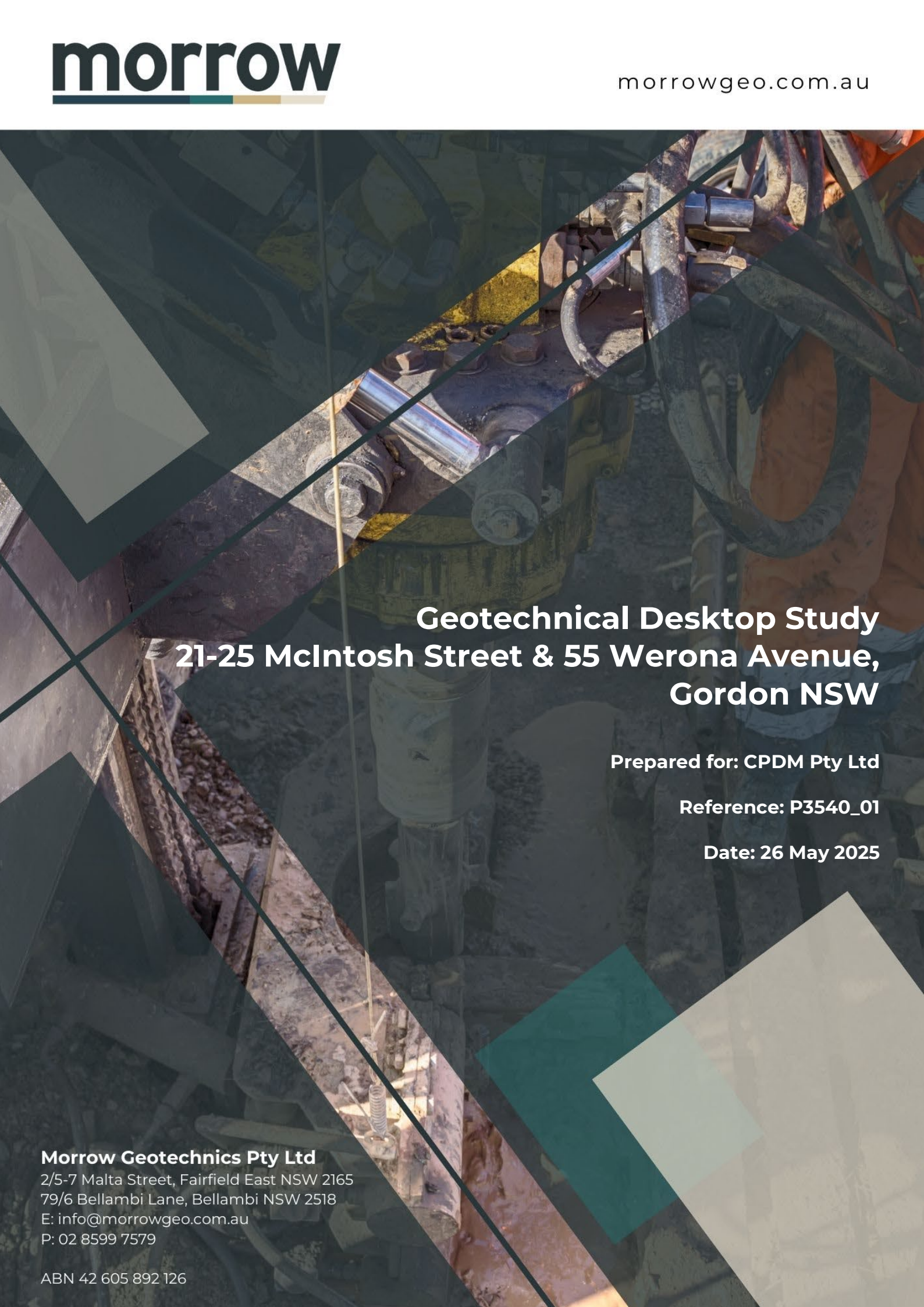


The background of the cover is a photograph of industrial machinery, likely a drilling rig, with various pipes, bolts, and mechanical components visible. The image is overlaid with several large, semi-transparent geometric shapes in shades of grey, teal, and orange, creating a modern, technical aesthetic.

Geotechnical Desktop Study 21-25 McIntosh Street & 55 Werona Avenue, Gordon NSW

Prepared for: CPDM Pty Ltd

Reference: P3540_01

Date: 26 May 2025

Morrow Geotechnics Pty Ltd

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Site Address	21-25 McIntosh Street & 55 Werona Avenue, Gordon NSW
Report Prepared for	CPDM Pty Ltd

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	Full Name & Title	Signature
Author	Ozzie Baskan Experienced Geotechnical Engineer	
Reviewer	Alan Morrow Principal Geotechnical Engineer	

PROJECT DETAILS

PROJECT NAME

Application number	SSD-83478456
Address of subject land	21-25 McIntosh Street & 55 Werona Avenue, Gordon NSW
Legal Description	Lot A in DP339345, Lot 5 in DP651557, Lot 1 in DP167505 and Lot 11 in DP1078667

APPLICANT DETAILS

Applicant name	CPDM Pty Ltd
Applicant address	Level 40, 2 Chifley Square Sydney NSW 2000

REPORT DETAILS

Name of report this declaration relates	Geotechnical Desktop Study for 21-25 McIntosh Street & 55 Werona Avenue, Gordon NSW
Report reference no.	P3540_01
Report date	26/05/2025
Company name (inc. ABN / ACN)	Morrow Geotechnics Pty Ltd
Author name	Ozzie Baskan
Author qualifications	BEng (Civil), MEng (Cvil), MIEAust
Author address	2/5-7 Malta Street, Fairfield East NSW

DECLARATION BY CONSULTANT

Name	Alan Morrow
Registration no.	2474672
Organisation registered with	Engineers Australia

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
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Signature



26/05/2025

1. Project Background

Morrow Geotechnics Pty Ltd has undertaken a Geotechnical Desktop Study (GDS) for the proposed development at 21-25 McIntosh Street & 55 Werona Avenue, Gordon 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.	<i>The site is not in an area of riparian lands and further assessment is not required.</i> Concept Groundwater Impact Assessment provided in Sections 2.3, 2.4 & 4.5 of this report. <i>The site is not in a mapped acid sulfate soil area and further assessment is not required.</i> <i>The site is not in a mapped area of high salinity potential and further assessment is not required.</i>

1.1 Proposed Development

We understand that the proposed development will involve the demolition of existing structures and the construction of 3 x eight-storey residential developments over two levels of 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 four lots in irregular shape in total. See Figure 1 . At the time of the study, the site is occupied by two single-storey and two double-storey residential properties with a swimming pool at the southeastern corner of 55 Werona Avenue Gordon NSW.
Current Zoning	R2 – Low Density Residential, Ku-ring-gai Local Environmental Plan 2015. See Figure 2
Site Area	Approximately 7272 m ² (from NSW Spatial Explorer, https://portal.spatial.nsw.gov.au/explorer)



Figure 1 Site Plan (source: <https://portal.spatial.nsw.gov.au/explorer>; 20 May 2025)

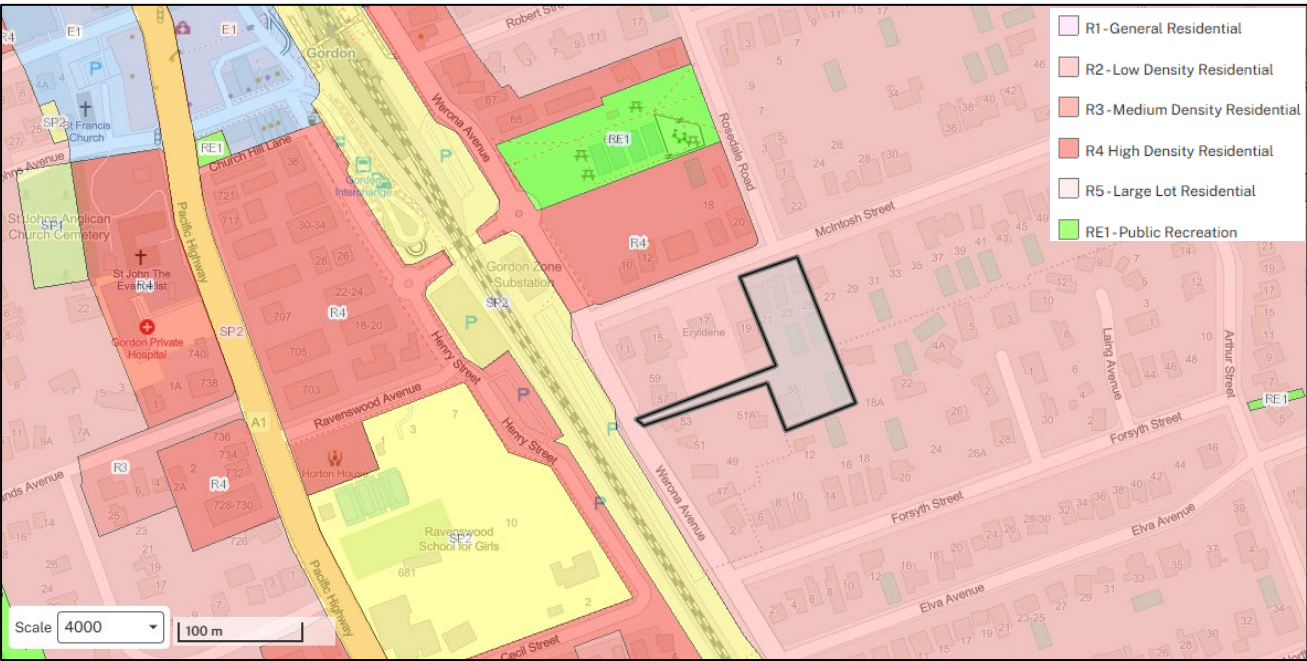


Figure 2 Current Zoning (source: geo.seed.nsw.gov.au; accessed 22 May 2025)

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	Mcintosh Street.
East	Occupied by a single-storey residential house (27 McIntosh Street, Gordon NSW and 18A Forsyth St, Killara NSW).
West	Occupied by a double-storey residential house (51A Werona Avenue Gordon NSW and 17 McIntosh Street, Gordon NSW).
South	Occupied by two double-storey residential houses (16 and 18 Forsyth St, Killara NSW) and a single-storey residential house (12 Forsyth St, Killara NSW)

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 site slopes gently downwards towards the north at less than 3°, and slopes more noticeably towards the east at approximately 3°. Additionally, the ground elevations within the entire site are between RL 107.0 mAHD and 111.0 mAHD.
Soil Landscapes	The site is divided two distinct soil landscapes: Lucas Heights (9130lh) in the north and Glenorie (9130gn) in the south. The Lucas Heights landscape features gently undulating crests on Mittagong formation shales and sandstones, with low relief (<30 m) and slopes under 10%. Soils are moderately deep Yellow Podzolic Soils and Soloths, with low fertility, stoniness, and limited water-holding capacity. The Glenorie landscape consists of rolling low hills on Wianamatta Group shales, with greater relief (50–80 m) and slopes of 5–20%. Soils range from shallow Red Podzolics on crests to deep Yellow and Gleyed Podzolics in drainage areas, with limitations including high erosion risk, plasticity, and moderate reactivity. See the Figure 3 .
Regional Geology	The geology of the site is covered by the Geological Survey of New South Wales (GSNSW) Seamless Geology Project Version 2.5, published in May 2025. The GSNSW seamless mapping, presented in Figure 4 indicates that the site sits within the Ashfield Shale (Twia) of the Wianamatta Group, which is typically comprised of black to dark-grey shale.
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 found five bores within 500m from the site. There is no recorded data for these bores. From previous jobs within similar soil and rock landscapes within the local area our experience is that minor volumes of seepage water may be expected within open excavations from the soil rock interface.

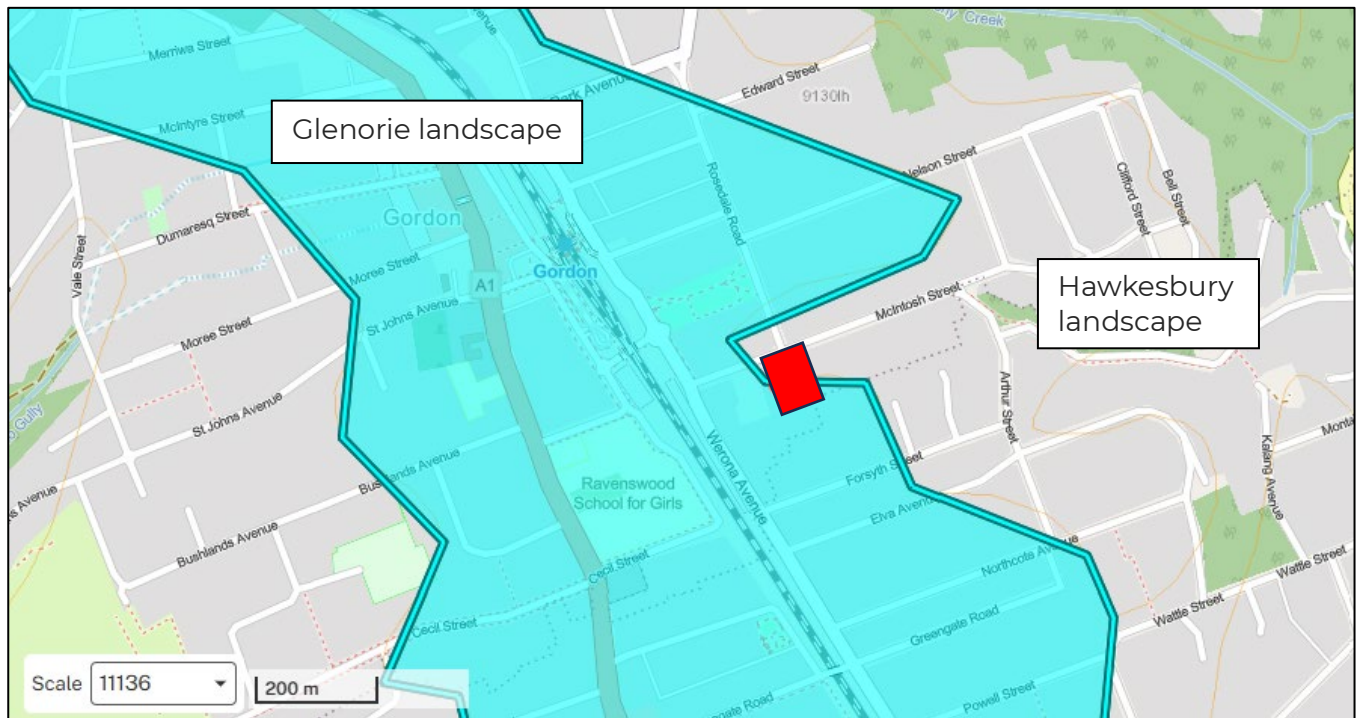


Figure 3 Glenorie and Hawkesbury Soil Landscape (source: geo.seed.nsw.gov.au; accessed 22 May 2025)

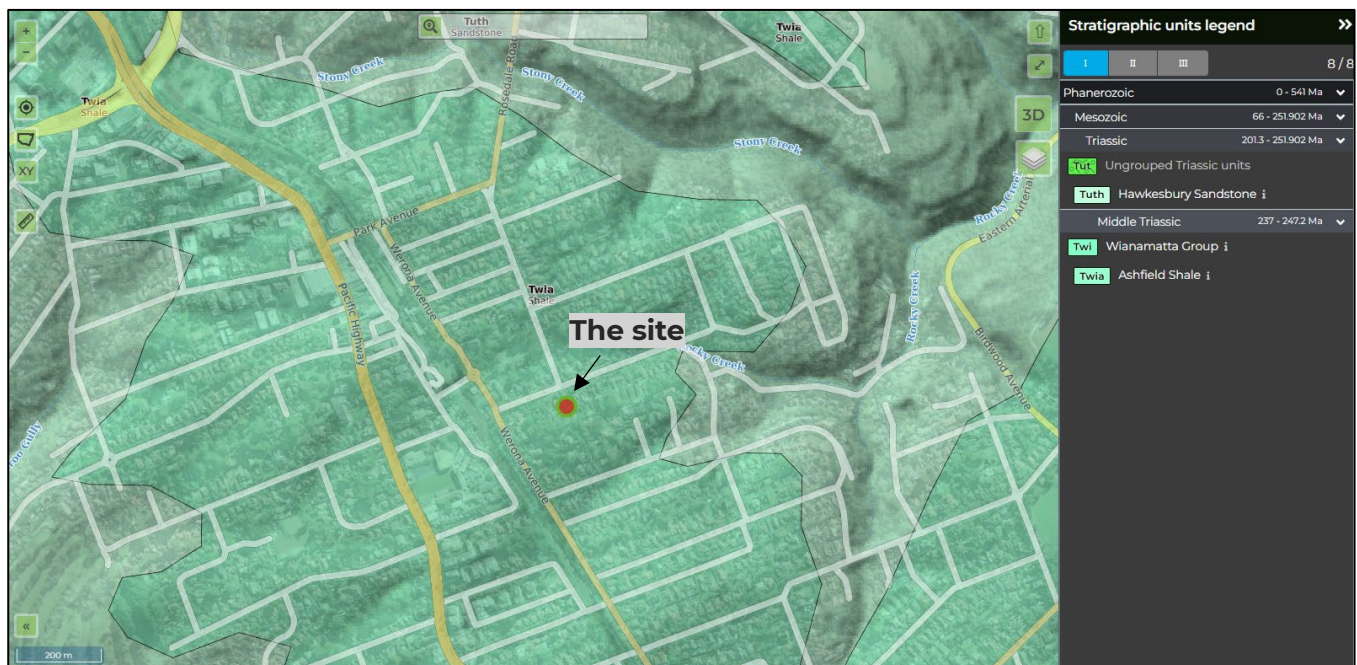


Figure 4 Regional geology for the Site (source: minview.geoscience.nsw.gov.au; accessed 22 May 2025)

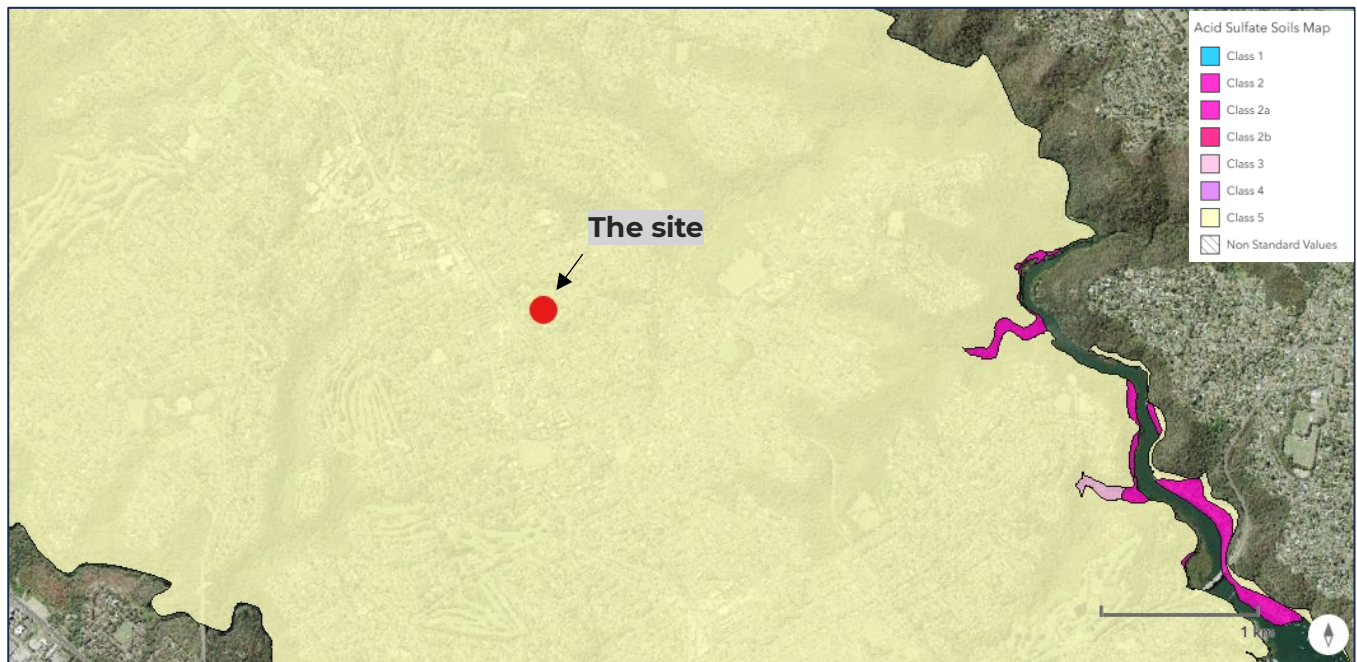


Figure 5 An excerpt from ASS Map (source: planningportal.nsw.gov.au; accessed 22 May 2025)

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 stratigraphic conditions at that location are consistent with those expected at the current site. The details are listed below in **Table 4**.

Table 4 Previous Geotechnical Investigations

Project	Author	Year
Stanhope Road, Killara NSW	Morrow Geotechnics Pty Ltd	2025

2.4.1 Stanhope Road, Killara NSW

A geotechnical investigation was carried out by the Morrow Geotechnics in April 2025 at Stanhope Road, Killara NSW, involving the drilling of five boreholes between 15.7 and 20.2 mBGL (metres below ground level). The site is located on the same ridge line along the alignment of the Pacific Highway and ground conditions are expected to be similar at McIntosh Street, Gordon. The subsurface material encountered during the investigation was summarised below.

- **Fill:** Silty to Gravelly SAND, loose, fine grained, fine to coarse sized gravel. Unit 1 is inferred to be uncontrolled and poorly compacted, encountered at depths of 0.0 and 1.2 mBGL.

- **Residual Soils:** Silty to Gravelly CLAY, stiff to hard, medium to high plasticity, fine to coarse sized gravel, subangular to subrounded ironstone gravel, less than plastic limit, encountered at depths of 0.1 and 3.6 mBGL.
- **Class V/IV Shale:** Extremely to highly weathered Shale, extremely low to very low strength, fine grained, with extremely weathered seams and ironstone bands, 5° laminations, encountered at depths of 2.0 and 14.9 mBGL.
- **Class III Shale:** Moderately to Slightly weathered Shale, low to medium strength, fine grained. Defects consist of subhorizontal partings at 1 to 10 mm, and Joints between 20° – 90°, encountered at depths of 8.3 and 17.8 mBGL.
- **Class II Shale:** Fresh Shale, medium to high strength, fine grained, with subhorizontal laminations at 1-2 mm spacing, encountered at depths of 13.0 and 20.2 mBGL.

Standpipe piezometers were installed within BH1, BH4, and BH5 as part of the geotechnical investigation. Long-term groundwater monitoring is underway on the Killara site at the time of preparation of this report.

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

Due to proximity of the site to the 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 close proximity of 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 Sulfate 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	Middle Triassic age
Soil horizons less than 5 m AHD	No	Above RL 5 mAHD
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

Assessment Criteria	Yes/No	Comments
In area where the dominant vegetation is mangroves, reeds, rushes and other swamp-tolerant or marine vegetation such as swamp mahogany (<i>Eucalyptus robusta</i>), paperbark (<i>Melaleuca quinquenervia</i>) and swamp oak (<i>Casuarina glauca</i>)	No	See Section 2.3
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 acid sulphate soils occurring at the proposed development site, based on the assessment, is very low. As a result, further investigation into the presence of acid sulphate soils can be excluded.

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*.

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.

The Conceptual Groundwater Assessment has determined that the proposed development may be carried out without detrimental impact to the regional groundwater regime.

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.

4.7 Pavement Design

Based on the supplied architectural drawings, one of the site access points will be from Werona Avenue, using the existing driveway, which extends approximately 100 metres to the proposed buildings. If renewal of the existing driveway pavement is planned, a specific geotechnical investigation is recommended to support appropriate pavement design.

The investigation should include the following laboratory tests:

- **3 x California Bearing Ratio (CBR)** tests to assess the subgrade strength;
- **3 x Standard Compaction** tests to determine the optimum moisture content and maximum dry density; and
- **3 x Moisture Content and Atterberg Limits** tests to classify the subgrade soils and evaluate their plasticity.

All tests should be performed in accordance with relevant Australian Standards. The results will provide essential data for pavement thickness design and construction quality control.

5. Conclusion

The Geotechnical Desktop Study indicates that the site is suitable for development. Further drilling and long-term groundwater studies must be taken prior to issue of a Construction Certificate in order to confirm the conceptual geotechnical and hydrogeological models presented in this study. 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.

The Conceptual Groundwater Assessment has determined 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 Six 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.

AS3798:2007, *Guidelines on earthworks for commercial and residential developments*, 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.

Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.

Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Morrow Geotechnics for incomplete or inaccurate data supplied by others.

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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