

20 July 2022

CES Document Reference:
CES220609-SHB-AA

Shobha Designs Pty Ltd
Suite 21, Level 2
No. 1 - 7 Jordan Street
Gladesville NSW 2111

For the attention of Mr. Nilesh Munot,

**RE: Proposed Residential Development at No.20 The Esplanade, Narrabeen NSW
2101 – Geotechnical Investigation and Slope Stability Assessment Report**

1 INTRODUCTION

Consulting Earth Scientists Pty Ltd (CES) has been engaged by Shobha Designs Pty Ltd (the Client) to undertake a geotechnical investigation and a slope stability assessment for the proposed residential development located at No.20 The Esplanade, Narrabeen in New South Wales (herein referred to as 'the Site').

Based on the supplied Development Application (DA) architectural drawings (refer Appendix A), it is understood that the proposed development at the Site comprises demolition of existing structures to allow construction of a new dwelling, a pool and associated driveway. According to the Landslip Risk Map of the Warringah Local Environmental Plan 2011, the Site lies within Area A and Area D. A geotechnical investigation was required at the Site to assess the existing subsurface conditions, provide information for the structural footing design and to carry out the slope stability assessment.

This geotechnical assessment report is required to support the Client's DA to the Northern Beaches Council (the Council).

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2 SITE INFORMATION

2.1 SITE DESCRIPTION

The Site is located at 20 The Esplanade, in Narrabeen suburb, approximately 18km north-east of Sydney CBD. It is legally described as Lot 32 within Deposited Plan (DP) 7090 which covers a total approximate area of 833.1m². Currently zoned as R2 - Low Density Residential and located within the Local Government Area (LGA) of Northern Beaches Council. The Site location is shown in Figure 1, appended to this report.

The Site can be described as a rhomboid-shaped block bounded by neighbouring residential properties to the west, east and south, and The Esplanade to the north. The Site is currently occupied by a single-storey residence with a porch and concrete driveway at the front and a backyard garden.

In terms of topography, the Site generally slopes with a minor gradient from south to north (backyard to the front).

Site photographs are appended to the report.

2.2 SITE GEOLOGY

NSW Surface Geology (2022) indicates that the Site is underlain by two separate geological units; Holocene-aged coastal deposits (QH_bf) on the northern portion and Triassic-aged Buralow Formation (Tngb) on the southern portion. The Holocene-aged coastal deposits are described as backbarrier flat facies consisting of fine to medium grained quartz-lithic sand with carbonate and humic components (marine-deposited), indurated sand, silt, clay, gravel, organic mud, peat.

The Tngb unit is expected to consist of fine-grained, micaceous, quartz to quartz-lithic sandstone; interbedded with siltstone, grey shale and red-brown claystone.

Due to the current development, the presence of fill is expected at the Site.

2.3 HYDROLOGY & GROUNDWATER

The nearest natural water body is the Narrabeen Lakes situated immediately across the Esplanade, at approximately 30m north of the Site.

A groundwater bore (GW108000) located 500m to the east recorded standing water level of 1.3m (WaterNSW, 2010). The groundwater level is expected to be relatively shallow (less than 2m below ground level) at the Site due to its close proximity to Narrabeen Lakes.

2.4 LANDSLIP RISK

Reference to Clause E10 of Warringah Local Environmental Plan (WLEP) 2011 indicates that the Site predominantly lies partly within Area A and Area D.

Area A correlates to Landslip Risk Class A, topographically described as plateau areas, ridge crests, major spur slopes, footslope areas; and beach, foredune and alluvial flats. The associated geology can be described as follows:

“At higher elevations, generally shallow residual soils developed on Hawkesbury Sandstone. Hawkesbury Sandstone exposed in occasional outcrops and in near vertical road cuts. Some areas of fill. At lower elevations, unconsolidated marine and alluvial sands often overlying deep marine sediments.”

Area B correlates to Landslip Risk Class A, topographically described as flanking slopes (Collaroy Plateau area). The associated geology can be described as follows:

“Colluvial and residual soils (possibly deeper than in Class A) developed on Narrabeen Group or Hawkesbury Sandstone. Minor detached sandstone blocks, occasional exposures of sandstone in cliffs and road cuts. Occasional fill areas associated with playing fields, roads and some developments.”

In consideration of the above, a geotechnical assessment report is required for the proposed residential development at the Site to satisfy the Council’s Development Applications (DA) conditions.

3 FIELDWORK INVESTIGATION

The fieldwork investigation including a site inspection was carried out on 04 July 2022 by CES Engineering Geologist, which included:

- A site inspection which recorded the following observations:



- o The backyard was observed to be predominantly grassed with a large palm tree in the south-eastern corner and a tree (approx. 5m tall) close to the west boundary. A relatively flat grassed area exists at the backyard on the west portion;
 - o The existing dwelling is surrounded by a concrete paved footpath along the eastern boundary and the backyard which leads to the clothesline and the mid-section;
 - o No other cut or fill were observed on site or adjacent areas;
 - o No signs of heavy erosion, soil instability or history of landslips;
 - o A short rock retaining wall (approx. 1.2m high) was observed along the north-western boundary;
 - o An existing subsurface grated drain was observed on the edge of the footpath in the mid-south section of the backyard. Surface water expected to flow down the minor gradient from south to north and eventually discharged into the existing stormwater drainage system further north on The Esplanade and Narrabeen Lakes;
 - o Some water ponding resulting from rainfall was noted on the edge of the concrete paved area near the rock retaining wall;
 - o Site generally slopes at minor to moderate gradients from south to north (from backyard to the front); and
 - o A geotechnical risk map annotated with risk and slope features is provided in Figure 3.
- Due to space constraints at the Site, drilling of two hand-auger boreholes (i.e. HA01 to HA02) were proposed and carried out using manual hand-auger equipment at the back of the dwelling. A Dynamic Cone Penetrometer (DCP) test was conducted adjacent to each borehole. The borehole locations are shown in Figure 1, appended to this report.
 - Soil logging in accordance with AS1726-2017, recording of DCP test results and site photography by the CES Engineering Geologist.

The borehole coordinates were determined using a hand-held GPS unit with an estimated $\pm 5\text{m}$ accuracy. The borehole surface elevation data have been estimated from the Site Survey

Drawing (Vertex Surveyors, 2022). A summary of the drilled borehole information is presented in Table 1.

Table 1. Summary of Borehole Locations and Termination Depths

Borehole	Easting	Northing	Practical Refusal Depths (m)	Estimated Borehole Surface Elevation (mAHD)
HA01	341533	6267533	1.5	3.6
HA02	341537	6267532	1.5	4.0

HA01 to HA02 were drilled at the backyard of the dwelling to within the proposed development footprint.

4 INFERRED SUBSURFACE CONDITIONS

The inferred subsurface conditions at the site are summarised as follows:

- Unit 1: Inferred Topsoil/ Fill (from ground surface up to depth of 0.25m)

The topsoil layer is typically 200mm to 250mm thick consisting of Silty SAND; dark grey brown, fine to medium grained sand, low plasticity silt. This unit has been assessed to be generally loose and moist.

- Unit 2: Inferred Residual Soil (to borehole termination depths of 1.5m)

Inferred to be Residual Soil described as SAND with silt; grey, fine to medium grained sand, low plasticity silt. This unit has been assessed to be loose to medium dense, and moist.

Wet soils were recovered in both boreholes and thus groundwater has been inferred to be present at shallow depths. Both boreholes were terminated at 1.5m due to hole collapse. It should be noted that rainfall occurred on the day of fieldwork investigation.

Detailed material descriptions along with the DCP test results are shown on the engineering borehole logs provided in Appendix B.

5 RECOMMENDATIONS

5.1 SITE CLASSIFICATION

Given the presence of current development and the Site being subject to landslip risk, a site classification of 'Class P' is considered appropriate in accordance with AS2870-2011 Residential Slabs and Footings. For Class P sites, a purpose-designed footing system using engineering principles should be undertaken in accordance with AS2870.

5.2 FOOTINGS

5.2.1 Shallow Footings

A purpose-designed footing system should be adopted for the proposed development.

Due to the presence of loose sands within Unit 2, it is recommended that the Unit 2 (Inferred Residual Soil) is re-compacted using a suitable compaction equipment (e.g. smooth drum roller) on a prepared and proof-rolled subgrade to achieve a uniform medium dense strength at the proposed footing locations. The shallow footings such as raft/ deep edge beams, strip and pad should be taken through Unit 1 (Topsoil/ Fill) and uniformly founded into the re-compacted medium dense Unit 2 (Inferred Residual Soil) where an allowable bearing capacity of 100kPa may be adopted. The footing settlements are expected to be less than 1% of the minimum footing dimension.

A series of Dynamic Cone Penetrometer (DCP) testing should be undertaken at the excavated footing locations to confirm the allowable bearing capacity for the re-compacted Unit 2 (Inferred Residual Soil).

For loose sand foundation, the raft/ slabs may be stiffened to resist the potential hydrostatic uplift pressures from groundwater subject to the Structural Engineer's well-established local knowledge of its satisfactory performance in terms of bearing capacity (Clause 4.2.5 of AS2870-2011).

If controlled filling is required to achieve subgrade levels, the footings may be uniformly founded on a controlled fill foundation using structural fill which must provide a minimum allowable bearing capacity of 100kPa. The controlled filling required at the Site for the proposed development should be placed and compacted in accordance with AS3798-2007 – Guidelines on Earthworks for Commercial and Residential Developments.

A suitably qualified and experienced geotechnical engineer should be engaged during footing excavations prior to blinding and steel fixing to assess the footing conditions, check against the design assumptions and confirm the suitable founding depth of Unit 2 (Inferred Residual Soil) at the Site.

5.2.1 Deep Footings

A purpose-designed footing system for the proposed development may comprise concrete bored piles founded on medium dense Unit 2 (Inferred Residual Soil) or weathered bedrock.

For deep footings in soils, the bored piers should have a minimum embedment of 3 times pile diameter and founded on medium dense or better Unit 2 (Inferred Residual Soil), where an allowable end bearing pressure of 200kPa can be adopted for the bored pier design. The allowable skin friction is assumed to be negligible.

For deep footings in rock, the bored piers are recommended to be at least 3 times pile diameters long and socketed adequately into weathered bedrock. An allowable end bearing pressure of 400kPa and allowable skin friction of 10kPa can be adopted for the bored pier design.

It is recommended that a suitably qualified and experienced geotechnical practitioner is engaged during footing excavations to inspect the exposed founding material and verify the design assumptions presented in this report.

The borehole logs should be examined and reviewed by the Piling Contractor to determine most suitable machine for constructing the bored piers.

A suitably qualified and experienced geotechnical engineer should be engaged during pier footing excavations to check cleanliness of the base against the design assumptions.

5.3 FURTHER INVESTIGATION

After the demolition of the existing dwelling, it is recommended that a supplementary geotechnical investigation is undertaken to confirm the suitable founding depths across the Site for the shallow/ deep footings, assess the bedrock levels, and verify the design assumptions presented in this report.

6 SLOPE STABILITY ASSESSMENT

A qualitative geotechnical risk assessment with regard to slope stability has been carried out for the Site in accordance with Australian Geomechanics Society (AGS) Guidelines 2007.

The definitions, hazard identification, property elements at risk, risk evaluation and evaluation of risk level undertaken as part of the qualitative risk assessment are described below.

6.1 DEFINITIONS

A qualitative risk assessment involves identification of the hazard event, and a qualitative estimation of the consequences and frequency of occurrence of the event.

The terms used in the risk assessment process are defined below:

Hazard: A condition with the potential for causing an undesirable consequence.

Likelihood: The probability, expressed qualitatively, that the hazardous event will occur.

Consequence: Outcome arising from a hazard, expressed as loss or damage.

Risk: A term combining the probability and severity or consequence of any event causing adverse effects to property or the environment.

6.2 HAZARD IDENTIFICATION

The following hazards that could potentially impact on this site are assessed as follows:

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H1) Debris flow (<200m³) flow impacting on new development due to excavations.

H2) Small scale rotational landslide impacting on new development.

In assessing risk, the descriptors used are from Australian Geomechanics Society Publication Practice Note Guidelines for Landslide Risk Management, 2007.

6.3 PROPERTY ELEMENTS AT RISK

Elements at risk for the identified hazards are the proposed residential development. The following consequence assessment addresses the risks associated with potential damage to the current residence in consideration of the proposed development including the excavation works.

The consequences associated with loss of life of occupants of the dwelling are a separate issue and are not addressed by this assessment.

6.4 RISK EVALUATION

The matrix below evaluates the hazards outlined above and their likelihood of occurring.

Hazard	H1	H2
Consequence	Medium	Medium
Likelihood	Rare	Rare
Risk	Low	Low

6.5 EVALUATION OF RISK LEVEL

Based on the above, and in accordance with the “Classification of Risk of Slope Instability” enclosed in Appendix C, the overall site is assessed as having a "Low" risk of slope instability. The assessed risk of slope instability at the site considers that the recommendations provided in Section 7 are fully implemented.

7 GEOTECHNICAL RISK MANAGEMENT RECOMMENDATIONS

It is recommended that the following is adopted for the site.

- a) Based on the cut and fill plan, maximum fill thickness of 300mm is proposed at the front which should be placed and compacted in accordance with AS3798-2007 – Guidelines on Earthworks for Commercial and Residential Developments. At the backyard, a maximum 1.4m has been proposed for the pool construction. The recommended temporary cut batters in Unit 2 (Inferred Residual Soil) is no steeper than 1V:2.5H for up to 1.5m slope height and above groundwater. Where there is insufficient room to form unsupported batters, vertical shoring walls should be considered.

All batters should be protected to prevent surface erosion and local instability and surcharge loads should be kept clear of the crest of batters. Should retaining structures be required, they are required to be designed by a suitably qualified and experienced engineer according to the principles in AS4678-2007 - Earth Retaining Structures. It is recommended that a geotechnical engineer is present on site during

the excavation of batters to assess the risk of slope instability. Batters and retaining structures should be provided with adequate drainage.

- b) Adequate surface drainage such as contour and cut-off drains should be constructed to reduce water inflow and discharge surface water away from the site in an efficient and controlled manner. This is to ensure there is no adverse impact on existing subsurface flow conditions and no adverse impact resulting from stormwater discharge.
- c) Building footings should be taken below the topsoil and fill into the Residual Soil or weathered bedrock. An experienced geotechnical practitioner should observe footing excavations in order to assess the allowable bearing pressures.
- d) The occupant of the house should carry out regular inspections and maintenance of both existing and new drainage and retaining structures.
- e) The construction of the proposed development should adhere to the Good Hillside Practices provided in Appendix C.
- f) Supplementary geotechnical investigation may be undertaken during post-demolition stage of the existing dwelling structures to confirm suitable founding depths across the Site for the shallow/ deep footings, assess the bedrock levels, and verify the design assumptions presented in this report.

8 SUITABILITY OF THE PROPOSED DEVELOPMENT

In consideration of the above, the site is considered geotechnically capable of being developed conditional upon the implementation of risk management recommendations in Section 7.

9 REFERENCES

- Australian Geomechanics Society (AGS), 2007. Extracts from Practice Note Guideline for Landslide Risk Management.
- Landcom publication, 2004. Managing Urban Stormwater: Soils and Construction. Fourth Edition, NSW Government.
- Northern Beaches Council, 2011. Clause E10 of Warringah Local Environmental Plan (WLEP) 2011.
- Northern Beaches Council, 2021. Development Application Lodgement Requirements for Geotechnical Report.
- Regional NSW 2021. New South Wales Surface Geology accessed from <https://minview.geoscience.nsw.gov.au/>
- Shobha Designs Pty Ltd, 2022. Draft Architectural Drawings (Drawing No. DA-00 to DA-11 Rev A dated 24 June 2022)
- Standards Australia, 2007. AS3798-2007 – Guidelines on Earthworks for Commercial and Residential Developments.
- Standards Australia, 2009. AS 2159-2009 Piling - Design and Installation.
- Standards Australia, 2011. AS2870-2011 – Residential slabs and footings.
- Vertex Surveyors Pty Ltd, 2022. Site Survey Drawing (Job No. 22039, Plan NO. 22039_001)

10 LIMITATIONS OF THIS REPORT

This report has been prepared for use by the Client who commissioned the works in accordance with the agreed scope of works and based on information provided by the Client. The advice contained in this report relates only to the current status of the project and all findings, recommendations should be reviewed by a competent person with experience in geotechnical engineering before being used for any other purpose. Consulting Earth Scientists Pty Ltd (CES) accepts no liability for use or interpretation by any person or body other than the Client.

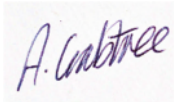
This report must not be reproduced except in full and must not be amended in any way without prior approval by the Client and CES. If there is any change in the proposed development described in this report, all the recommendations should be reviewed.

Actual conditions in some parts of the site may differ from those found in the boreholes. If excavations reveal soil and groundwater conditions that differ significantly from those shown on the borehole logs, excavations should be stopped immediately and CES should be consulted for further advice.

This report does not provide a complete assessment of the geotechnical status of the site due to the current site constraints and is limited to the scope defined therein. Should further geotechnical information become available that has not been reviewed as part of this assessment, CES reserves the right to review the report in the context of the additional information.

For and on behalf of Consulting Earth Scientists Pty Ltd,

Prepared by:



Alex Crabtree

Geotechnical Engineer

Reviewed by:



Ivan Wong

Principal Geotechnical Engineer

Enclosed:

- Site Photographs
- Figure 1: Site Location Plan
- Figure 2: Borehole Location Plan
- Figure 3: Geotechnical Risk Map
- Appendix A – Selected Architectural Drawings
- Appendix B – Borehole Logs
- Appendix C – Classification of Risk of Slope Instability and Good Hillside Practices (AGS Guidelines 2007)



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Site Photographs

		Site Photographs	
Client Name: Shobha Designs Pty Ltd		Site Location: 20 The Esplanade, Narrabeen, NSW 2101	Project Number: CES220609-SHB
Date: 04/07/2022	Plate No: 1		
Description: View at the backyard of HA02 location at the south-east corner where the large palm tree exists.			
Date: 04/07/2022	Plate No: 2		
Description: View at the backyard looking west, with paved footpath.			

Site Photographs

Client Name:
Shobha Designs Pty Ltd

Site Location: 20 The Esplanade, Narrabeen, NSW 2101

Project Number: CES220609-SHB

Date:

**Plate
No:**

04/07/2022

3

Description:

View of the wall separating the site and No.18 The Esplanade, looking south.



Date:

**Plate
No:**

04/07/2022

4

Description:

View of the lawn at the backyard, looking east.



		Site Photographs	
Client Name: Shobha Designs Pty Ltd		Site Location: 20 The Esplanade, Narrabeen, NSW 2101	Project Number: CES220609-SHB
Date: 04/07/2022	Plate No: 5		
Description: View of recovered subsurface materials from HA02.			
Date: 04/07/2022	Plate No: 6		
Description: View of the tree at the backyard, looking west.			



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Figures



Figure 1: Site Location Plan



Legend

⊕ Hand-auger borehole

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Figure 2: Borehole Location Plan

CES Project ID:
CES220609-SHB

Date:
14/07/2022

Prepared by:
A.Crabtree

Checked by:
I.Wong



Figure 3: Geotechnical Risk Map



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Appendix A – Selected Architectural Drawings

DRAWING No.	DESCRIPTION
DA-01	COVER SHEET
DA-02	SITE PLAN & SITE ANALYSIS
DA-03	GROUND FLOOR PLAN
DA-04	FIRST FLOOR PLAN
DA-05	ROOF PLAN
DA-06	FRONT & EAST ELEVATIONS
DA-07	REAR & WEST ELEVATIONS
DA-08	SECTION A & B
DA-09	SECTION C
DA-10	DEMOLITION PLAN
DA-11	CUT & FILL PLAN
DA-12	SHADOW DAIGRAM (9:00AM)
DA-13	SHADOW DAIGRAM (12 NOON)
DA-14	SHADOW DIAGRAM (3:00PM)
DA-15	WINDOW SCHEDULE
DA-16	WINDOW SCHEDULE
DA-17	DOOR SCHEDULE

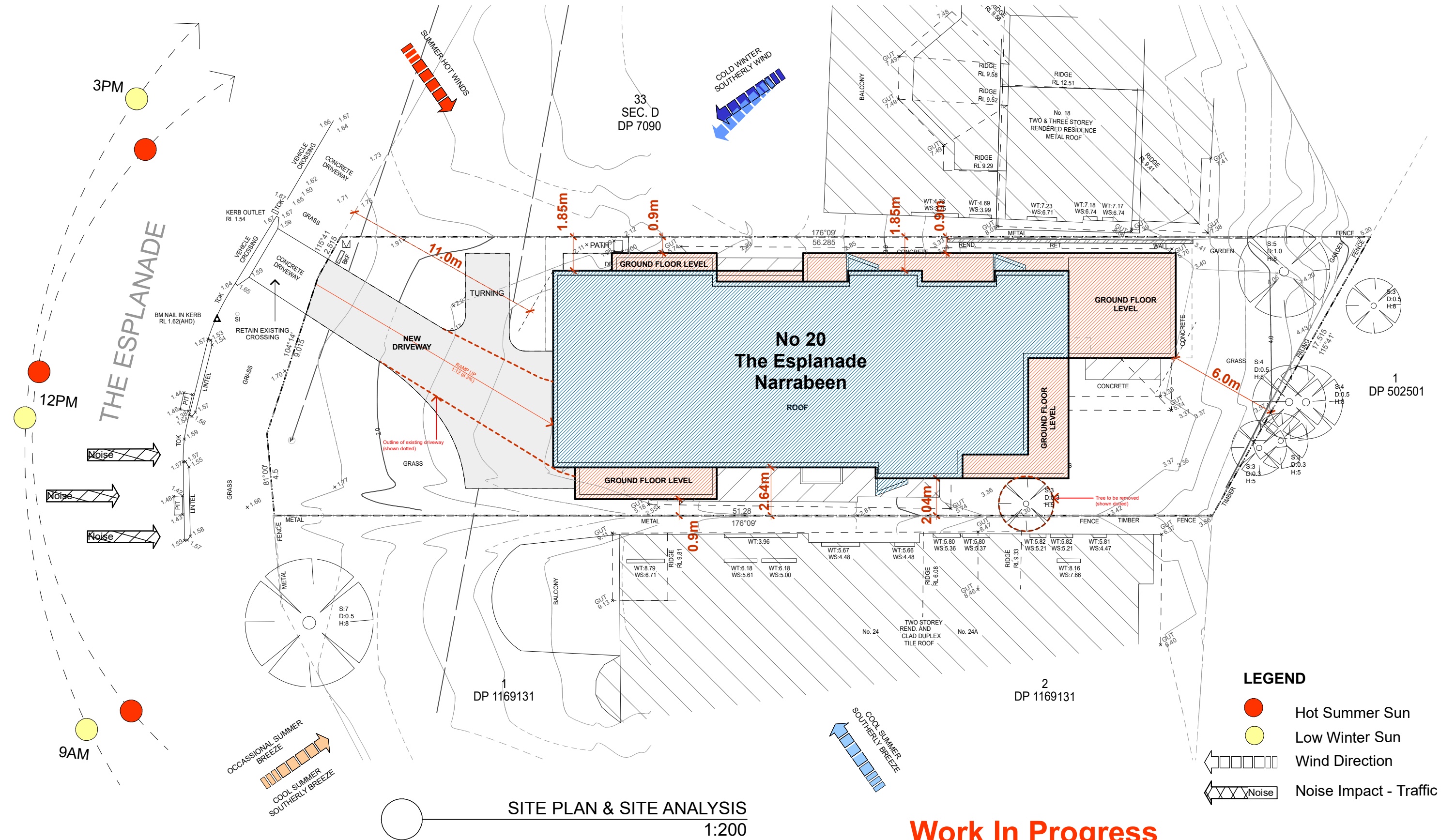
AREA STATEMENT	
SITE AREA	= 833.1 m²
LANDSCAPED AREA REQUIRED AS PER DCP	
40% OF SITE AREA TO BE LANDSCAPED <i>(Min 2m wide & Min 1m deep soil)</i>	= 333.24 m²
Swimming Pools & rock outcrops included in landscaped area as per DCP	
DEEP SOIL AREA PROVIDED	= 340.26 m²
= (41% of site area)	
PRIVATE OPEN SPACE REQUIRED AS PER DCP	
Min 60m² <i>(Min 5m wide & directly accessible from Living area and located at the rear)</i>	
PRIVATE OPEN SPACE PROVIDED	= 78.00 m²
GROSS FLOOR AREA	
No Council Control	
GROSS FLOOR AREA PROVIDED (excl garage & voids)	
GROUND FLOOR	= 189.47 m²
FIRST FLOOR	= 212.44 m²
TOTAL GROSS FLOOR AREA	= 401.91 m²



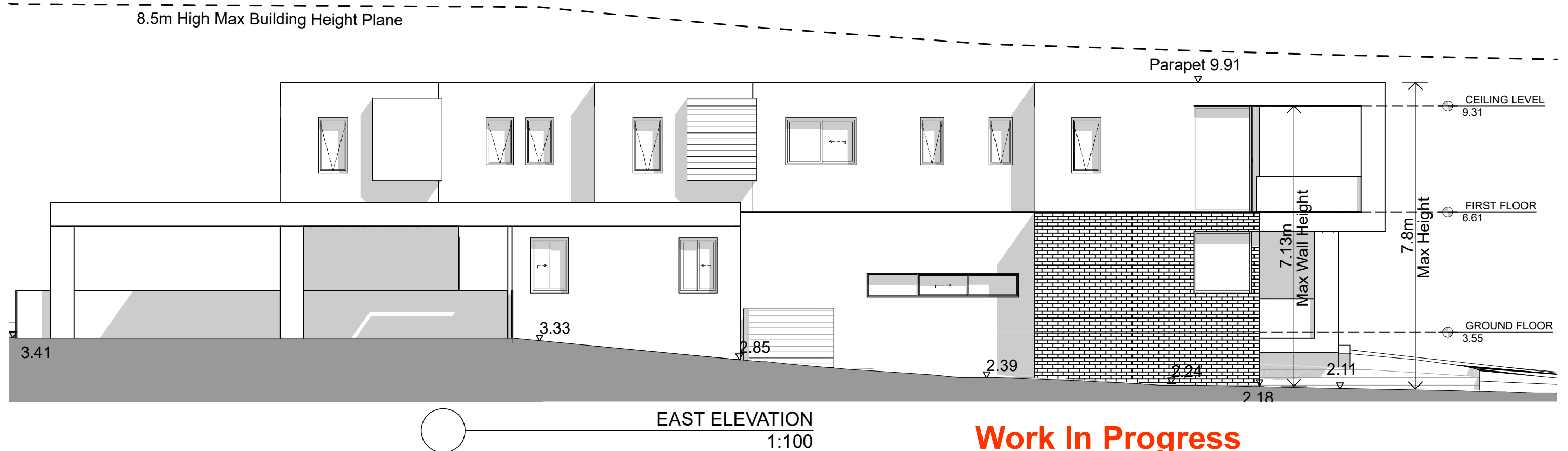
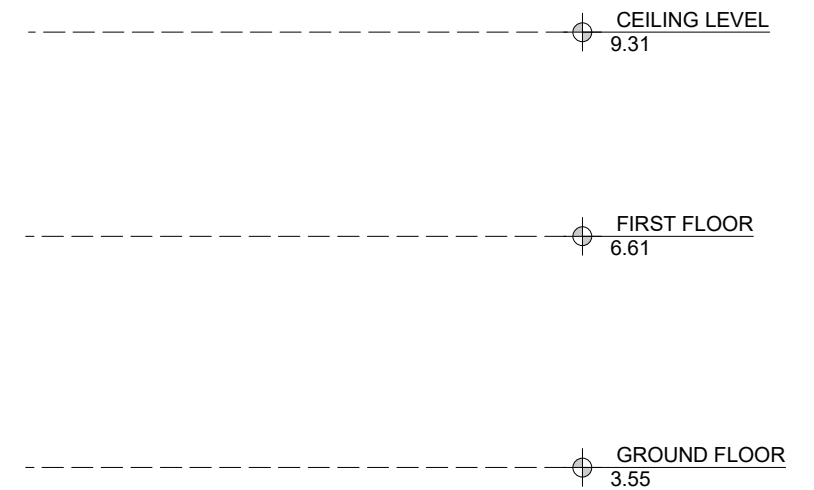
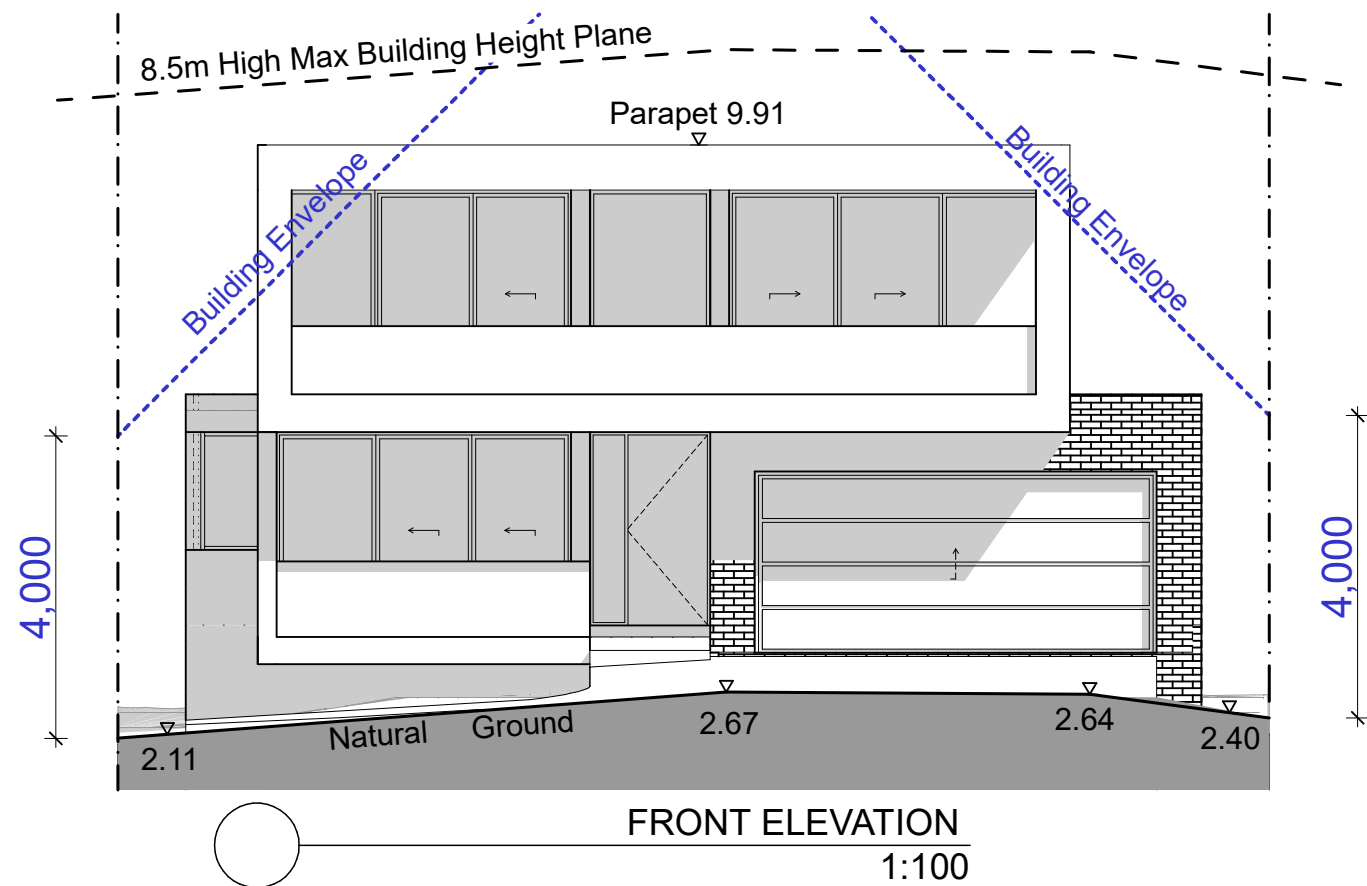
Work In Progress

Demolition of Existing Structures & Construction of a New Dwelling and Pool at 20 The Esplanade Narrabeen



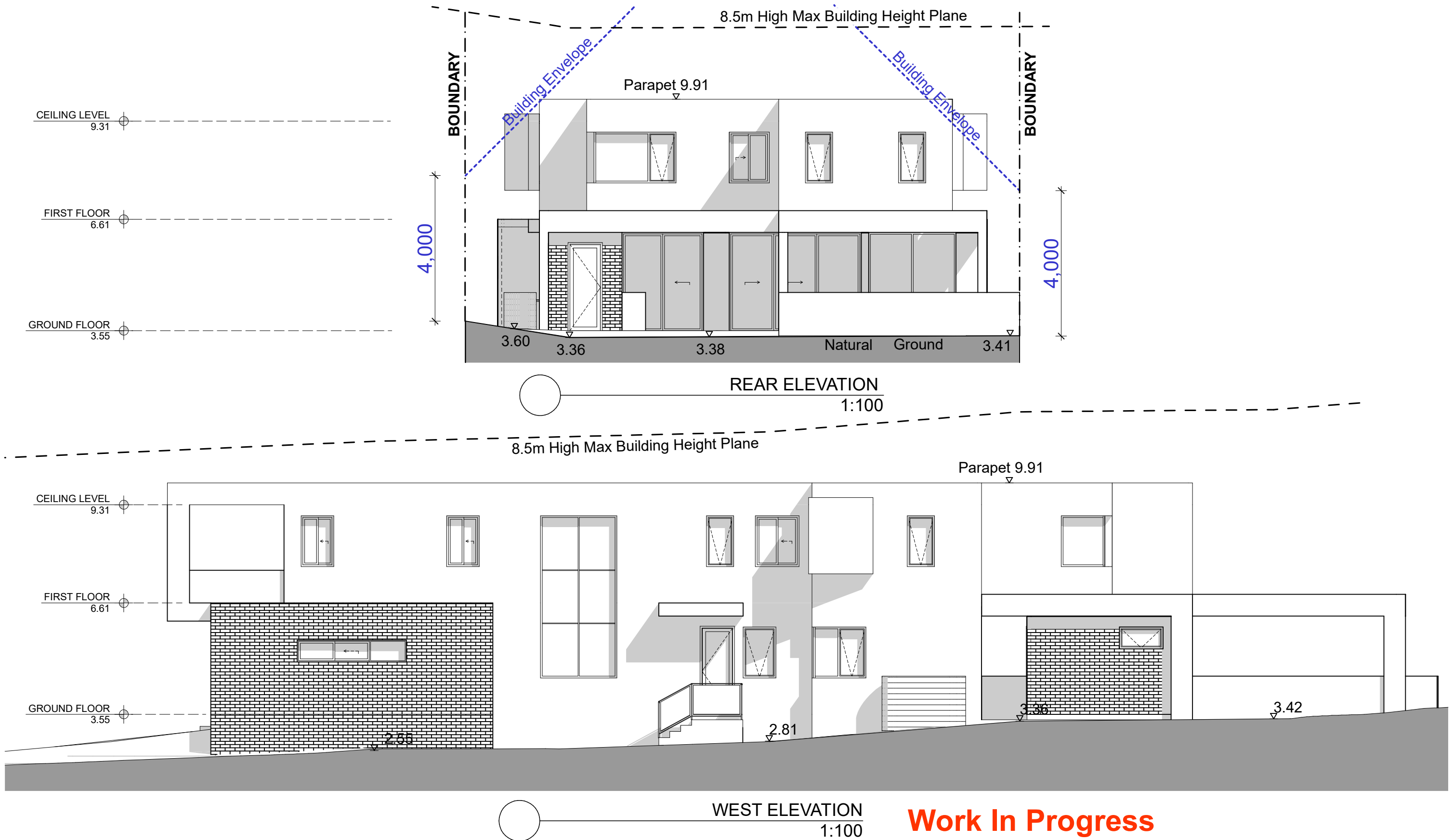


Architects: SHOBHA DESIGNS ARCHITECTS & URBAN DESIGNERS Suite 21, 1 - 7 Jordan St, Gladesville NSW 2111 PHONE : 02 98790020 MOBILE : 0418112677 EMAIL : nilesh@shobhadesigns.com.au shobha	PROJECT Demolition of Existing Structures & Construction of a New Dwelling and Pool at 20 The Esplanade Narrabeen CLIENT Jason Smith N	Drawing Name SITE PLAN & SITE ANALYSIS General Notes The Builder shall check all dimensions and levels on site prior to construction. Notify any errors, discrepancies or omissions to the architect. Drawings shall not be used for construction purposes until issued for construction. Do not scale drawings. All boundaries and contours subject to survey	Amendments				Date of Issue	24-Jun-22	
			Transmittal Set ID	Transmittal Set Name	Checked by	Date	Drawing Scale	Drawn By : Sandy Martikas	
			A	DA Issue to Council	NM			Checked By: NM	
							Layout ID	Issue	
							DA-02	A	

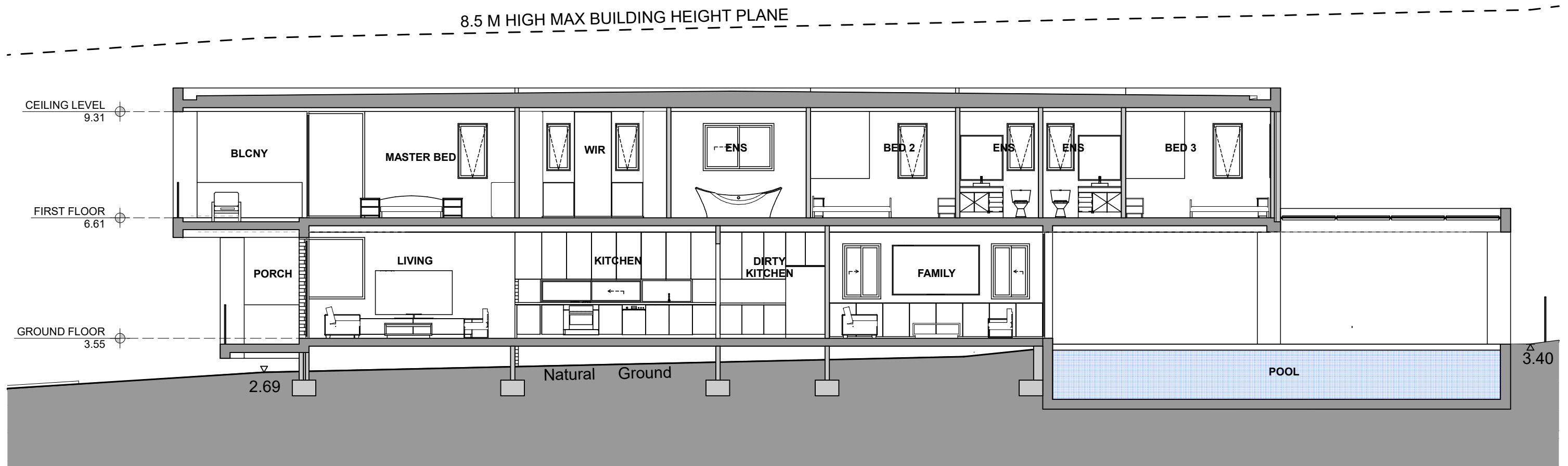


Work In Progress

Architects: SHOBHA DESIGNS ARCHITECTS & URBAN DESIGNERS Suite 21, 1 - 7 Jordan St, Gladesville NSW 2111 PHONE : 02 98790020 MOBILE : 0418112677 EMAIL : nilesh@shobhadesigns.com.au shobha	PROJECT Demolition of Existing Structures & Construction of a New Dwelling and Pool at 20 The Esplanade Narrabeen CLIENT Jason Smith	Drawing Name FRONT & EAST ELEVATIONS General Notes The Builder shall check all dimensions and levels on site prior to construction. Notify any errors, discrepancies or omissions to the architect. Drawings shall not be used for construction purposes until issued for construction. Do not scale drawings. All boundaries and contours subject to survey	Amendments				Date of Issue	
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Architects: SHOBHA DESIGNS ARCHITECTS & URBAN DESIGNERS Suite 21, 1 - 7 Jordan St, Gladesville NSW 2111 PHONE : 02 98790020 MOBILE : 0418112677 EMAIL : nilesh@shobhadesigns.com.au shobha	PROJECT Demolition of Existing Structures & Construction of a New Dwelling and Pool at 20 The Esplanade Narrabeen CLIENT Jason Smith	Drawing Name REAR & WEST ELEVATIONS General Notes The Builder shall check all dimensions and levels on site prior to construction. Notify any errors, discrepancies or omissions to the architect. Drawings shall not be used for construction purposes until issued for construction. Do not scale drawings. All boundaries and contours subject to survey	Amendments				Date of Issue	24-Jun-22	
			Transmittal Set ID	Transmittal Set Name	Checked by	Date	Drawing Scale	Drawn By	: Sandy Martikas
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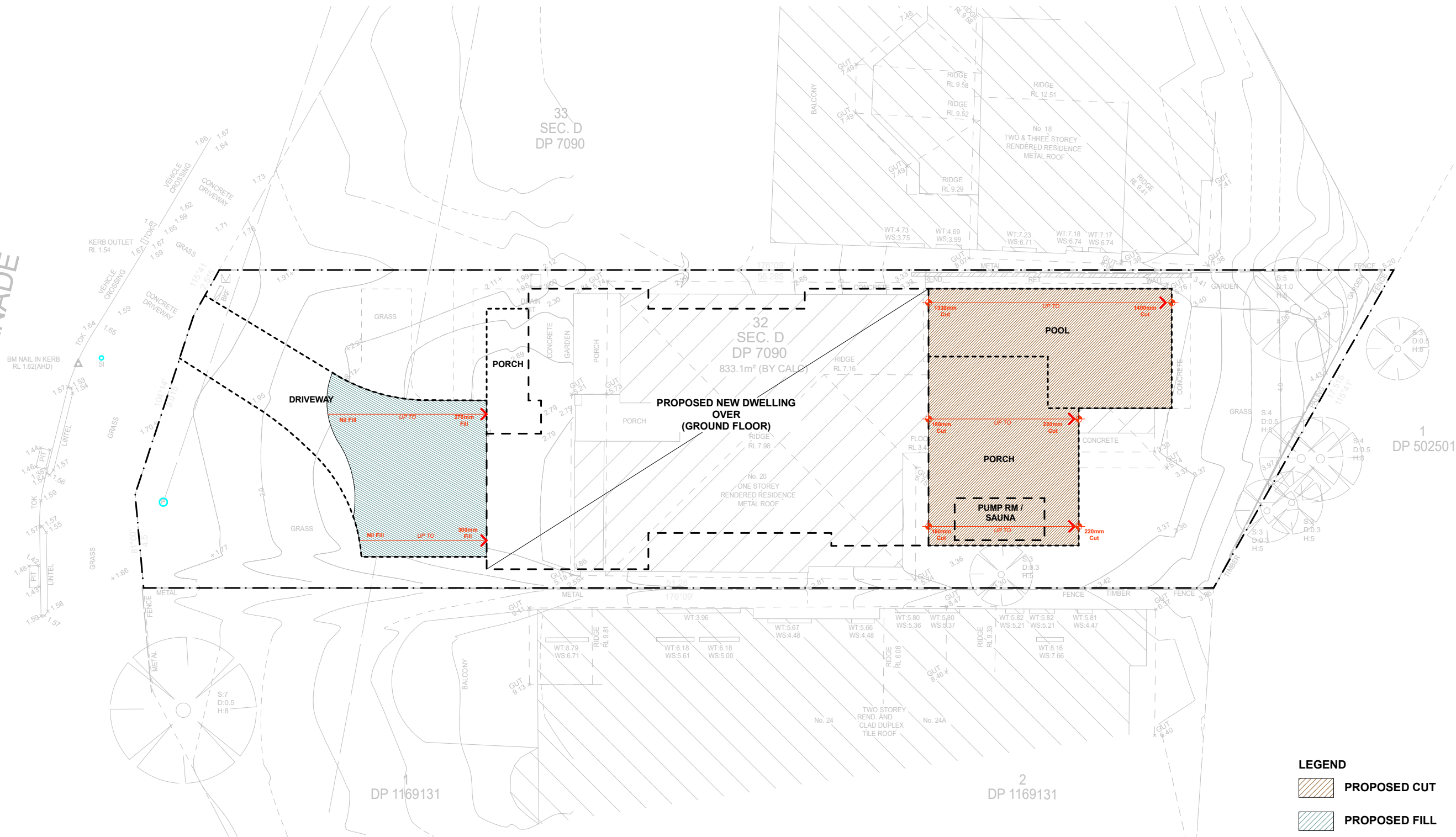


SECTION C
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Work In Progress

Architects: SHOBHA DESIGNS ARCHITECTS & URBAN DESIGNERS Suite 21, 1 - 7 Jordan St, Gladesville NSW 2111 PHONE : 02 98790020 MOBILE : 0418112677 EMAIL : nilesh@shobhadesigns.com.au shobha	PROJECT Demolition of Existing Structures & Construction of a New Dwelling and Pool at 20 The Esplanade Narrabeen CLIENT Jason Smith	Drawing Name SECTION C General Notes The Builder shall check all dimensions and levels on site prior to construction. Notify any errors, discrepancies or omissions to the architect. Drawings shall not be used for construction purposes until issued for construction. Do not scale drawings. All boundaries and contours subject to survey	Amendments				Date of Issue	
			Transmittal Set ID	Transmittal Set Name	Checked by	Date	24-Jun-22	
			A	DA Issue to Council	NM		Drawing Scale	Drawn By : Sandy Martikas
							1:100	Checked By: NM
							Layout ID	Issue
							DA-09	A

THE ESPLANADE



Cut & Fill Plan
1:200

Work In Progress

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			A	DA Issue to Council	NM		1:200, 1:100	Checked By: NM
							Layout ID	Issue
							DA-11	A

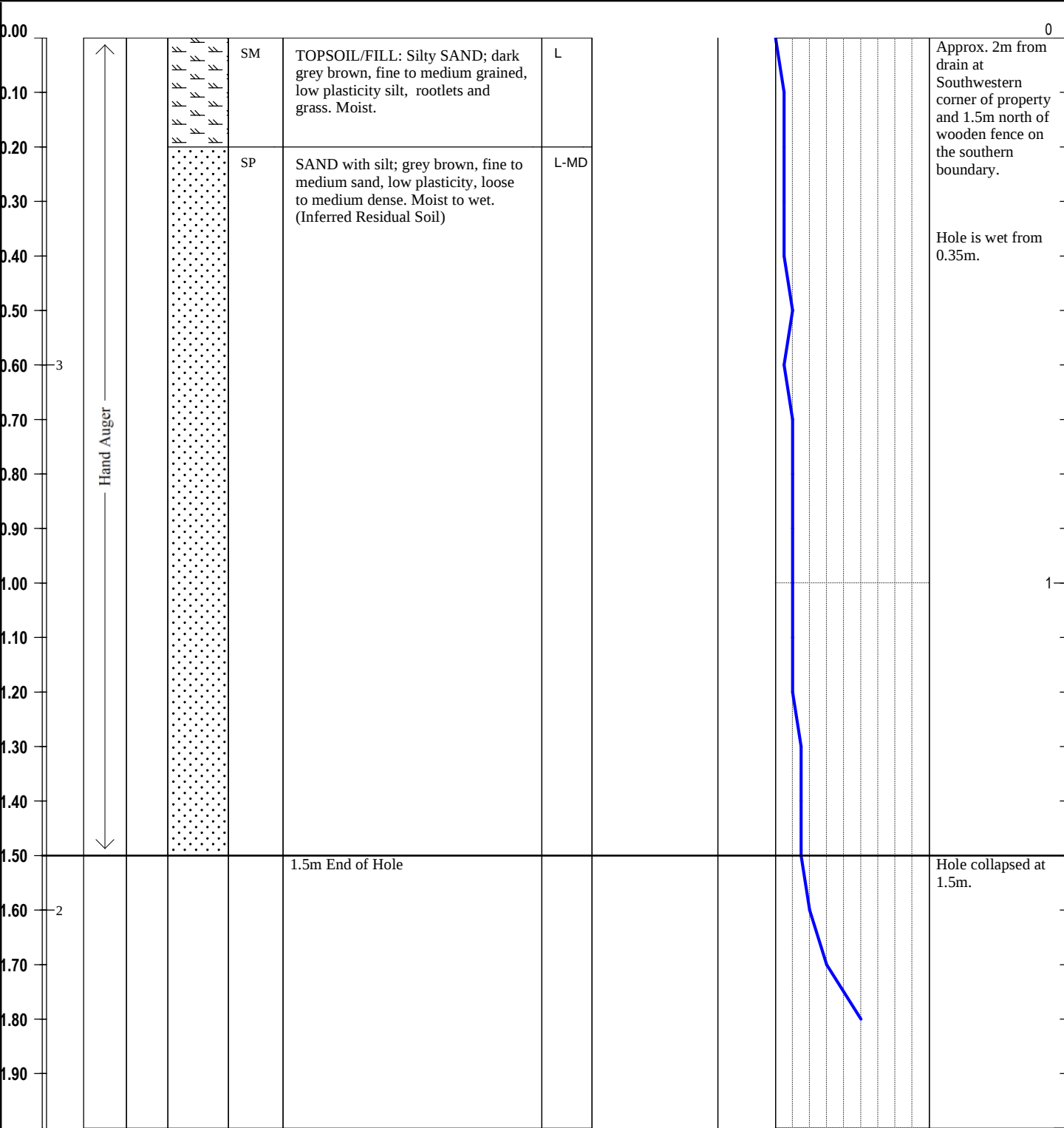


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Appendix B – Borehole Logs

X-Coord:	341533	GDA 94 MGA 56	Date Commenced:	04/07/2022	Logged by:	A. Crabtree
Y-Coord:	6267533		Date Completed:	04/07/2022	Checked by:	I. Wong
Surface Elevation (R.L.) :	3.6	m AHD	Hole Diameter (mm):	80		

Drilling Information				LITHOLOGY				Samples		Tests	Notes and additional observations
Depth (mBGL)	R.L. (m)	Method (Support)	Water	Symbol	USCS Symbol	Description	Consistency / Density	Sample ID	Type	Dynamic Cone Penetrometer (Blows per 100mm)	
						SOIL TYPE: plasticity or particle characteristics colour, moisture, secondary and minor components				2 4 6 8 10 12 14 16	



Project ID: CES220609-SHB-AA
Client: Shobha Designs Pty Ltd
Project: Geotechnical Investigation for
Location: 20 The Esplanade, Narrabeen



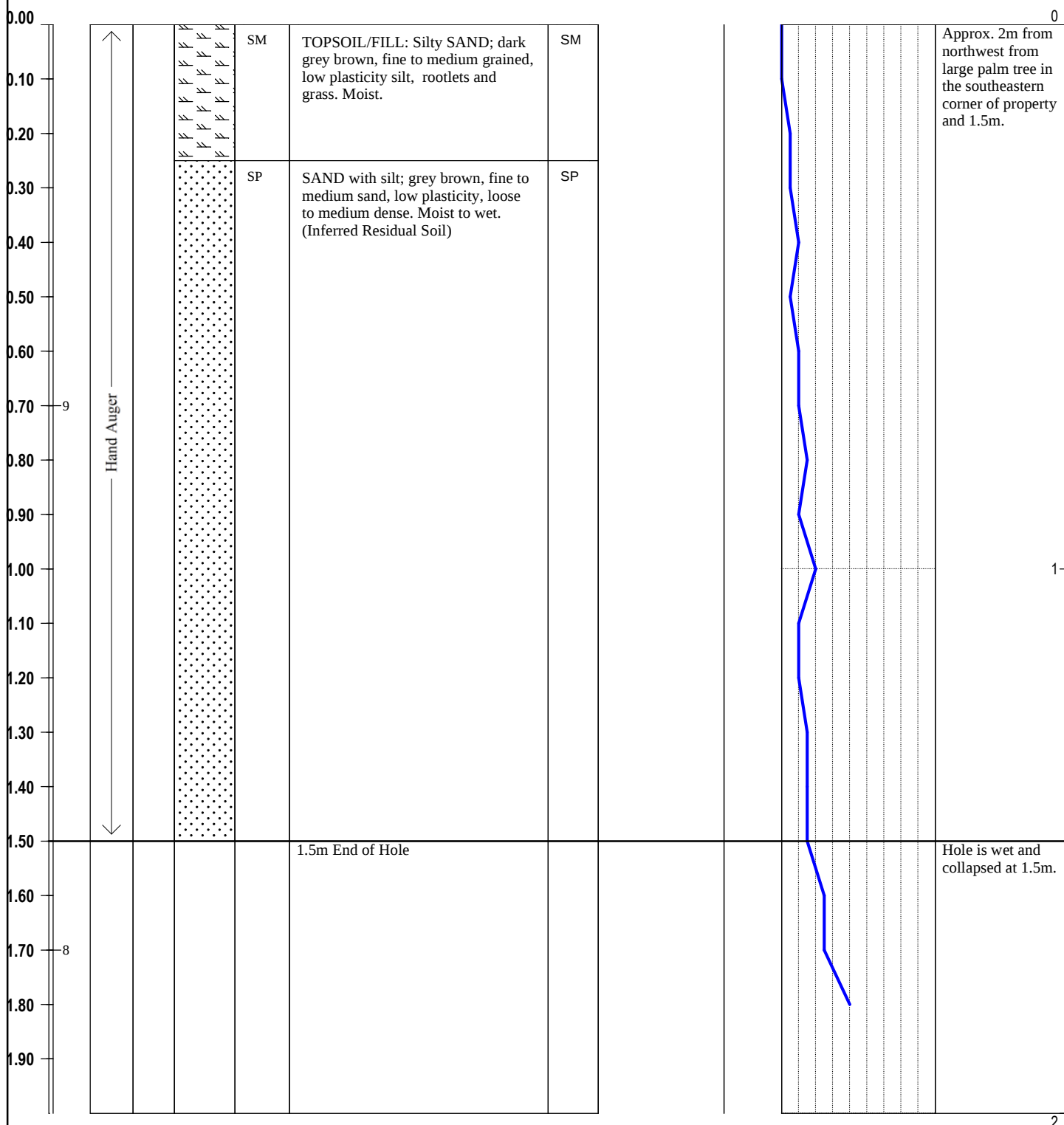
Development Suite 3 Level 1
55 Grandview Steet, Pymble NSW 2073
PH: (02) 8569 2200 FAX: (02) 9552 4399
www.consultingearth.com.au

LOG ID:
HA02

Sheet: 1 of 1

X-Coord:	341537	GDA 94 MGA 56	Date Commenced:	04/07/2022	Logged by:	A. Crabtree
Y-Coord:	6267532		Date Completed:	04/07/2022	Checked by:	I. Wong
Surface Elevation (R.L.) :	4 m AHD		Hole Diameter (mm):	80		

Drilling Information				LITHOLOGY			Samples		Tests								Notes and additional observations	
Depth (mBGL)	R.L. (m)	Method (Support)	Water	Symbol	USCS Symbol	Description SOIL TYPE: plasticity or particle characteristics colour, moisture, secondary and minor components	Consistency / Density	Sample ID	Type	Dynamic Cone Penetrometer (Blows per 100mm)								
										2	4	6	8	10	12	14		16



Drill Company:	Consulting Earth Scientists	Operator Name:	A. Crabtree
Machine Type:	Hand Auger	Operators Licence No.:	-

Refer to Standard Sheets
for details of abbreviations



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SCIENTISTS**

Appendix C

Key Extracts from AGS Guidelines 2007

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: – QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY (CONTINUED)

QUALITATIVE RISK ANALYSIS MATRIX – LEVEL OF RISK TO PROPERTY

LIKELIHOOD		CONSEQUENCES TO PROPERTY (With Indicative Approximate Cost of Damage)				
	Indicative Value of Approximate Annual Probability	1: CATASTROPHIC 200%	2: MAJOR 60%	3: MEDIUM 20%	4: MINOR 5%	5: INSIGNIFICANT 0.5%
A – ALMOST CERTAIN	10 ⁻¹	VH	VH	VH	H	M or L (5)
B – LIKELY	10 ⁻²	VH	VH	H	M	L
C – POSSIBLE	10 ⁻³	VH	H	M	M	VL
D – UNLIKELY	10 ⁻⁴	H	M	L	L	VL
E – RARE	10 ⁻⁵	M	L	L	VL	VL
F – BARELY CREDIBLE	10 ⁻⁶	L	VL	VL	VL	VL

Notes: (5) For Cell A5, may be subdivided such that a consequence of less than 0.1% is Low Risk.

(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

RISK LEVEL IMPLICATIONS

Risk Level		Example Implications (7)
VH	VERY HIGH RISK	Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low; may be too expensive and not practical. Work likely to cost more than value of the property.
H	HIGH RISK	Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.
M	MODERATE RISK	May be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable.
L	LOW RISK	Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
VL	VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

Note: (7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX G - SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

GOOD ENGINEERING PRACTICE

POOR ENGINEERING PRACTICE

ADVICE

GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical practitioner at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
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PLANNING

SITE PLANNING	Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.	Plan development without regard for the Risk.
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DESIGN AND CONSTRUCTION

HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	Indiscriminatory bulk earthworks.
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements
FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill, which if it fails, may flow a considerable distance including onto property below. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may have unacceptable risk. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOOTINGS	Found within rock where practicable. Use rows of piers or strip footings oriented up and down slope. Design for lateral creep pressures if necessary. Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide general falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	Discharge roof runoff into absorption trenches.
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes. Use absorption trenches without consideration of landslide risk.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.

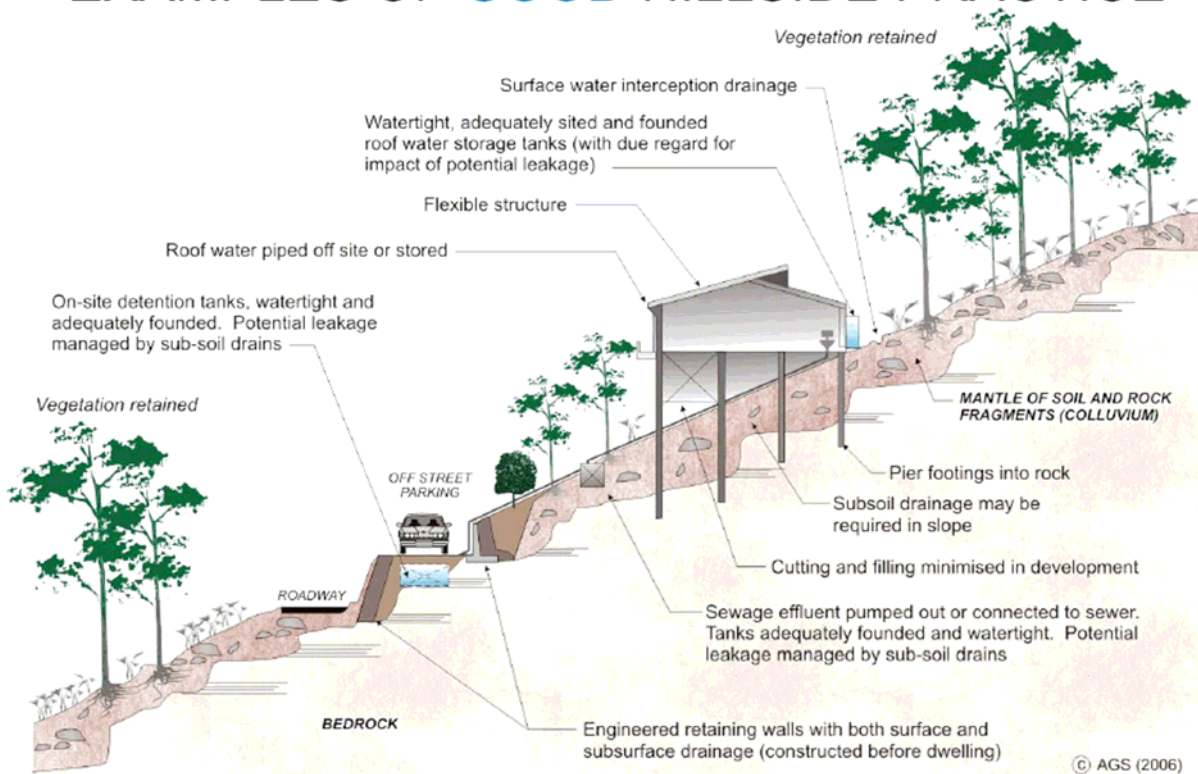
DRAWINGS AND SITE VISITS DURING CONSTRUCTION

DRAWINGS	Building Application drawings should be viewed by geotechnical consultant	
SITE VISITS	Site Visits by consultant may be appropriate during construction/	

INSPECTION AND MAINTENANCE BY OWNER

OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident see advice. If seepage observed, determine causes or seek advice on consequences.	
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EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE

