



CONSULTING EARTH SCIENTISTS

ACID SULFATE SOILS MANAGEMENT PLAN
20 THE ESPLANADE, NARRABEEN NSW 2101
PREPARED FOR JASON SMITH

CES DOCUMENT REFERENCE: CES220609-SHB-AB

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ACID SULFATE SOILS MANAGEMENT PLAN
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1 INTRODUCTION

Consulting Earth Scientists Pty Ltd (CES) has been commissioned by Nilesh Munot from Shobha Designs on behalf of Jason Smith (the Client) to prepare an Acid Sulfate Soils (ASS) Management Plan for the proposed development at 20 The Esplanade, Narrabeen NSW 2101 (the site).

This ASSMP is to be implemented during the development works being undertaken by Shobha Designs. The location of the site is shown in Figure 1.

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.

1.1 BACKGROUND INFORMATION ON ACID SULFATE SOILS

Acid Sulfate Soils are the common name given to naturally occurring sediments and soils containing iron sulfides (principally iron sulfide or iron disulfide or their precursors). The exposure of the sulfide in these soils to oxygen by drainage or excavation may lead to the generation of sulfuric acid.

Acid Sulfate Soils (ASS) include Actual Acid Sulfate Soils (AASS) and Potential Acid Sulfate Soils (PASS). AASS and PASS are often found in the same soil profile, with AASS generally overlying PASS horizons. For the purposes of this report AASS and PASS will be collectively referred to as Acid Sulfate Soils/ASS, except where the AASS or PASS should be handled or treated differently.

AASS are soils containing highly acidic soil horizons or layers resulting from the aeration of soil materials that are rich in iron sulfides, primarily sulfide. This oxidation produces hydrogen ions in excess of the sediments capacity to neutralise the acidity resulting in soils of pH of 4 or less. These soils can usually be identified by the presence of pale yellow mottles and coatings of jarosite.

PASS are soils which contain iron sulfides or sulfidic material which have not been exposed to air and oxidised. The field pH of these soils in their undisturbed state is 4 or more and may be neutral or slightly alkaline. However, they pose a considerable environmental risk when disturbed, as they can become strongly acid following oxidation on exposure to the air.

Characteristics of ASS typically include:

- Sediments of recent geological age (Holocene) up to 10,000 years old.
- Formation in soil horizons at an elevation of less than 5m AHD.
- Formation in marine or estuarine sediments and tidal lakes.
- Formation in coastal wetlands or back swamp areas; waterlogged or scalded areas interdune swales or coastal sand dunes.
- Formation where the dominant vegetation is mangroves, reeds, rushes and other swamp tolerant and marine vegetation.
- They may be present in areas identified in geological descriptions or in maps bearing sulfide minerals, coal deposits or former marine shales/sediments.
- They may be present in deeper older estuarine sediments greater than 10m below the ground surface of Holocene or Pleistocene age.
- They possess visual and olfactory indicators such as sulfidic odours, bright yellow, yellow or straw-coloured mottling and pore space and fissure infill and coatings that could indicate the presence of jarosite, goethite or other similar acid producing sulfate minerals.
- They may be indicated by the presence of shells, organic matter and dark reddish streaks that would indicate the presence of iron oxides.
- They may be indicated by the presence of dark grey or black monosulfidic sediments or material showing the characteristics of fluvial bottom sediments or sediments deposited in a lacustrine environment.

2 OBJECTIVES AND SCOPE

The objective of this report is to provide suitable management strategies and concepts to minimise potential impact to the environment during the works required as part of the proposed development. To achieve these objectives, the following scope of works was undertaken:

- Desk study: a review of relevant information relating to ASS was undertaken, including previous ground investigation reports in the area, aerial photographs, soil and geological maps, ASS planning maps, and the *Acid Sulfate Soil Manual*, NSW ASSMAC (1998);
- Preparation of this ASSMP.

3 SITE INFORMATION

3.1 SITE IDENTIFICATION

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 830 m². 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.

3.2 SITE TOPOGRAPHY

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

Site elevations range from 5.2 m AHD in the south to 1.8 m AHD in the north.

3.3 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.

3.4 SOILS

Previous geotechnical Investigation carried out by CES (July 2022) (CES Document Reference: CES220609-SHB-AA) inferred subsurface conditions at the site are 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.

3.5 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.

During CES geotechnical Investigation (CES, July 2022) (CES Document Reference: CES220609-SHB-AA) the following observations were recorded:

- *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.*

3.6 ACID SULFATE SOILS MAPS

3.6.1 Acid Sulfate Soil Risk Maps Hornsby Mona Vale

A review of the Hornsby Mona Vale Acid Sulfate Soils Risk Map (Department of Land and Water Conservation 1997) indicates that an area to the north of the site (undelying the existing driveway) is classified as High Probability of the occurrence of Acid Sulfate Soils, at or near the ground surface, The landform risk codes for the northern area of the site EP1: Estuarine plain at elevation of 1-2 m.

The remainder of the site is classified as No Known Occurrence of Acid Sulfate Soils.

3.6.2 Warringah Local Environment Plan 2011

A review of Acid Sulfate Soils Map - Sheet ASS_009 of the Warringah Local Environmental Plan 2011, indicated that the site is classified as: Class 2 (North end - In front of existing dwelling) and 5 Acid Sulfate Soil (remainder of site).

For Class 2 lands development consent is required for “*Any works beneath the natural ground surface, or works which are likely to lower the water table*”.

Similarly, for Class 5 lands development consent is required for “Works within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres Australian Height Datum and by which the water table is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land”.

For both Class 2 and Class 5 lands “Development consent must not be granted... for the carrying out of works unless an acid sulfate soils management plan has been prepared for the proposed works in accordance with the Acid Sulfate Soils Manual” or “a preliminary assessment of the proposed works prepared in accordance with the Acid Sulfate Soils Manual indicates that an acid sulfate soils management plan is not required for the works”.

4 CONSTRUCTION SUMMARY

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 two-storey residential dwelling, No basement excavation is proposed.
- a pool (1.2 m depth)
- and associated driveway.

Cut & Fill Plan provided (refer to Appendix A) indicated that the maximum cut will be 1400 mm for the proposed pool. No cut is proposed in the northern portion of the site, associated with the new driveway, with up to 300 mm of filling proposed.

5 ACID SULFATE SOILS RISK ASSESSMENT

Based on the information provided in the Development Application drawings (Appendix A) and the Acid Sulfate Soils Risk Mapping, there is a low likelihood of the development disturbing Acid Sulfate Soils as:

- The development does not include bulk excavations, with the exception of the pool excavation which is limited to 1.4 m depth, in an area of No Known Occurrence of Acid Sulfate Soils.
- In addition to the pool excavation, there may be localised detailed excavations to allow for the construction of building foundations. Similar to the pool excavation, these excavations are likely to be shallow and of limited extents.
- No deep excavation or construction dewatering is proposed as part of the development.
- The lateral, vertical, and temporal extent of the pool and foundation excavations are unlikely to lower the groundwater table, if groundwater is encountered, with the exception of locally, in close vicinity to the excavation. As such the excavations do not have the potential to lower the groundwater table in the area of the site mapped as High Probability of Acid Sulfate Soils.

-
- No excavations or cut operations are proposed for the northern area of the site (mapped as High Probability of Acid Sulfate Soils). Works in this area are limited demolition of the existing driveway followed by construction of a new driveway. The new driveway construction includes an area to be filled by up to 300 mm.

As noted above there is a low likelihood of the development disturbing Acid Sulfate Soils, however as an Acid Sulfate Soils Assessment has not been carried out to confirm the absence of Acid Sulfate Soils from the areas of the site which will be subject to excavations management of Acid Sulfate Soil risks is required.

Based on the development details and the likely Acid Sulfate Soils distribution at the site the following management methods are to be implemented:

- Screening of Excavated Soils by visual assessment combined with Acid Sulfate Soils Field Screening in accordance with ASSMAC (1998);
- Minimise the extent of soil disturbance by excavation and management of excavated soils and stockpiles;
- Acid Sulfate Soils Management if required by Neutralisation followed by Offsite Disposal of Acid Sulfate Soils, or excavation and offsite disposal of unoxidized Potential Acid Sulfate Soils.

6 SCREENING OF EXCAVATED SOILS

All soils excavated are to be screened for Acid Sulfate Soils. Screening can be undertaken by the excavation of test pits or boreholes prior to the excavation works or alternatively on stockpiled soils following excavation.

Where screening is undertaken in test pits or boreholes prior to excavation, soils should be assessed in a minimum of 4 locations within the excavation footprint, in accordance with ASSMAC (1998) and field screening should be completed every 0.5 m or on every soil type encountered. Test pits or boreholes should be extended to a minimum of 1 m past the total depth of excavation.

Where screening is undertaken on excavated, stockpiled soils, the excavated soils should be managed in accordance with the excavation and stockpiling controls presented in Section 7. Screening should be undertaken at a minimum of one screen per 10 m³ and be completed on all soil types encountered.

Acid Sulfate Soils screening should be carried out in accordance with ASSMAC (1998) by a combination of visual and olfactory assessment and the conduction of field peroxide screening.

Visual and olfactory assessment comprises assessment of soils for the following indicators of Acid Sulfate Soils:

- Presence of sulfidic odours, bright yellow, yellow or straw-coloured mottling that would indicate the presence of jarosite, goethite or other similar acid producing sulfate minerals;
- Presence of shells, organic matter or dark reddish streaks that could indicate the presence of iron oxides;
Presence of dark grey or black monosulfidic materials (Grey to dark grey and black, clays, silts and sands);
- Sulfidic odours from soils.

Following visual assessment, soils should be screened in accordance with the protocol for field screening for field pH and Peroxide test provided in Appendix 1 of the *Acid Sulfate Soil Manual*, ASSMAC (1998). Positive indicators of Acid Sulfate Soils to be identified during field peroxide screening include:

- pH of less than 4 following the addition of deionised water;
- change in colour following the addition of hydrogen peroxide of the soil from grey tones to brown tones;
- effervescence following the addition of hydrogen peroxide;
- the release of sulfur smelling gases such as sulfur dioxide or hydrogen sulphide following the addition of hydrogen peroxide; and
- a lowering of the soil pH by at least one unit following the addition of hydrogen peroxide;
- a strongly exothermic reaction following the addition of hydrogen peroxide;
- pH_{fox} of less than 5.5 following the addition of hydrogen peroxide;

If no positive indicators of Acid Sulfate Soils are encountered, no further actions are required, as acid sulfate soils are unlikely to be affected by the development.

Where positive indicators of Acid Sulfate Soils are encountered in the visual and olfactory assessment, or the field Acid Sulfate Soils Peroxide Test, representative samples should be submitted to a NATA accredited laboratory for the Chromium Reducible Sulphur analysis suite.

6.1 ASSESSMENT CRITERIA

Table 1 details the texture-based action criteria for management of ASS disturbance, as sourced from the Acid Sulfate Soil Manual, NSW ASSMAC (1998) to be used to interpret the results of Chromium Reducible Sulphur analysis if undertaken.

Where soils containing concentrations at or above the action criteria are disturbed, there is a potential for the soil to generate acid and specific management is required, in accordance with the management options presented in Section 8.

Table 1: Acid Sulphate Soil Action Criteria

Type of Material		Action Criteria			
		1-1000 tonnes disturbed		> 1000 tonnes disturbed	
Texture	Approx Clay Content (% < 0.002 mm)	Sulfur Trail % S oxidisable (oven-dry basis) eg: STOS or SPOS	Acid Trail mol H ⁺ / tonne (oven-dry basis) eg: TPA or TSA	Sulfur Trail % S oxidisable (oven-dry basis) eg: STOS or SPOS	Acid Trail mol H ⁺ / tonne (oven-dry basis) eg: TPA or TSA
Coarse <i>Sands to loamy sands</i>	5	0.03	18	0.03	18
Medium <i>Sandy loams to light clays</i>	5 – 40	0.06	36	0.03	18
Fine <i>Medium to heavy clays and silty clays</i>	40	0.1	62	0.03	18

Source: Table 4.4 – ASSMAC – 1998

7 MANAGEMENT OF EXCAVATIONS AND SOIL STOCKPILING

The following controls should be implemented if Acid Sulfate Soils have been identified or where the Acid Sulfate Soils screening assessment is to be completed following excavation and stockpiling, the following controls should be implemented.

7.1 PREPARATION OF STOCKPILING/CONTAINMENT AREA

Prior to the commencement of the excavation works where Acid Sulfate Soils have been identified or where the Acid Sulfate Soils screening assessment is to be completed following excavation and stockpiling a designated Containment Area should be prepared:

- The designated Containment Area should consist of a bunded area of adequate size to contain the excavated material. The Containment Area shall have low permeability sides and base to contain any leachate produced. The size of the containment area will require to be a function of the anticipated excavation rate and the total volume of soils to be excavated.

Should small volumes of soils be anticipated, a suitable containment area may comprise a skip bin lined and sealed using a HDPE liner;

- Materials stored within the Containment Area should be covered with a low permeability liner (HDPE or similar) to minimise the generation of leachate
- Adequate water management will be required during the works to contain any potential acid leachate and to prevent clean storm/surface water from coming into contact with disturbed soil and/or leachate.

7.2 EXCAVATION METHODOLOGY

The following recommendations are provided in relation to excavation of ASS at the site:

- Minimise excavations to the extent possible.
- Any soils positively identified as Acid Sulfate Soils or that has not been field screened should be excavated and placed directly into the designated Stockpile/Containment Area to prevent spillage, egress or leakage of water/leachate during handling.
- Multiple containment areas can be maintained in order to segregate material types, source areas or screening results.
- If required, Acid Sulfate Soils Screening should be completed in accordance with Section 6, or Treatment of Acid Sulfate Soils in accordance with Sections 8.2 or 8.3 should be completed.

7.3 LEACHATE MANAGEMENT

Leachate generated in the Containment Area area needs to be collected and tested prior to discharge by any method. If Acid Sulfate Soils are confirmed, and the leachate is being generated off ASS stockpiles it cannot be disposed of to receiving waters. If the water requires disposal offsite, it will have to go to a facility that can lawfully receive the waste and it must first be tested for a wider suite of analytes.

7.4 DEWATERING ACTIVITIES

Dewatering is not anticipated but if required, dewatering should be kept to a minimum and a suitable Dewatering Management Plan should be prepared prior to dewatering. Where possible, activities should be planned so that no dewatering is necessary, or if unavoidable, that the extent of dewatering and the duration is minimised.

The following should be included in a Dewatering Management Plan considering the ASS present onsite:

-
- The depth of dewatering should be minimised to reduce the risk of generation of acidic conditions from the oxidation of ASS. The dewatering and excavation should be staged over short durations to reduce the time and volume of ASS exposed to oxidation in the excavation. This is an important consideration if below the permanent groundwater table disposal is to be used to manage the ASS.
 - Approvals for the disposal of groundwater and stormwater may need to be obtained from Council, the NSW Office of Water, Sydney Water and any other relevant authority, considering that the Site contains ASS;
 - Water from the excavation and stormwater should be collected in portable tanks or a suitably designed engineered pond where samples can be obtained for analysis
 - Prior to disposal the pH of the water should be in the range of 6.5 to 8.5. If the pH is outside this range some treatment may be required prior to disposal;
 - pH of groundwater should be monitored on a regular basis throughout the excavation and construction period, and treatment may be necessary to address a change in pH;
 - The approvals for disposal from the relevant authorities may require that further contaminants may also be screened for.

7.5 STORMWATER MANAGEMENT

Stormwater should be diverted away from excavations and stockpiles by a series of bunds to be retained until excavations are backfilled or until permanent stormwater infrastructure is installed on the site. Management measures for the site should include:

- Stormwater diversion bunds around excavations and designated Containment Areas (as required);
- Minimising surface disturbance and maximising the retention of existing surface cover (pavements, vegetation) during the works;
- Construction of sediment controls downstream of any diversion bunds, hardstand and traffic areas to minimise the off-site migration of sediment; and
- Vehicular access is to be stabilised to prevent tracking of mud onto roads and footpaths. Soil, earth and mud shall be removed from the roadway by sweeping, shovelling or a means other than washing on a daily basis or as required.

8 ACID SULFATE SOIL MANAGEMENT STRATEGY

The following ASS management options are provided in relation to the excavation works if Acid Sulfate Soils are identified. It should be noted that the most effective management strategy for dealing with ASS is to avoid disturbance of ASS. However, if disturbance of ASS cannot be avoided, the following management options/strategies are considered appropriate in order to minimise the impact of disturbance of ASS on the environment:

- Option 1 - Excavation and disposal of Potential ASS (PASS) beneath the water table at an approved landfill, prior to oxidation.

This option is only suitable where the Acid Sulfate Soils are identified by investigation prior to excavation. Where Acid Sulfate Soils are identified in assessment of excavated materials this option is not considered suitable.

- Option 2 - Excavation, neutralisation and disposal of ASS at a suitably licensed landfill facility.
- Option 3 - Excavation, neutralisation and onsite re-use of PASS subject to compliance with EPA general and specific resource recovery exemptions.

These options are further considered below:

8.1 OPTION 1 - EXCAVATION AND DISPOSAL OF PASS BENEATH THE WATER TABLE AT SUITABLY LICENSED LANDFILL FACILITIES

For the excavation and disposal of PASS below the water table at a suitably licensed landfill facility, the PASS should be excavated, transported and deposited below the water in a period no greater than 24 hours. A number of conditions and controls must be satisfied for disposal beneath the water table to be a viable option for the disposal of PASS:

- There must be a suitably licenced landfill within a reasonable distance to the Site to ensure the excavation, transport and disposal can be carried out within 24 hours;
- The PASS should not have been impacted by contaminants; and
- The pH of soils on excavation and immediately prior to disposal has not experienced a significant change.

This management option is considered to be suitable for the proposed works, where natural soils underlying the Site are considered to be PASS. However, care should be exercised to ensure that any potentially impacted fill material is separated prior to excavation of the PASS. Sequencing

management and control of all excavation works will require careful consideration to prevent oxidization of PASS.

Landfill facilities in the Greater Sydney Area that are licenced to accept PASS as waste have specific agreements with the NSW EPA to accept PASS only if it meets the following criteria (as outlined in the *Waste Classification Guidelines Part 4: Acid Sulfate Soils*, EPA 2014):

- PASS must be kept wet at all time during excavation and subsequent handling, transport and storage until they can be disposed of safely. They must be received at the proposed disposal point within 16 hours of being dug up.
- PASS can only be disposed of in water below the permanent water table before they have had a chance to oxidise, i.e. within 24 hours.
- PASS must be able to be classified as VENM in accordance with the NSW EPA (2014) *Waste Classification Guidelines Part 4 Acid Sulfate Soils*, even though they contain sulfidic ores or soils.
- The material should have a pH greater than 5.5, both immediately following excavation and immediately prior to disposal beneath the permanent water table; where soil pH is less than 5.5 it must be considered as Actual Acid Sulfate Soil and treated by neutralisation prior to disposal (in accordance with the ASSMAC Guidelines) and then chemically assessed as per the NSW EPA Waste Classification Guidelines, prior to disposal at an appropriate landfill.
- Documentation must be provided to the landfill operator for each truckload of PASS received, indicating that the soil's excavation, transport and handling have been in accordance with the ASSMAC and EPA Guidelines. Information to be included in documentation should include:
 - pH of each load of ASS recorded at the source site and at the disposal site;
 - details of the source site;
 - details of the transporter;
 - date and time of the extraction of the ASS;
 - pH of the ASS at time of extraction;
 - pH of ASS immediately prior to placement under the water in the landfill;
 - name and details of the person classifying the material as ASS;
 - satisfactory review and confirmation by a representative from the landfill of geotechnical and contamination reports pertaining to the source site;
 - an inspection of the source site by a representative of the landfill.

8.1.1 Assessment Against Waste Classification Guidelines Part 4: Acid Sulfate Soils

In accordance with *Waste Classification Guidelines Part 4: Acid Sulfate Soils* (NSW EPA 2014) PASS may be disposed of below the permanent water table provided:

-
- This occurs before they have had a chance to oxidise, i.e. within 24 hours of excavation; and
 - They meet the definition of ‘virgin excavated natural material’ (VENM) under the Protection of the Environment Operations Act 1997, even though they contain sulfidic ores or soils.

In order to assess whether or not the PASS at the site meets the definition of ‘virgin excavated natural material’, even though they contain PASS, CES has undertaken a review of the historical aerial photographs in order to identify if any potentially contaminating activities have taken place at the Site.

The aerial photographs indicate that the site has remained a residential dwelling from 2003 to present, with minor clearing on the northern boundary of the site occurring prior to the 2009 aerial photographs. In 2009, the residential dwelling footprint was significantly expanded covering the vast majority of the site.

Natural soils were reported during the Geotechnical Investigation carried out by CES (July 2022) (CES Document Reference: CES220609-SHB-AA) from a depth 0.25 m.

Given the site history and geotechnical investigation, the natural soils underlying the Site are unlikely to have been contaminated from past site activities or from the Fill present on Site. However, the PASS material to be excavated, treated and potentially disposed of needs visual assessment and chemical analysis to confirm that it meets the requirements for disposing of potential acid sulfate soils below the water table in accordance with the guidelines laid down in *Waste Classification Guidelines Part 4: Acid Sulfate Soils (NSW EPA 2014)*.

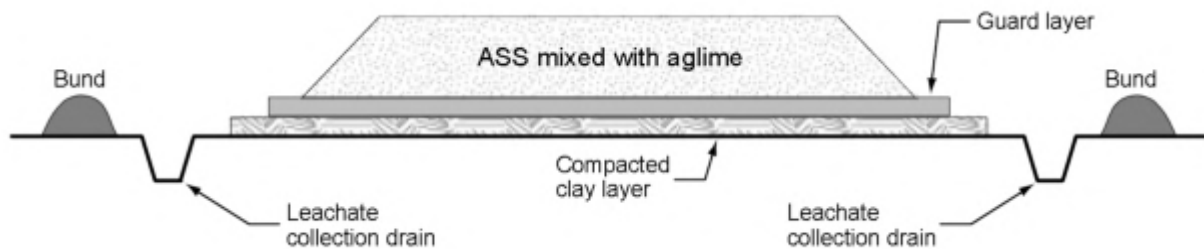
8.2 OPTION 2 - EXCAVATION, NEUTRALISATION AND OFF SITE DISPOSAL

Excavated soil identified as ASS could be treated by neutralisation with lime as follows:

ASS treatment should occur at an ASS treatment location within the site appropriately set up to treat and store the volumes of spoil anticipated during the works. It would be expected that the process would include the following:

- an untreated stockpile storage area;
- treatment pad or bay(s);
- treated stockpile area;
- loadout area;
- leachate collection system and storage tanks; and
- suitable bunding.

A treatment pad should be prepared in general accordance with In-Text Figure 1, as per the Queensland Acid Sulfate Soil Technical Manual (Dear et al. 2014). An impermeable layer and leachate collection system are required. The treatment pad should be located at least 40 m from any waterway and if possible, placed in a topographically high area to avoid inundation following heavy rain.



In-Text Figure 1. Cross-section of typical treatment pad

Soil for treatment should be either:

- spread in thin (<200 mm) layers on the impervious pad, the required lime spread and then incorporated by rotary hoe / road stabiliser or similar; or
- required lime spread evenly and distributed through the use of bulk bags with an open chute on one end over a low levelled stockpile and then thoroughly mixed with the aid of an excavator bucket or front-end loader. Due to the small volumes of spoil anticipated, in lieu of the use of a pugmill or allu bucket typically used for mixing of large soil volumes, the mixing approach may require more than a single pass to achieve the same homogenous blend.

Mixing by standard excavator bucket is not considered a suitable treatment / mixing technique.

The stockpiling for ASS should be managed in a combination of In-text Figure 1, and stockpiling controls which include:

- All stockpiles must be placed in areas that do not allow material to spill onto the road pavement or drainage lines / watercourses.
- Construct stockpiles, preferably with no slope greater than 2:1 (horizontal to vertical) and no more than 3m in height. to manage dust generation and erosion. A less steep slope may be required once the surrounding area is flattened to reduce dust emission.
- Apply periodic dampening, where necessary, to suppress dust from being released;
- Stockpiled materials must have a sediment control fence to be installed down gradient of the stockpile, to minimise erosion.
- Any water that comes into contact with contaminated spoil is leachate and must be contained and pumped into leachate storage tanks.
- Stockpiles are to be covered at the completion of each day to minimise the generation of

leachate from rainfall. The plastic sheeting or geotextile fabric (or suitable alternative cover/stabiliser) used to cover stockpiles should have sufficient overlap so that soil does not become exposed at the join.

A stockpile register will be maintained by the contractor that allows for tracking of material from source, through the treatment process, to the disposal location. To facilitate the tracking process and ensure risks of PASS oxidising are managed, the following protocol should be implemented:

- Stockpiles should be kept to a (nominal) maximum of 75 m³.
- Field screening of soil must occur within 48 hours of excavation and will comprise:
 - Four field samples collected from each quarter of the stockpile. Each sample should be a composite of five grab samples from the quarter of the stockpile being assessed. The samples will be screened using the field peroxide method
 - Field screening results assessed and actioned as follows:
 - If all result show field pH peroxide (pH_{FOX}) >6, then the soil considered very low risk of being acid sulfate soil and suitable for onsite reuse or otherwise suitable for waste classification testing.
 - If one or more results show pH_{FOX}<6 submit a composite of the four samples for testing at the lab by CRS method.
 - This will provide confirmation that the soils are not acid sulfate generating or otherwise provide a treatment liming rate.
- Where test results show treatment is necessary, the recommended liming rate will be applied, and the lime mixed thoroughly before verification testing occurs. Note: the liming rate should be based on the net acidity excluding the acid neutralising capacity (ANC).
 - Verification will include:
 - collection of four samples for field screening as above;
 - if all screening results show no further liming required, then a composite will be formed for laboratory verification testing (and if offsite disposal is intended, waste classification analysis);
 - if lab results confirm that no further lime is required, the material will be considered appropriately treated and suitable for onsite reuse or offsite disposal (pending waste classification testing);
 - if further liming is required this will be applied, mixed and the verification testing repeated; and
 - records of the testing and verification works will be maintained throughout the works.

Treated soils that do not meet the pH, sulfur trail and acid trail criteria stated in Table 1 must be re-treated with the required extra lime dosage and re-tested until they meet the criteria.

Following adequate neutralisation of the ASS, Waste Classification of the soils should be undertaken in accordance with the NSW EPA (2014) *Waste Classification Guidelines*. The material should then be removed from site and disposed of at a suitably licensed landfill facility.

8.2.1 Lime Storage

Lime should be added (with appropriate PPE) at the rates specified in the laboratory transcripts, followed by careful but thorough mixing for the full depth of the stockpile, making sure that no dust is generated. Relatively small quantities of lime are expected to be needed onsite and so it is recommended that it is stored in bulk bags within a covered skip bin. This will mitigate the risk of seepage from the lime presenting an environmental risk during heavy rain. Having lime provided in bags will also assist in more accurate measuring out of lime in accordance with laboratory recommended liming rates.

8.3 OPTION 3 - EXCAVATION, NEUTRALISATION AND ONSITE RE-USE SUBJECT TO RELEVANT EPA RESOURCE RECOVERY EXEMPTIONS.

For the excavation, neutralisation and onsite re-use of treated ASS, the ASS is excavated and neutralised with lime as described above (Section 8.2). The treated ASS could be re-used onsite, provided that it is geotechnically and environmentally suitable for purpose. The re-use of treated ASS on site would require the following to be confirmed prior to re-use:

- The ASS has not been impacted by contaminants;
- The acid producing potential of the ASS has been sufficiently neutralised;
- The treated material complies with a General or Specific Resource Recovery Exemption as authorised by the NSW EPA.
- Written approval has been obtained from the NSW EPA and Council; and
- The soil material is geotechnically suitable for use.

8.4 WASTE DISPOSAL

8.4.1 WASTE CLASSIFICATION

Disposal of virgin excavated PASS and co-mixed PASS with non-virgin material (fill) will be in accordance with the following guidelines:

- NSW EPA (2014) *Waste Classification Guidelines – Part 1: Classifying Waste*.
- NSW EPA (2014) *Waste Classification Guidelines – Part 4: Acid Sulfate Soils*.

Any facility accepting untreated PASS must be licensed to accept the material in accordance with the guidelines indicated above. Evidence from the landfill demonstrating their approval to accept untreated PASS should be obtained prior to dispatching any materials.

Co-mixed PASS and fill, or PASS and any other waste cannot be disposed of untreated. This material will require excavation, onsite treatment for ASS, waste classification and then disposal in accordance with the waste classification at a landfill licenced to accept it.

The following protocols should be followed to ensure that the material is appropriately classified for disposal assuming the facility is licensed to accept the material as stated.

8.4.2 DISPOSAL OF UNTREATED POTENTIAL ACID SULFATE SOIL

NSW EPA (2014) *Waste Classification Guidelines – Part 4: Acid Sulfate Soils* allows for disposal of PASS directly below the water table at facilities licenced to accept untreated PASS.

8.4.3 DISPOSAL OF TREATED ASS

The most likely disposal option will be a general solid waste landfill licensed to receive treated ASS and contaminant-impacted soil. The following requirements consistent with ASS disposal ‘above the water table’ must be adhered to:

- The material is to be treated as per the protocol in Section 8.2.
- The material is to be classified for waste disposal in accordance with Step 5 of the NSW EPA (2014) *Waste Classification Guidelines – Part 1: Classifying Waste*.
- When the classification has been established, the soil should be disposed of to a landfill that can lawfully accept that class of waste.

Prior arrangements should be made with the occupier of the landfill to ensure that it is licensed to accept the waste. The landfill should be informed that the material has been treated in accordance with the neutralising techniques outlined in the ASS Manual and that the waste has also been classified in accordance with the NSW EPA (2014) *Waste Classification Guidelines – Part 1: Classifying Waste*.

8.4.4 DISPOSAL OF ACTUAL ACID SULFATE SOIL

Where AASS is encountered, or PASS is excavated and not disposed of within the 24-hour time restriction, it must be treated prior to disposal (see Section 8.2). It cannot be disposed of untreated (as PASS). Treatment can either occur on within the site, or at a facility licenced to treat ASS.

9 RESPONSABILITIES

A copy of this ASSMP should be made available for all relevant personnel working on the project and a copy should be kept on site for reference during construction. The recommendations of the ASSMP should be referenced in conjunction with the construction environmental management plan (CEMP) as well as other works plans to include safe work method statements (SWMS). Prior to commencement of works, all field staff will be inducted to the site and will be made familiar with their obligations under the site management plans and associated environmental and worker health and safety requirements.

Any staff involved in sediment excavation and/or handling will be made familiar with the procedures discussed in this ASSMP.

Table 2 provides a summary of responsibilities of stakeholders while involved with the Project.

Table 2: Responsibilities Summary

Position/Organisation	Reports to	Summary of Responsibilities
Shobba Designs	Client representative/ Project Manager	• Prepare or commission project management plans (e.g. construction environmental management plan (CEMP) and occupational health and safety management plan). • Induct all staff involved in excavation works in the ASSMP requirements. • Ensure works and subcontractor works are undertaken in compliance with this ASSMP. • Ensure routine compliance monitoring and associated reporting is carried out.
Environmental Consultant	Shobba Designs	• Provide environmental consulting services as required. • Maintain and update this ASSMP as required. • Assist with verification of treatment and waste classification works. • Prepare the environmental and validation documentation associated with the works (as needed).

10 WORK HEALTH AND SAFETY CONSIDERATIONS IN RELATION TO ACID SULFATE SOILS

A Work Health and Safety (WHS) Plan should be prepared to ensure that the works are conducted in a controlled and safe manner with due regard for potential hazards and safe work practices. The WHS plan should be implemented and enforced by the appointed site supervisor. The following considerations should be included, relating to the presence and treatment of PASS at the site.

10.1 PERSONNEL AND RESPONSIBILITY

All personnel should be made aware of the person responsible for implementing health and safety procedures. All personnel should read and understand the WHS plan prior to commencing work and have signed a statement to verify this understanding. Contractors shall be responsible for ensuring that their employees are aware of and comply with the WHS plan.

10.2 IDENTIFICATION OF POTENTIAL HAZARDS

10.2.1 Chemical Hazards

Chemicals or compounds that may be present at the site include, but are not limited to:

- Acidic soils;
- Strongly alkaline materials (Lime).

Potential risks to personnel associated with these compounds, if present at the site, include:

1. Ingestion of soil or liquids;
2. Dermal (skin) contact with contaminated soil or liquids including acidic soils and lime; and
3. Inhalation of dust or aerosols containing contaminants.

10.2.2 Physical Hazards

The following physical hazards may exist at the site:

- Heavy equipment;
- Excavations;
- Heat exposure;
- Traffic and vehicle hazards;
- Buried Services;
- Noise;
- Dust;
- Electrical equipment; and
- Any lime or other neutralising agents used in the management of ASS.

10.3 MEDICAL SURVEILLANCE

It is expected that all personnel on the site have undergone specific training for working on excavation sites and to be participants in a recognised medical surveillance scheme.

10.4 SITE WORK PRACTICES

10.4.1 Personal hygiene

A designated clean location should be allocated for smoking and the consumption of food or drink. These areas should be equipped with hand washing facilities which must be used prior to engaging in these activities. Personnel should be made aware of the location of these facilities.

10.4.2 Personal protection

Personnel should take measures to avoid coming into direct contact with ASS material. Workers are to ensure that soil, surface water or groundwater are not ingested or swallowed and that direct contact with skin is avoided. It is recommended that personnel should wear the following Personal Protective Equipment (PPE):

1. Steel-capped boots;
2. Safety vest;
3. Hard hat meeting AS1801-1981 requirements when working within the site;
4. Hearing protection meeting AS1270-1988 requirements when working around machinery or plant and equipment if noise levels exceed exposure standards;
5. Dust masks meeting appropriate Australian Standards when handling and administering neutralising agents for ASS;
6. Safety glasses or goggles with side shields meeting AS1337-1992 requirements as necessary (particularly during demolition and when neutralising ASS); and
7. Disposable latex gloves for personnel involved in soil or water sampling and the handling of neutralising agents.

10.5 EMERGENCY RESPONSE PLAN

An emergency response plan should be developed for the site.

10.5.1 Responsibilities

The site supervisor will be responsible for ensuring that site personnel are aware of emergency services available. A site safety officer should be available during works.

11 ENVIRONMENTAL MANAGEMENT CONSIDERATIONS

Excavation works shall be conducted in a manner to minimise environmental impacts and to meet statutory requirements. Site works should comply with the relevant legislation and consent(s).

The contractor should endeavour to:

-
- Minimise fugitive dust emissions;
 - Minimise the volume of water containing suspended sediment leaving the site;
 - Ensure that all water discharged from the site conforms to water quality criteria contained in the Council consent conditions, and ASSMAC (1998) guidelines;
 - Prevent vehicles from tracking mud on local roads; and
 - Ensure that noise and vibration levels conform to legislative requirements.

11.1 SITE SECURITY, RESTRICTED ACCESS AND SIGNAGE

Access to the site should be restricted and gates locked outside operating hours.

Vehicular access to the site shall be through controlled entry and exit points. All loads shall be covered with a tarpaulin prior to leaving the site.

During works, the site will be designated as a construction area. Consequently, access will be restricted to authorised staff and contractors equipped with appropriate Personal Protective Equipment (PPE). Site access will be controlled by the site supervisor. All visitors will report to the site supervisor prior to entering the site.

11.2 CONTROL OF DUST AND ODOUR

It is not expected that dust will be produced by the excavation works as all soil materials are expected to be wet. However, works should be undertaken in a manner that minimises fugitive dust and odour emissions. The following measures can be taken to control dust and odour:

- Careful handling of material in a manner that minimises dust emissions;
- Placement of screening material (e.g., hessian) on perimeter fences adjacent to excavations;
- Spraying dusty parts of the site with water;
- Keeping excavations moist (where practical);
- Use of tarpaulins to cover loads (incoming and outgoing).

12 REFERENCES

Ahern, C.R., Stone, Y., and Blunden, B., 1998: *Acid Sulfate Soils Management Guidelines*. Published by the Acid Sulfate Soil Management Advisory Committee, Wollongbar, NSW, Australia.

Acid Sulphate Soil Management Advisory Committee NSW: *Acid Sulfate Soil Manual* 1998.

CES (July 2022) *Proposed Residential Development at No.20 The Esplanade, Narrabeen NSW 2101 – Geotechnical Investigation and Slope Stability Assessment Report*. CES Document Reference: CES220609-SHB-AA.

Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M., 2014. *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines*. Brisbane: Department of Science, Information Technology, Innovation and the Arts, Queensland Government.

Department of Environment, Climate Change and Water 2009: *Waste Classification Guidelines Part 4: Acid Sulphate Soils*, EPA, November 2014

Landcom, 1994. *Managing Urban Stormwater: Soils and Construction*.

NSW Environment Protection Authority (EPA) 2014a, *Waste Classification Guidelines, Part 1: Classifying Waste*.

NSW Environment Protection Authority (EPA) 2014b, *Waste Classification Guidelines, Part 4: Acid Sulfate Soils*.

NSW Government (2011) *Work Health and Safety Act (NSW)*.

NSW Government (2017) *Work Health and Safety Regulation (NSW)*.

Figures



Legend

 Site Boundary

Figure 1: Site Location Plan

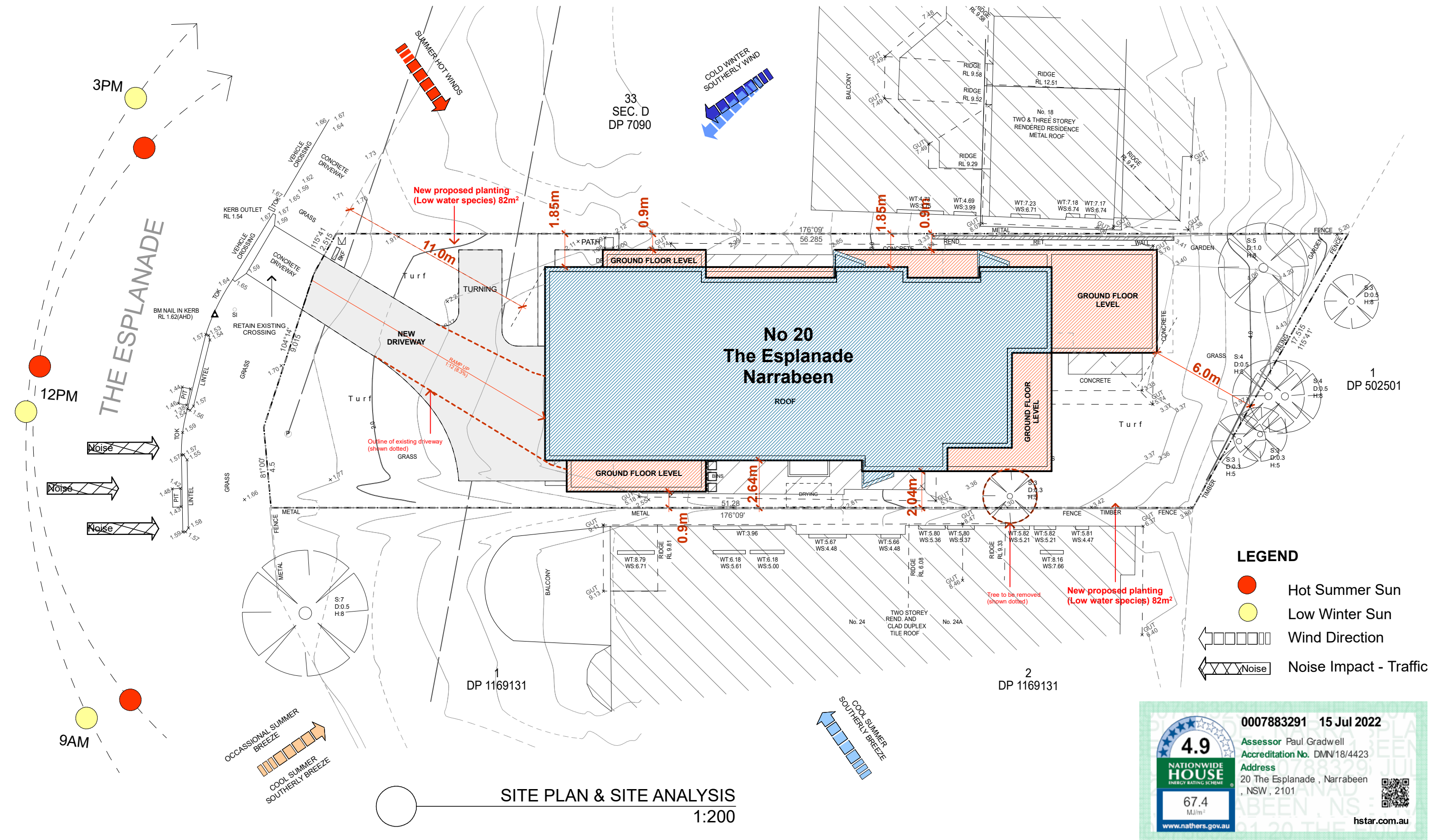
Appendix A

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 ELEVATION
DA-07	EAST ELEVATION
DA-08	REAR ELEVATION
DA-09	WEST ELEVATION
DA-10	SECTION A & B
DA-11	SECTION C
DA-12	DEMOLITION & WASTE SITE MANAG...
DA-13	CUT & FILL PLAN
DA-14	SHADOW DIAGRAM (9:00AM)
DA-15	SHADOW DIAGRAM (12 NOON)
DA-16	SHADOW DIAGRAM (3:00PM)
DA-17	SCHEDULE OF EXTERNAL FINISHES

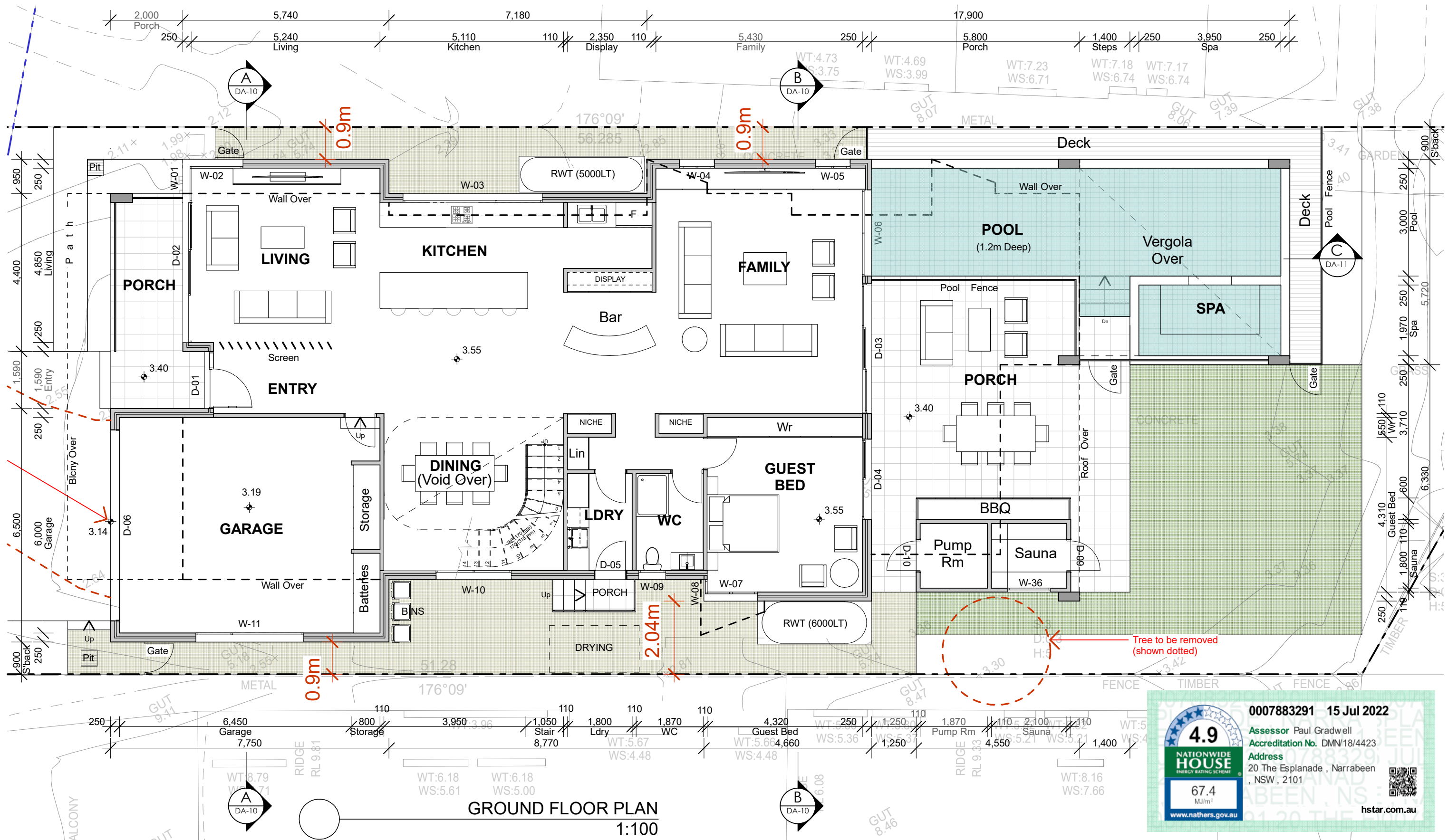
AREA STATEMENT	
SITE AREA	= 833.1 m ²
LANDSCAPED AREA REQUIRED AS PER DCP	
40% OF SITE AREA TO BE LANDSCAPED <i>(Min 2m wide & Min 1m deep soil)</i>	= 333.24 m ²
Swimming Pools & rock outcrops included in landscaped area as per DCP	
DEEP SOIL AREA PROVIDED	= 334.76 m ²
= (40% of site area)	
PRIVATE OPEN 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	= 85 m ²



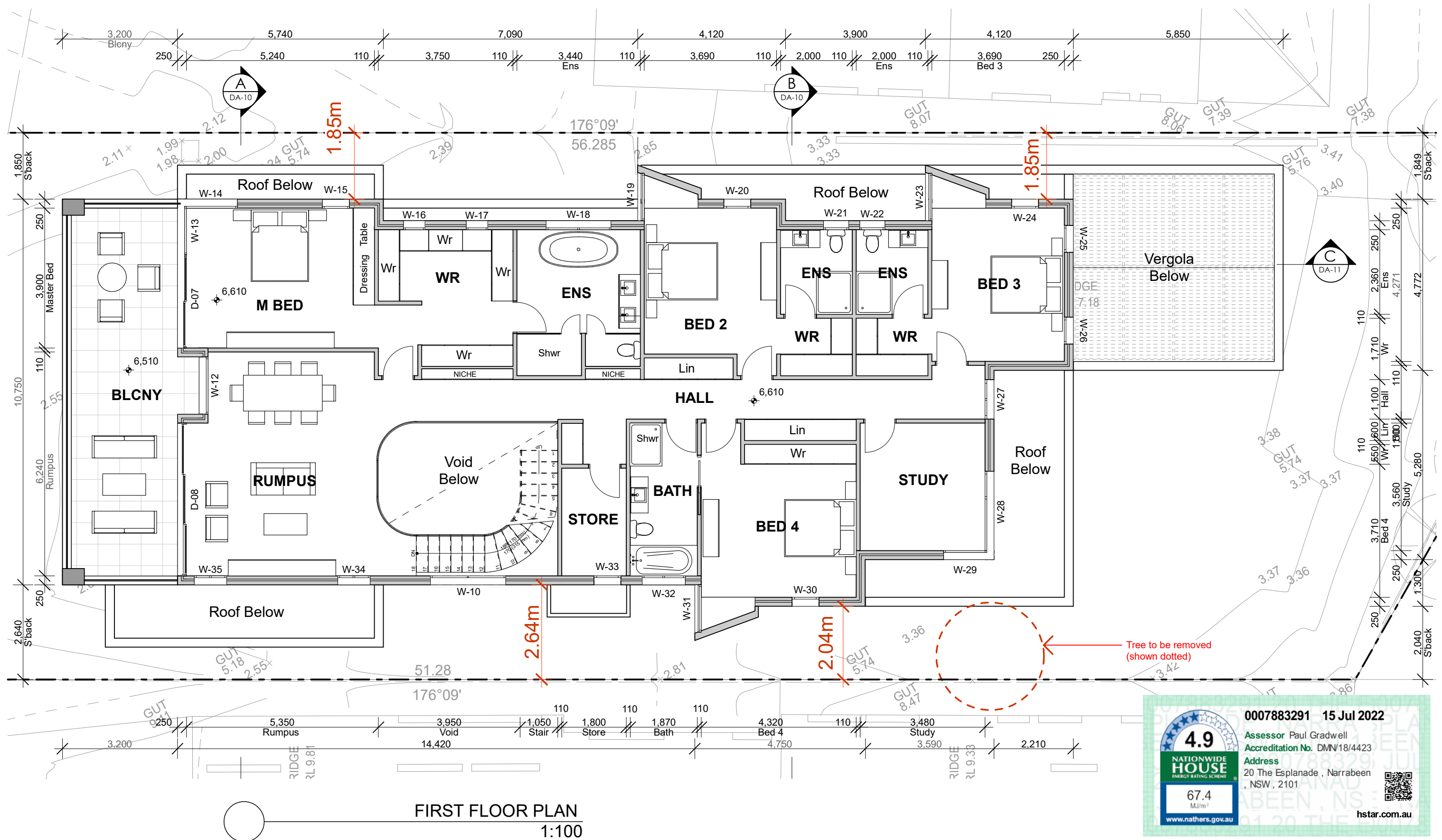
SUBJECT SITE



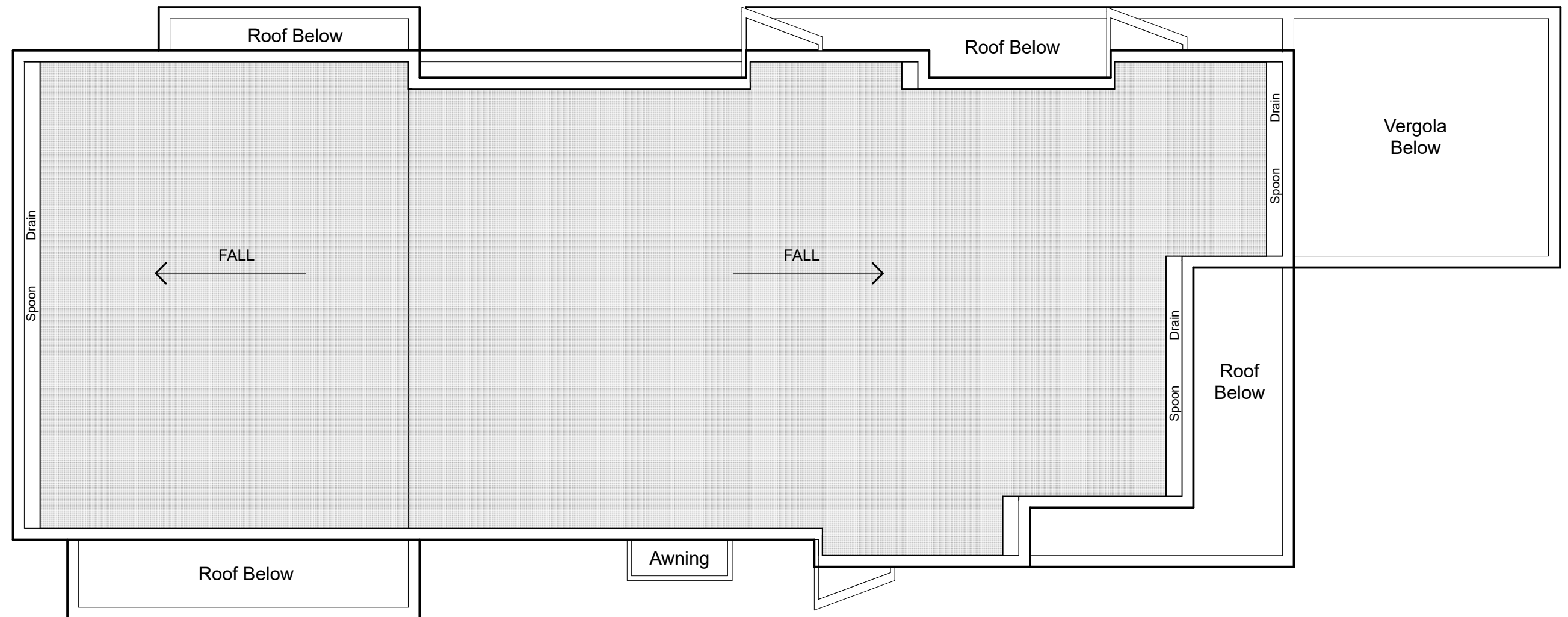
Architects: SHOBHA DESIGNS ARCHITECTS & URBAN DESIGNERS Suite 21, 1 - 7 Jordan St, Gladesville NSW 2111 PHONE : 02 98790020 MOBILE : 0418112677 EMAIL : nilesh@shobhadesigns.com.au shobha	PROJECT Demolition of Existing Structures & Construction of a New 2-storey Dwelling and Swimming Pool at 20 The Esplanade Narrabeen	Drawing Name SITE PLAN & SITE ANALYSIS	Amendments <table><tr><th>Transmittal Set ID</th><th>Transmittal Set Name</th><th>Checked by</th><th>Date</th></tr><tr><td>A</td><td>DA Issue to Council</td><td>NM</td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table>				Transmittal Set ID	Transmittal Set Name	Checked by	Date	A	DA Issue to Council	NM																						Date of Issue 20-Jul-22
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CLIENT Jason Smith ≧ 	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	Drawing Scale Drawn By : Sandy Martikas																																	
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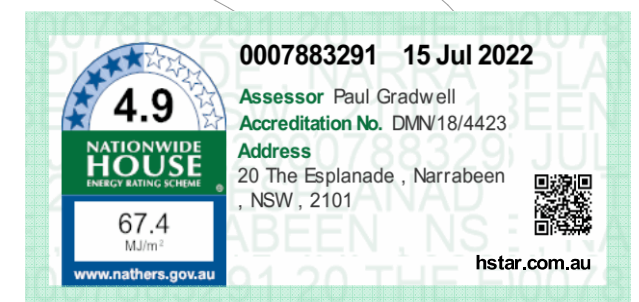
Architects: SHOBHA DESIGNS ARCHITECTS & URBAN DESIGNERS Suite 21, 1 - 7 Jordan St, Gladesville NSW 2111 PHONE : 02 98790020 MOBILE : 0418112677 EMAIL : nilesh@shobhadesigns.com.au shobha	PROJECT Demolition of Existing Structures & Construction of a New 2-storey Dwelling and Swimming Pool at 20 The Esplanade Narrabeen CLIENT Jason Smith N	Drawing Name GROUND FLOOR PLAN 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	20-Jul-22	
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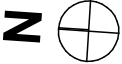


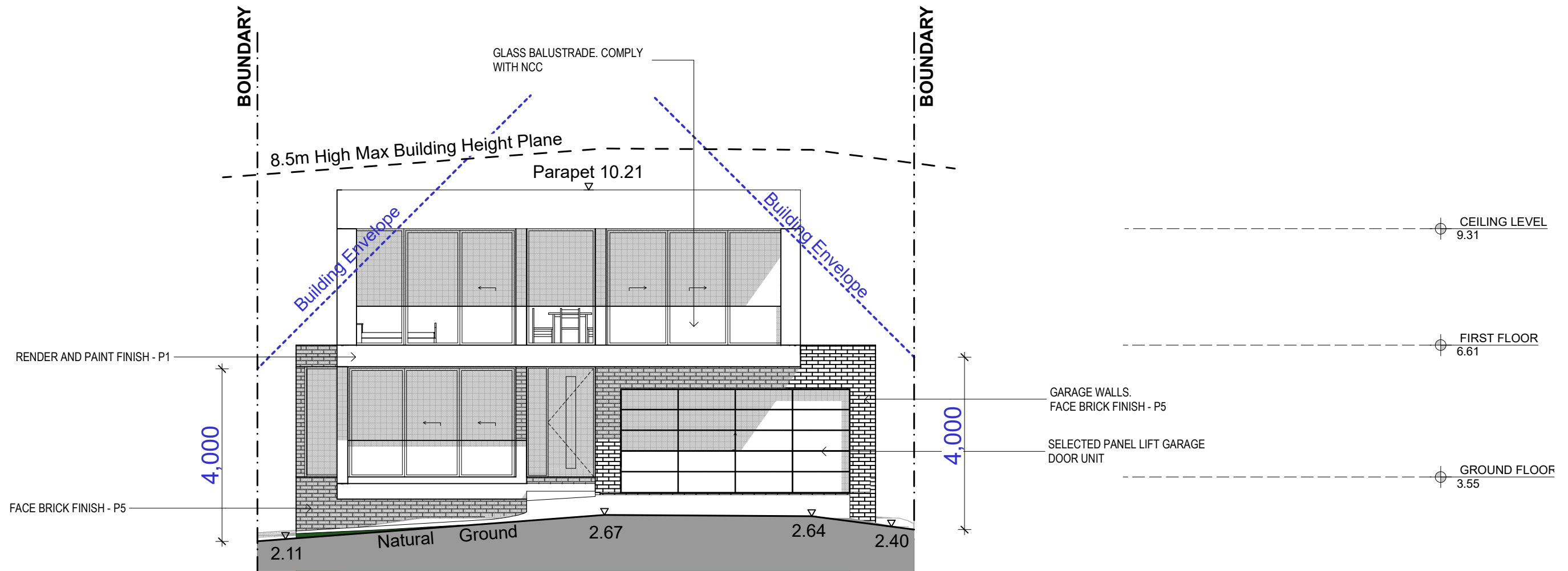
Architects: SHOBHA DESIGNS ARCHITECTS & URBAN DESIGNERS Suite 21, 1 - 7 Jordan St, Gladesville NSW 2111 PHONE : 02 98790020 MOBILE : 0418112677 EMAIL : nilesh@shobhadesigns.com.au shobha	PROJECT Demolition of Existing Structures & Construction of a New 2-storey Dwelling and Swimming Pool at 20 The Esplanade Narrabeen CLIENT Jason Smith N	Drawing Name FIRST FLOOR PLAN 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 20-Jul-22	
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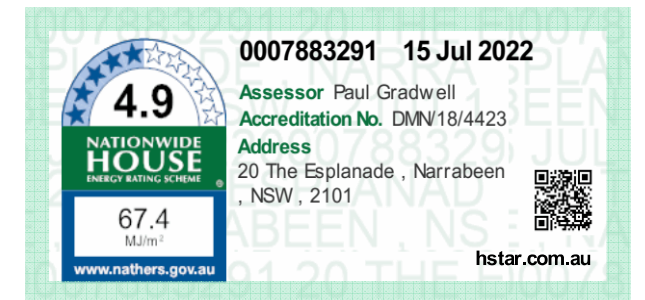
ROOF PLAN
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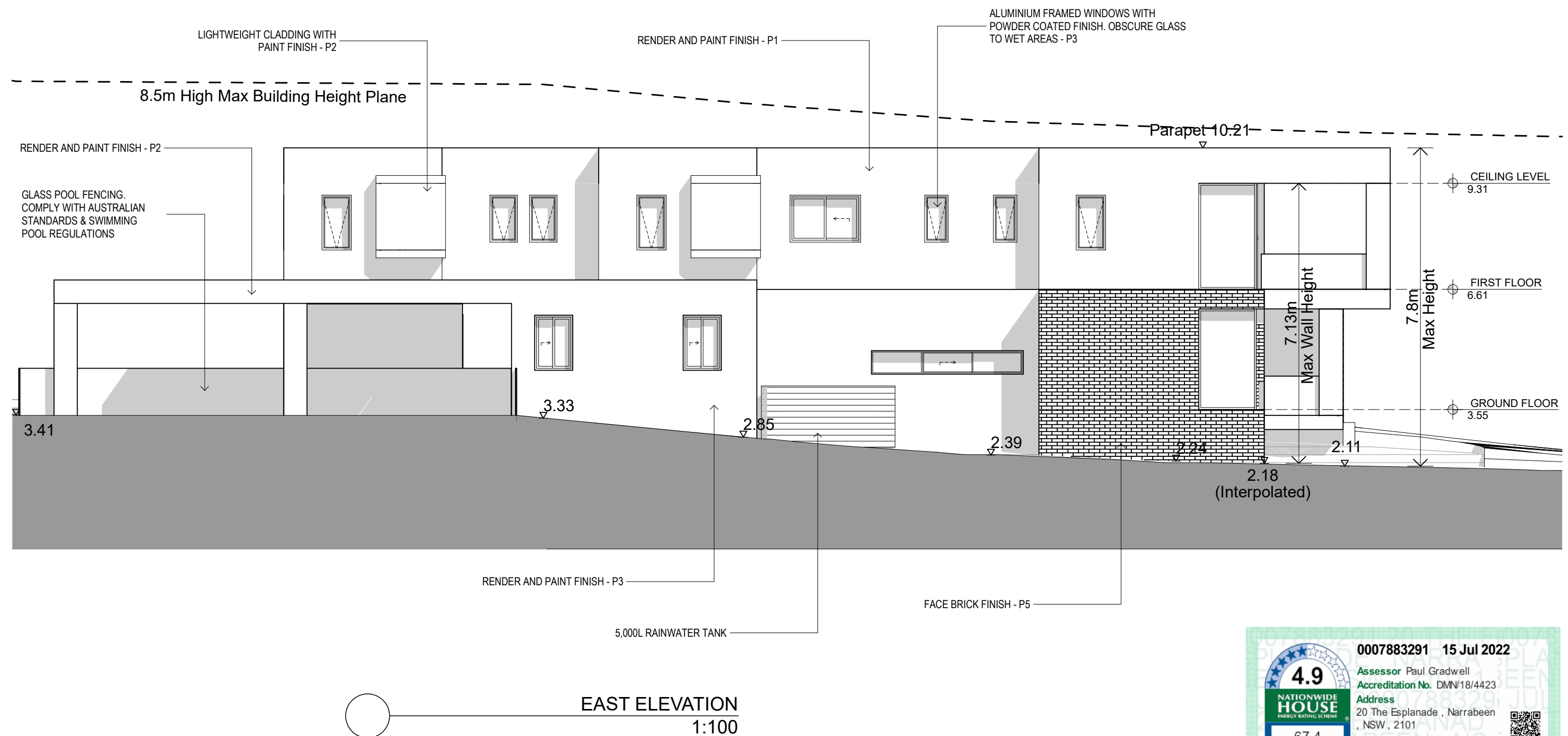
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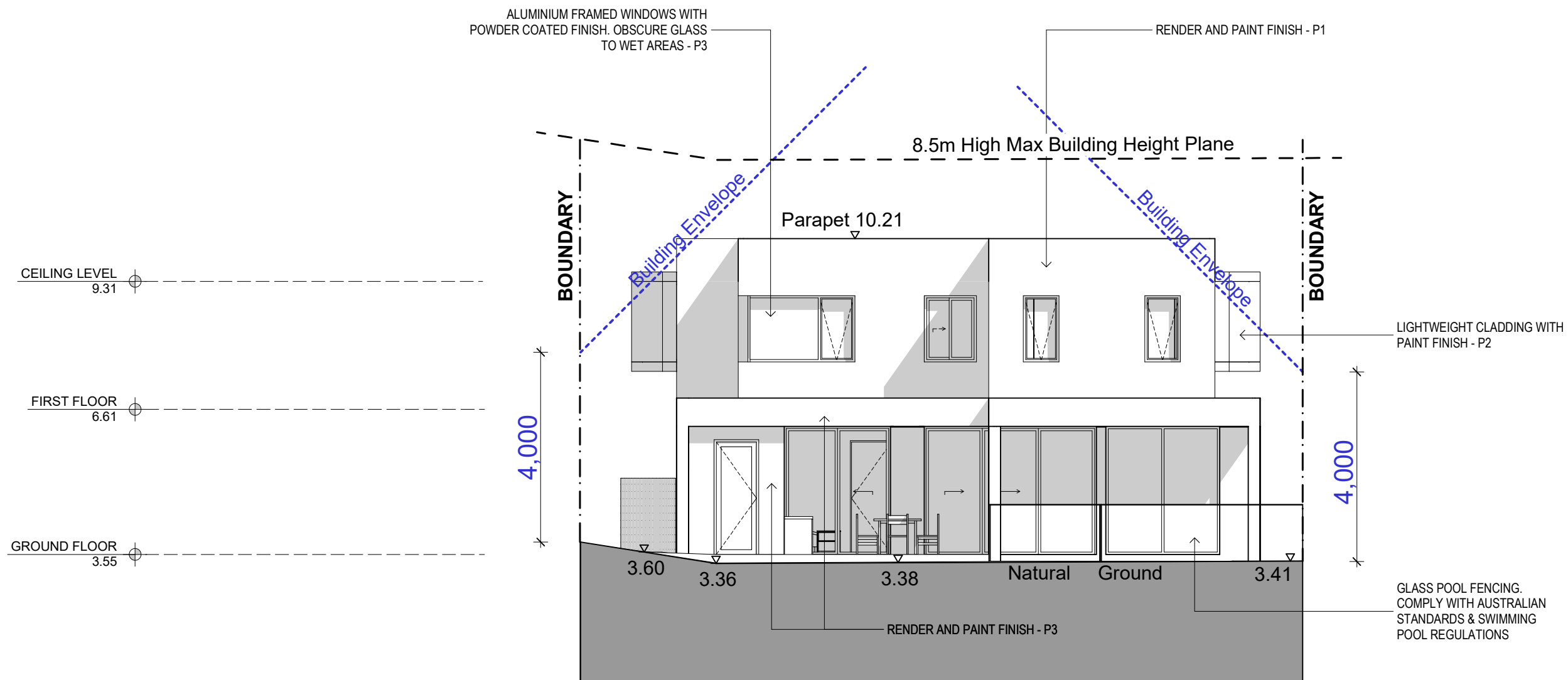
FRONT ELEVATION
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Architects: SHOBHA DESIGNS ARCHITECTS & URBAN DESIGNERS Suite 21, 1 - 7 Jordan St, Gladesville NSW 2111 PHONE : 02 98790020 MOBILE : 0418112677 EMAIL : nilesh@shobhadesigns.com.au 	PROJECT Demolition of Existing Structures & Construction of a New 2-storey Dwelling and Swimming Pool at 20 The Esplanade Narrabeen CLIENT Jason Smith	Drawing Name FRONT ELEVATION 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 20-Jul-22	
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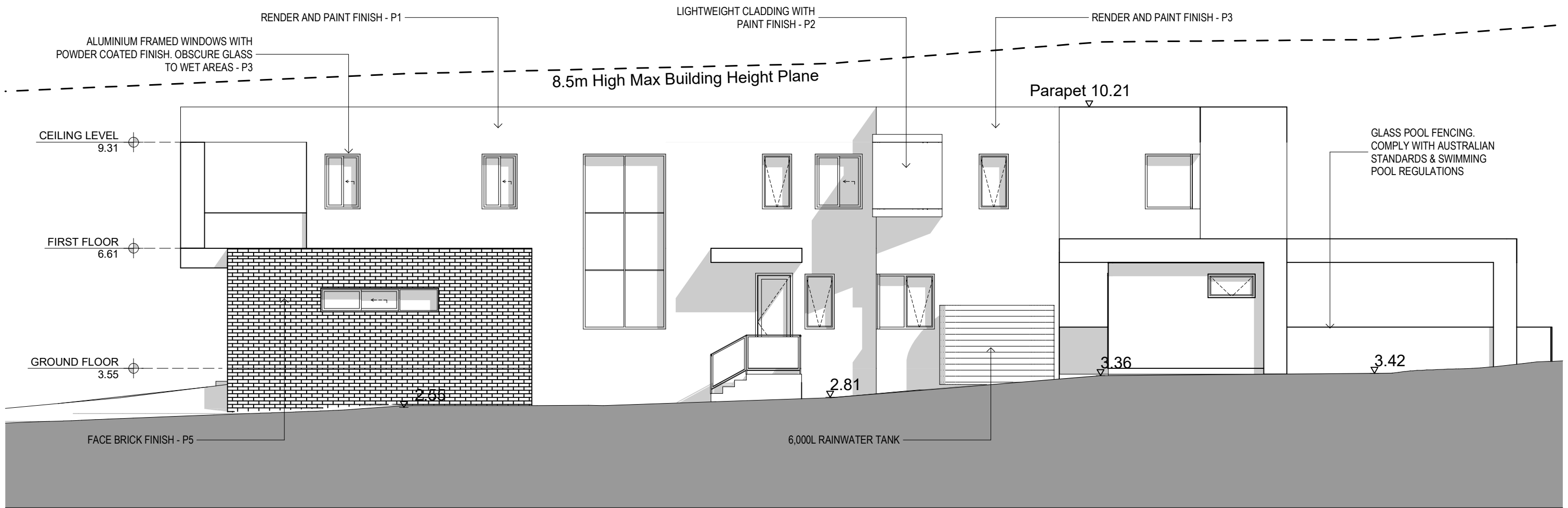
Architects: SHOBHA DESIGNS ARCHITECTS & URBAN DESIGNERS Suite 21, 1 - 7 Jordan St, Gladesville NSW 2111 PHONE : 02 98790020 MOBILE : 0418112677 EMAIL : nilesh@shobhadesigns.com.au shobha	PROJECT Demolition of Existing Structures & Construction of a New 2-storey Dwelling and Swimming Pool at 20 The Esplanade Narrabeen CLIENT Jason Smith	Drawing Name EAST ELEVATION 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	20-Jul-22	
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REAR ELEVATION
1:100



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WEST ELEVATION
1:100

0007883291 15 Jul 2022

Assessor Paul Gradwell
Accreditation No. DMN/18/4423
Address 20 The Esplanade , Narrabeen , NSW , 2101

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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 2-storey Dwelling and Swimming Pool at 20 The Esplanade Narrabeen CLIENT Jason Smith	Drawing Name WEST ELEVATION 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 20-Jul-22	
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4.9

NATIONWIDE
HOUSE
ENERGY RATING SCHEME

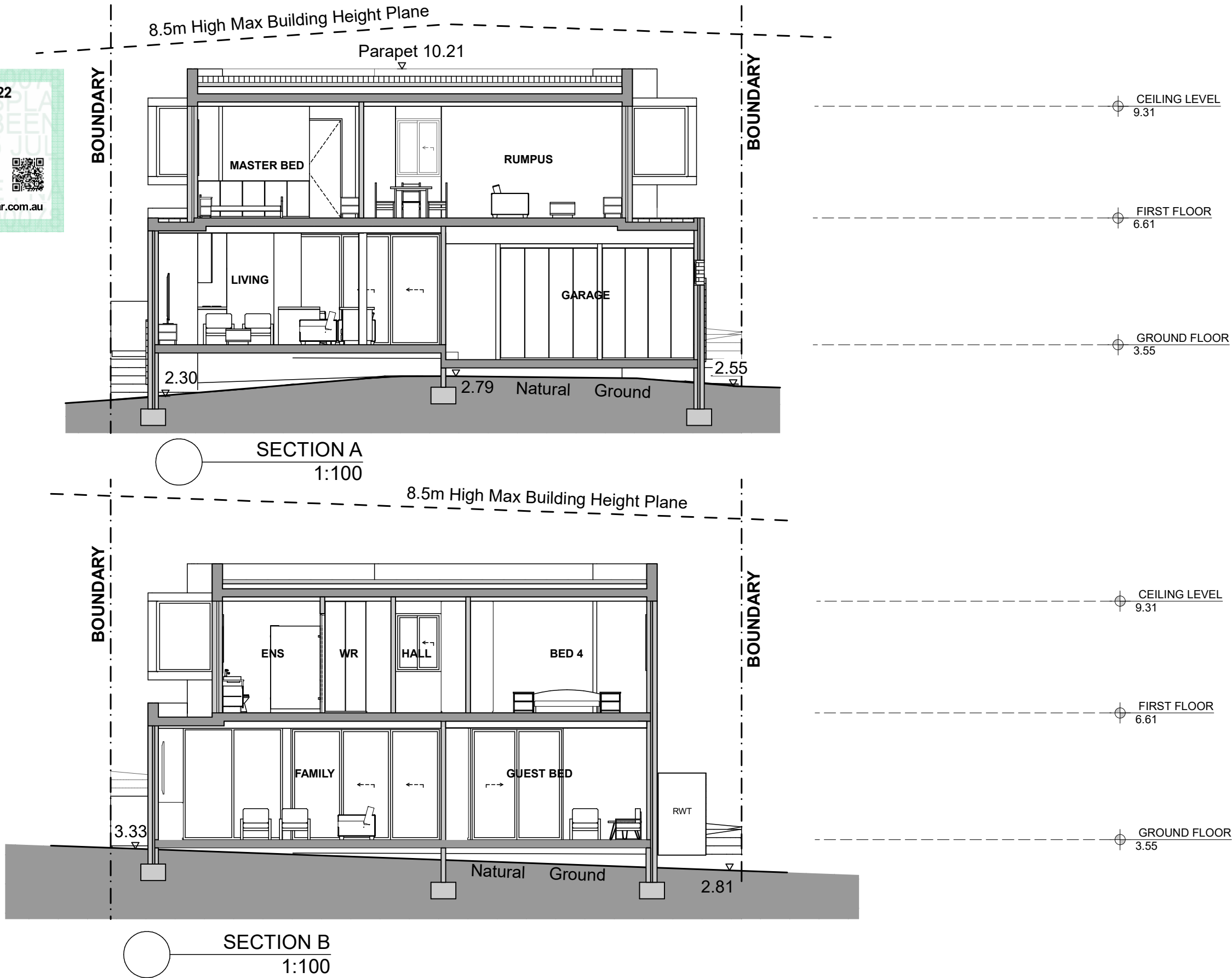
67.4
MJ/m²

www.nathers.gov.au

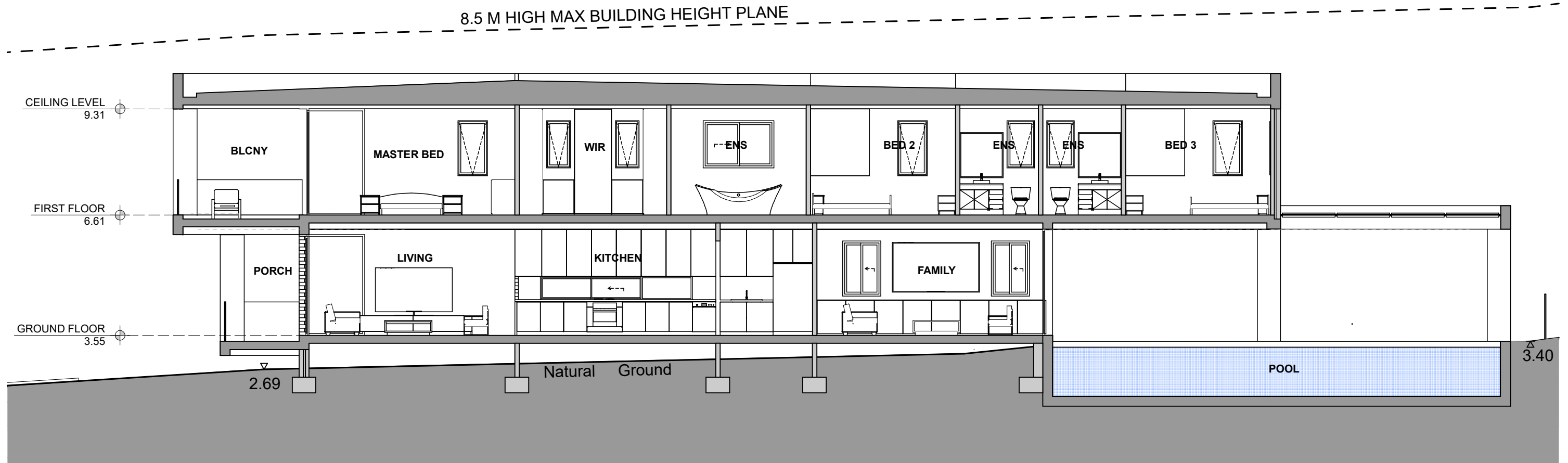
0007883291 15 Jul 2022

Assessor Paul Gradwell
Accreditation No. DMN/18/4423
Address
20 The Esplanade, Narrabeen
, NSW, 2101

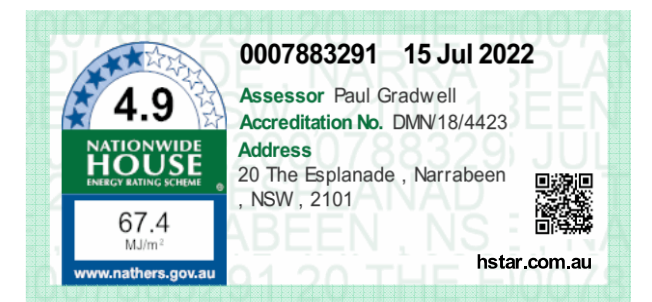
hstar.com.au



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	PROJECT Demolition of Existing Structures & Construction of a New 2-storey Dwelling and Swimming Pool at 20 The Esplanade Narrabeen CLIENT Jason Smith	Drawing Name SECTION A & B 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	20-Jul-22	
			Transmittal Set ID	Transmittal Set Name	Checked by	Date	Drawing Scale	Drawn By	: Sandy Martikas
			A	DA Issue to Council	NM		1:100	Checked By:	NM
							Layout ID	Issue	
							DA-10	A	



SECTION C
1:100



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			Transmittal Set ID	Transmittal Set Name	Checked by	Date	Drawing Scale	Drawn By : Sandy Martikas
			A	DA Issue to Council	NM		1:100	Checked By: NM
							Layout ID	Issue
							DA-11	A