Memorandum

To:	Ryhan Thompson	**At:**	Indesco Pty Ltd
From:	Carly Roder	**At:**	SLR Consulting Australia Pty Ltd
Date:	26 November 2019	**Ref:**	660.20071-M01- Cooby Road Peer Review -v1.0.docx
Subject:	Peer Review 105 Cooby Road, Tullimbar NSW		

1 Introduction

Indesco Pty Ltd (Indesco) has engaged SLR Consulting Australia Pty Ltd (SLR) to undertake high level peer review of the Northern Area Precinct 5, within the proposed residential development off Cooby Road, Tullimbar New South Wales.

This memorandum has been undertaken in general accordance with SLR's proposal 660.20071-P01-v1.0 20191115, dated 20th November 2019; and e-mail acceptance from Indesco, dated 22nd November 2019.

105 Cooby Road and surrounding area is currently mixed residential and agricultural/rural land use with low population density. The location of the property is shown in **Figure 1**. The proposed residential development off Cooby Road spans approximately 34,000m^2, which has been divided into numbered Precincts, nominated by Indesco, based on the proposed development stages.

This memorandum refers specifically to the proposed re-zoning of the site to enable future development of the Northern Area Precinct 5, which has an area of approximately 8,000m^2 (**Figure 1**).

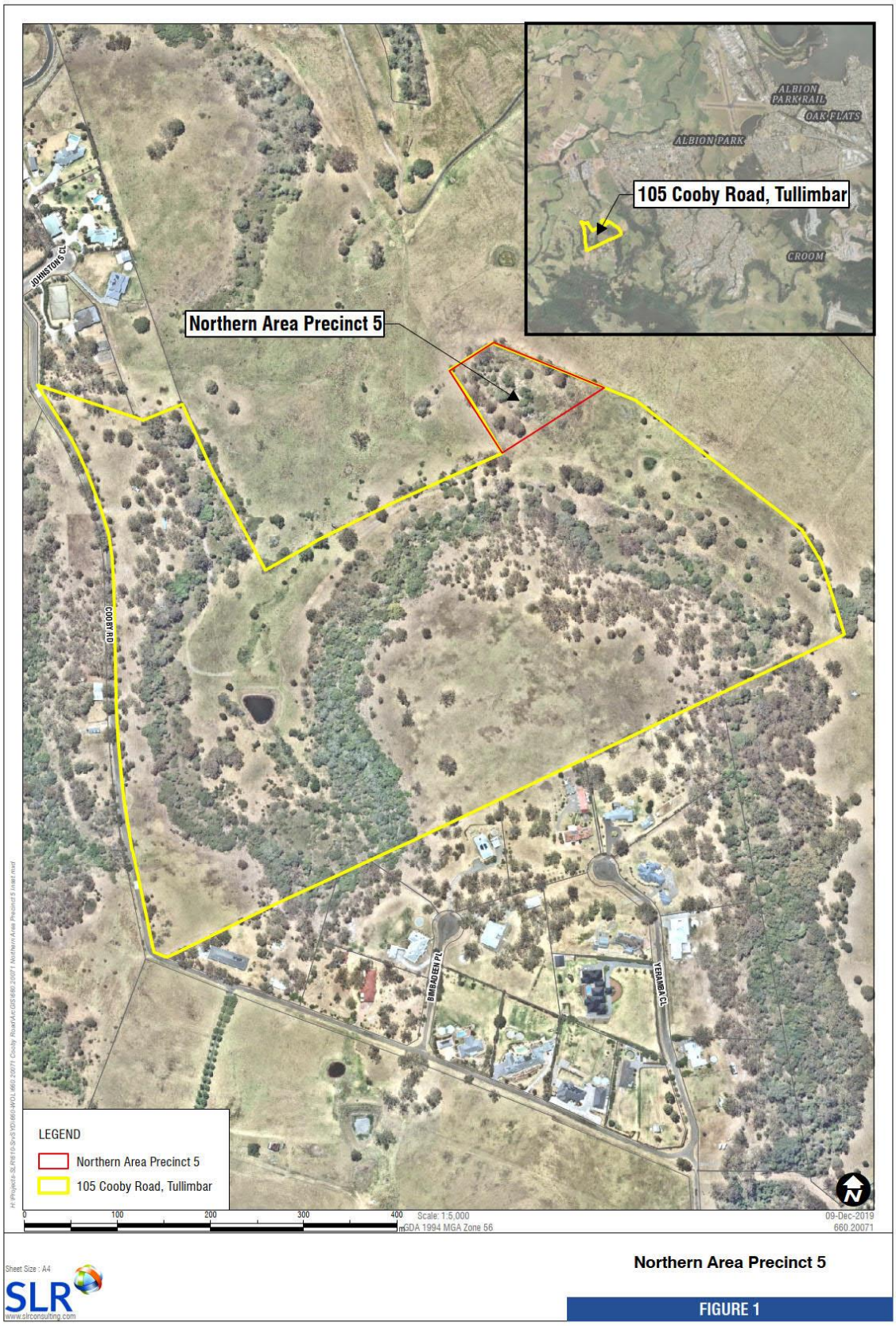

Figure 1: Site Location and Northern Area Precinct 5

2 Background Information

As part of the assessment, SLR has reviewed the following provided documentation:

- Terra Insight, 15th August 2019, Residential Subdivision of No. 105 Cooby Road, Tullimbar NSW – Report on Preliminary Geotechnical Assessment. Ref: TERRA18320.Rep1.Rev1
- Jeffery and Katauskas Pty Ltd, 3rd May 2002, Report to Sangha Holdings Pty Ltd on Geotechnical Assessment for L & E Court Appeal for Subdivision at 105 Cooby Road, Yellow Rock, near Albion Park. Ref: 16630Jrpt
- Shellharbour City Council, Ordinary Council Meeting – 24th September 2019 (selected pages): 10.3.3 Development Application No. 0073/2018 – Lot 16 and 17, DP1168920, Exeter Place, Tullimbar (11278324)

Based on the information provided, SLR understands a Planning Proposal has been submitted to Shellharbour City Council (Council) to rezone the land within Northern Area Precinct 5 to R2 Low Density Residential with a minimum lot size of 300m^2.

Subsequent Council response to the proposed lot size recommend a minimum lot size of 2000 m^2 within Northern Area Precinct 5. The current lot size constraint has been derived from the findings of the Preliminary Geotechnical Assessment (Terra Insight, 2019) whereby a moderate risk of land sliding within Northern Area Precinct 5 was the primary constraint to the proposed re-zoning.

This memorandum addresses the ambiguity relating to the proposed re-zoning, specifically in relation to Northern Area Precinct 5. **Figure 2** (from Terra Insight, 2019 outlining the proposed subdivision by block size).

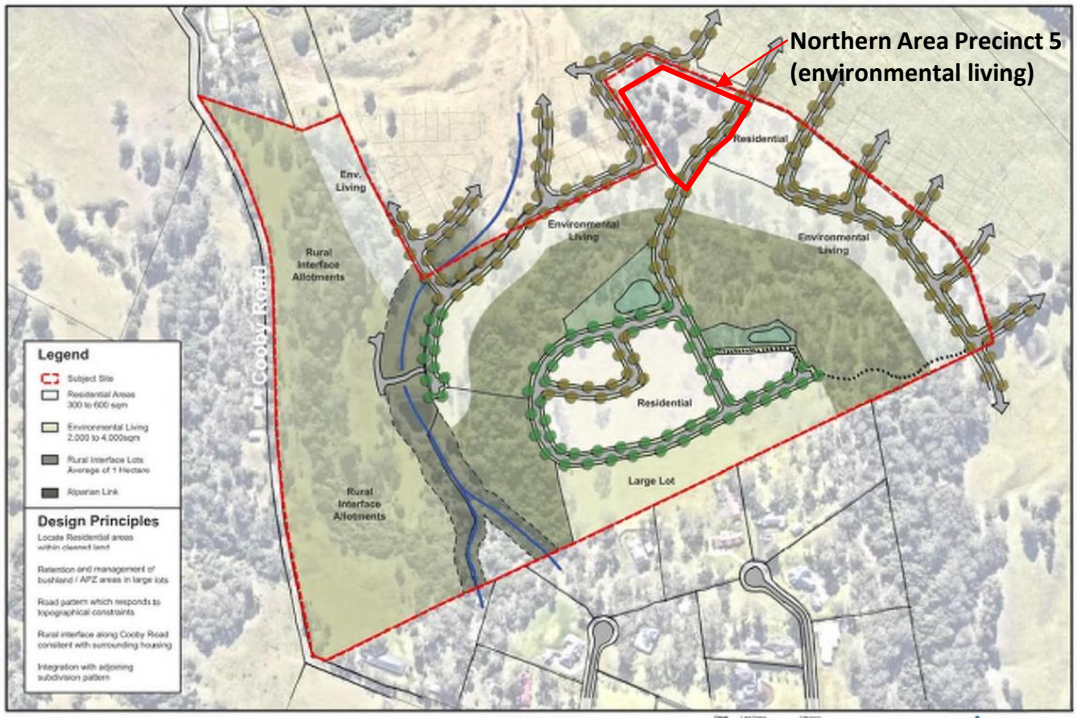

Figure 2: Proposed Subdivision Block Sizes, from Terra Insight, 2019.

Terra Insight (2019) characterised 105 Cooby Road into terrain units based on geomorphological and geological characteristics. Northern Area Precinct 5 was classified as Terrain Unit 3A (**Figure 3**).

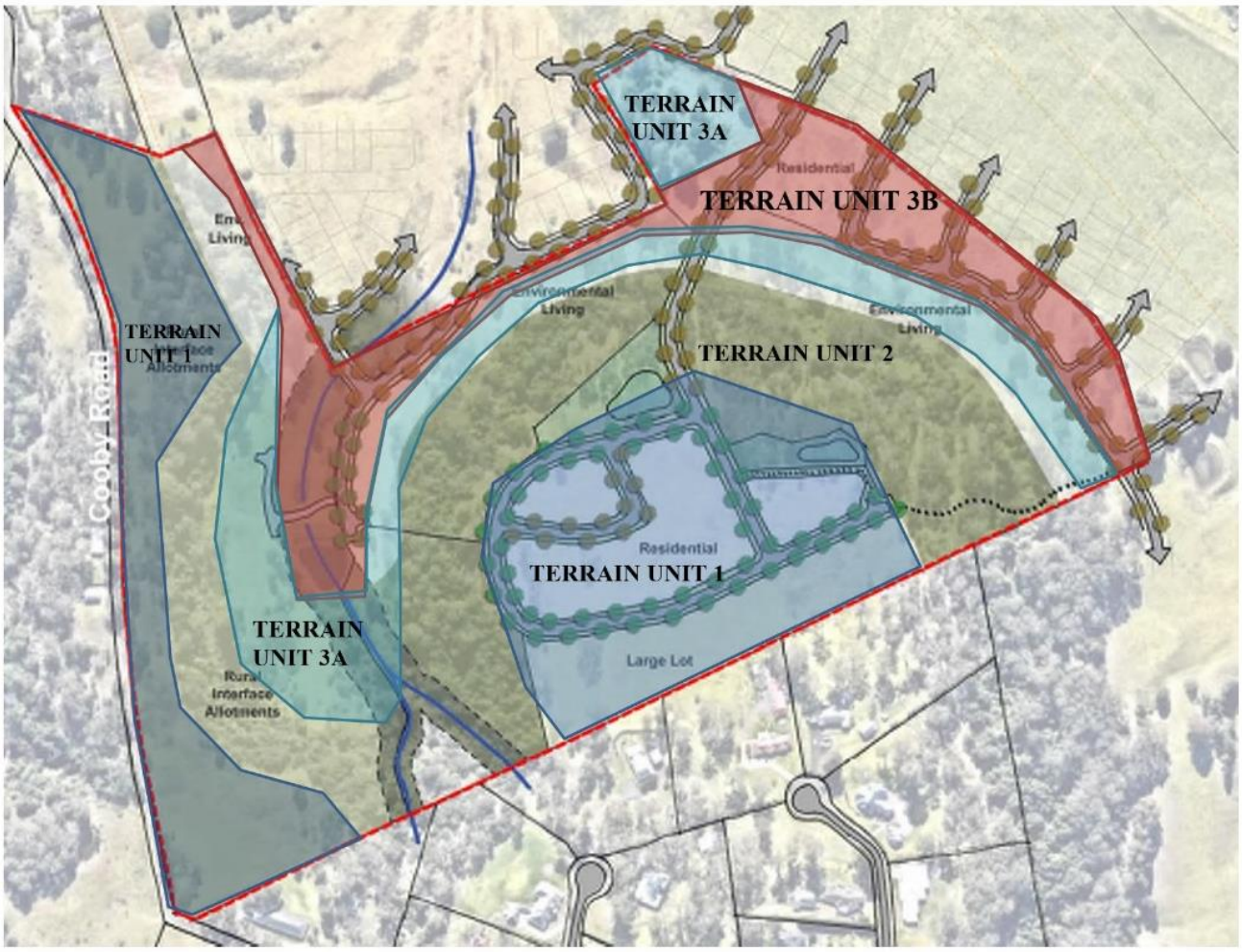

Figure 3: Terrain Units defined by Terra Insight, 2019.

An extract of the Council notes (**Figure 4**) relating to the requirement and relevant geotechnical assessment (**Figure 5)** on which the requirement is based are provided below for reference.

5. **Precinct 5 - Land to east of the site** see **Attachment 7**, about 36,307m²

Proposed Zoning: R2 Low Density Residential
Proposed Lot Size: 300m². About 52 lots
Proposed Building Height: 9.5m

Council position

Zoning: R2 Low Density Residential
Lot Size: Northern area shown in **Attachment 7B** – 2,000m², about 4 lots; Southern area 300m² about 45 lots
Building Height: 9.0m
FSR: 0.5:1

The existing Residential 2(e) zoned land has an area of about 34,000m². The proposed R2 Low Residential Density zone has an area of about 32,720m².

Shellharbour DCP identifies this Precinct into two areas (see **Attachment 7A**): MDR6 – average lot size 390m² and LDR9 – average lot size 540m². The exact location of these two areas are difficult to identify on SLEP 2000 and this Planning Proposal due to mapping changes and scale. However, it would appear that most of the southern area is LDR9 and the northern area both but predominantly MDR6.

The location of the northern area is shown approximately in **Attachment 7B**.

The Geotechnical report dated August 2019 lodged with the Planning Proposal identifies the northern part of this Precinct as Area 4 and Terrain Unit 3A. The Geotechnical report states that *Development within Terrain Unit 3A is also deemed possible but should be limited to larger environmental living and rural interface allotments*, (page 11).

The Planning Proposal proposes a minimum lot size of 300m² which is contrary to the Geotechnical report. The Geotechnical report identifies larger environmental living and rural interface allotments. These terms are shown on the Concept Plan in Appendix 3 of the Planning Proposal. That Plan shows an indicative lot size of 2,000 – 4,000m² for the environmental living lots and an average of 1 hectare for the rural interface lots.

Based on the information in the August 2019 Geotechnical report a lot size of 300m² is not appropriate for the northern area of Precinct 5.

Council staff recommends that the northern area of Precinct 5 have a minimum lot size of 2,000m² in accordance with the concept plan lodged with the Planning Proposal and, if a smaller lot size is considered appropriate, an additional Geotechnical report be prepared to justify that lot size as part of any Gateway determination.

Figure 4: Extract of Council Notes

Development within Terrain Unit 3A is also deemed possible but should be limited to larger environmental living and rural interface allotments. The following geotechnical constraints and opportunities have been identified for these parts of the site:

- Terrain Unit 3A:
  - The potentially moderate depth to rock (< 2 to 3m) provides reasonably foundation depths. On the upper hill slopes, the shallow to moderate depth to rock provides a potential source of low reactivity fill, depending on the extent of earthworks in these areas.
  - This part of the site is most at risk from rock falls from slopes within Area 2 / Terrain Unit 2. A catch berm or trench along the toe of slopes within area 2 is recommended to capture any small boulders or cobbles that may detach from the extremely steep slopes upgradient from Terrain Unit 3A. This ditch or berm could potentially be constructed as part of a road and drainage system (eg the access road could be constructed on the upper slope rather than lower slopes on the northern part of the site).

Figure 5: Extract from Terra Insight Geotechnical Assessment

SLR understand the determination of the 2000 m^2 lot size requirement has been driven from the assessed moderate risk of land slide for Terrain Unit 3A, Northern Area Precinct 5.

To this end, the objective for this memorandum is to review the slopes within Unit 3A and assess the suitability for development into a minimum proposed lot size of 300 m^2 in relation to the unit's geotechnical constraints, outlined within the Terra Insight 2019 report.

3 Data Review

3.1 Terra Insight Pty Ltd, 2019, Residential Subdivision of No. 105 Cooby Road, Tullimbar NSW – Report on Preliminary Geotechnical Assessment

Terra Insight Pty Ltd completed a detailed geotechnical assessment in August 2019 of the entire Cooby Rd site. Summarised here is the information referring to Area 4 (nomenclature assigned in the Terra Insight report referring to Northern Area Precinct 5) which was classified as Terrain Unit 3A. The relevant findings include:

- Area 4 is comprised of a small isolated hill with a crest elevation of approximately 70m AHD;
- Desktop mapping studies indicate the hill is in the vicinity of steep to extremely steep slopes and potentially unstable land;
- Field observations indicate Area 4 is characterised by moderate to steep slopes (<20°) with rock visible at the surface. No signs of mass slope movement were observed, however the potential for local slippage, soil creep and rock fall was noted;
- Potential landslide mechanisms identified include localised soil creep, local slope failure (shallow), rock fall and large-scale slope failure uphill or downhill from Area 4. All events are categorised at a Moderate Level of Risk based on the Risk Matrix provided in AGS (2007), with excerpt from the assessment shown below;

Terrain Unit 3A			
Localised soil creep	Likely	Minor	Moderate
Local failure of slopes.	Possible	Minor	Moderate
Rock Falls	Possible	Minor	Moderate
Large scale slope failure	Unlikely	Major	Moderate

- Terrain Unit 3A covers lower escarpment slopes within Area 2 and 4 and upper valley slopes within Area 3 (**Figure 4**), and is characterised as *'moderately to steeply graded upper valley slopes underlain by colluvial soils (< 1.5m thick), residual soils (< 1.0m thick) with rock (latite and rocks from the Berry Formation) expected at depths between 1.5 and 2.5m'*; and
- Terrain Unit 3A is determined to be at moderate risk of landslide, and therefore recommended to be developed as environmental living residential blocks with minimum lot size of 200m^2, noting that *'this area is most at risk from rockfalls from slopes within Area 2 / Terrain Unit 2'*.

3.2 Jeffery and Katauskas Pty Ltd, 2002, Geotechnical Assessment for Subdivision at 105 Cooby Road, Yellow Rock, near Albion Park.

Jeffery and Katauskas Pty Ltd (J&K) undertook a geotechnical assessment in 2002 of the entire Cooby Road site. In summary, the relevant findings include:

- Higher elevation geology is durable latite, while lower slopes and floodplains are red-brown or grey volcanic sandstone of the Budgong Formation;

- Gravel, cobbles and boulders of Latite in upper topsoil profile from slow colluvial flows or slope wash; and
- No evidence of landslip was observed, except isolated, slightly tilted trees indicating minor soil creep.

3.3 Council Comments

Following review of the Planning Proposal and the supporting Terra Insight Preliminary Geotechnical Assessment (2019), the Council has identified the geotechnical assessment recommends living blocks in Northern Area Precinct 5 larger than that outlined in the submitted Planning Proposal.

The Council identifies the proposed average lot size from the planning proposal is predominantly 390m^2, whilst the recommended lot size, based on the geotechnical report, is a minimum of 2000m^2. The Council's position is for the implementation of large lot size (2000m^2) in this area based on the previous geotechnical assessment.

4 Site Observations

SLR attended the proposed Northern Area Precinct 5 on 25th November 2019. Typical photographs of the geomorphology at Precinct 5 are included in **Figure 6 and 7.** A typical cross section through Precinct 5 landform is included in **Figure 8.** A summary of the site observations is included below:

- The slopes are moderately sloping at approximately 15 degrees, with localised steep slopes on the northern side of the hill at generally less than 25 degrees (**Figure 6 and Figure 8**);
- Latite bedrock is visible at surface as tabular cobbles and boulders, mostly covered in moss, showing signs of in-situ physical weathering on the northern hill slope (**Figure 7**);
- A thin cover of residual soil / topsoil overlies the lower hill slopes;
- Vegetation includes grass with interspersed larger native trees and shrub-like trees on hill crest;
- No visible signs of slope movement were observed.

Figure 6: Typical moderately sloping landform of hill of Northern Area Precinct 5, looking northeast

Figure 7: Moss covered Latite boulders exposed at surface as a result of near surface weathering

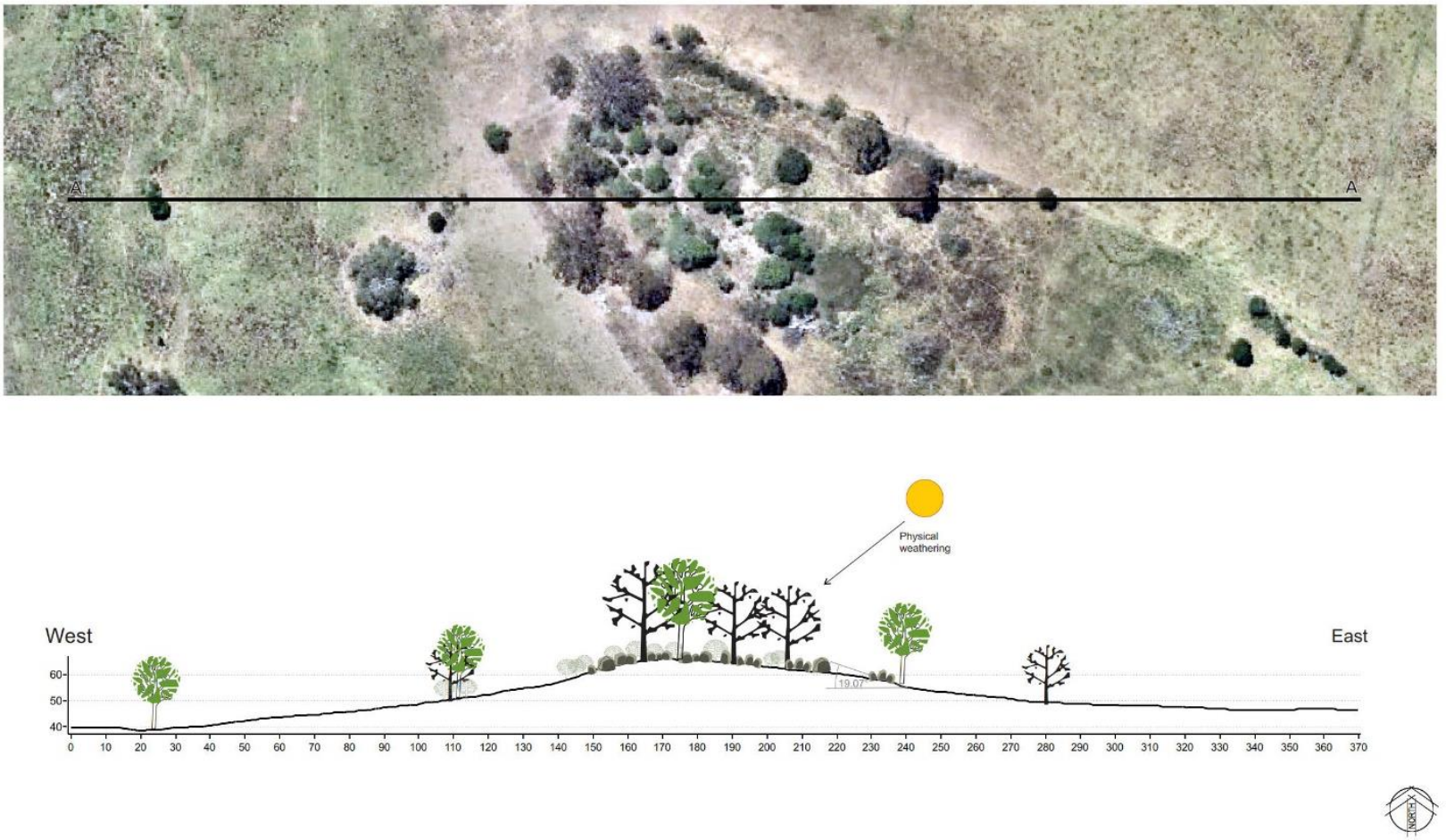

Figure 8: Cross Section West to East across Northern Area Precinct 5

5 Discussion

Terra Insight (2019), classifies Terrain Unit 3A to be inclusive of Northern Area Precinct 5 and the area downslope of the upper steep slopes of Terrain Unit 2 (**Figure 3**). The terrain in Terrain Unit 3A is identified to be moderately to steeply graded upper valley slopes underlain by <1.5m of colluvial soils, residual soils overlying bedrock (Bumbo Latite and/or Berry Formation). Terra Insight (2019) assessment of the Northern Area Precinct 5 identified that potential land instability mechanisms included surficial creep, local and large-scale slope failure or rock fall on the slopes.

Based on the AGS (2007c) Risk Matrix, Terrain Unit 3A has been assigned a moderate risk of landslide by Terra Insight, 2019, a greater risk than the other terrain units proposed for development. Due to this risk rating, Terra Insight, 2019 has recommended larger sized environmental living blocks to be the most suitable development within Terrain Unit 3A, which is inclusive of Northern Area Precinct 5.

SLR considers Northern Area Precinct 5 typically comprises highly durable latite and meta-sediments of the Budgong Formation which are high to very high strength rocks at shallow depths.

Site observations indicate bedrock is at or near the surface across the majority of Northern Area Precinct 5, while the lower slopes of the hill are likely to comprise of a thin layer of superficial soil overlying shallow bedrock. The bedrock at surface is considered to have weathered insitu as a result of shallower physical weathering causing joints and fracture planes to 'crack' through wet-dry, hot-cold processes and subsequent secondary infilling of residual soil.

This weathering results in tabular, angular boulders and cobbles (**Figure 7**), creating a limiting factor to the rocks ability to roll down the gentle to moderate slopes. Furthermore, no cliff line was noted within the Precinct 5 hill and hence the potential for blocks to travel large distances is significantly reduced. Moss covered boulders and cobbles indicate there has been little to no movement of surface rocks. SLR consider past movement of the rocks is a result of movement of animals across the site which displace the cobbles and slow, downslope migration of blocks under gravitational forces over long periods of time.

Furthermore, the shallow, very high strength nature of the bedrock within the Precinct 5 also suggests that rotational or deep-seated instability does not present a feasible failure mechanism and hence the risk of such failure impacting Precinct 5 is considered barely credible.

While SLR agree with the categorisation approach taken by Terra Insight, 2019, SLR believe the Northern Area Precinct 5 has been classed at a moderate risk of landslide due to its characteristics being extrapolated to fit within Terrain Unit 3A.

SLR consider Northern Area Precinct 5 to be a different terrain unit to Terrain Unit 3A which lies directly below Terrain Unit 2, as it does not have the inherent risks that result from proximity to the steeply sloped Terrain Unit 2, i.e. the Precinct 5 area is not considered to lie within the travel distance of any potential instability originating within Terrain Unit 2.

Based on the above observations, SLR consider that Northern Area Precinct 5 be re-classified as a separate terrain unit with the following defining characteristics:

- **Terrain Unit 4 – Shallow Rock Slope:**
  Moderately graded shallow bedrock slopes, overlain by superficial soil, with low gradient foot slopes comprising < 500 mm residual soil overlaying shallow bedrock.

Based on the reclassification of Northern Area Precinct 5 to Terrain Unit 4, SLR recommend the following update to the assessed level of risk to property (Table 6-1, Terra Insight 2019):

Table 1: Landslide event - current and future likelihood and consequences to property

Event	Likelihood	Consequences to property	Level of Risk
Terrain Unit 4			
Localised soil creep	Unlikely	Minor	Low
Local slope failure	Rare	Minor	Very Low
Rock falls	Unlikely	Minor	Low
Large scale slope failure	Barely Credible	Major	Very Low

As a result of the updated characteristics of Terrain Unit 4, and the inherent distance from Terrain Unit 2 slope hazards, the assessed level of risk to property for Northern Area Precinct 5 is considered very low to low.

6 Conclusion

SLR consider there is an overall low risk of slope instability in Northern Area Precinct 5 based on the condition of shallow bedrock and the slopes observed. It is apparent that in an effort to broadly classify different areas across the site based on type sections, Northern Area Precinct 5 has inherited characteristics extrapolated from other areas mapped as Terrain Unit 3A, which do not represent its true geomorphological characteristics.

SLR propose Northern Area Precinct 5 be re-classified as an additional terrain unit, Terrain Unit 4, characteristic of a moderate angle rock slope. Terrain Unit 4 is considered inherently 'stable', showing little to no sign of previous slope instability and low risk of future instability and therefore risk to development.

SLR consider the 2000 m^2 lot sizing has been dictated by the assessed slope risk of Terrain Unit 3A, which has been updated for Terrain Unit 4 in this memorandum. The inferred risk to property has been reduced to low by decreasing the expected probability of instability in accordance with AGS Practice Note Guidelines for Landslide Risk Management 2007.

Based on the site observations, the inherent slope risk that has driven the recommendation for 2000 m^2 lots is not considered applicable to Northern Area Precinct 5, rather the reassessment of slope instability suggests there is no greater risk to lot sizes of 300 m^2 than that of larger sizing.

Checked/
Authorised by: AR